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UNITED NATIONS
ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

21 March 2025
Original: English

11th Meeting of the Post-2020 SAPBIO National Correspondents

Athens (Greece), 9-10 April 2025

Agenda Item 3: Steps undertaken towards the implementation of the Post-2020 Strategic Action Programme for the Conservation of Biodiversity and Sustainable Management of Natural Resources in the Mediterranean Region (Post-2020 SAPBIO) at regional and national levels

2023 Mediterranean Quality Status Report

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SPA/RAC
Tunis, 2025

UNITED
NATIONS

EP

UNEP/MED IG.26/Inf.10

Mediterranean
Action Plan
Barcelona
Convention

3 November 2023
Original: English

23rd Meeting of the Contracting Parties to the
Convention for the Protection of the Marine Environment
and the Coastal Region of the Mediterranean and its Protocols

Portorož, Slovenia, 5-8 December 2023

Agenda Item 3: Thematic Decisions
Agenda Item 5: Ministerial Session

2023 Mediterranean Quality Status Report

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UNEP/MAP
Athens, 2023

UNITED NATIONS

EP

UNEP/MED WG.568/Inf.16

Mediterranean Action Plan
Barcelona Convention

28 July 2023
Original: English

Meeting of the MAP Focal Points

Istanbul, Türkiye, 12-15 September 2023

Agenda Item 5: Specific Matters for Consideration and Action by the Meeting, including Draft Decisions

Draft 2023 Mediterranean Quality Status Report

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UNEP/MAP
Athens, 2023

UNITED
NATIONS

EP

UNEP/MED WG.567/Inf.3

Mediterranean
Action Plan
Barcelona
Convention

28 July 2023
Original: English

10th Meeting of the Ecosystem Approach Coordination Group

Istanbul, Türkiye, 11 September 2023

Agenda Item 4: 2023 Mediterranean Quality Status Report

2023 Mediterranean Quality Status Report

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UNEP/MAP
Athens, 2023

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List of Abbreviations / Acronyms

ACCOBAMS	Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area
AChE	Acetylcholinesterase
ADR	Adriatic Sea Sub-region
AEGS	Aegean Sea sub-division
AEL	Aegean and Levantine Seas Sub-region
AIS	Automated Identification System
ALBS	Alboran Sea sub-division
AM	Arithmetic mean
ASI	ACCOBAMS Survey Initiative
AZ	Assessment Zone
BAC	Background Assessment Concentrations
BaP	Benzo(a)pyrene
BAT	Best Available Technique
BC	Background Concentration
BChE	Butyrylcholinesterase
BDL	Below Detection Limit
BEP	Best Environmental Practices
BFCOD	7-benzyloxy-4-[trifluoromethyl]-coumarin-O-debenzyloxylase
BV	Baseline Values
BWQ	Bathing Water Quality
C	Concentration
CAS	Central Adriatic Sea sub-division
CAT	Catalase
CCI	Candidate Common Indicator (of IMAP)
CDR	Central Data Repository
CE	Carboxylesterase
CEN	Central Mediterranean Sea Sub-region
CENS	Central Mediterranean Sea sub-division
CFU	Colony forming units
CHASE+	Chemical Status Assessment Tool
Chl *a*	Chlorophyll *a*
CI	Common Indicator
COP	Conference of the Parties
CORMON	Correspondence Group on Monitoring
CP	Contracting Party
CR	Contamination Ratio
CS	Contamination Score
CW	Coastal waters monitoring zone
CWMS	Central Western Mediterranean Sea sub-division
D	Descriptor
DD	Data Dictionary
DIN	Dissolved Inorganic Nitrogen
DL	Detection Limit
dl	Dioxin like
DP	Drivers and Pressures
DPSIR	Driver, pressure, state, impact, response
DS	Data Standard
dw	Dry weight
E. coli	Escherichia coli
EAC	Environmental Assessment Criteria
EC	European Commission
EcAp MED III	EU-Funded Project “Mediterranean Implementation of the Ecosystem Approach, in Coherence with the EU MSFD”
EcoQOs	Ecological Quality Objectives
EDI	Estimated daily intake
EEA	European Environmental Agency
EIONET	European Environment Information and Observation Network

EMODnet	European Marine Observation and Data Network
EO	Ecological Objective
EPR	Extended Producer Responsibility
EQR	Ecological Quality Ratio
EQS	Environmental Quality Standard
ERL	Effects Range Low
EROD	Ethoxyresorufin-O21 deethylase
ESRI	Environmental Systems Research Institute
ESRI	Environmental Systems Research Institute
ETS	Electron Transport System
EU	European Union
EUNIS	European nature information system (of EEA)
EUSeaMap	Modelled mapping product of seabed habitats for European marine regions (of EMODnet)
EWI	Estimated weekly intake
FAO	Food and Agriculture Organization of the United Nations
FDA	Food and Drug Administration
FML	Floating Marine Litter
FRA	Fisheries Restricted Area (of GFCM)
G/M	Good/moderate status boundary
GES	Good Environmental Status
GFCM	General Fisheries Commission for the Mediterranean
GLY	Glycogen
GM	Geometric mean
GPML	Global Partnership on Marine Litter
GPS	Global Position System
GPx	Glutathione peroxidase
GRd	Glutathione reductase
GRID	Green, Resilient, Inclusive Development
GSA	Geographical subarea (of GFCM)
GSH	Glutathione
GST	Glutathione-S-transferase
HCB	Hexachlorobenzene
HELCOM	Helsinki Commission
HI	Total risk
HQ	Hazard quotient
ICES	International Council for the Exploration of the Sea
ICZM	Integrated Coastal Zone Management
IE	Intestinal enterococci
IHO	International Hydrographic Organization
IMAP	Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria
IMO	International Maritime Organization
INR	International Noise Register
IONS	Ionian Sea sub-division
JRC	Joint Research Centre
LDH	Lactate dehydrogenase
LEVS	Levantine Basin Sea sub-division
LMS	Lysosomal Membrane Stability
LOBE	Level of Onset of Biological Effects
LPO	Lipid peroxidation
MAP	Mediterranean Action Plan
MARPOL	International Convention for the Prevention of Pollution from Ships
MB	*Mullus barbatus*
MDA	Malondialdehyde
MED	Mediterranean
MedECC	Mediterranean Experts on Climate and environmental Change
MED POL	Programme for the Assessment and Control of Marine Pollution in the Mediterranean Sea
MED QSR	Mediterranean Quality Status Report
MEPC	Marine Environment Protection Committee
MG	*Mytilus galloprovincialis*
MN	Micronucleus Assay
MP	Microplastic

MPA	Marine Protected Areas
MRL	Maximum residue limit
MRU	Marine Reporting Unit
MSFD	Marine Strategy Framework Directive
MSs	Member States
MT	Metallothionein
MTS	Mid-Term Strategy
NAPs	National Action Plans
NAS	North Adriatic Sea sud-division
NEAT	Nested Environmental Status Assessment Tool
nonGES	not Good Environmental Status
NPA	Non-Problem Area
NRTT	Neutral red retention time
OOAO	One Out All Out
OSPAR	Oslo-Paris Commission, implementing the Oslo-Paris Convention for the Protection of the Marine Environment of the North-East Atlantic
OW	Offshore waters monitoring zone
OWG	Online Working Group
PA	Problem Area
PAHs	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PCDD	Polychlorinated dibenzo-para-dioxins
PCDD/Fs	Polychlorinated dibenzo-para-dioxins and dibenzofurans
PCDF	Polychlorinated dibenzofurans
PDBE	Polybrominated diphenyl ethers
PET	Polyethylene terephthalate
PFAS	Per- and polyfluorinated alkyl substances
POPs	Persistent organic pollutants
PPCP	Pharmaceuticals and Personal Care Products
PUHA	Potentially Usable Habitat Area
PWP	Plastic Waste Partnership (Basel Convention)
QSR	Quality Status Report
RC	Reference condition
RSC	Regional Sea Convention
SAS	South Adriatic Sea sub-division
SAU	Spatial Assessment Units
SCP	Sustainable Consumption and Production
SD	Sub-division
SOD	Superoxide dismutase
SOPs	Standard Operations and Procedures
SoS	Stress on Stress
SPA/RAC	Special Protected Areas Regional Activity Centre (of UNEP/MAP)
SUDS	Sustainable Urban Drainage Systems
SUPs	Single-Use Plastics
TEF	Toxic equivalency factor
TG	Task group
THQ	Target hazard quotient
TM	Trace metals
TP	Total Phosphorous
TV	Threshold Value
TYRS	Tyrrhenian Sea sub-division
UHMWPE	Ultra-high Molecular Weight Polyethylene
UNEA	United Nations Environmental Assembly
UNEP	United Nations Environmental Program
UNEP/MAP	United Nations Environment Programme – Mediterranean Action Plan-Barcelona Convention for the protection of the marine environment and coastal region of the Mediterranean
USWM	Urban Storm Water Management
VME	Vulnerable Marine Ecosystem
VTG	Vitellogenin
WFD	Water Framework Directive
WHO	World Health Organization
WMS	Western Mediterranean Sea sub-region

WW	Wet weight
WWTP	Wastewater Treatment Plants

Introduction

UNEP/MAP-Barcelona Convention: Vision, Goals, and Ecological Objectives

1. The regional cooperation for the Mediterranean Sea started in 1975 when the Mediterranean Action Plan (MAP) was launched as the first Regional Seas Programme within the framework of the United Nations Environment Programme (UNEP). A year later, in 1976, the countries bordering the Mediterranean adopted the Convention for the Protection of the Mediterranean Sea Against Pollution (Barcelona Convention), thus providing MAP with a legal basis constituting a framework allowing the Contracting Parties to unite their efforts for the preservation of the Mediterranean Sea as a common heritage of the peoples of the region.

2. Following a first period during which the efforts within MAP were mainly oriented to address pollution issues, the action under the Barcelona Convention has evolved towards a broader approach aimed at protecting and enhancing the Region's marine and coastal environment in line with a sustainable development vision. In this context, building on the global momentum created by the landmark 1992 Rio Conference, the MAP Coordinating Unit facilitated a consultation process that led to the adoption by the Contracting Parties, in June 1995, of the Action Plan for the Protection of the Marine Environment and the Sustainable Development of the Coastal Areas of the Mediterranean (MAP Phase II) and the amended Barcelona Convention, renamed "Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean".

3. The alignment with the Sustainable Development orientation was reinforced in 2016 when the Barcelona Convention Contracting Parties adopted the Mediterranean Strategy for Sustainable Development (MSSD) 2016-2025. The MSSD provides an integrative policy framework and a strategic guiding document for all stakeholders and partners to translate the 2030 Agenda for Sustainable Development at the regional, sub regional and national levels. The Strategy is built around the following vision: A prosperous and peaceful Mediterranean region in which people enjoy a high quality of life and where sustainable development takes place within the carrying capacity of healthy ecosystems. This is achieved through common objectives, strong involvement of all stakeholders, cooperation, solidarity, equity and participatory governance. Thirty-four indicators have been agreed in relation to the following six objectives:

a. Ensuring sustainable development in marine and coastal areas
b. Promoting resource management, food production and food security through sustainable forms of rural development
c. Planning and managing sustainable Mediterranean cities
d. Addressing climate change as a priority issue for the Mediterranean
e. Transition towards a green and blue economy
f. Improving governance in support of sustainable Development

4. In 2021, the Contracting Parties adopted the UNEP/MAP Medium-Term Strategy 2022-2027 (MTS) (Decision IG.25/1, COP22, Antalya, Türkiye)as a key strategic framework for the development and implementation of the Programmes of Work of UNEP/MAP. It aims at achieving transformational change and substantial progress in the implementation of the Barcelona Convention and its Protocols, also providing a regional contribution to relevant Global processes[1].

[1] In particular the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs), the UN Decade on Ecosystem Restoration, the UN Decade of Ocean Science for Sustainable Development and the UNEP's Medium-Term Strategy 2022-2025, approved at UNEA-5 in February 2021.

5. Today, the legal and institutional framework put in place over the years by the Contracting Parties to the Barcelona Convention have become an efficient cooperation instrument to which all the riparian countries adhere, despite the challenging geopolitical circumstances prevailing in the region. By adopting, in 2021, the UNEP/MAP Medium-Term Strategy (MTS 2022-2027), the Contracting Parties to the Barcelona Convention and its Protocols, agreed to orient their collaboration during the period 2022-2027 towards the following vision: "*Progress towards a healthy, clean, sustainable and climate resilient Mediterranean Sea and Coast with productive and biologically diverse marine and coastal ecosystems, where the 2030 Agenda for sustainable development and its SDGs are achieved through the effective implementation of the Barcelona Convention, its Protocols and the Mediterranean Strategy for Sustainable Development for the benefit of people and nature*". To this end, the Contracting Parties decided to further strengthen their collaboration to reach a dual long-term goal:

a) the achievement and maintenance of Good Environmental Status (GES) of the Mediterranean Sea and Coast, and
b) achieving sustainable development through the SDGs and living in harmony with nature.

Overall Objectives of the MTS 2022-2027:

- To drive transformational change in enhancing the impact of the "delivery as one" of the UNEP/MAP Barcelona Convention system, and its contribution to the region;
- To ensure that the Good Environmental Status (GES) of the Mediterranean Sea and Coast, the relevant SDGs and their targets, and the post-2020 global biodiversity goals and targets are achieved, through concrete actions to effectively manage and reduce threats and enhance marine and coastal resources;
- To contribute to strengthening Mediterranean solidarity and peoples' prosperity; and
- To contribute to the Building Back Better approach of the "UN framework for the immediate socio-economic response to COVID-19" and towards a "green recovery" of the Mediterranean by supporting new and sustainable business models, enabling a just and green transition to a nature-based solutions and circular economy.

6. In 2012, the Contracting Parties adopted 11 Mediterranean Ecological Objectives (EO) to achieve good environmental status (GES). These are presented in chapter 0.2.

Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast

7. In 2008, the Contracting Parties to the Barcelona marked a new important milestone when they decided to progressively apply the ecosystem approach to the management of human activities that may affect the Mediterranean marine and coastal environment for the promotion of sustainable development. A process was therefore initiated for the gradual application of the ecosystem approach as an overarching principle cutting across all UNEP/MAP operations and applied through an agreed implementation roadmap made of seven steps starting with the definition of an ecological Vision for the Mediterranean: "*A healthy Mediterranean with marine and coastal ecosystems that are productive and biologically diverse for the benefit of present and future generations*". Under this vision, eleven Ecological Objectives reflecting common issues for the management of the Mediterranean marine and coastal environments were defined:

Steps for the implementation of the Ecological Approach (EcAp) Roadmap in the Mediterranean: 1. Definition of an ecological vision for the Mediterranean. 2. Setting of common Mediterranean strategic goals. 3. Identification of important ecosystem properties and assessment of ecological status and pressures. 4. Development of a set of ecological objectives corresponding to the Vision and strategic goals. 5. Derivation of operational objectives with indicators and target levels. 6. Revision of existing monitoring programmes for ongoing assessment and regular updating of targets. 7. Development and review of relevant action plans and programmes.

Table 1: Ecological objectives and their related Common Indicators and Candidate Indicators

Ecological Objective	IMAP indicators
EO 1 Biodiversity	
Biological diversity is maintained or enhanced. The quality and occurrence of coastal and marine habitats and the distribution and abundance of coastal and marine species are in line with prevailing physiographic, hydrographic, geographic and climatic conditions.	Common Indicator 1: Habitat distributional range (EO1) to also consider habitat extent as a relevant attribute
	Common Indicator 2: Condition of the habitat's typical species and communities (EO1)
	Common Indicator 3: Species distributional range (EO1 related to marine mammals, seabirds, marine reptiles)
	Common Indicator 4: Population abundance of selected species (EO1, related to marine mammals, seabirds, marine reptiles)
	Common indicator 5: Population demographic characteristics (EO1, e.g., body size or age class structure, sex ratio, fecundity rates, survival/mortality rates related to marine mammals, seabirds, marine reptiles)
EO 2 Non-indigenous species	
Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem	Common Indicator 6: Trends in abundance, temporal occurrence, and spatial distribution of non-indigenous species, particularly invasive, non-indigenous species, notably in risk areas (EO2, in relation to the main vectors and pathways of spreading of such species)
EO 3 Harvest of commercially exploited fish and shellfish	
Populations of selected commercially exploited fish and shellfish are within biologically safe limits, exhibiting a population age and size distribution that is indicative of a healthy stock	Common Indicator 7: Spawning stock Biomass (EO3);
	Common Indicator 8: Total landings (EO3);
	Common Indicator 9: Fishing Mortality (EO3);
	Common Indicator 10: Fishing effort (EO3);
	Common Indicator 11: Catch per unit of effort (CPUE) or landing per unit of effort (LPUE) as a proxy (EO3)
	Common Indicator 12: Bycatch of vulnerable and non-target species (EO1 and EO3)
EO 4 Marine food webs	
Alterations to components of marine food webs caused by resource extraction or human-induced environmental changes do not have long-term adverse effects on food web dynamics and related viability	To be further developed

Ecological Objective	IMAP indicators
EO 5 Eutrophication	
Human-induced eutrophication is prevented, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters.	Common Indicator 13: Concentration of key nutrients in water column
	Common Indicator 14: Chlorophyll-a concentration in water column
EO 6 Sea-floor integrity	
Sea-floor integrity is maintained, especially in priority benthic habitats	To be further developed
EO 7 Alteration of hydrographical conditions	
Alteration of hydrographic conditions does not adversely affect coastal and marine ecosystems.	Common Indicator 15: Location and extent of the habitats impacted directly by hydrographic alterations to also feed the assessment of EO1 on habitat extent
EO 8 Coastal ecosystems and landscapes	
The natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved	Common Indicator 16: Length of coastline subject to physical disturbance due to the influence of human-made structures
	Candidate Indicator 25: Land use change
EO9 Pollution	
Contaminants cause no significant impact on coastal and marine ecosystems and human health	Common Indicator 17: Concentration of key harmful contaminants measured in the relevant matrix (related to biota, sediment, seawater)
	Common Indicator 18: Level of pollution effects of key contaminants where a cause-and-effect relationship has been established
	Common Indicator 19: Occurrence, origin (where possible), extent of acute pollution events (e.g., slicks from oil, oil products and hazardous substances), and their impact on biota affected by this pollution
	Common Indicator 20: Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood
	Common Indicator 21: Percentage of intestinal enterococci concentration measurements within established standards
EO10 Marine Litter	
Marine and coastal litter do not adversely affect coastal and marine environment	Common Indicator 22: Trends in the amount of litter washed ashore and/or deposited on coastlines
	Common Indicator 23: Trends in the amount of litter in the water column including microplastics and on the seafloor
	Candidate Indicator 24: Trends in the amount of litter ingested by or entangling marine organisms focusing on selected mammals, marine birds, and marine turtles
EO11 Energy including underwater noise	
Noise from human activities cause no significant impact on marine and coastal ecosystems	Candidate Indicator 26: Proportion of days and geographical distribution where loud, low, and mid-frequency impulsive sounds exceed levels that are likely to entail significant impact on marine animals
	Candidate Indicator 27: Levels of continuous low frequency sounds with the use of models as appropriate

8. The ultimate objective of the implementation of the Ecosystem Approach is to achieve and maintain Good Environmental Status (GES) of the Mediterranean Sea and coasts. A major component of the ecosystem approach is monitoring and assessment of the status of the marine and coastal environment. To this end, the Contracting Parties adopted the Integrated Monitoring and Assessment Programme (IMAP) whose objective is to perform regional assessments on the status of the Mediterranean Sea and coast. The IMAP sets out all the required elements to cover in an integrated manner, monitoring and assessment of biodiversity and fisheries, pollution and marine litter, and coast and hydrography. Accordingly, the Contracting Parties have established IMAP-based national monitoring programmes. The core of IMAP is the 23 regionally agreed common indicators and four candidate indicators, for which scientific knowledge and information is being developed to enable regional monitoring and assessment (Table 1). The monitoring in relation to each common indicator carried out at the national level by the Contracting Parties provides data and information enabling assessment at regional level, whether the GES related to the specific EO is met or not. Based on the assessments for each EO, the integrated assessment takes place on the state of the Mediterranean Sea and Coast and reflected in Quality Status Reports issued on a regular basis (Med QSRs).

9. In developing and implementing the steps of the Ecosystem Approach Roadmap in the Mediterranean, a special effort was made to ensure synergy and coherence where appropriate with the Marine Strategy Framework Directive (MSFD) adopted within the framework of the European Union (EU) with the objective to achieve a Good Environmental Status (GES).

Other relevant global and regional assessment processes

The UN Secretary-General’s annual report on the Sustainable Development Goals

10. At the global level, a reporting process started in 2016 to regularly provide an accurate evaluation of where the world stands in relation to the achievements of the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development adopted by world leaders at the UN Summit of September 2015. From 2016 to 2022 seven annual reports have been issued about the global and regional progress towards the 17 SDGs with in-depth analyses of selected indicators for each Goal. SDG custodian agencies contribute to the process by the development of methodologies to measure indicators and collecting data from Member States.

World Ocean Assessments

11. The Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including Socioeconomic Aspects is a global mechanism established in accordance with the recommendation of the United Nations World Summit on Sustainable Development of 2002 held in Johannesburg (South Africa). It aims at strengthening the regular scientific assessment of the state of the marine environment in order to enhance the scientific basis for policymaking.

12. The first cycle of the Regular Process (2010 to 2014) issued its report in 2016 and the second cycle covering five years from 2016 to 2020 led to the Second World Ocean Assessment (WOA II) published in 2021.

The Global Environment Outlook

13. The Global Environment Outlook (GEO) is an independent assessment of the state of the environment conducted by UNEP through a consultative and participatory process. UN Environment has produced six GEO reports. The process for the elaboration of the seventh report (GEO-7) started in 2022 and is expected be finalised in 2026. The categories of the GEO report are in line with the IMAP Ecological Objectives.

Mediterranean Strategy for Sustainable Development Dashboard (MSSD)

14. Whereas the IMAP indicators assess the state of the Mediterranean, the MSSD assesses the pressures and drivers.

15. In the framework of the monitoring of the implementation of the MSSD, indicator factsheets (Dashboard of the MSSD, Decision IG.24/3) were developed and regularly updated to inform about the progress made by the Mediterranean countries towards Sustainable Development. The Contracting Parties established the Simplified Peer Review Mechanism (SIMPEER) to facilitate the transposition, implementation and monitoring of the MSSD and SDGs at the regional and national level. They also mandated Plan Bleu in 2017 to launch a new foresight study on the environment and development in the Mediterranean by 2050. It is an ambitious foresight exercise designed as an original science-policy interface, aiming at mobilizing decision makers and stakeholders from the North and South of the Mediterranean, going beyond geographical and institutional borders. Its goal is to confront several possible visions of the Mediterranean future by 2050 (with an intermediate step at 2030) and co-construct solid and grounded transition paths towards common goals.

The EU Marine Strategy Framework Directive (MSFD)

16. The Marine Strategy Framework Directive (MSFD) was adopted in 2008 as a legal instrument of the European Union aiming to protect more effectively the marine environment across Europe and to protect the resource base upon which marine-related economic and social activities depend. In 2010 with the MSFD framework a Decision on GES was achieved, which was further revised in 2017 (Commission Decision (EU) 2017/848). Moreover, the MSFD at large is currently undergoing through a review process in consultation with the EU Member States.

17. MSFD requests EU Member States to take the necessary measures to achieve and/or maintain a Good Environmental Status (GES) of the marine environment. GES, as targeted by the MSFD, corresponds to the proper functioning of ecosystems (at the biological, physical, chemical and health levels) allowing the sustainable use of the marine environment.

18. A Common Implementation Strategy has been adopted within the MSFD framework, calling each EU Member State to prepare and implement a marine strategy for its marine waters, on a 6-year cycle, and currently undergo its second implementation cycle (2018-2023).

19. The Directive lists four European marine regions – the Baltic Sea, the North-east Atlantic Ocean, the Mediterranean Sea and the Black Sea. Cooperation between the EU Member States with neighbouring countries, is provided through the respective Regional Seas Action Plans and Conventions. Close and effective collaboration is in place to ensure harmonisation between the implementation of the MSFD, and the activities related to GES achievement undertaken within the framework of UNEP/MAP-Barcelona Convention, including through the mutual participation to the respective Technical Groups (TGs) and Ecosystem Approach Correspondence Groups (CORMONs).

20. The European Environment Agency (EEA) and the United Nations Environment Programme/Mediterranean Action Plan (UNEP/MAP) collaborated in the elaboration of the Horizon 2020 indicator-based technical report. The first regional assessment “Horizon 2020 Mediterranean report — Toward shared environmental information systems” was published in 2014 and the second. The second Horizon 2020 indicator-based technical report was jointly issued in 2021 by EEA and UNEP/MAP.

Approach and methodology for the preparation of the Mediterranean 2023 QSR

21. The first ever Quality Status Report for the Mediterranean (2017 Med QSR) built on the structure, objectives and available data collected under the IMAP (presented chapter 0.2). It provided an overview of the status of marine and coastal ecosystems in the Mediterranean, while also identifying knowledge gaps to be addressed. The 2017 Med QSR thus provided an important baseline for future assessments of the status of the Mediterranean Sea and Coast to be conducted based on further regular reporting of IMAP data by Contracting Parties.

22. The 2023 Med QSR Roadmap[2] focused on the implementation of identified priority activities required for the successful delivery of the 2023 Med QSR. This included support to the implementation of IMAP-based national monitoring programmes; harmonisation and standardisation of monitoring and assessment methods through agreement on scales of monitoring, assessment and reporting and on methodological tools and assessment criteria for integrated assessment of good environmental status (GES); full operationalisation of the IMAP Info System[3]; strengthening of regional partnerships for data sharing; and effective regional cooperation with the Contracting Parties to the Barcelona Convention.

23. Draft sections of the 2023 Med QSR were presented and reviewed by the relevant meetings of the Ecosystem Approach Correspondence Groups on Monitoring (Biodiversity & Fisheries, Pollution, Marine Litter and Coast & Hydrography), the Ecosystem Approach Coordination Group and the meetings of the respective MAP Components Focal Points (MED POL, PAP/RAC, REMPEC and SPA/RAC), and were revised accordingly.

Data:

24. Since the 2017 Med QSR Contracting Parties have significantly increased their submission of national data to the IMAP Info System. The IMAP Info System has been developed by INFO/RAC as a platform to facilitate access to knowledge for managers and decision-makers as well as stakeholders and the general public, in close consultation with UN Environment/MAP Components. The IMAP Info System is able to receive and process data according to the Data Standards and Data Dictionaries that set the basic information on data reporting within IMAP.

25. The assessment approach followed for the 2023 Med QSR was to use all available data in the IMAP Info System for the IMAP Common and Candidate Indicators and to complement and address data gaps with inputs from numerous diverse sources where appropriate. Each Ecological Objective assessment in Chapter 2 provides details of the sources of data and information used, the assessments, reports and publications provided by the Contracting Parties and other scientific partners. This includes information related to national reports on the implementation of the Barcelona Convention and its Protocols, implementation of the National Action Plans (NAPs), ICZM demonstration projects, as well as the results of regionally and nationally driven implementation of relevant policies, programmes and projects.

Assessment Methods:

26. The main assessments in Chapter 2 are provided in chapters per Cluster: Pollution & Marine Litter; Biodiversity & Fisheries; and Coast & Hydrography. These are based on assessments of Common Indicators (CIs) and some Candidate Common Indicators (CCIs) within Ecological Objectives (EO) (Table 1). Where feasible and where data permit, indicators have been integrated

[2] The 2023 Med QSR Roadmap and Needs Assessment (Decision IG.24/4)
[3] http://www.info-rac.org/en/infomap-system/imap-pilot-platform

within EOs and across EOs. The detailed methodologies for assessing each CI are described in the relevant Cluster.

27. The assessments provided under Chapter 2 present the status of implementation of the appropriate assessment methods; identify the available information necessary for assessing the status of marine and coastal ecosystems where possible; and identify the trends as appropriate. They also describe the knowledge gaps and define key directions to overcome them for future assessments.

Drivers, Pressures, State, Impact and Response (DPSIR):

28. The 2023 Med QSR is a step towards the analytical model of Drivers, Pressures, State, Impact, Response (DPSIR) in the marine environment. A DPSIR framework uses indicators of environmental quality to inform the decisions of policymakers of the likely impact of their choices. The framework is based on a causal-chain starting with drivers (e.g., economic sectors, human activities) and pressures (e.g., emissions, waste). These cause the current state of the environment which can be physical, chemical and biological, that result in impacts on the environment, ecosystems and ultimately human health. The policy responses could for example be to adopt new measure or set targets. DPSIR in the marine environment can be challenging because environmental changes are usually the result of multiple and cumulative causes and there is a natural lag-time in environmental responses to measures.

Science Policy Interface:

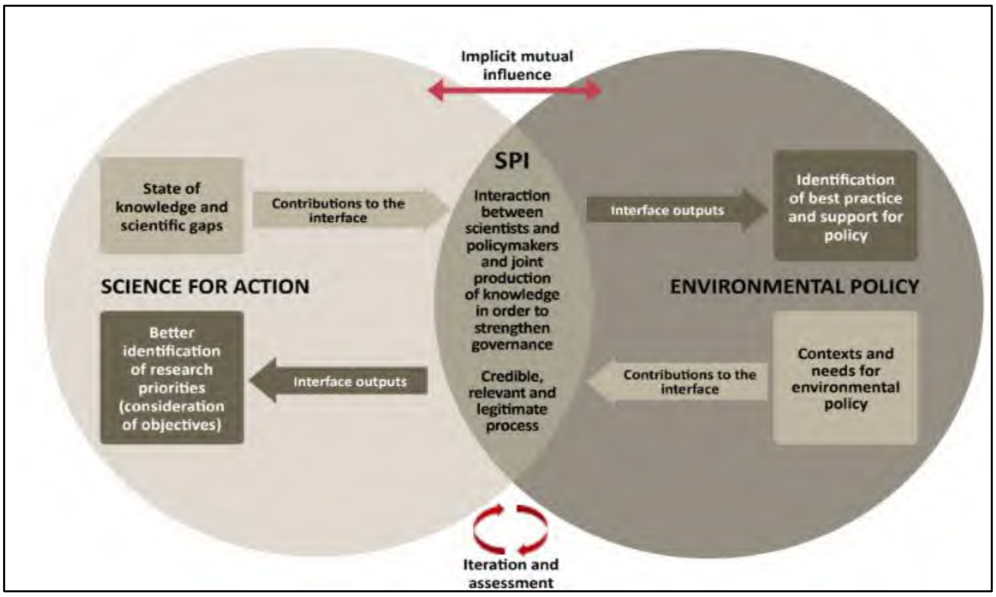
29. A prerequisite for the successful design of IMAPs to monitor the implementation of the EcAp for the management of human activities that may affect the Mediterranean marine and coastal environment, is bridging the existing gaps between the scientific and policy-making spheres by promoting a stronger science-policy interface (SPI).

30. Strengthening SPI ensures that:

(i.) Outcomes of scientific projects resulting in data collection/harvesting are reflected in the design and implementation of national and regional IMAPs to develop evidence-based environmental policies;

(ii.) The policy process supports the articulation of policy challenges and defines priorities and needs where monitoring and scientific input is necessary.

31. Through this process, policy-making and scientific communities are made aware of mutual needs and challenges to develop efficient sub-regional and regional monitoring policies.



Source: Plan Bleu, 2018

1. The Mediterranean Sea

Environmental characteristics

The Mediterranean marine and coastal environment

32. The Mediterranean is a semi-enclosed sea located between Africa, Asia and Europe and is bordered by twenty-one countries. It is connected to the Atlantic through the Strait of Gibraltar, to the Black Sea through the Strait of Dardanelles, and to the Red Sea through Suez Canal.

33. Although representing only 0.82% of the surface area of all oceans, with a total surface area of about 2.9 million square kilometres, the Mediterranean is the largest enclosed sea on Earth. According to the Barcelona Convention, the Mediterranean Sea is “bounded to the West by the meridian passing through Cape Spartel lighthouse, at the entrance of the Straits of Gibraltar, and to the East by the southern limits of the Straits of the Dardanelles between Mehmetcik and Kumkale lighthouses”.

34. The Western Basin of the Mediterranean Sea has a narrow and fragmented continental shelf and a maximum depth of 2850 m, while the Eastern Basin is characterized by a relatively wide continental shelf, and it includes the deepest part of the Mediterranean (5267 m).

35. Apart from the coastal plains along the eastern Mediterranean coasts of Egypt, Libya and Tunisia, and the deltaic zones of large rivers (e.g., Ebro, Rhone, Po and Nile), the geomorphology of the Mediterranean coasts is characterised by an irregular, deeply indented coastline, especially in the north, and the presence of mountain ranges: the Atlas, the Rif, the Baetic Cordillera, the Iberian Cordillera, the Pyrenees, the Alps, the Dinaric Alps, the Hellenides, the Balkan, and the Taurus.

36. The most striking feature of the underwater geomorphology of the Mediterranean Sea is the presence of abrupt submarine canyons linking the coastal areas to the deep sea. They facilitate exchanges between coastal waters and deep waters and form essential habitats for several species by providing a place of refuge, nursery and export to the continental shelf for many species (fish larvae, decapods, cetaceans, etc.).

37. The presence of numerous islands is another striking characteristic of the Mediterranean. According to some reports there are about ten thousand islands in the Mediterranean, most of them are in the Aegean Sea. The largest islands are Sicily, Sardinia, Corsica, Cyprus, and Crete, and the major island groups include the Balearics off the coast of Spain and the Ionian, Cyclades, and Dodecanese islands off Greece.

Sea water masses and circulation:

38. The average annual sea surface temperature in the Mediterranean show strong gradients from west to east and from north to south, as well as a strong seasonal variation between 10 and 28°C, reaching 30°C in summer. This sea is considered a warm temperate sea. It is characterized by high salinities, temperatures and densities. Its deep waters have a constant temperature around 13°C with an average salinity of 38‰. The Mediterranean water column is made of a surface layer, an intermediate layer and a deep layer that sinks to the bottom. The evaporation water losses are partially compensated by the rivers that flow into the Mediterranean and a surface current from the Black Sea through the Bosporus, the Sea of Marmara, and the Dardanelles. The main compensation of evaporation losses is provided by a continuous inflow of surface water from the Atlantic Ocean through the Strait of Gibraltar. The current it generates is the main driver of the water circulation in the Mediterranean. It flows eastward along the southern coasts of the western basin, then across the Sicily Strait and continues along the southern coasts of the eastern basin.

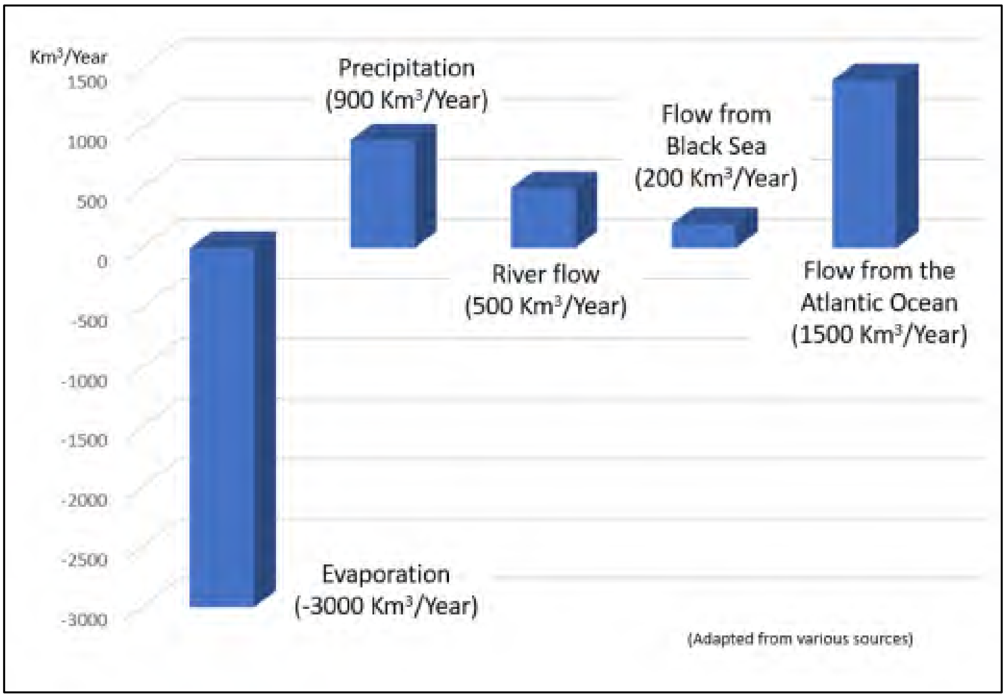


Figure 1: Annual hydrological balance of the Mediterranean Sea

39. With a low amplitude of semi-diurnal tides (30-40 cm), except for the northern Adriatic and the Gulf of Gabes where it can reach up to 150 and 180 cm, respectively, the Mediterranean Sea is considered a medium microtidal sea by global ocean standards.

Trophic level:

40. In terms of nutrients, the Mediterranean is among the most oligotrophic oceanic systems. The most eutrophic waters are located on the north shore in the western basin and Adriatic at the mouth of the large rivers Rhone, Ebro and Po. However, riverine nutrient inputs are relatively low, as most river systems discharging in the Mediterranean Sea are small. The main source of nutrients in the Mediterranean lies in the inflowing Atlantic surface waters at the level of the Gibraltar Strait. As the waters move eastwards from the Gibraltar Strait, they become depleted in nutrients. By the time they reach the Egyptian coasts, their nutrient signature has almost disappeared. Additionally, the Nile River nutrient signature has disappeared due to the 1960s Nile Dam construction. All this contributes towards making the Levantine Basin (at the eastern part of the Mediterranean Sea) one of the most oligotrophic areas in the world ocean. The outflow of Black Sea surface waters constitutes another source of nutrients to the Mediterranean, but its influence is limited to the north Aegean zone.

Biodiversity:

41. Home to 17,000 species of fauna and flora representing respectively 7.5% and 18% of the world's marine flora and fauna, the Mediterranean Sea is a hotspot of biodiversity. The evolution of the Mediterranean marine fauna and flora over millions of years in a unique mixture of temperate and subtropical species gives this almost closed sea the second place in the world in terms of endemic species richness with more than a quarter of its species found nowhere else on Earth.

42. The species diversity of the Mediterranean, although unevenly distributed between the eastern and western basins, is higher than in most other regions of the world, due to the geological history of this sea, its close communication with the Atlantic and its position at the junction of three continents Europe, Asia and Africa which make it a melting pot of biodiversity.

43. The uniqueness of the Mediterranean biotope comes from a combination of morphological, chemical and biotic characteristics reflected by the presence of certain ecosystem building species and assemblages. The meadows formed by *Posidonia oceanica* and the bioconcretions of the coralligenous assemblages are among the most important marine ecosystems of the Mediterranean Sea. They provide a wide range of ecosystem services and sustain many human activities such as fisheries and tourism. They are, however, particularly sensitive and vulnerable to coastal urbanization, pollution, turbidity, anchorages, trawling, etc.

44. The shallow coastal waters are home to key species and sensitive ecosystems such as seagrass beds and coralligenous assemblages, whilst the deep waters host a unique and fragile fauna. Many of these species are rare and/or threatened and are globally or regionally classified by IUCN as “endangered” or “critically endangered”, such as the monk seal *Monachus monachus*, the Mediterranean shellfish *Pinna nobilis* and cartilaginous fish species (sharks and rays). Many other species have strongly regressed during the 20th century.

45. Non-indigenous and invasive species (NIS) are increasingly present in the Mediterranean Sea. As of 2020, more than 1,199 non-indigenous species have been reported in the Mediterranean Sea, 513 of which are considered as established. The highest number of established alien species has been reported in the eastern Mediterranean, whereas the lowest number was recorded in the Adriatic Sea. Of those established species, 107 have been flagged as invasive.

46. The NIS in the Mediterranean Sea are linked to four main pathways of introduction: the corridors, shipping (ballast waters and hull fouling), aquaculture, and aquarium trade. Corridors are the most important pathway of introduction (33.7%) followed by shipping (29%) and aquaculture (7.1%).

47. The vast majority of the marine NIS recorded in the Mediterranean have their native distribution in the Western and Central Indo-Pacific and Red Sea, being mostly associated with introductions into the Mediterranean Sea through corridors.

48. In 2021, the number of Marine and Coastal Protected Areas (MCPAs) recorded in the MAPAMED (**Error! Reference source not found.**) database reached 1,126 sites covering 209,303 km², including only 0.06% of strictly protected areas. There are no other effective area-based conservation measures (OECMs) reported for the Mediterranean to date; however, combining areas that could be potential OECMs (i.e., 1 Particularly Sensitive Sea Area and 8 Fisheries Restricted Areas) the total MCPA and potential OECM coverage currently stands at 9.3% of the Mediterranean Sea. As shown in **Error! Reference source not found.**, there is a large disparity in MCPA coverage between countries, with the majority of MCPAs occurring in the western Mediterranean Sea and 90.05% occurring in in the northern part of the Mediterranean. In addition to geographical representation, there is also uneven distribution of MPAs according to sea depth, with less than 4% of depths greater than 1,000 m covered by MPAs. As the region now faces new targets, not only is coverage expected to increase, but it is essential that coverage is more equitably represented across Contracting Parties and the different ecosystems.

Climate change:

49. The Mediterranean region climate is characterized by mild winters and hot and dry summers. From the West, the Atlantic Ocean regimes have a great intra-seasonal and interannual variability influences in the Mediterranean reaching mainly the northeast part of the Mediterranean land and sea, whilst the Eastern and Southern climatic regimes provide the characteristics of the southern Mediterranean areas.

50. Climate change is one of the most critical challenges that the Mediterranean region is facing. In its Sixth Assessment Report the IPCC concluded that “during the 21st century, climate change is projected to intensify throughout the region. Air and sea temperature and their extremes (notably heat waves) are likely to continue to increase more than the global average (high confidence)”. The report

predicted (i) a decrease in precipitation in most areas by 4–22%, depending on the emission scenario, (ii) a further rise in the Mediterranean Sea level during the coming decades and centuries, likely reaching 0.15 to 0.6 m in 2050 and 0.6 to 1.1 m in 2100 (relative to 1995–2014) and the process is irreversible at the scale of centuries to millennia; (iii) coastal flood risks will increase in low-lying areas along 37% of the Mediterranean coastline with an increase in the number of people exposed to sea level rise, especially in the southern and eastern Mediterranean region, and may reach up to 130% compared to present in 2100; (iv) ocean warming and acidification will impact marine ecosystems, with however uncertain consequences on fisheries.

51. For the marine environment, the available data indicates that since the 1980's, documented impacts on marine Mediterranean species and habitats were attributed to climate change. These included frequent and drastic mortalities of sessile benthic species of the infralittoral and circalittoral communities. For the deeper Mediterranean ecosystems, recent scientific articles reported that in the 1990's, Climate change caused an accumulation of organic matter on the deep-sea floor and altered the carbon and nitrogen cycles.

52. By affecting all trophic levels, the Climate Change may alter the distribution of some species as a response to changes in the availability of their preys. Indications were reported about shifts in the distribution and density of cetacean species in relation to variations of sea surface temperature (SST). Furthermore, the rise in seawater temperature has the potential to favour pathogen development and transmission. It is also an accelerating factor for the introduction and spread of non-indigenous species. The thermal stress it generates on the native species make them weaker competitors which favours the establishment and growth of non-indigenous species populations in their habitats.

53. The consequences of climate change in the Mediterranean are especially manifested through hydrographic alterations of the Mediterranean Sea, which is explained in detail in the last Copernicus Ocean State Report – 6th issue (2022) and the MedECC 2020 First Mediterranean Assessment Report (MAR1, MedECC 2020).

54. Taking advantage of the freely available high-resolution satellite-derived sea surface temperature dataset from the Copernicus Marine Environment Monitoring Service, that covers the longest period, it could be observed that the surface temperatures in the Western Mediterranean Sea have been rising over the last 39 years with an average rate of 0.036°C yr-1 (Krauzig et al., 2022; according to Pisano et al. 2020).

55. Over the last three decades, **marine heatwaves** (MHWs) in the Mediterranean Sea have caused mass-mortality events in various marine species, and critical losses for seafood industries. Three different sea surface temperature products (Copernicus Marine datasets) show that the maximum intensity, frequency and duration of MHWs have all increased on average over the Mediterranean Sea since 1993.

56. Based on the satellite observations over the 1993–2019 period, the number of MHWs showed an inhomogeneous spatial distribution in the entire Mediterranean Sea, with a lower number of events per year in the south-eastern Mediterranean Sea and slightly more events in the western Mediterranean Sea, especially in the north-western area, as well as the Adriatic Sea (Dayan et al., 2022). On average, the number of MHWs substantially increased across the entire Mediterranean Sea by approximately 1 event per decade. The number of MHWs increased significantly in distinct ways in the four sub-regions (Figure 2). Satellite observations show that the number of MHWs has increased the most in the Adriatic Sea (1.61 ± 0.17 per decade), followed by the Aegean Sea (1.30 ± 0.23 per decade), the western Mediterranean Sea (1.13 ± 0.12 per decade) and finally the eastern Mediterranean Sea (1.01 ± 0.14 per decade). Satellite observations reveal that the duration of moderate and strong MHWs increased the most in the Adriatic Sea (23.01 days ± 2.67 and 3.22 ± 0.53 days per decade, respectively), while the duration of severe and extreme MHWs increased the most in the Aegean Sea (0.59 ± 0.18 days per decade) and the western Mediterranean Sea (0.53 ± 0.15 days per decade).

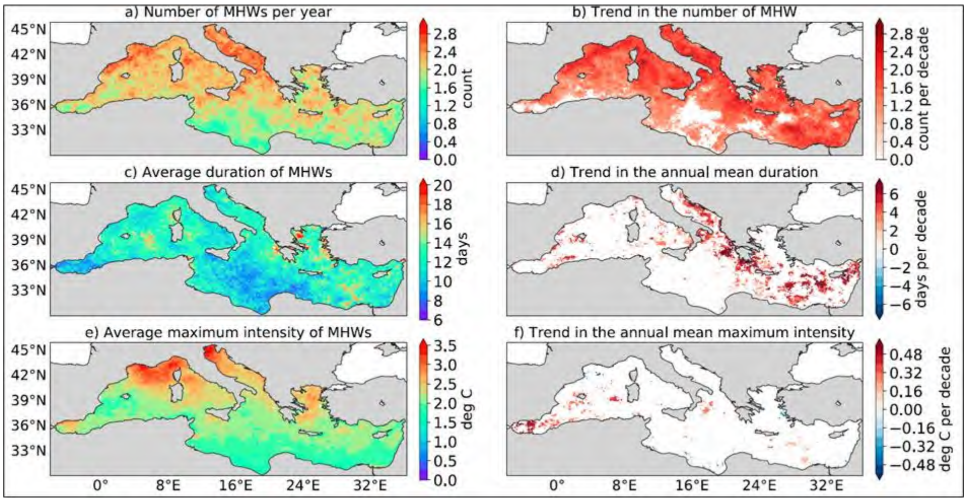


Figure 2: Spatial distribution of the marine heatwave (MHW) metrics from satellite-derived SST record over the period 1993–2019
Source: Dayan et al., 2022

57. In the future, MHWs may undermine many benefits and services that Mediterranean ecosystems normally provide, such as food, maintenance of biodiversity, and regulation of air quality (Dayan et al., 2022, Martín-López et al. 2016). MHWs are predicted to become more intense and more frequent under anthropogenic warming, embodying a growing threat to both marine ecosystems and human society (Dayan et al., 2022).

58. The annual 99th percentile of **significant wave height** (SWH) – a measure of extremes – has increased almost everywhere in the basin during the last 28 years at a maximum rate of 0.026 m yr^{-1}. The most significant upward trends were found in the south-eastern Levantine and eastern Alboran Seas (Figure 3: Long-term 99th percentile of SWH in meters (1993–2020)), followed by the Adriatic Sea and contained areas of the Tyrrhenian (Zacharioudaki et al., 2022).

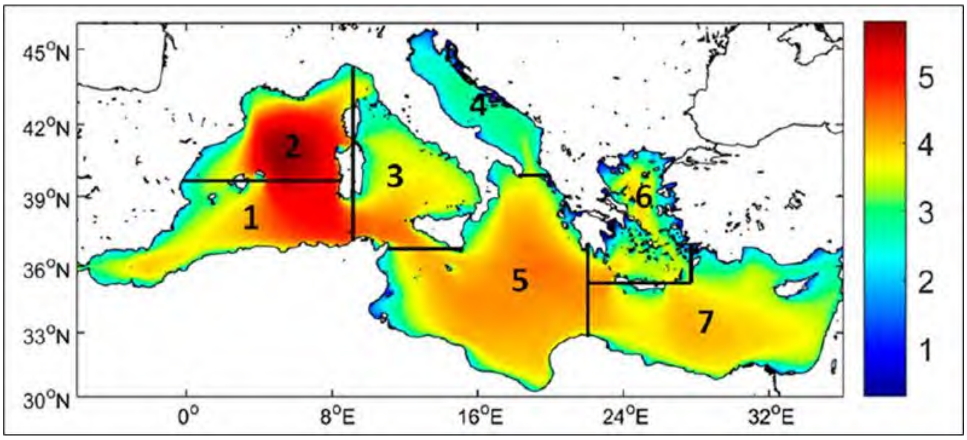


Figure 3: Long-term 99th percentile of SWH in meters (1993–2020)
Source: Zacharioudaki et al., 2022

59. The **water mass temperature and salinity** changes of the water outflowing from the Mediterranean Sea through the Strait of Gibraltar are 0.077°C $decade^{-1}$ and 0.063 Practical Salinity Scale (PSS)decade-1, respectively, compared to 2004 (MedECC, 2020).

60. Mediterranean Sea water **surface pH** has decreased by -0.08 units since the beginning of the 19th century, similar to the global ocean, with deep waters exhibiting a larger anthropogenic change in pH than the typical global ocean deep waters because ventilation is faster (MedECC, 2020). Nutrient enrichment causes eutrophication and may provoke harmful and toxic algal blooms, trends which will likely increase. Harmful algal blooms may cause negative impacts on ecosystems (red-tide, mucilage

production, anoxia) and may present serious economic threats for fisheries, aquaculture and tourism (MedECC, 2020).

61. As a result of increasingly pronounced hydrographic alterations, the marine habitats in the Mediterranean Sea are increasingly endangered, and some of them are threatened with complete extinction. It stands out in particular for the Adriatic Sea where current climatological and oceanographic research (Bonacci and Vrsalović, 2022; Mihanović et al., 2021; Pastor et al., 2018; Šepić et al., 2021; Vilibić et al., 2013; Vilibić et al., 2019; Vilibić et al., 2022) indicates that the Adriatic Sea is already experiencing significant changes in hydrographic alterations, and their intensity will become more and more pronounced, while the occurrence of climatological extremes could increase.

Socioeconomic characteristics

Unsustainable consumption and production patterns are the main drivers of environmental change in the Mediterranean

62. Current consumption and production patterns in the Mediterranean are characterised by high resource consumption combined with low recycling rates and unsatisfactory waste management. They are unsustainable overall and lead to considerable environmental degradation in the Mediterranean region, including land take and degradation, water scarcity, noise, water and air pollution, biodiversity loss and climate change (UNEP/MAP and Plan Bleu, 2020).

63. Achieving a high level of development is historically linked to environmental trade-offs. Figure 4 shows that none of the Mediterranean countries has both a high level of human development and an Ecological Footprint that lies within the planetary boundaries. The challenge ahead is to move all countries into the Sustainable Development Quadrant of the figure. Strategies to achieve this goal need to be differentiated: countries with a low Ecological Footprint and low Human Development Index (HDI) need to find solutions to increase HDI without increasing their Ecological Footprint. Countries with a high HDI and high Footprint need to find solutions to maintain high HDI but decrease their Footprint[4].

[4] Note that **Error! Reference source not found.** does not make indications about the state of the rule of law, respect of civil rights and equality, that should also be included in a measure of inclusive sustainable development and resilience.

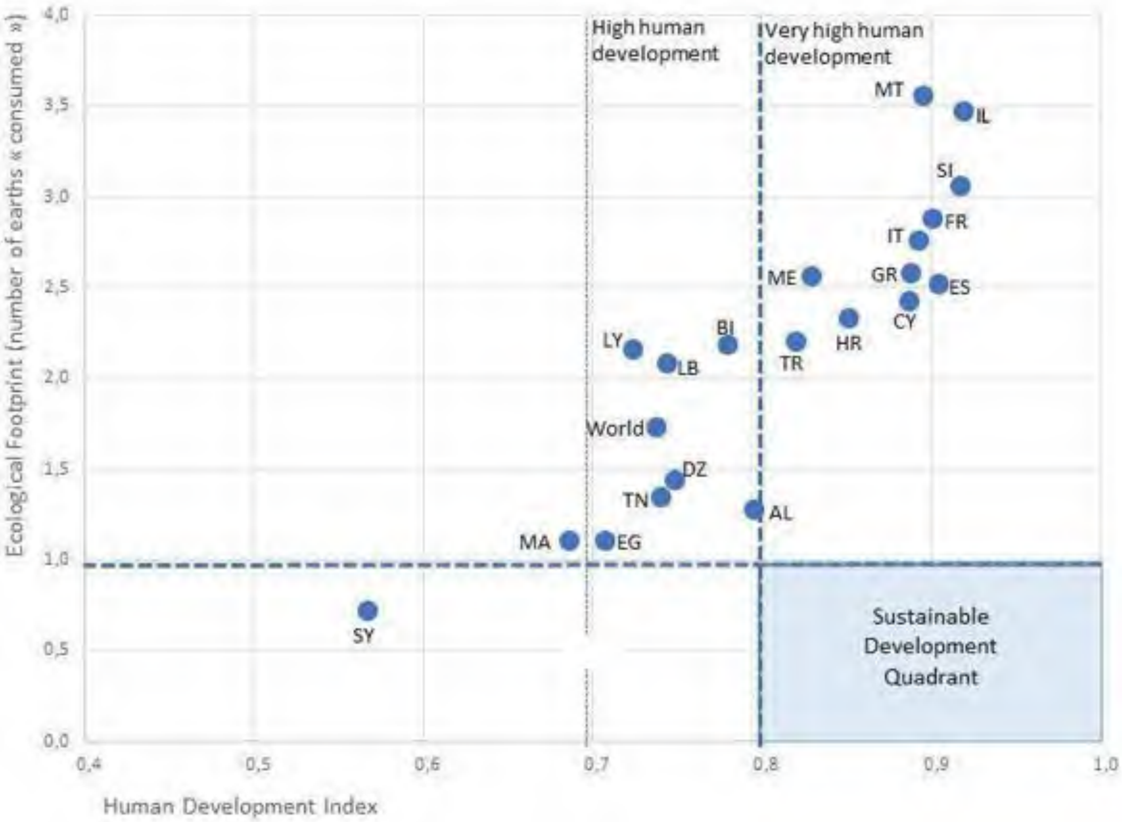


Figure 4: Ecological Footprint 2017 and Human Development Index (HDI) 2019 in Mediterranean countries
(Source: Graph by Plan Bleu, inspired by Wackernagel et al., 2017. Data from Global Footprint Network, 2021 and UNDP, Human Development Report 2020).

<u>Ecological Footprint</u>

64. The ecological deficit in the Mediterranean countries is twice as high as the global average, meaning that Mediterranean countries consume approximately 2.5 times more natural resources and ecological services than the region's ecosystems can provide (Akcali et al, 2022). The gap between the Mediterranean and the world averages remained substantial: an Ecological Footprint[5] of 3.4 global hectares per capita is found in the Mediterranean, as compared to 2.8 globally in 2018.

65. Ecological Footprint ranges from 1.1 to 5.5, with ecological deficits assessed for all Mediterranean countries. Countries with the highest ecological deficit are the two island states (Malta and Cyprus), but also Israel, Italy and Slovenia. Over the past 15 years, the Ecological Footprint has been mainly on the rise in southern and eastern Mediterranean countries (SEMC), with the exception of Syrian Arab Republic and Libya, as well as in Bosnia and Herzegovina and Montenegro, and declining in the EU Mediterranean countries, most notably in Cyprus, Spain, Italy and Greece, as well as in Israel. A slight decline was also seen in other EU countries, whereas stagnation was recorded in Egypt, Albania and Tunisia.

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[5] The Ecological Footprint measures how much biocapacity humans demand, and how much is available. It does not address all aspects of sustainability, nor all environmental concerns. Biocapacity is the area of productive land available to produce resources or absorb carbon dioxide waste, given current management practices. Global hectares (gha) is a unit of world-average bioproductive area, in which the Ecological Footprint and biocapacity are expressed.

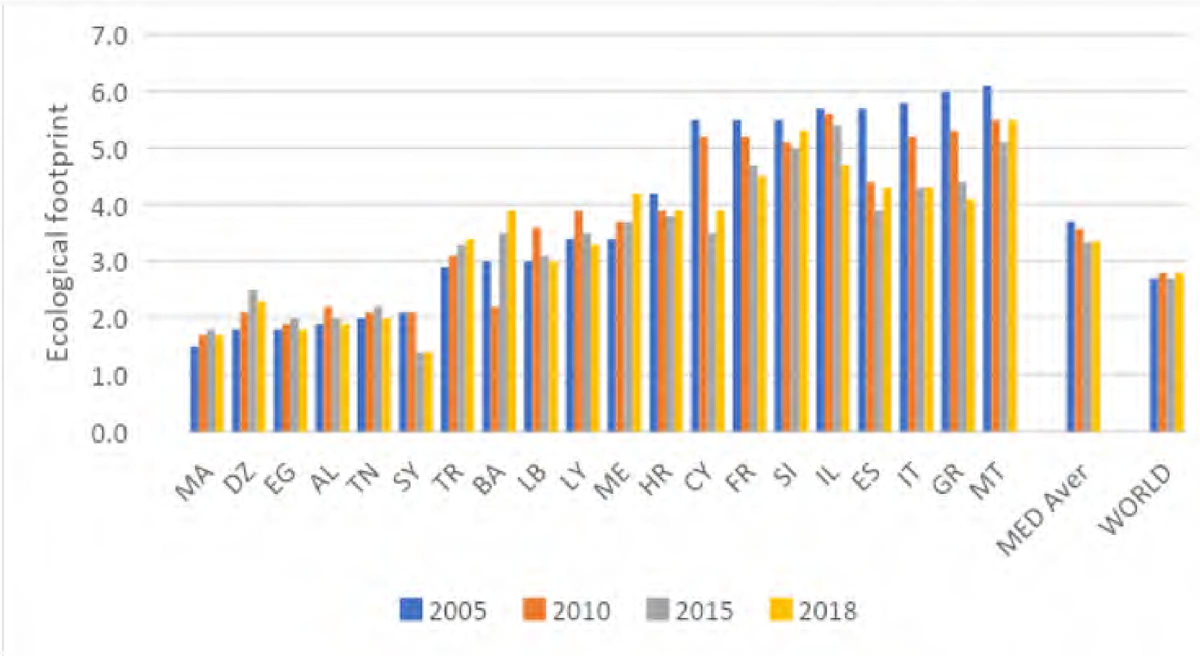

Figure 5: Ecological Footprint of the Mediterranean countries 2005 – 2018.
(Source: Global Footprint Network, York University, FoDaFo (2022). National Footprint and Biocapacity Accounts, 2022 Edition)

Human development and gender equality

66. Sixteen Mediterranean countries rank at or above the world average of human development as measured by the HDI (world average of 0.732). Countries with the highest HDI values include Israel, the EU Mediterranean and Western Balkan countries and Türkiye, followed by Algeria, Egypt and Tunisia. Libya, Lebanon, Morocco and the Syrian Arab Republic have HDIs lower than the world average, ranking between 104th and 150th.

Table 2: Human development and gender inequality indexes (GII) with related indicators, 2021. SDG: Sustainable Development Goals.

Countries	**Human Development Index (value)**	**HDI rank**	**Mean years of schooling (SDG 4.4)**	**Gender inequality index (value)**	**GII rank**	**Adolescent birth rate [a)] (SDG 3.7)**	**Share of parliament seats held by women (SDG 5.5)**
AL	0.796	67	11.3	0.144	39	14.5	35.7
DZ	0.745	91	8.1	0.499	126	11.7	7.5
BA	0.780	74	10.5	0.136	38	9.9	24.6
HR	0.858	40	12.2	0.093	26	8.6	31.1
CY	0.896	29	12.4	0.123	35	6.8	14.3
EG	0.731	97	9.6	0.443	109	44.8	22.9
FR	0.903	28	11.6	0.083	22	9.5	37.8
GR	0.887	33	11.4	0.119	32	8.5	21.7
IL	0.919	22	13.3	0.083	22	7.6	28.3
IT	0.895	30	10.7	0.056	13	4.0	35.3
LB	0.706	112	8.7	0.432	108	20.3	4.7
LY	0.718	104	7.6	0.259	61	6.9	16.0
MT	0.918	23	12.2	0.167	42	11.5	13.4
MC	--	--	- -	--	--	--	--
ME	0.832	49	12.2	0.119	32	10.4	24.7

Countries	**Human Development Index (value)**	**HDI rank**	**Mean years of schooling (SDG 4.4)**	**Gender inequality index (value)**	**GII rank**	**Adolescent birth rate [a)] (SDG 3.7)**	**Share of parliament seats held by women (SDG 5.5)**
MA	0.683	123	5.9	0.425	104	25.9	20.4
SL	0.918	23	12.8	0.071	18	4.5	21.5
ES	0.905	27	10.6	0.057	14	6.3	42.3
SY	0.577	150	5.1	0.477	119	38.7	11.2
TN	0.731	97	7.4	0.259	61	6.7	26.3
TR	0.838	48	8.6	0.272	65	16.9	17.3
WORLD	**0.732**	--	**8.6**	**0.465**	**--**	**42.5**	**25.9**

NOTES: a) Births per 1,000 women ages 15–19. (Source: https://hdr.undp.org/data-center/documentation-and-downloads (accessed November 2022)).

67. Women disproportionately suffer the impacts of climate change and other environmental hazards, especially in developing countries. To achieve inclusive sustainable development, it is vital to achieve gender equality. A gender gap persists in all Mediterranean countries. Gender inequality, as measured by the Gender inequality index (GII)[6], is highest in Algeria, Syrian Arab Republic, Egypt, Lebanon and Morocco. Mediterranean countries that get closest to gender equality, without however reaching equality, are Italy, Spain and Slovenia. A third or more seats in the national parliaments are held by women in just a few countries – Spain, France, Albania and Italy (SDG indicator 5.5). Among the SEMC, relatively high participation of women in the national assemblies is found in Israel, Tunisia, Egypt and Morocco. The share of female members of parliament is relatively low in Cyprus and Malta. The highest adolescent birth rates (SDG indicator 3.7) are found in Egypt.

<u>Population as a multiplier of pressures on the coastal and marine environment</u>

68. Population in the Mediterranean countries reached 531.7 million in 2021, increasing by close to 20 million people in only 3 years between 2018 and 2021 (UN DESA Population Division, 2022). An overall increase of 41.4% was recorded between 1990 and 2021, while decade-on-decade growth accelerated (from a rate of 12.5% between 1990 and 2000, to 13.5% between 2000 and 2010 and 17.2% for the last decade). Human-caused pressures on the coastal and marine environment are stemming from unsustainable production and consumption patterns, and a growing population multiplies these pressures, unless incremental population increase comes with sustainable lifestyles.

69. The most populated countries are Egypt (109.3 million in 2021) followed by Türkiye (84.8 million), France (64.5 million), Italy (59.2 million) and Spain (47.5 million). Montenegro, Malta and Monaco count less than a million inhabitants. Monaco is the most densely populated country with 24,622 inhabitants per square kilometer. Other densely populated countries are Malta, countries of the east Mediterranean coast (Lebanon and Israel), and Italy. Low population density (of 100 inhabitants per km^2 or less) is found in Spain, Morocco, Greece, Tunisia, Croatia, Bosnia and Herzegovina, Montenegro, Algeria (18 inhabitants/ km^2) and Libya (4 inhabitants/ km^2). These are national averages, and it must be noted that settlements tend to concentrate in the coastal zones of Mediterranean countries, where population density is thus generally higher than the national average. In this sense, population can be seen as a concentrator of human pressures on the coastal and marine environment.

[6] GII is a composite metric of gender inequality using three dimensions: reproductive health, empowerment and the labour market. A low GII value indicates low inequality between women and men, and vice-versa.

Table 3: Key demographic data, 2021.

Countries	Median age of population (years)	Population change prev. yr., (in 000)	Population density (inhab./ km^2)	Total population (in 000)	Popul. % change '21/'01	Total net-migration (in 000)	Life expectancy at birth (years)
AL	37.27	-13.71	104.19	2,854.71	-9.5	-10.61	76.46
DZ	27.80	731.25	18.55	44,177.97	41.6	-18.80	76.38
BA	41.82	-49.80	63.89	3,270.94	-22.0	-25.87	75.30
HR	43.73	-37.93	72.64	4,060.14	-9.9	-10.40	77.58
CY	37.59	5.78	134.65	1,244.19	29.0	2.00	81.20
EG	23.94	1,741.26	109.76	109,262.18	50.0	-32.37	70.22
FR	41.59	58.20	117.04	64,531.44	9.3	20.61	82.50
GR	44.74	-71.51	79.85	10,445.37	-5.7	-14.81	80.11
IL	29.04	141.35	411.22	8,900.06	42.7	16.86	82.26
IT	46.83	-241.86	200.15	59,240.33	3.9	28.02	82.85
LB	28.27	-77.39	546.69	5,592.63	27.4	-115.12	75.05
LY	26.27	78.84	4.02	6,735.28	27.7	-0.70	71.91
MT	39.01	11.25	1,672.22	526.75	31.0	10.41	83.78
MC	54.52	-0.25	24,621.48	36.69	13.1	0.21	85.95
ME	38.19	-0.69	45.46	627.86	-0.8	-0.10	76.34
MA	28.67	375.77	83.08	37,076.59	28.2	-46.24	74.04
SL	43.20	0.76	105.24	2,119.41	6.9	4.57	80.69
ES	43.88	178.55	94.53	47,486.94	15.9	275.02	83.01
SY	20.94	530.44	116.08	21,324.37	27.5	212.19	72.06
TN	31.74	91.50	78.90	12,262.95	22.7	-9.19	73.77
TR	30.93	632.46	110.15	84,775.40	30.3	-69.73	76.03
TOTAL MED				**531,685.56**	24.3		

Source: UN DESA, Population Division (2022); own calculations

70. Decreases in population (on a year-by-year basis) have been recorded for some time sequences or the entire period since 2000 in some of the Mediterranean countries. The downward population trend has been most consistent in Albania, Bosnia and Herzegovina (since 2002), Croatia (since 2005) and Montenegro (almost all years in the observed period), as well as in Greece (since 2005). Periodic population decreases during the last 20 years also characterise a few SEMC (Lebanon, Libya, Syrian Arab Republic) and can be correlated with periods of conflicts and crises[7]. Negative population growth was also seen in Italy (since 2014), Spain (in the period 2012 – 2015) and Monaco. In other Mediterranean countries, annual population changes during the past two decades were positive. With dominantly unsustainable lifestyles that are linked to negative environmental externalities (resource depletion, waste generation, etc.), fluctuations of population generally impact the weight of overall pressures on the coastal and marine environment, at varying levels depending on the per capita environmental footprint.

71. Cumulative population change rates 2001 – 2021 indicate population declined in Bosnia and Herzegovina (-22%), as well as in Croatia, Albania, Greece and Montenegro (by less than 10% and in case of Montenegro by less than 1%). Countries with the highest population growth (around 60% to

[7] E.g., Lebanon since 2015; Libya had a negative population balance of 0.74 million in 2011; Syrian Arab Republic in particular in the period 2012 – 2015.

40% respectively) were Egypt, Israel and Algeria; growth rates above the Mediterranean average (of 24.3%) were also recorded in Malta, Türkiye, Cyprus, Morocco, Libya, Syrian Arab Republic and Lebanon. Migration flows influence population numbers and move environmental pressures from one place to the other. In addition, human and natural disasters can cause spontaneous movement and displacement of large numbers of people. This may have significant impacts on the environment, such as deforestation and soil erosion, as well as depletion and pollution of water resources, impacting also the coastal and marine environment (UNHCR website, 2023).

Human activities interact with the marine environment

72. The relationship between maritime economic activities and the marine and coastal environment is characterised by impact and dependence. The maritime economy can foster the development of sustainable practices for livelihoods that depend on the sea and its resources. At the same time, if not properly managed, it can have environmental impacts that cause marine and coastal ecosystem degradation and hinder achievement of good environmental status (GES). In turn, degraded marine and coastal ecosystems provide fewer economic opportunities for those activities that depend on healthy ecosystems (fisheries, tourism, …). Other economic activities that heavily impact the marine environment can function independently from the state of the marine environment (maritime transport, offshore oil and gas, etc.).

73. In most Mediterranean countries, the regulation of maritime activities is still insufficient to make the maritime economy a sustainable blue economy, whether through legislation, monitoring or policing. This economic “openness” stands in contrast with the biological semi-closed character of the Mediterranean Sea (water renewal time of around 80 years). The fragmentation of policies, including within countries, and the persistence of insufficiently rigorous international standards, are hindering the implementation of regulation, monitoring and sanctioning measures, essential for the sustainable use of common resources.

74. A knowledge gap remains when it comes to measuring the sustainability of maritime economic activities and their individual contribution to the degradation of the environment. This chapter provides a qualitative analysis of this link, while further work on the monitoring and observation of the pressures caused by the maritime economy needs to be conducted, linking the Blue Economy with the Ecosystem Approach.

75. However, action to “close the tap” of impacts on the marine environment that stem from the maritime economy cannot wait for complete datasets on these impacts to be available. In application of the precautionary principle, a well-calibrated balance between the development of the maritime economy and increased protection and restoration of the Mediterranean environment is needed, through urgent and systemic regulatory action, in order to achieve a truly sustainable Blue Economy that is compatible with achieving GES in the Mediterranean.

Tourism

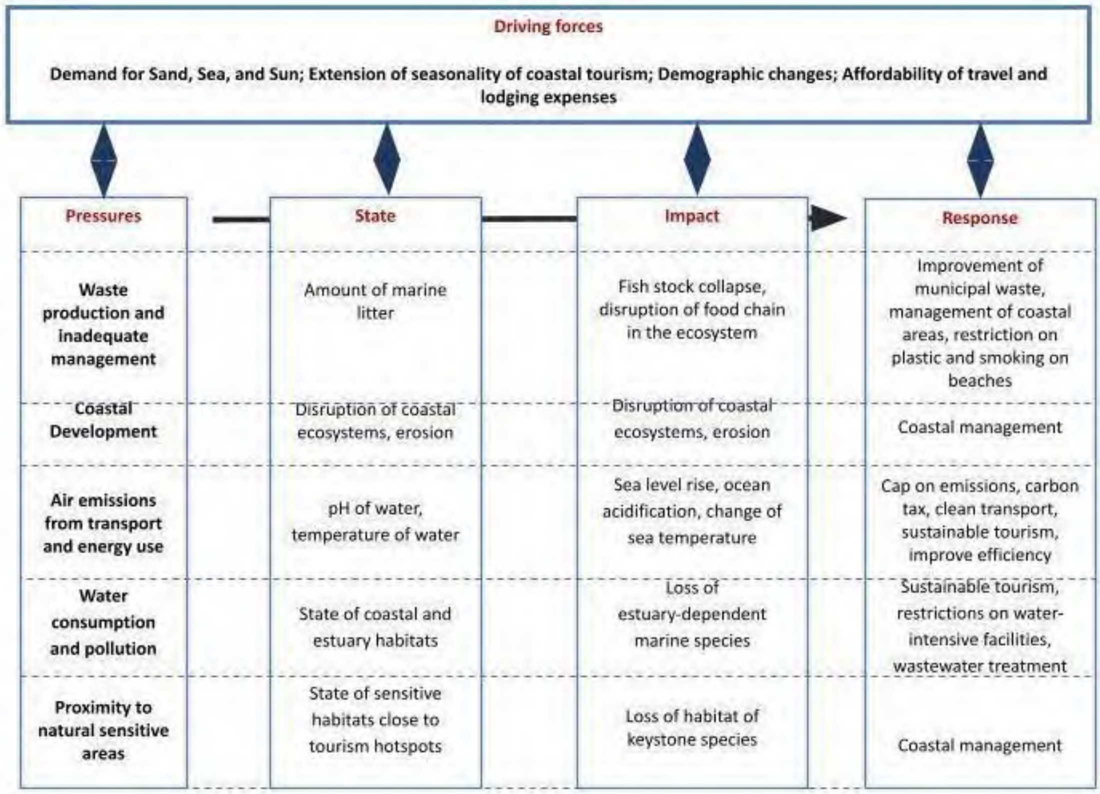

Figure 6: Pressures exerted by the tourism sector on the marine environment. (Source: UNEP/MAP and Plan Bleu, 2020).

76. Exceptional natural resources (including 46,000 km of coastline), cultural heritage, diversity of the region, its gastronomy and climate, coupled with favourable geographic location and good connectivity with the main source markets have all contributed to the Mediterranean becoming the world’s leading tourism destination (UN World Tourism Organisation, UNWTO, 2015; UNEP/ MAP and Plan Bleu, 2020). Mediterranean destinations developed a rich and diverse set of tourism products, services and experiences, completing the traditional sun and sea attractions with health, sports, nature and culture as well as cruise and business tourism.

77. Data on tourism specifically related to the Mediterranean coastal region is generally not available and data contained in this chapter refers to national data (all marine façades included for countries with multiple marine façades).

Tourism in the Mediterranean: the key facts

- Over the past 50 years (1970 – 2019), the number of international tourist arrivals (ITAs) increased by a factor of seven: from around 58 million in 1970 (161 in 1995, 246 in 2005) to 408 million in 2019
- During the past decade (2010 – 2019), a cumulative increase of ITAs to the Mediterranean countries was 43.2%
- In 2019, close to one third (27.8%) of the global ITAs were recorded in the Mediterranean
- Tourism was severely affected by COVID-19 pandemic: the number of ITAs decreased by more than two thirds in 2020; a moderate recovery was seen in 2021, with total number of ITAs reaching 45.5% of the 2019 level
- According to pre-COVID-19 projections, the total number of ITAs was to reach 500 million by 2030
- A strong growth in receipts from international tourism was recorded, with the total amount almost quadrupling between 1995 (USD 81 billion) and 2019 (USD 308 billion); the receipts plunged in 2020 (-64.3% compared to 2019 level)
- Economic impact of tourism is strong: contribution of tourism and travel to GDP has been estimated by WTTC at USD 943.4 billion, with 18.4 million direct and indirect jobs across the region in 2019; the COVID-19 crisis halved the GDP from tourism and travel in the Mediterranean, causing a loss of 3.1 million jobs
- Ranking within the top five Mediterranean destinations did not change much over time; Türkiye and Greece were the fastest growing; the cumulative share of the top five destinations in total Mediterranean ITAs has been gradually decreasing due to emergence and development of new destinations across the region

1995	**2005**	**2019**
(88% of the Med ITAs)	(82% of the Med ITAs)	(79% of the Med ITAs)
France (60.0 mill)	France (75.0 mill)	France (90.9 mill)
Spain (33.0 mill)	Spain (55.9 mill)	Spain (83.5 mill)
Italy (31.1 mill)	Italy (36.5 mill)	Italy (64.5 mill)
Greece (10.1 mill)	Türkiye (20.3 mill)	Türkiye (51.2 mill)
Türkiye (7.1 mill)	Greece (14.8 mill)	Greece (31.3 mill)

(Sources: Plan Bleu, 2016; UNWTO, 2022 and 2022b; WTTC, 2022)

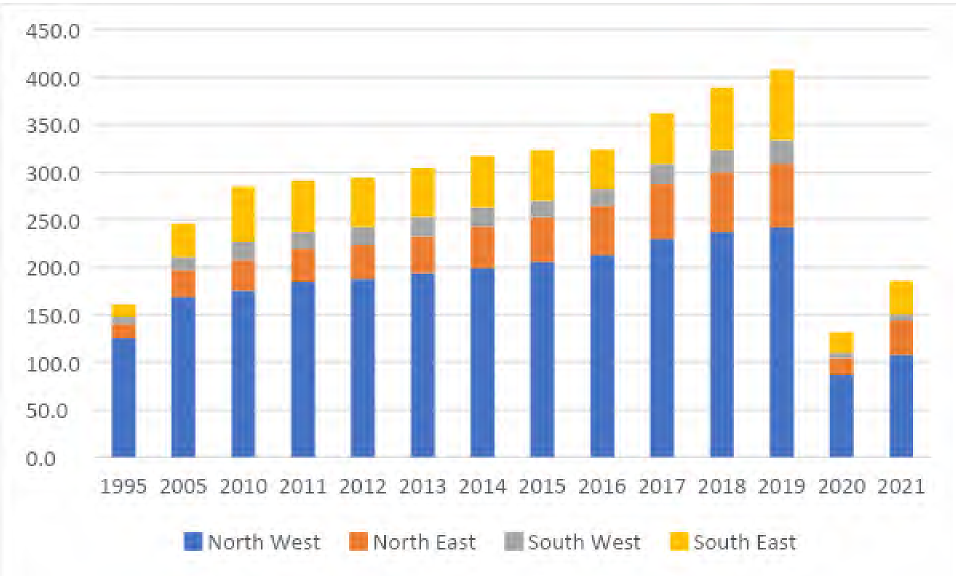

Figure 7: International Tourist Arrivals (ITAs) in the Mediterranean (in millions).
(Sources: Based on UNWTO 2022 and 2022b).

78. The overall number of ITAs in Mediterranean countries reached 408 million in 2019. During the past decade (2010 – 2019) alone, an average annual increase of 13.7 million ITAs (4.1% year-on-year) was recorded. While tourism in the established North West Mediterranean destinations (primarily France, Spain and Italy) remained predominant, their relative share in the total numbers of visits decreased by nearly 20 percentage points between 1995 and 2019. The share of fast-growing destinations from the South East and North East (in particular Türkiye, but also Albania, Croatia and Montenegro) in the overall number of tourists in the region has increased considerably, in particular during the past 15 years. The share of ITAs to North East Mediterranean countries, for example, increased from 11.4% in 2005 to 16.4% in 2019. Despite significant potential, the contribution of South West destinations to the overall Mediterranean ITAs remained modest (5 to 6%). In 2019, the Mediterranean earned close to USD 308 billion in international tourism receipts[8], which is approximately at the level of Egypt's GDP for the same year, or 1.5 times higher than the GDP of Greece.

Table 4: International Tourist Arrivals (ITAs) and receipts from tourism per capita.

Country code	**ITAs per capita**	**Receipts from tourism per capita (in USD)**
AL	2.07	805.8
DZ	0.06	2.3
BA	0.36	363.5
HR	4.28	2,902.6
CY	3.34	2,753.3
EG	0.13	129.5
FR	1.35	944.3
GR	2.92	1,902.7
IL	0.51	839.4
IT	1.08	830.4
LB	0.28	1,254.4
LY	no data	no data
MT	5.55	3,769.4
MC	10.01	no data
ME	4.02	1,929.2
MA	0.35	224.8
SI	2.25	1,532.3
ES	1.77	1,690.9
SY	0.14	no data
TN	0.80	179.6
TR	0.61	357.2
MED	***0.79***	***593.3***

Colour codes

≥ 10 ITAs p.c		
5 – 10		
2 – 5		
0.5 – 2		
≤ 0.5		

(Sources: Based on UNWTO 2022 and 2022b; World Bank, 2022).

[8] Spending by international visitors on goods and services in destinations.

79. The main pressures of the tourism sector on the marine environment are marine litter, coastal land take, habitat degradation, air emissions, water consumption and sewage generation, and proximity to natural sensitive areas (UNEP/ MAP and Plan Bleu, 2020). Fluctuations in numbers of tourist arrivals come with a direct impact on the environment due to resource consumption and generation of externalities that are caused at the individual level, and that add on to more general impacts caused by tourism infrastructure.

80. In recent years, the number of tourist arrivals in Mediterranean countries was highly variable due to several reasons: Armed conflicts in the region, security concerns as well as political instability along with deteriorating social and economic conditions, all resulted in tourism downturns and/ or serious disruptions in some of the SEMC in the period since 2010, affecting in particular Syrian Arab Republic (with 8.1 million ITAs in 2010 and only 2.4 million in 2019), Libya, Egypt and Tunisia[9]. Egypt experienced a rapid tourism growth in the past – from 2.9 million arrivals in 1995 to a record of 14 million in 2010. However, following the 2011 instability and related events, ITAs plummeted and remained below 10 million for several years, to start rising again in 2018 and 2019.

81. The COVID-19 pandemic brought the total number of international arrivals down to 131.4 million in 2020 (-67.8% compared to 2019) i.e., well below the 1995 level (of 161 million). Receipts also plummeted from USD 308 billion in 2019 to USD 110 billion in 2020 (- 64.3%), while losses were spread unevenly across the region: Monaco and France recorded the lowest decreases in ITAs (-50% and -54% respectively), while Cyprus was the most affected (-85%), followed by Montenegro (-84%), Bosnia and Herzegovina (-83.3%) and Israel (-82.6%). Signs of recovery were visible already in 2021, with the total number of ITAs reaching 45.5% of the 2019 level, representing an increase of 41.3% compared to 2020, whereas receipts increased by an even larger margin (56.7%). Mediterranean tourism recovered faster than the global average and regional ITAs made up as much as 41.6% of the world tourism in 2021, compared to 27.8% in the pre-pandemic 2019. According to the WTTC data[10], the impact of COVID-19 crisis on employment was less severe than the impact on on tourism GDP: following a loss of 3.1 million jobs across the region in 2020 (a decline of 17.1% compared to 2019), total employment in 2021 was 16.8 million (representing a decline of 8.8% in relation to 2019). Full recovery of global tourism to pre-pandemic levels is projected for 2024 (EIU, 2022).

82. According to available estimates, almost half (47.2%) of all ITAs to Mediterranean countries in 2017 were linked to coastal areas (UNEP/MAP and Plan Bleu, 2020). Shares of coastal tourism varied markedly between different groups of countries, reaching for example 85% in the North East Mediterranean countries while remaining below 40% in North West and South East; the estimated share of coastal tourism in the South West Mediterranean was around 62%. In 2019, coastal areas accounted for a very high share of the total nights spent in tourist accommodation in Malta (100%), Cyprus (97%), Greece (96%), Spain (96%), and Croatia (93%) (EU, 2022). Nights spent in coastal regions of EU countries in 2018 represented 42% of the total; at the same time, coastal regions had the highest tourism intensity[11] with 12.3 nights-spent per inhabitant (Batista e Silva et al., 2020).

83. While tourism had a strong positive economic impact across the region and has emerged as a pillar of many national economies in the Mediterranean, the benefits associated with tourism came at significant environmental and social costs. The negative impacts of tourism have been widely recognised and documented[12], and there is a growing set of recommendations, policies and projects aiming at the development of sustainable tourism in the Mediterranean. When ITAs decreased in

[9] During 1990's, similar effects of conflicts and instability were seen in some Balkan countries that have recovered meanwhile and became major tourist destinations.
[10] Refer to direct and indirect GDP/ jobs.
[11] Compared to other types of tourism such as mountains and nature, cities, urban mix, and rural.
[12] In e.g., Plan Bleu, 2016; UNEP/ MAP and Plan Bleu, 2020; Plan Bleu, 2022; Fosse et al., 2021.

recent years, pressures on the environment caused by tourism decreased as well, giving coastal and marine biodiversity “a break” and the possibility to recover in some places, in conjunction with decreasing pressures from other human activities. For example, some marine species occurrences increased and water quality improved in many places during the COVID-19 pandemic (Coll, 2020). But the dominant Mediterranean mass tourism model has picked up speed again and continues to concentrate in coastal areas. Unless this model is profoundly changed into a sustainable model, the coastal and marine environment is likely to continue to be adversely affected by tourism in the years to come.

Note: For Morocco share of tourism in GDP 7,1% in 2019 (Source: Moroccan Ministry of Tourism)

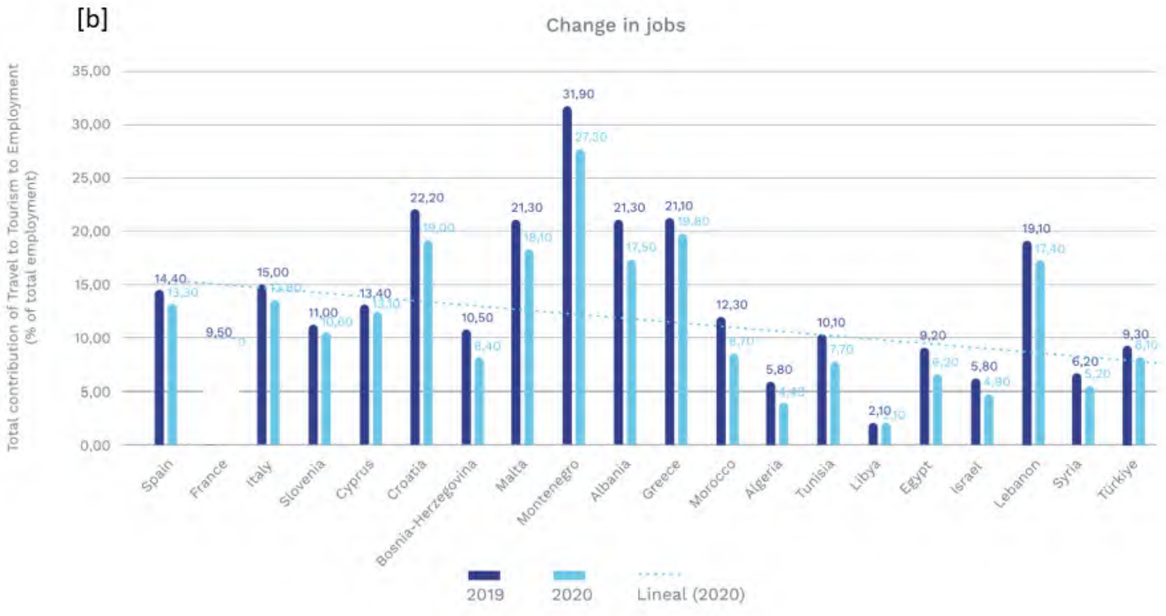

Figure 8: Change in tourism GDP(a) and jobs (b), 2019-2020.
(Source: Plan Bleu (2022). State of Play of Tourism in the Mediterranean, Interreg Med Sustainable Tourism Community project).

Fisheries and Aquaculture

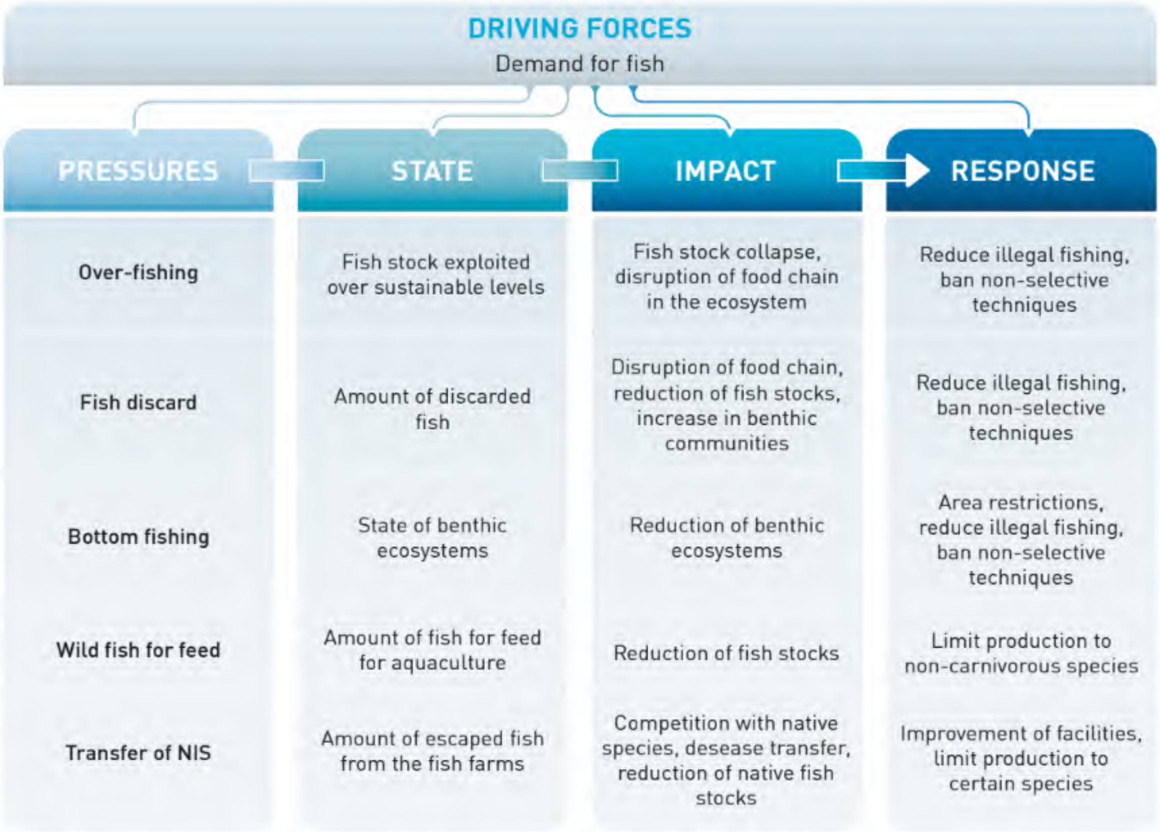

Figure 9: Pressures exerted by fisheries and aquaculture.
(Source: UNEP/MAP and Plan Bleu, 2020)

84. A variety of capture fishery and aquaculture techniques are employed across the Mediterranean at different scales, including industrial, semi-industrial and small-scale fisheries, as well as industrial and small-scale farming. Capture fisheries exploit a variety of benthic and pelagic fish stocks, molluscs and crustaceans. Aquaculture production includes extensive aquaculture in pond or lagoon areas and small family farms cultivating mussels, but also more intensive offshore finfish cage farms. Fishery and aquaculture represent a relatively small sector of the Mediterranean blue economy (both in terms of GVA – less than 5%, and job creation – less than 10%)[13], nevertheless with an important socioeconomic and cultural function in terms of food production, revenue, employment and preservation of traditional activities (UNEP/MAP and Plan Bleu, 2020).

[13] Union for the Mediterranean (UfM) 2017 report *Blue economy in the Mediterranean*, https://ufmsecretariat.org/wp-content/uploads/2017/12/UfMS_Blue-Economy_Report.pdf based on earlier Plan Bleu analyses (e.g., 2014 report *Economic and social analysis of the uses of the coastal and marine waters in the Mediterranean*, https://planbleu.org/sites/default/files/publications/esa_ven_en.pdf).

Fisheries[14]

85. According to the latest available data (as reported to the GFCM Secretariat and/ or estimated), a total of 76,280 fishing vessels were operating by 2019 in 20 Mediterranean countries[15], with a total capacity of around 758,000 gross tonnage (GT)[16]. These figures are likely to be underestimating the actual size of the fleet, given the lack of data in some countries, especially regarding small-scale vessels (FAO, 2020).

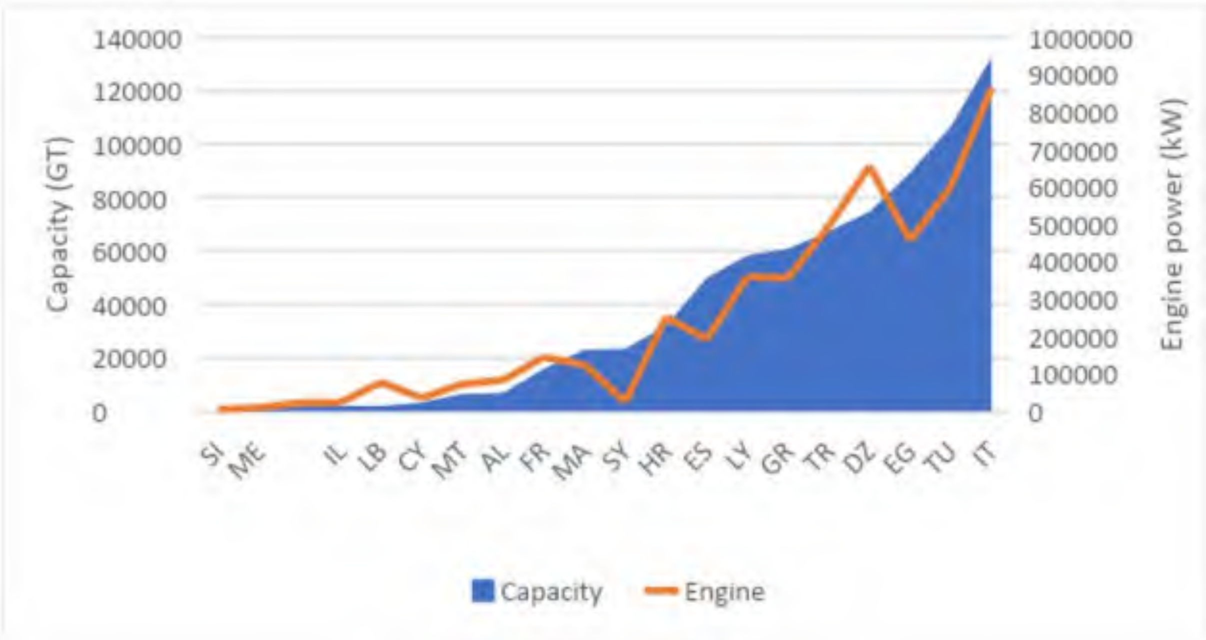

Figure 10: Capacity of the fishing fleet operating in the Mediterranean basin by country, 2019 (Source: FAO, 2020; own estimate)

86. In terms of capacity (expressed in gross tonnage (GT)), more than 62% of the fishing fleet is operated by five countries: Italy (17.5%), Tunisia (14.1%), Egypt (11.8%), Algeria (9.8%) and Türkiye (8.9%[17]). Greece's fishing fleet makes 16.8% of the total number of vessels, but only 8% of the total capacity, indicating that small-scale fisheries are prevalent. Besides Greece, small-scale fishing vessels account for 90% or more of the total fleet in Lebanon, Cyprus, Türkiye, Tunisia, Croatia and Morocco[18]. Four out of five fishing vessels in the Mediterranean are small-scale vessels[19]

[14] For capture fisheries, information on fishing fleet, landings, revenues and jobs is predominately based on the report on the State of Mediterranean and Black Sea Fisheries (FAO, 2020).
[15] Data for Türkiye refers to the number of vessels operating in the Mediterranean, whereas capacity of these vessels was estimated based on an assumption it mirrors the share (39.3%) of the total number of vessels reported for the Mediterranean and Black Seas. Bosnia and Herzegovina and Monaco informed the GFCM Secretariat they had no operating fishing fleet in the last reporting period.
[16] The overall number of vessels reported and/ or estimated (by FAO, 2020) for the Mediterranean and the Black Sea was 87,641 (903,270 GT).
[17] Taking only into account 6,026 vessels that operate in the Mediterranean. Türkiye's total fishing fleet operating in the Mediterranean and Black Seas was reported to include 15,352 vessels (with capacity of 171,785 and engine power of 1,261,241 kW).
[18] For Morocco: According to the Moroccan Department of marine fisheries, reference year 2021.
[19] Including small-scale vessels 0–12 m with engines using passive gear; polyvalent vessels 6–12 m; and small-scale vessels 0–12 m without engines using passive gear. Polyvalent vessels are all vessels using more than one gear type, with a combination of passive and active types of gear, none of which are used for more than 50 percent of the time at sea during the year.

which are the predominant fleet segment in all Mediterranean fishing sub-regions, in particular in the Eastern and Central Mediterranean. Another important fleet segment are trawlers and beam trawlers, accounting for 7.9% of the total, predominantly used in the Western Mediterranean and the Adriatic; purse seiners and pelagic trawlers make up 5.5% of the fleet.

87.

Table 5: Mediterranean fishing fleet by country and segment

Country code	**No of vessels**	**Share (%) of operating vessels by fleet segment**				
		Small-scale	**Trawlers, beam trawlers**	**Purse sein., pelagic trawl.**	**Other segments[20]**	**Unallocated**
AL	445	67.0	27.0	5.2	0.9	0.0
DZ	5,608	61.8	9.9	28.4	0.0	0.0
HR	6,211	91.2	5.5	2.7	0.5	0.0
CY	774	94.4	1.0	0.0	4.5	0.0
EG	3,945	44.6	24.0	5.3	26.1	0.0
FR	1,418*	88.9	6.0	1.1	3.9	0.0
GR	12,807	95.4	1.8	1.7	1.2	0.0
IL	336	79.8	5.7	3.0	11.6	0.0
IT	10,909	69.7	18.6	4.1	7.6	0.0
LB	2,084	95.0	0.0	4.4	0.7	0.0
LY	3,974	73.3	2.0	3.1	17.8	3.7
MT	682	77.6	2.9	0.6	18.9	0.0
ME	224	85.3	5.8	8.9	0.0	0.0
MA	3,496*	87.0*	4.3	7.0	1.7	0.0
SI	72	87.5	12.5	0.0	0.0	0.0
ES	2,056	51.2	28.0	10.7	10.1	0.0
SY	1,300	0.0	0.0	0.0	0.0	100.0
TU	13,300	92.7	3.6	3.4	0.3	0.0
TR	6,026	93.9	3.8	1.0	1.4	0.0
Med total	**76,280**	**80.5**	**7.7**	**5.4**	**4.5**	**1.9**

* For France: 1,340 in 2020 according to national French sources DGAMPA, SSP, Ifremer-SIH, 2020.
For Morocco: 3,543 vessels on the Mediterranean façade in 2021, of which 92% artisanal according to the Moroccan Department of marine fishing. (Source: FAO, 2020).

88. Contribution of the Mediterranean and Black Sea fisheries to the global marine capture ranged from 2.55% during the 1980s to 1.55% in 2020 (FAO, 2022), taking into account that the Mediterranean Sea represents less than 1% of the world's ocean surface. After an irregular decline in total landings in the Mediterranean that started in the mid-1990s and led to the lowest volumes in 2015 (760,000 tonnes), production increased again over the following three years to 805,700 tonnes in 2018. The average landings over the 2016-2018 period were 787,830 tonnes (a 3% increase compared to the average for the period 2014-2016).

[20] Includes polyvalent vessels 12–24 m, longliners 12–24 m, dredgers 12–24 m, and longliners > 6 m.

89. From 2016 to 2018, Italy continued to be the main producer (22.7% of the total Mediterranean landings), followed by Algeria (13.1%), Tunisia (12.2%), Spain (10%), Greece (9.3%), Croatia (8.9%), Egypt (6.9%), and Türkiye[21](6.4%). The remaining 12 countries[22] accounted for less than 4% individually; added together, their landings represented 10.6% of the Mediterranean total. Compared to the previous period (2014-2016), total landings increased the most in Türkiye (by 20.4%), while as the most substantial decrease (-10.6%) among major producers was recorded in Morocco; in Slovenia and Israel average landings decreased by 30.5% and 22.2% respectively.

Figure 11: Distribution of landings per country, average 2016-2018.
(Source: FAO, 2020).

90. In the period 2016-2018, the main species and their contributions to the total catch were as follows: sardine (23%); European anchovy (14.1%); Sardinellas nei (5.8%); marine fishes nei (4.6%); jack and horse mackerels nei (2.8%); deep-water rose shrimp (2.8%); bogue (2.6%); and European hake (2.5%); other species' individual contributions were below 2%.

91. During the five years 2013-2018, total revenues in the GFCM area (including Black Sea) were between 3.2 and 3.6 billion (in constant 2018 USD). Total revenue/ value at first sale[23] from marine capture fisheries in the Mediterranean is estimated at USD 3.4 billion in 2018. When different fleet segments are considered, the highest revenues are generated by trawlers, followed by small-scale vessels and purse seiners/ pelagic trawlers. As regards the fishing sub-regions, predominant shares of total revenues are generated in the Western and Eastern Mediterranean (FAO, 2020).

[21] Average landings 2016-2018 for the Mediterranean Sea equalled 50,772 tonnes; average total landings (including Black Sea) were 273,977.
[22] Total landings by Bosnia and Herzegovina and Monaco are negligible.
[23] Revenue is estimated as the value at first sale of fish from vessel-based marine capture, prior to any processing or value-addition activities.

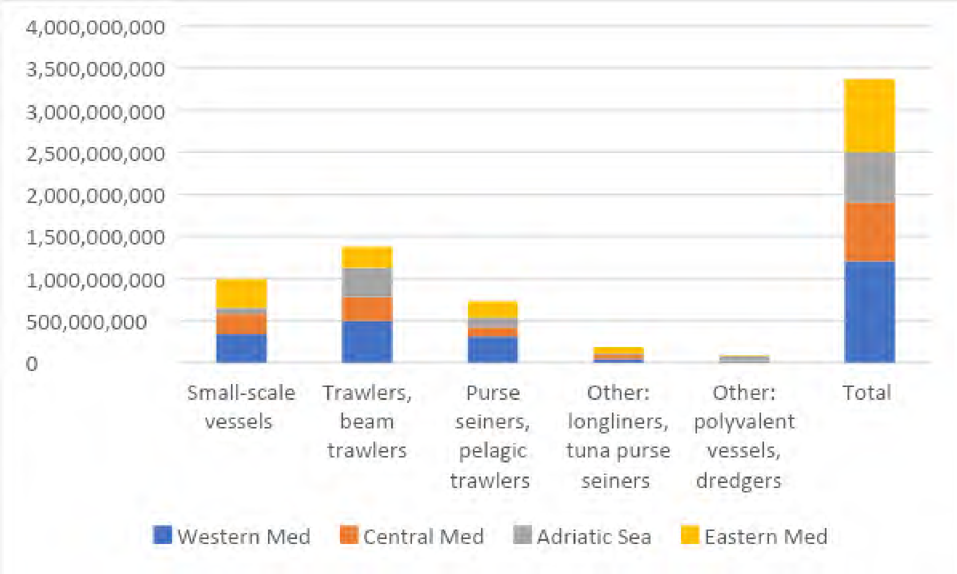

Figure 12: Revenue by fleet segment and sub-region (constant 2018 USD).
(Source: FAO, 2020).

92. The wider economic impact of fisheries along the value chain in the region, including direct and indirect and induced effects, is estimated to be 2.6 times the value at first sale (FAO, 2018). In the Mediterranean, revenue from small-scale fisheries makes 29% of the total; however, in some countries (e.g., Cyprus, France, Greece, Lebanon, Morocco, Slovenia), small-scale fisheries account for as much as 50% of the total revenue (FAO, 2020).

93. According to FAO (2020), total employment onboard fishing vessels in the Mediterranean was near 202,000 in 2018. Approximately one third of these jobs are linked to fishing in the Western and Eastern Mediterranean sub-regions; the Central Mediterranean accounts for 24% of the total number of jobs, and the Adriatic Sea sub-region for 9%. Estimates from the previous analyses (for example by the World Bank, FAO and WorldFish) suggest that non-vessel-based jobs employ almost 2.5 times as many people as those onboard vessels. On average, employment onboard fishing vessels represents around 0.1% of total coastal populations (i.e., approximately one fisherman per 1,000 coastal residents), but is six to 11 times higher in Morocco, Croatia and Tunisia. Small-scale fisheries account for 55% of the total employment onboard fishing vessels (but the share can go to as much as 70 – 90% in some countries). Women represent between 1 and 6% of the capture fisheries workforce. In processing, women either represent the majority of workers or are in the same numbers as men. Women are considered to play a vital role in the sale of fish, pesca-tourism and gastronomic activities. Where available, disaggregated data showed women were predominantly found in lower-level jobs with less pay than men (EC, 2019).

94. The Mediterranean fisheries were severely affected by the COVID-19 pandemic (GFCM, 2020; FAO, 2020). A reduction in operating vessels of up to 80% was observed in some countries, with a decrease in production of some 75% during the first months following the outbreak. This may have led (at least temporarily) to reduced pressure on resources and the environment. Total marine captures in the Mediterranean and Black Sea decreased by 14.4% in 2020 compared to 2019, i.e., by 9.2% compared to the average annual production during the 2010s (FAO, 2022) but longer-term COVID-19 impacts on fisheries are yet to be analysed.

95. Overall, fisheries in the Mediterranean remain highly threatened by overfishing, pollution, habitat degradation, invasive species and climate change (UNEP/MAP and Plan Bleu, 2020). Among FAO's 16 Major Fishing Areas in 2019, the Mediterranean and Black Sea had the second highest rate of stocks fished at unsustainable levels (63.4%), behind the Southeast Pacific with 66.7% (FAO, 2022).

96. Most stocks remain in overexploitation; however, the number of stocks in overexploitation has further decreased, as has the overall exploitation for the whole Mediterranean and Black Sea region. For the stocks for which validated assessments are available, a notable decrease of stocks in overexploitation has been assessed in recent years: from 88% in 2014, to 75% in 2018. This dynamic is reflected in marked improvements for a number of demersal species in terms of fishing mortality and, in some cases, biomass, too (FAO, 2020).

97. Nevertheless, the GFCM estimates the overall fishing mortality for all resources combined is nearly 2.5 times higher than sustainable reference points. A clear (although not significant) decreasing trend has been seen in the average exploitation ratio (current fishing mortality over target fishing mortality, F/FMSY) since 2012. Based on available information (for 62 stocks covering 20 geographical subareas and 14 species), 36% of Mediterranean stocks are assessed to have low biomass levels, 19% intermediate and less than a half (46%) high biomass level (FAO, 2020).

98. In addition to its negative environmental impact, bycatch from fishing activities – including discards and incidental catch of vulnerable species – has significant implications for the sector, including from economic, regulatory and public perception perspectives. Sea turtles (around 89%) and elasmobranchs (around 8%) continue to represent the highest share of reported incidental catch of vulnerable species; seabirds and marine mammals together account for the remaining 3% (FAO, 2020). Discards represent a window for improvement in the fishing sector as 18% of total catches are discarded (UNEP/MAP and Plan Bleu, 2020, based on the FAO's The State of Mediterranean and Black Sea Fisheries 2018).

99. While playing a particularly important cultural and employment role, small-scale fisheries are generally considered to have less ecological impact than industrial fisheries but can still have significant impacts that need to be addressed (Bolognini et al., 2019).
Aquaculture[24]

100. Total marine aquaculture production (excluding freshwater, including Türkiye's Black Sea production) approached one million (994,623) tonnes in 2020 with average annual growth rates of 6.8% and a cumulative increase of around 90% between 2010 and 2020. The most extensive growth was recorded in Algeria, where production increased by a factor of 15 to 30. In the same period, production increased by several folds in Tunisia, Albania, Türkiye, Egypt and Malta. A decrease was recorded in France and Italy, as well as in Bosnia and Herzegovina and Lebanon. Marine aquaculture output was not negatively affected by the COVID-19 pandemic: production in 2020 increased by 13.2% compared to 2019.

101. The biggest aquaculture producers are Egypt, Türkiye, Greece and Italy. Taking into account the average annual production (2010-2020), Egypt and Türkiye accounted for 27.2 and 23.4% of the total respectively; due to high growth rates in these two countries, their relative shares in the overall production increased by 2020 approaching and/or slightly exceeding one third of the total (35.4% for Egypt and 29.5 for Türkiye). Egypt is a globally significant producer, where total aquaculture output (including freshwater) grew from less than half a million tonnes in the early 2000s, to 1.6 million

[24] Information on production (quantity, value) 2010-2020 from the FAO FishStatJ database (FAO, 2022a). Data for Libya and Syrian Arab Republic were not available for the observed period; no production reported for Monaco. Data for Türkiye include Black Sea aquaculture. Sources other than FishStatJ database were used, as referenced in the text. Although freshwater aquaculture may impact the marine environment via discharges to Sea, freshwater aquaculture has not been considered in this analysis.

tonnes in 2019, making more than 80% of the total fish production (capture fisheries and aquaculture) in the country (FAO, 2022).

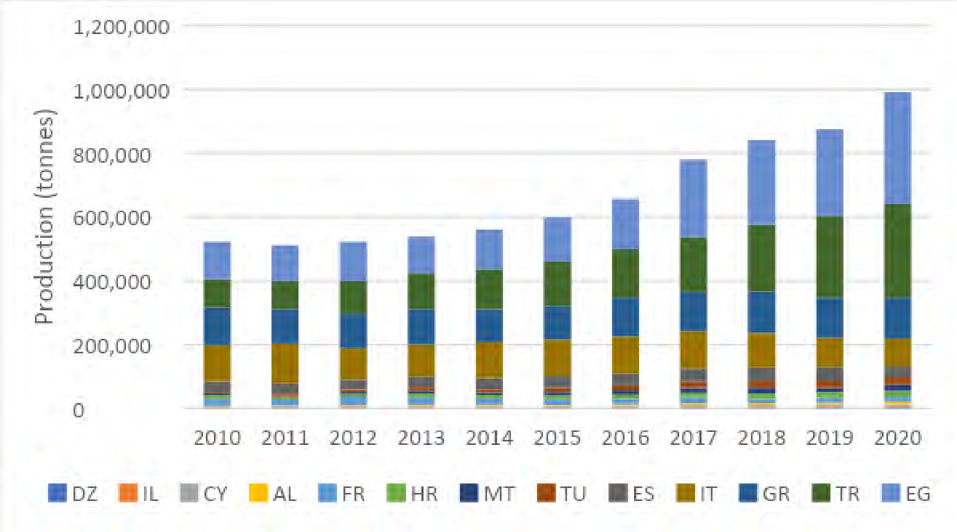

Figure 13: Aquaculture output 2010-2020: contribution of the main producers.
Note: countries with production of more than a thousand tonnes in recent years (Cumulatively accounting for more than 99% of the total) shown in the graph. (Source: FAO, 2022a, FishStatJ database accessed November 2022).

102. In 2019, production of less than one thousand tonnes was recorded in Slovenia (914), Morocco (465), Montenegro (379), Bosnia and Herzegovina (176) and Lebanon (19).

103. Among the top five producers, stable output trends were recorded in Greece and Spain, while in Italy production dropped by a quarter in 2020 compared to 2010 (mainly due to reduced shellfish production). High growth rates characterise production in Türkiye and Egypt, especially as of 2016.

104. Value of production increased from USD 2.3 billion in 2010 to USD 4.3 billion in 2020. In 2018, aquaculture production value (USD 3.5 billion) slightly exceeded total revenue from capture fisheries (USD 3.4 billion)[25]. Highest production values in 2020 were recorded in Türkiye, Egypt, Greece, Italy, Spain and Malta (accounting for some 88% of the total).

[25] It should be noted that aquaculture production value includes Türkiye's Black Sea production (while capture fisheries revenue refers only to the Mediterranean fishing area).

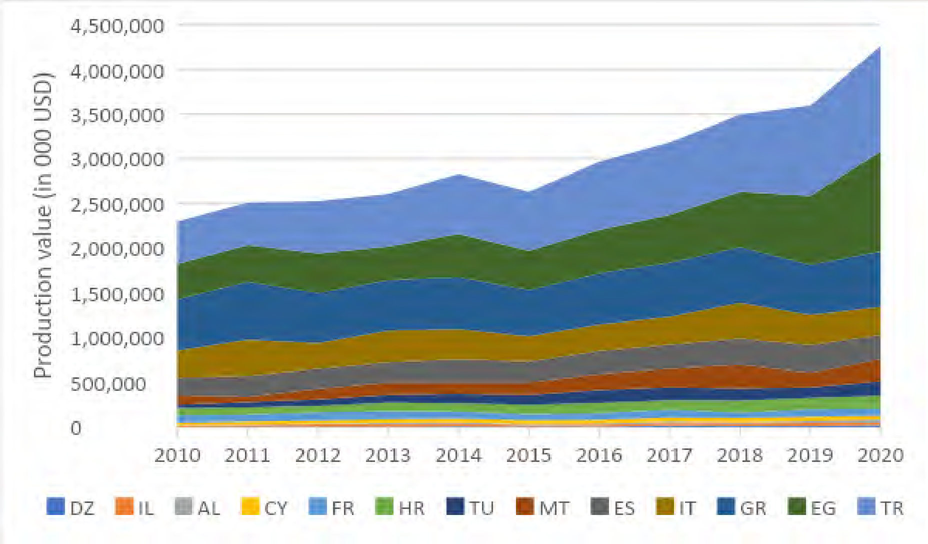

Figure 14: Aquaculture production value, main producers 2010-2020.
(Source: FAO, 2022a, FishStatJ database accessed November 2022).

105. Mediterranean marine aquaculture is dominated by finfish, accounting for 83% of the total production; molluscs account for 16% of the overall output. Gilthead seabream (*Sparus aurata*) and Seabass (*Dicentrarchus labrax*) are the most commonly farmed species, at 464,000 tonnes and USD 2.24 billion in 2019. More than 95% of the world's seabream and seabass production comes from aquaculture, of which 97% is produced by Mediterranean countries. In terms of quantity, other important farmed species are mullets and mussels. With a production of 99,200 tonnes in 2019, Mediterranean mussel (*Mytilus galloprovincialis*) is the fourth most farmed species in the region, with Italy (62% of the region's production) and Greece (24%) as the main producers (Carvalho and Guillen, 2021). Bluefin tuna are also raised in some locations.

106. Data on aquaculture jobs are less available than for capture fisheries. One of the recent estimates suggest that Mediterranean aquaculture offers employment to 313,000 persons, taking into account both direct and indirect jobs (Bolognini et al., 2019). Like fisheries, aquaculture is also a sub-sector dominated by male workers in the EU Member States, with women representing 7% to 26% of the workforce, but with more opportunities being provided for women (EC, 2019). In this sub-sector, there is also an unreported number of "invisible" female workers, particularly in small-scale freshwater aquaculture and shellfish farming.

107. Aquaculture made around half the total fishery output in the Mediterranean in recent years, and is expected to continue growing, in line with global trends. Its environmental effects depend on the size of the farms, the production systems and management methods used, as well as on the marine habitats in which they are located; aquaculture may harm the marine environment, and at the same time depends on a good quality environment to be productive (Bolognini et al., 2019).

108. Growth in aquaculture production in the Mediterranean can be accompanied with high dependency on fish meal from sea catches, large nitrate and phosphorus effluents, as well as genetic modification of natural fish stocks (UNEP/ MAP and Plan Bleu, 2020). Some of the priority issues related to sustainable aquaculture development in the Mediterranean (as identified by Massa et al., 2017) include integration of aquaculture into coastal zone management and sea use planning, improvements in site selection and licensing procedures, enhancement of aquaculture-environment interactions and implementation of environmental monitoring.

Maritime transport

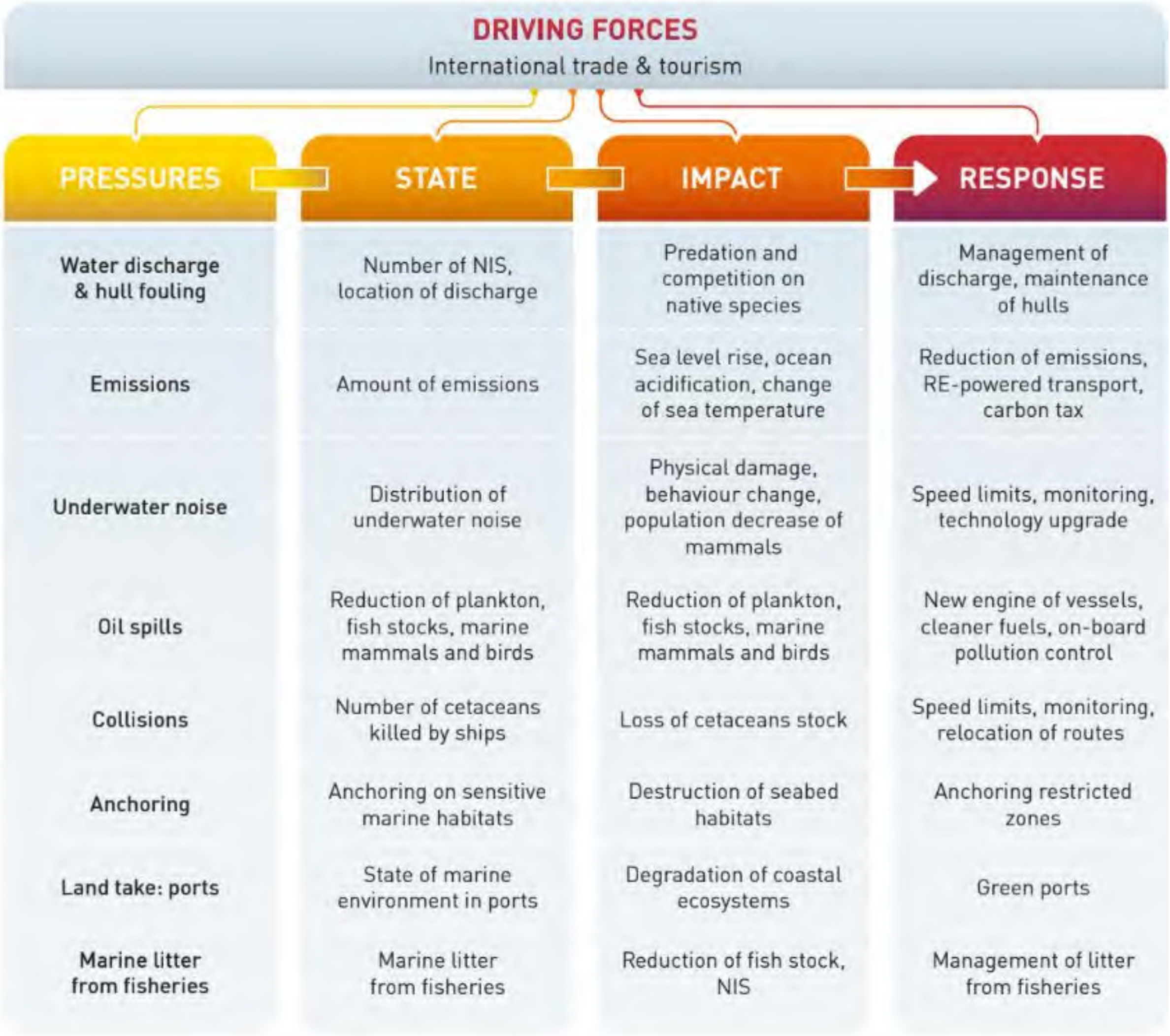

Figure 15: Pressures exerted by maritime transport on the marine environment.
(Source: UNEP/MAP and Plan Bleu, 2020).

109. The Mediterranean Sea is located at the crossroads of three major maritime crossings: Strait of Gibraltar, opening into the Atlantic Ocean and the Americas; the Suez Canal, a major shipping gateway which connects to Southeast Asia via the Red Sea; and the Dardanelles Strait, leading to the Black Sea and Eastern Europe/Central Asia. With such a strategic location, it is an important transit and trans-shipment area for international shipping, as well as a realm for Mediterranean seaborne traffic (movement between a Mediterranean port and a port outside the Mediterranean) and short sea shipping activities between Mediterranean ports (UNEP/MAP and Plan Bleu, 2020).

110. Despite covering less than 1% of the world's oceans, the Mediterranean Sea accounted for more than a fifth (21-22%) of global shipping activity measured by the annual number of port calls, and around 9% of the annual container port throughput in recent years (Randone et.al, 2019; own calculations based on UNCTAD, 2022a). Approximately 18% of global seaborne crude oil shipments take place within or through the Mediterranean. In some countries (Croatia, Cyprus, Greece, Italy, Malta, Spain), maritime transport (including port activities and shipbuilding and repair) accounted for between 0.4 and 1.3% of the total employment in 2019. The Western Mediterranean and the Aegean-Levantine Sea are the busiest parts of the basin (Randone et al., 2019).

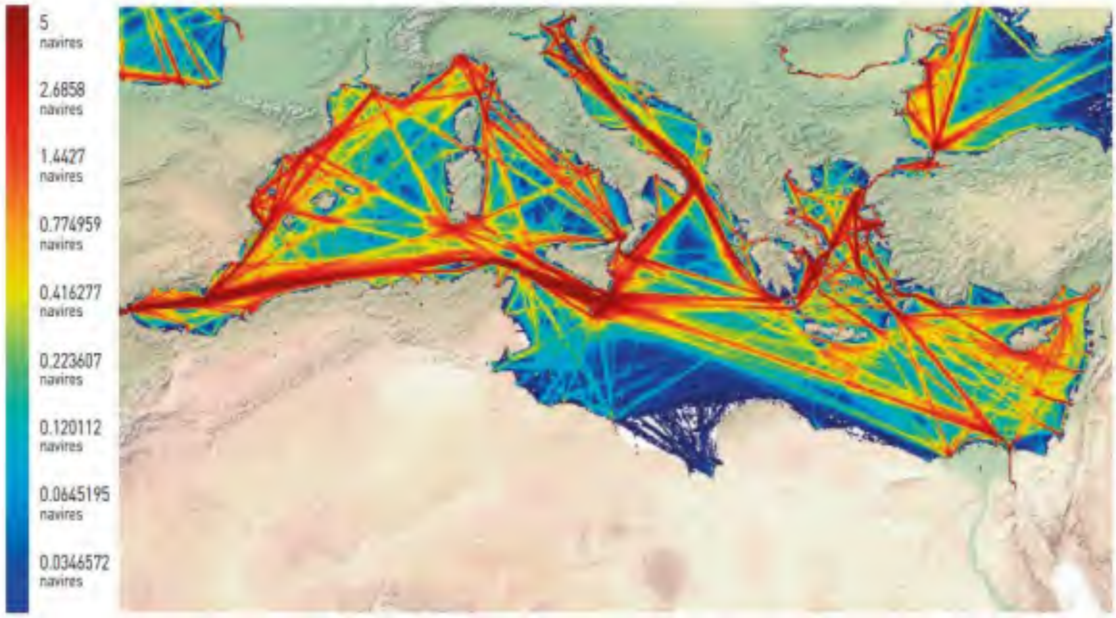

Figure 16: Traffic density in the Mediterranean Sea area.
(Source: INERIS, 2019).

111. Over the period 2015 – 2021, the merchant fleet registered in 20 Mediterranean countries[26] encompassed a total of around 9,400 vessels, with a capacity of more than 245 million dead-weight tons in 2021. Total carrying capacity increased by 63.5% (from 152.9 million) in comparison with 2005. Four countries (Malta with 46.5%, Greece with 25.9%, Cyprus with 13.7% and Italy with 4.5%) account for 90% of the total merchant fleet carrying capacity (UNCTAD, 2022a).

112. As regards ownership of the world fleet (by carrying capacity expressed in dead-weight tons) in 2021, five Mediterranean countries were among top 35 world economies: Greece (4,705 vessels in total, 620 under national flag) with 17.6% of the world total; Monaco (478 vessels, none under national flag), accounting for 2.1% of the total; Türkiye (1,548 vessels, 426 under national flag), 1.3%; Italy (651 vessels, 481 under national flag), 0.8%; and Cyprus (311 vessels, 134 under national flag), with 0.6% of the carrying capacity of the world's fleet (UNCTAD, 2021).

113. The Mediterranean has more than 600 commercial ports and terminals (Plan Bleu, 2014). Nine of these are among the 20 largest cargo ports in the European Union: Algeciras and Valencia (Spain), Marseille (France), Genova and Trieste (Italy), Piraeus (Greece), and Aliaga, Izmir and Ceyhan and İskenderun ports (Türkiye). Important ports in the southern Mediterranean with more than 1 million TEU include Port Said and Alexandria (Egypt), Tangier (Morocco), Beirut (Lebanon) and Haifa (Israel) (Randone et al., 2019, and Grifoll et al., 2018).

114. With nearly one million (935,649) port calls in 2021, volume of maritime transport reached 96% of 2019 level in the Mediterranean countries. Italy's ports accounted for one quarter of the total port calls in 2021, Türkiye's for one fifth, followed by Greece (16.4%), Spain (12.7%), Croatia (7.8%), France (6.8%) and Malta (3.2%). Share of passenger ships in total port calls in 2019 exceeded 75% in Croatia, Malta, Italy, Greece and Türkiye; cargo ship calls were predominant (accounting for 75% of the total or more) in Tunisia, Cyprus, Algeria, Slovenia and Israel. COVID-19 impact (measured by the number of port calls) was the lowest in Albania (-3% in 2020 compared to 2019), the highest in Montenegro (reduction of nearly 52%); in the countries with largest annual numbers of port calls, reduction was around 15% (UNCTAD, 2022a).

[26] No data for Bosnia and Herzegovina.

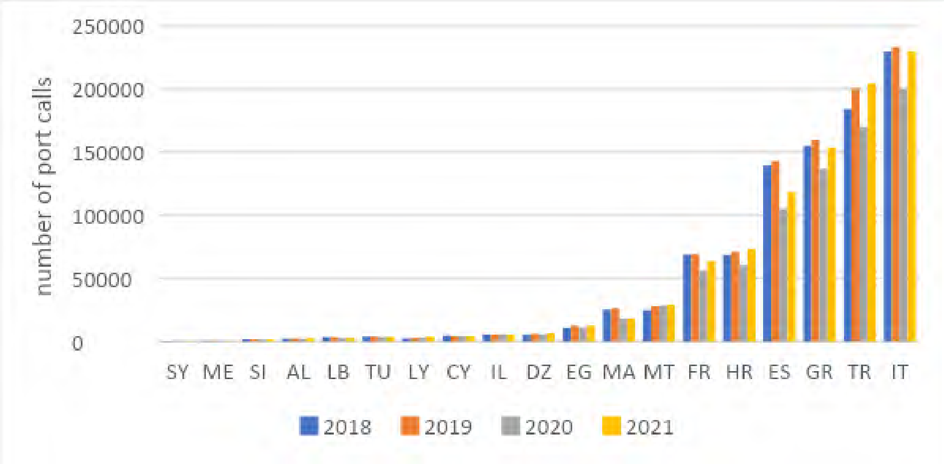

Figure 17: Number of port calls by country, 2018-2021.
(Source: UNCTAD 2022a)

115. Shipbuilding activities are present in several Mediterranean countries (Egypt, Greece, Spain, Croatia, Türkiye, France and Italy), and represent a very small share of the global shipbuilding: with a share of 0.6 to 0.9% since 2016, Italy was the lead Mediterranean country. Türkiye is a provider for ship recycling, with 9.2% (or 1.6 million gross tons) of the total reported tonnage sold for ship recycling in 2020 (UNCTAD, 2021).

116. The impact of the COVID-19 pandemic on international maritime trade was not as dramatic as initially expected[27]. Growth had already been weak in 2019 at 0.5%, and in 2020 total maritime trade declined by 3.8%. In 2021, a 3.2% growth was recorded bringing global maritime trade to only slightly below the pre-pandemic level. In line with the global expansion of seaborne trade, shipping in the Mediterranean basin is expected to increase in the coming years, in terms of both number of routes and traffic intensity.

117. The main pressures from maritime transport on the environment include: potential accidental and illicit discharges of oil and hazardous and noxious substances (HNS); marine litter; water discharge and hull fouling; air emissions from ships; underwater noise; collisions with marine mammals; land take through port infrastructure; and anchoring (UNEP/ MAP and Plan Bleu, 2020).

[27] A study (IEMed, 2021) looking at the COVID-19 impacts in, *inter alia* the Western Mediterranean, found out that the number of vessels sharply decreased in the first days of mobility restrictions (starting from March 2020) compared to pre-disturbance baselines (i.e., equivalent periods of 2019), reaching an overall median drop of 51% during the initial national lockdowns (lasting approximately until 22 June 2020). Maximal reductions ranged from 22.2% (tankers) to 93.7% (recreational boats), with a maximal overall drop across all categories of 62.2% during mid-April.

Energy (Oil and Gas and Renewable energy - offshore)

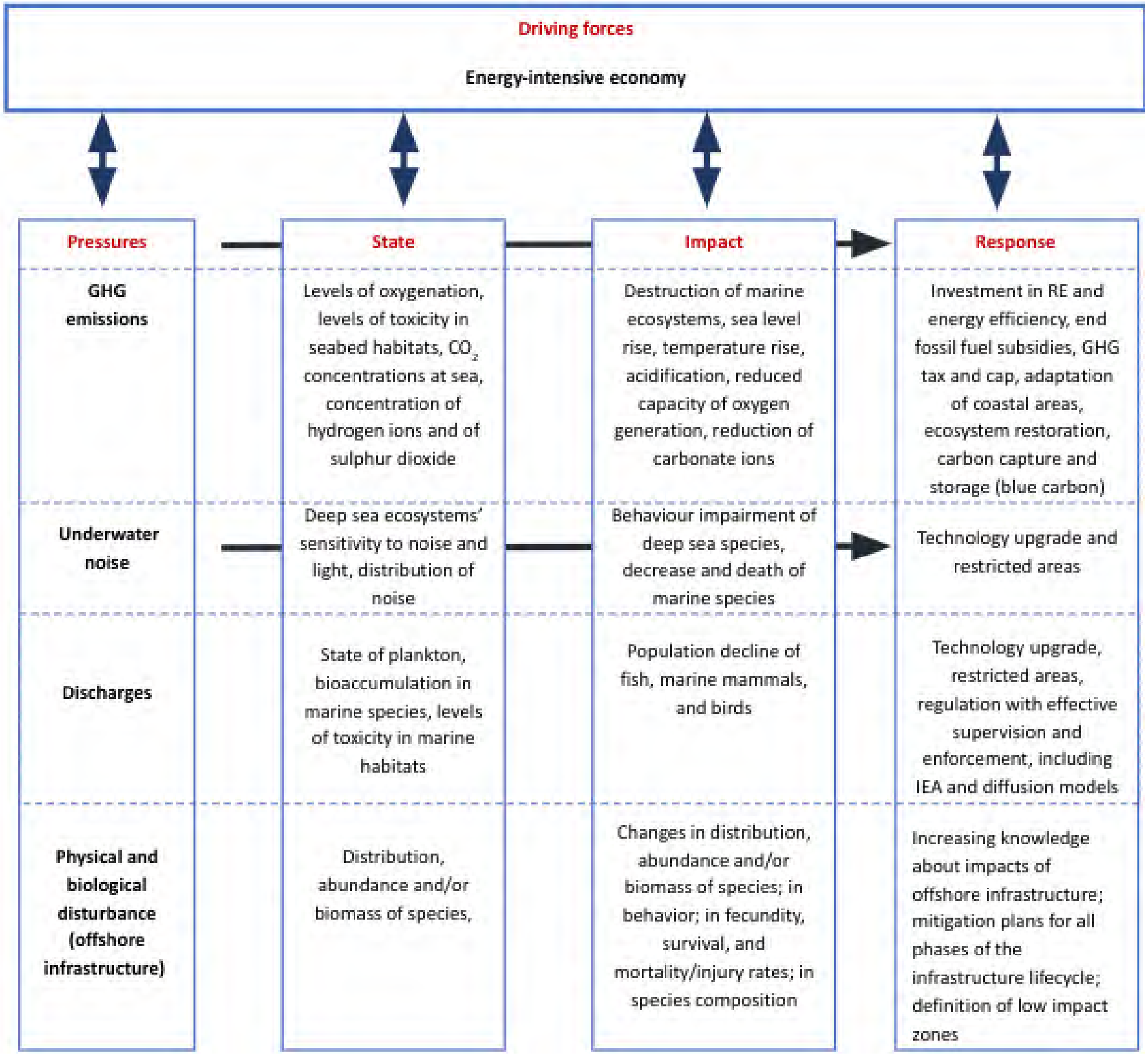

Figure 18: Pressures exerted by energy production and consumption in the Mediterranean. (Source: Based on UNEP/MAP and Plan Bleu, 2020).

118. The Mediterranean region is a net importer of energy: in 2018, total consumption exceeded total production by 39%. If the current trends continue, import dependence is projected to grow over the next decades (OME, 2021).

Primary energy demand:

119. Total primary energy demand (Table 6) in the Mediterranean equalled 1,021 Mtoe[28] in 2018 and 1,030 Mtoe in 2019, with an overall increase of around 45% compared to 1990. In 2020, a decrease of around 9% was recorded due to the effects of the COVID-19 pandemic, bringing primary energy demand down to 938 Mtoe.

Table 6: Primary energy demand in the Mediterranean

	1990		**2018**		**2020**	
	Mtoe	Share (%)	Mtoe	Share (%)	Mtoe	Share (%)
Coal	106	14.9	105	10.3	95	10.1
Oil	350	49.1	369	36.1	322	34.3
Gas	108	15.2	303	29.7	284	30.3
Nuclear	97	13.6	124	12.1	99	10.6
Hydro	16	2.3	24	2.4	24	2.6
Renewables	35.5	4.9	96.1	9.4	113.6	12.1
TOTAL	**712.5**		**1021.1**		**937.6**	

(Source: OME (2021), Mediterranean Energy Perspectives to 2050, edition 2021).

120. Shares of coal and oil in the total primary energy demand had a downward trend over the past three decades, with a particularly pronounced decrease for oil (accounting for about half the energy demand in 1990, going down to around one third in 2020); shares of nuclear sources and hydro energy were relatively stable (Table 6). Major changes in the primary energy mix were seen for gas (doubling of the share in 2020 compared to 1990) and renewables (increase of 2.4 times between 1990 and 2020). Demand for renewables proved resilient to the effects of COVID-19 crisis, with a recorded increase of around 18% in 2020 (compared to 2018).

121. There are marked differences in the primary energy consumption across the Mediterranean, with the South Mediterranean countries currently accounting for 40% of the region's total, while per capita energy demand in the South is less than half that in the North. Disparities are also pronounced as regards energy transition. Despite recent investments, some eastern and southern rim countries lag behind the Northern Mediterranean in energy mix diversification, energy efficiency improvements and in increasing the share of renewable energies (MedECC, 2020).

Renewables.

122. The most significant uptake of renewables has been recorded in power generation, while the share of renewable sources is still very low in end-use sectors, especially in industry and transport. In 2020, renewable energy technologies made up 43% (686 GW) of the total power generation capacity, deployed predominantly in the North Mediterranean countries. Nevertheless, the development of renewable capacity was very fast in the South and East where it nearly tripled over the period 2005 – 2020 (OME, 2021).

123. Biomass and waste had a dominant share (59.3%) in the structure of renewables in 2020, followed by geothermal (14.6%), wind (14.4%) and solar (11.5%); the share of tide, wave and ocean energy was below 1%. Photovoltaics were the main contributor to solar energy demand in 2020, accounting for 58.6% of the total, followed by solar heating and cooling (25%) and concentrated solar power (16.3%). The fastest growing renewables are wind and solar: demand for wind energy reached

[28] Million tons of oil equivalent.

16.36 Mtoe in 2020 while it was non-existent in 1990; demand for solar energy increased from 0.54 Mtoe in 1990 to 13.11 Mtoe in 2020 (data from OME, 2021).

124. Offshore wind installations, as well as wave, tide-current and thermal gradient energies are in the early stages of development in the Mediterranean. The offshore wind sector is expected to grow in the coming decades, inter alia due to new developments in floating platform constructions making them more suitable to deep waters. In the EU Mediterranean countries, production of electricity by offshore wind farms could reach 12 gigawatts (GW) in 2030 (UNEP/MAP and Plan Bleu, 2020).

125. While supporting energy decarbonization, the expansion of marine energy production may lead to significant environmental impacts, many of which are not yet sufficiently studied: adverse impacts on bird behaviour, abundance and survival, especially if offshore wind farms are located on major migratory routes; impacts on behaviour and abundance of marine mammals including through noise; increased marine traffic to service the infrastructure; impacts on ecosystem structure, functions and processes; but also including potential positive impacts on biodiversity through the artificial reef effect of marine infrastructure. While knowledge gaps persist, marine renewables may hinder the achievement of good environmental status for biodiversity or seafloor integrity (Galparsoro et al., 2022).

Fossil fuels

126. Although shares of fossil fuels in the total primary energy are slowly declining, demand for oil and gas continued to rise in absolute numbers and the reliance on these energy sources is still very high across the Mediterranean. Coal, oil, and gas accounted for three quarters of the region's primary energy demand in 2020.

127. The Mediterranean oil and gas resources (onshore and offshore) are assessed at close to 7% of oil and over 9% of the world's conventional gas resources (OME, 2021).

128. More than two hundred offshore oil and gas platforms were active in the Mediterranean in the second half of 2010s (UNEP/MAP and Plan Bleu, 2020). With recent explorations (in the Levantine Basin,, as well as in the Nile Delta Basin and the Aegean Basin) and new discoveries of large fossil fuel (mainly gas) reserves[29], the number is expected to increase, with potential transformative effects for ecosystems and economies, in particular in the Eastern Mediterranean. In recent years, resurgence of interest in exploration has also been recorded in the Adriatic, in the areas south-west and west of Crete, and in the Ionian Sea (OME, 2021).

129. Between 1990 and 2018, total production of fossil fuels in the Mediterranean increased by 8.3% (from 349 to 378 Mtoe), whereas oil and coal production shrank and gas production more than doubled.

130. Alternative gases were not used to a significant extent in the past. But the development and use of gases such as biomethane from organic sources, bio-LNG and synthetic natural gas, or by blending hydrogen[30] into existing natural gas networks (OME, 2021). Alternative fuels must be carefully produced and managed to avoid serious unintended consequences of their use, including greenhouse gas emissions.

[29] According to OME, 2021, one of the most important recent (2015) natural gas discoveries was the super-giant Zohr field offshore Egypt with 850 bcm of gas in place, confirming the substantial hydrocarbons potential in the Mediterranean Sea and the region's significance in the global fossil fuels exploration and production industry.
[30] Green hydrogen produced from water using renewable electricity or blue hydrogen produced from natural gas supported with Carbon Capture, Utilisation and Storage (CCUS).

131. When it comes to offshore oil and gas activities, environmental impacts may arise at all phases: exploration, exploitation and decommissioning. These impacts include oil discharges from routine operations, use and discharge of chemicals, atmospheric emissions, noise, light and physical impacts from the placement of pipelines and installations. During the transportation of oil and gas by pipeline or tanker, accidental spills from installations have the potential to cause impacts beyond the area of production. A high dependence of the Mediterranean region on fossil fuels is correlated to environmental risk stemming from the exploration, exploitation, decommissioning and transport of these fossil fuels (UNEP/MAP and Plan Bleu, 2020).

Marine mining

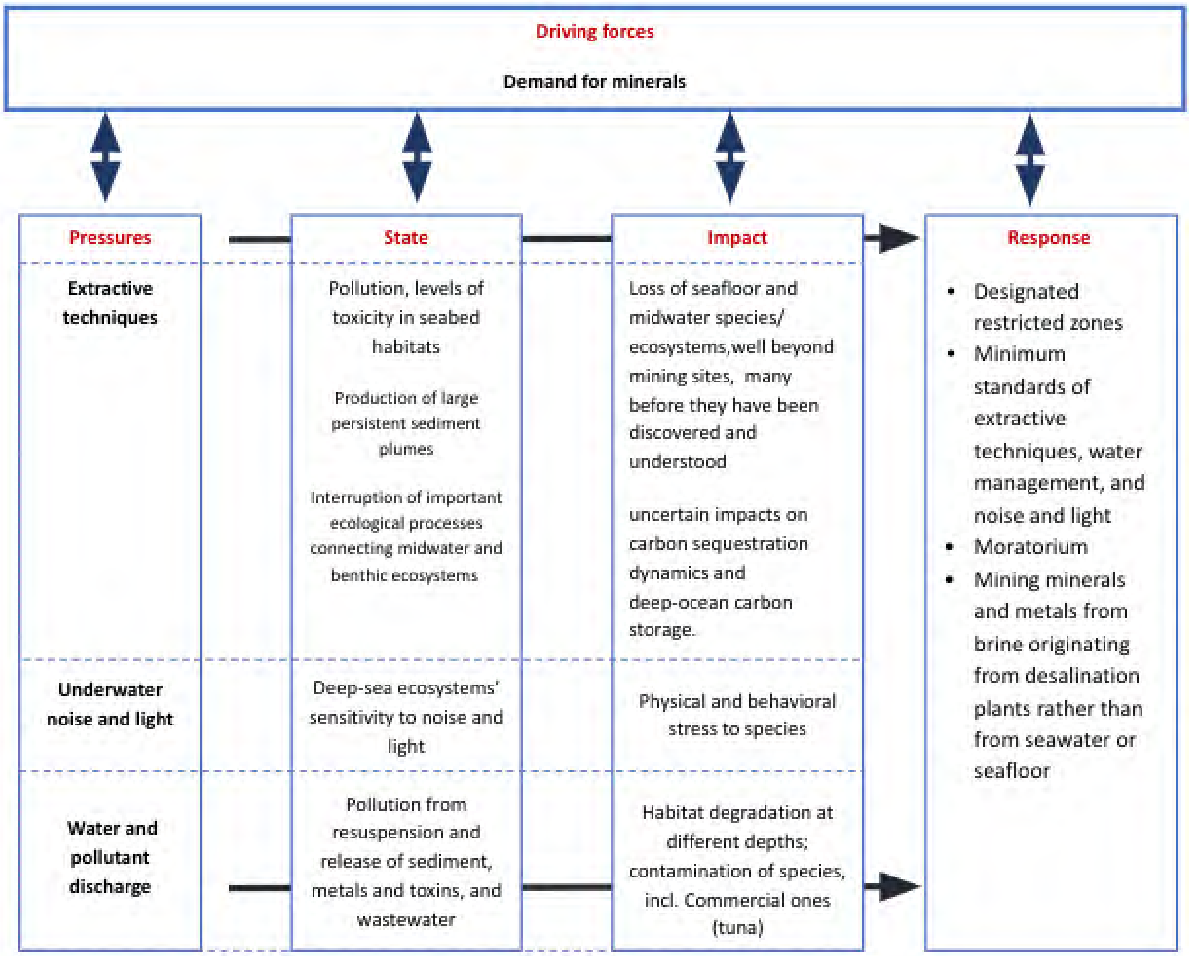

Figure *19*: Driving forces (demand for minerals) in the Mediterranean.
(Source: Based on UNEP/MAP and Plan Bleu, 2020 and Seabed mining science statement website[31]).

[31] http://www.seabedminingsciencestatement.org, 2023.

132. Marine and seabed mining is defined by OECD as the production, extraction and processing of non-living resources in seabed or sweater (OECD, 2016). For example, this includes extraction of minerals and metals from the seabed (in shallow waters or the deep sea), marine aggregates (limestone, sand and gravel) and minerals dissolved in seawater. Analyses conducted in the framework of the European Maritime Spatial Planning Platform (Pascual and Jones, 2018) offered the following definitions/ assessments:

- Marine mining refers to exploration, exploitation and extraction of marine minerals, such as iron ore, tin, copper, manganese and cobalt; the sector is characterised as growing;
- Deep-sea mining is done at depths from 800 to 6,000 m, primarily targeting deposits of polymetallic nodules, manganese crust and sulphides, and is in early stages of development – referred to as an emerging sector;
- The exploitation of marine aggregates is a mature sector that refers to exploration, exploitation, extraction and dredging of sand and gravel from the seabed, primarily for the purpose of construction and beach nourishment. Mining of aggregates had an estimated gross value added (GVA) of EUR 625 million and provided 4,800 jobs in Europe (EEA, 2015).

133. At a longer time scale, Rare Earth Elements (REE) that are present in deep-sea mud may also become strategic mining targets as land-based reserves become progressively less accessible (Piante and Ody, 2015) and demand for these resources is soaring especially with the massive electrification of the world economy. Seabed mining is thus likely to become a priority area of the maritime economy for further study, especially of the largely unknown but potentially significantly adverse environmental impacts.

134. Potential areas for seabed mining have been identified in the Mediterranean Sea, with sulphide deposits identified along the Italian and Greek coastlines (Piante and Ody, 2015). Results of the EC funded project GeoERA-MINDeSEA[32] revealed promising prospects in placer deposits near the coasts in the eastern Mediterranean – Greece and Cyprus, as well as ferromanganese crusts in the Western Mediterranean off the coasts of Spain and Morocco (Sakellariadou et al., 2022).

135. While the economic potential of deep-sea mining is assessed as significant, the Mediterranean is not considered a priority area for these activities. The UfM Blue Economy report concluded there were no projects that have been granted a mining license[33] in the Mediterranean and no deep-sea activities by 2017, with the exception of the 2007 exploration project in the Tyrrhenian Sea in Italy. The slow development of deep-sea exploitation in the Mediterranean can be partially attributed to low technological development in the region and the lack of a dedicated regulatory system (UfM, 2017). However, exploitation of the Mediterranean seabed may become more economically interesting with increasing global prices for relevant resources.

136. Potential environmental issues linked to deep-sea mining are not well known, which questions the sustainability of such a practice; the main pressures (with potential to cause harmful environmental consequences) are linked to extractive techniques, underwater noise and light, and water and/or chemical discharges (UNEP/MAP and Plan Bleu, 2020).

137. An attempt to identify and understand better potential environmental impacts from deep-sea mining undertaken within the MIDAS project (Managing Impacts of Deep-seA reSource exploitation project, partly funded by the EU, implemented over the period 2013 – 2016) resulted in a set of

[32] Launched in 2018 to map and to establish the metallogenic context for different seabed mineral deposits with economic potential in the pan-European setting.
[33] Any project or activity being planned in a country's continental shelf can not be conducted without explicit consent of that country and references in this report do not mean that consent has been obtained.

recommendations and best practices for ensuring relative sustainability of the industry, including creation of conservation zones where mining activities would be prohibited; these recommendations were taken into account for the regulations of the EU Member States for areas located in their Exclusive Economic Zones, as well as for the regulations of the International Seabed Authority for international waters (located more than 200 miles from a State's baseline) (UfM, 2017).

138. In the EU Communication on Blue Economy (EC, 2021) it is emphasised that marine minerals in the international seabed area cannot be exploited before the effects of deep-sea mining on the marine environment, biodiversity and human activities have been sufficiently researched, the risks understood and before it is demonstrated that the technologies and operational practices do not cause serious harm to the environment (EC, 2021). The recent "Marine Expert Statement Calling for a Pause to Deep-Sea Mining" has been signed by 704 marine science & policy experts from over 44 countries. The scientists "strongly recommend that the transition to the exploitation of mineral resources be paused until sufficient and robust scientific information has been obtained to make informed decisions as to whether deep-sea mining can be authorized without significant damage to the marine environment and, if so, under what conditions"[34].

139. Some statistics about marine mining are available for European countries: Overall, the share of the marine *Non-living resources* sector in the EU blue economy in 2019 was 0.2 % of jobs and 2.5 % of GVA (EU, 2022). The *Other minerals* sub-sector continues to be on the rise, with a GVA of about EUR 160 million of GVA (3 % of the GVA in the sector of *Non-living resources*) and employment of 1,426 in 2019, referring mainly to marine aggregates rather than to mining activities. More than 50 million m^3 of marine aggregates, primarily sand and gravel, are extracted from the European marine seabed, mostly for the construction industry, beach nourishment and sea defence construction (EU, 2022). The demand is expected to continue rising as the construction sector expands and coastal communities try to adapt to new pressures posed by climate change.

140. Extraction of marine aggregate material, together with dredging, is recognised as highly damaging to seabed habitats. These activities result in substantive (and often permanent) alterations to hydrodynamic and ecosystem processes. The main pressures linked to extraction/ dredging include seabed disturbance and disruption of habitat, disruption to wildlife, pollution and water contamination, and use conflicts (UNEP Finance Initiative, 2022).

<u>Water abstraction</u>

Freshwater resources

141. The Mediterranean region has been estimated to hold about 1.2% of the world's renewable water resources and is recognised as one of the most water-challenged regions in the world (IAI, 2021). The pre-existing water scarcity is being aggravated by population growth, urbanization, growing food and energy demands, pollution, and climate change (UNEP/MAP and Plan Bleu, 2020).

142. The ten largest Mediterranean river basins are the Nile (Egypt), Rhone (France), Ebro (Spain), Po (Italia), Moulouya (Morocco), Meric/Evros (Greece, Türkiye), Chelif (Algeria), Büyük Menderes (Türkiye), Axios/Vardar (Greece) and Orontes/Asi (Türkiye). In the last 50 years, a decline in water discharge from rivers (estimated at around 340 km^3) has been observed, resulting from multiple stressors such as decreasing precipitation, an increasing number of reservoirs and increasing irrigated areas (UNEP/ MAP and Plan Bleu, 2020).

[34] https://www.seabedminingsciencestatement.org/.

143. Total renewable freshwater resources of the countries belonging to the Mediterranean Basin were reported[35] at between 1,212 $km^3 yr^{-1}$ and 1,452 $km^3 yr^{-1}$, with Northern Mediterranean countries holding between 72 and 74% of the resources and the SEMCs sharing the remaining 26 to 28% (MedECC, 2020).

144. Analyses conducted towards preparation of the Fifth Assessment Report of the IPCC showed that by 2014, 44 out of 73 catchments[36] in the Mediterranean region were under high to severe water stress, with hotspots in southern Spain, Tunisia, Libya, Syrian Arab Republic, Lebanon, and Israel. Furthermore, it was assessed that except for France and the Balkans, all the catchments in the Mediterranean would be under high to severe water stress by 2050, mainly due to climate change (reduced mean precipitation and groundwater availability, increased frequency and duration of droughts etc.), leaving 34 million people under high water stress and 202 million under severe water stress (IAI, 2021). Water shortages, especially pronounced during the summer, coincide with tourism peaks in coastal areas.

Water withdrawals

145. Total freshwater withdrawals in the Mediterranean countries were at the level of 290 billion m^3 in 2019 (FAO Aquastat). The largest consumers were Türkiye and Egypt with 61.5 and 77.5 billion m^3 respectively; freshwater withdrawals of around 10 billion m^3 or higher were recorded in Algeria, Greece, Morocco, Syrian Arab Republic, France, Spain and Italy. Per capita withdrawals ranged from less than a 150 m^3 to close to 1,000 m^3 (
146. Table *7*).

Table 7: Freshwater withdrawals per capita and by sector, 2019

	Total freshwater withdrawal (10^9 m^3/ year)	**Total withdrawal per capita (m^3 pc/ year)**	**Withdrawals by sector (%)**		
			Agriculture	**Municipal**	**Industrial**
AL	1.13	392.58	61.2	21.0	17.8
DZ	9.802	243	63.8	34.4	1.8
BA	0.3055				
HR	0.67	176.74	11.0	62.6	26.4
CY	0.202	231.11	59.9	40.1	0.0
EG	77.5	772	79.2	13.9	7.0
FR	26.85	412.24	11.1	19.8	69.1
GR	10.115	965.77	80.2	16.7	3.2
IL	1.16	272.09	51.4	43.1	5.5
IT	34.05	564.62	49.7	27.8	22.5
LB	1.812	268.39	38.0	13.0	48.9
LY	5.72	860.21	83.2	12.0	4.8
MT	0.041	143.06	36.5	61.9	1.6
MC	0.005	128.32	0.0	100.0	0.0
ME	0.16	256.22	1.1	59.9	39.0
MA	10.573	286	87.8	10.2	2.0
SI	0.944	454.11	0.3	18.0	81.7

[35] In the MedECC's First Mediterranean Assessment Report, based on the data of the FAO's Aquastat database and previous research.
[36] Areas where water is collected by the natural landscape.

ES	29.469	630.53	65.3	15.3	19.4
SY	13.964	981.86	87.5	8.8	3.7
TN	3.781	328.76	76.3	22.5	1.2
TR	61.534	742.18	87.7	10.6	1.7

(Source: FAO, 2023. AQUASTAT Core Database. Food and Agriculture Organization of the United Nations. Database accessed on 21 February 2023).

147. Irrigated agriculture is the most water-demanding sector accounting for nearly 80% or more of total withdrawals in Egypt, Greece, Libya, Morocco, Syrian Arab Republic, Tunisia and Türkiye.

148. Besides freshwater withdrawals, a total of 6.6 billion m^3 of treated wastewater is used across the region, primarily in Egypt, Spain, Israel, France and Greece. Israel is the leader among the SEMCs when it comes to reuse of treated wastewater (with a rate of over 85% of collected wastewater). Among the EU Mediterranean countries, Cyprus and Malta are the most advanced with 90% and 60% of their treated wastewater reused (UNEP/ MAP and Plan Bleu, 2020, based on IPEMED, 2019).

149. The largest producers of freshwater through desalination in 2019 were Israel (645 million m^3), Algeria (631 million m^3), Spain (405 million m^3) and Egypt (200 million m^3). Malta is the desalination leader in terms of percentage of desalinated water in national water consumption, with more than half of its drinking water supply produced via desalination (UNEP/MAP and Plan Bleu, 2020). Morocco produced 6.3 million m3 of desalinated water on its Mediterranean coast in 2022 (ONEE Water Branch). The available projections suggest that the production of desalinated water in the Middle East and North Africa (MENA) region will increase thirteen times by 2040 in comparison with 2014 (Ibid.)

150. According to De Roo et al., the Mediterranean is a water scarce region already under current climate and water use conditions, with high ratios of water abstraction and consumption compared to water availability, where regional groundwater depletion is already an issue. Under the scenario of global warming of 2ºC, projections indicate that the water availability in the Mediterranean could decrease by 10 – 30% locally. In such a context, implementation of irrigation and urban water efficiency measures gains importance. Water reuse is seen as an important measure to reduce abstractions, but the costs of treatment for reuse (as per the new EU standards) may exceed the current willingness to pay for water in agriculture. Desalination could become an increasingly applied option (De Roo et al., 2021).

151. Anthropogenic water abstractions are likely to impact freshwater-seawater dynamics in the Mediterranean basin, in combination with natural and climate-change induced variations of water flow into the sea. Water abstractions include both freshwater abstractions from the catchments that change the characteristics of freshwater reaching the coastal and marine environment, and coastal saltwater abstractions for the purpose of producing drinking water via desalination.

152. Freshwater abstractions in catchments may result in diversions and reductions in freshwater flow, alterations of timing and rates of flow to estuarine and coastal systems, and/or adverse water quality conditions with major changes in nutrient loading. This can affect sediment loads, pH, temperature, salinity, clarity, oceanography and nutrients. The effects of such changes can include mortality, changes in growth and development, and in some cases movement of organisms (Gillanders & Kingsford, 2002).

153. Desalination is the process of removing salts from water. A by-product of this process is toxic brine which can degrade coastal and marine ecosystems unless treated. For every litre of potable water produced, about 1.5 litres of liquid polluted with chlorine and copper are created in most desalination processes. The toxic brine depletes oxygen and impacts organisms along the food chain when pumped back into the sea (UNEP, 2019). Desalination also comes with a high energy demand. Using renewable energy sources for desalination can be an option to mitigate carbon emissions stemming from desalination.

Wastewater and waste disposal

Waste generation in the Mediterranean

154. According to the latest available data (as presented in

155. Table *8*), more than 198 million of tonnes of municipal solid waste (MSW) is generated in the Mediterranean countries[37] annually - an average of around 400 kg per capita per year (or 1.1 kg a day), ranging from less than 0.6 kg/day to more than 3.3 kg/day.

Table 8: Municipal waste generation and recycling rates in Mediterranean countries[38]

Country	**Year**	**MSW (t)**	**MSW pc (kg/y)**	**Share of MSW recycled**	
				%	year
MA	2014	7,126,000	202	8	2014
SY	2009	4,500,000	216	2.5	--
TN	2014	2,686,000	219	4	2014
EG	2016	22,000,000	284	12	2013
DZ	2016	12,378,740	305	8	2016
BA	2015	1,248,718	353	n.a.	--
LB	2014	2,149,000	358	8	2015
AL	2019	1,087,447	381	18.1	2020
LY	2011	2,420,000	385	n.a.	--
TR	2019	35,374,156	424	11.3*	2019
HR	2019	1,810,038	445	29.5	2020
ES	2019	22,408,548	476	36.4	2020
IT	2019	30,088,400	499	51.4	2020
SI	2019	1,052,325	504	59.3	2020
GR	2019	5,615,353	524	21	2020
ME	2018	329,780	530	4.6	2020
FR	2019	36,748,820	548	42.7	2020
CY	2019	769,485	642	16.6	2020
MT	2019	348,841	694	10.5	2020
IL	2021	6,150,962	656	23.5	2021
MC	2012	46,000	1,217	5.4	--
Med		**198,347,650**	**400**		

[37] Close to 97 million in the SEMCs and around 101 million in the NMCs. The regional/ sub-regional sums were derived from the data referring to 2019 for most NMCs and Türkiye, while the last available data for the SEMCs mainly refer to the period 2014 – 2016; data for Syrian Arab Republic and Libya were only available for 2009 and 2011 (respectively).
[38] Covering all marine façades of multi-façade countries.

Note: own calculation based on the data from EEA and UNEP/ MAP, 2021 and on data from the Ministry of Environmental Protection of Israel, 2023. Sources: World Bank What a Waste Global Database[39], EEA and UNEP/MAP, 2021, EEA, 2023, Ministry of Environmental Protection of Israel, 2023

Colour	Countries with annual MSW generation (kg/pc)
	200 – 300
	300 – 400
	400 – 500
	≥ 500

156. Total quantities of e-wastes generated in the Mediterranean countries are at the level of 8.3 millions of tonnes, while generation of hazardous wastes exceeds 28.5 millions of tonnes annually (World Bank database, accessed January 2023).

157. As regards the MSW composition, organic materials represent the main fraction in most of the SEMCs, accounting for as much as 68% in Tunisia and 70% in Libya (World Bank database, accessed January 2023). Share of plastics ranges from few percent to more than a fifth of the total quantity and is generally higher in the NMCs (Ibid.).

158. MSW generation has been increasing across the Mediterranean and a growing trend is expected to continue in the coming decades. While municipal waste generation in the NMCs is significantly higher compared to the SEMCs, waste management systems are more advanced. Despite notable improvements, collection of MSW is still a significant issue in most SEMCs where only a few countries are succeeding in reaching full waste collection coverage (EEA and UNEP/ MAP, 2021), whereas collection services are, as a rule, underdeveloped in rural areas, suburbs and slums.

159. According to EEA and UNEP/ MAP report (2021), more than a half (54%) of total MSW is, on average, disposed at open dumps in the SEMCs[40], while the share goes to as high as 80% in some countries. Landfilling (different types of landfills) has been reported as the main disposal option in Algeria (accounting for 89% of total MSW), Israel (75%) and Tunisia (70%). On the other hand, the overall landfill rate – waste sent to landfill as a share of generated waste – decreased from 23% to 16% during 2010 and 2020 in the EU as a whole, in line with the objective of reducing reliance on landfilling; total quantity of waste sent to landfill in this period decreased by 27.5% – from 173 million tonnes to 125 million tonnes[41].

160. Reported recycling rates are mainly below 10% in the SEMCs, except for Egypt where the rate is higher (12%) due to a significant impact of informal recycling activities, and Israel (where nearly a quarter of MSW is recycled). Recycling rates are also low in Türkiye (around 11%) as well as in the non-EU NMCs (

161. Table *9*); with a recycling rate of 18.1% in 2020, Albania made a significant step forward in recent years (Figure 20). Over the past 15 years, the EU Mediterranean countries made significant progress with recycling, with Slovenia and Italy doubling the recycling rates and countries like Croatia and Cyprus increasing the rates by as much as eight and four times respectively (Figure 20). Nevertheless, recycling rates in most EU Mediterranean countries (the only exceptions being Slovenia

[39] According to the World Bank, information presented in the database is the best available based on a study of current literature and limited conversations with waste agencies and authorities. While it is recognized variations in the definitions and quality of reporting for individual data points might exist, the general trends depicted by the database records are believed to be representative of the global reality.
[40] Including Jordan.
[41] https://www.eea.europa.eu/ims/diversion-of-waste-from-landfill accessed January 2023.

and Italy) were well below the EU-27 average and are particularly low in Malta (10.5%) and Cyprus (16.6%).

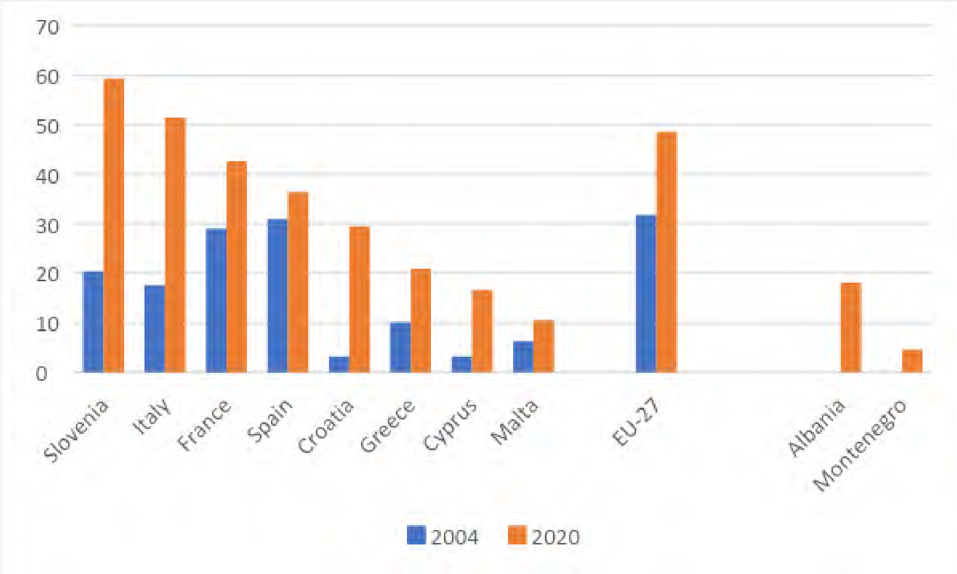

Figure 20: Recycling rates in the Mediterranean EU Member States, Albania and Montenegro (2004 and 2020).
(Source: https://www.eea.europa.eu/ims/waste-recycling-in-europe accessed February 2023).

Wastewater

162. Total municipal wastewater generation in the riparian countries of the Mediterranean Sea was at the level of 32,872 million m^3 (Mm^3) per year (
163. Table *9*). Around three quarters of produced wastewater (24,847 Mm^3) were treated (FAO, 2023), with uneven treatment shares across the region.

Table 9: Generation and treatment of municipal wastewater, 2017-2019

Country	**Municipal WW (Mm3/year)**		**Treated WW share (%)**
	produced	**treated**	
AL	54.0*	20.5	38.0
DZ	1,500.0	400.0	26.7
BA	82.3	57.0	69.2
HR	360.0	300.0	83.3
CY	30.0	30.0	100.0
EG	7,078.0	4,282.0	60.5
FR	4,000.0	3,770.0	94.3
GR	568.0*	568.0	100.0
IL	500.0	450.0	90.0
IT	3,926.0	3,902.0	99.4
LB	310.0	56.0	18.1
LY	504.0	40.0	7.9
MT	26.0	24.0	92.3
MC	8.0	6.0	75.0
ME	31.0	9.5	30.6
MA	700.0 *	166.0 *	23.7 *
SI	241.0	158.0	65.6
ES	5,870.0	5,465.0	93.1
SY	1,370.0	550.0	40.1
TN	312.0	274.0	87.8
TR	5,280.0	4,236.0	80.2
Med	**32,872.3**	**24,847.0**	**75.6**

Notes: For Albania, data on produced wastewater was used as reported in EEA and UNEP/ MAP, 2021 (data recorded in the database seems to be an outlier). For Greece, data on produced municipal wastewater was not available in the database; data on collected wastewater is recorded instead. For Morocco, alternative data with different reference years is available as follows: Volume of wastewater produced by households 1,513.46 1000M3/day in 2015 (Source: Eurostat, ONEE/Water Branch), Volume of wastewater treated in urban wastewater treatment plants 1,027 1000M3/day in 2019 (Source: Eurostat, ONEE/Water Branch), ratio of treated wastewater 56% in 2020 (Source: 4th Report on the State of the Environment of Morocco).
(Source: FAO AQUASTAT Core Database accessed on 17 February 2023).

164. The analysis conducted for the EEA and UNEP/ MAP report (2021) showed that wastewater generation was on the rise across the region (resulting mainly from population growth and fluctuations from tourism), as was the case with wastewater collection and treatment. The largest volumes are generated by the Mediterranean EU countries, where almost all the produced municipal wastewaters (96% on average) are treated. While significant progress with wastewater treatment has been achieved in the non-EU NMCs and most of the SEMCs during the past decade, significant volumes (estimated at around 5 km^3/year) of wastewater are still discharges untreated into the environment, streams, wadis or directly into the sea (EEA and UNEP/ MAP, 2021). The instability in Lebanon, Libya and Syrian Arab Republic have either resulted in the shutting down of wastewater treatment plants or the suspension of constructing new ones (Ibid.).

165. Inadequate levels of treatment are a key challenge in the Mediterranean, with 21% of treated wastewater (25% in southern countries) undergoing only basic treatment, and less than 8% (1% in southern countries) undergoing tertiary treatment (UNEP/MAP and Plan Bleu, 2020, EEA and UNEP/MAP, 2021).

166. The achieved progress with waste and wastewater management is not sufficient to curb the pressures and that further reduction in key pressures, such as waste and marine litter, wastewater and industrial emissions, is required to achieve a clean Mediterranean and the Good Ecological Status of its sea.

Infrastructure: underwater cables and pipelines

Underwater cables

167. Over the past 15 years, the Mediterranean region has seen a rapid spread of information and communication technologies (ICTs), with, for example, the total number of mobile cellular telephone subscriptions doubling between 2005 and 2021 to exceed 580 million. The share of the population using the internet has increased by several folds in a number of countries, most notably in Albania and Algeria, but also in Lebanon, Tunisia, Syrian Arab Republic, Egypt, Morocco and Türkiye. As of 2021, the share of internet users in the national populations is above 70% in almost all the Mediterranean countries, and above 90% in Cyprus, Israel and Spain. The number of mobile-cellular subscriptions per 100 inhabitants is the lowest in Libya (around 43) and remains below 100 in Albania, Egypt, Lebanon and Syrian Arab Republic.

168. Submarine cables are deployed in an imbalanced way throughout the Mediterranean Sea, promoting connections of the most developed regions of the world. This contributes to maintaining a digital divide for the SEMCs where despite remarkable progress, significant shares of the population remained excluded from the use of ICTs (because of inability to access technologies or lack of skills to use them). The digital transition seemed to be slower and mainly focused on urban areas in Algeria, Egypt, Libya, Tunisia and Syrian Arab Republic (UNEP/ MAP and Plan Bleu, 2020).

Pipelines.

169. An overview of the existing and planned oil and gas pipelines (onshore and underwater) for the Mediterranean is not available.

170. One of the older gas conveyors is the 2,475 km long Trans-Mediterranean Pipeline built in 1983 to transport natural gas from Algeria to Italy via Tunisia and Sicily, with a capacity of more than 33.5 billion cubic metres a year (bcm/ yr)[42]. Several new gas pipelines, such as the Trans-Adriatic and EastMed Pipelines are planned to respond to the need for an increased gas supply to Europe and to diversify natural gas import routes by the EU. The recent construction of the TANAP (Trans-Anatolian Pipeline) is planned to establish a connection to the Trans-Adriatic Pipeline to reach Greece and Italy, and provide the EU with access to 16 bcm/ yr of gas extracted by Azerbaijan from the Caspian Sea (UNEP/ MAP and Plan Bleu, 2020).

Coastal development and artificialisation of coastline

171. Due to a range of amenities (including favourable climate, landscape, cultural, recreational and other benefits) and development and employment opportunities (activities analysed above), Mediterranean coastal areas are among the most sought-after areas. They are frequently an end point

[42] https://www.hydrocarbons-technology.com/projects/trans-med-pipeline/

for internal migration flows, including rural – urban population movements, and coastal areas are also highly valued as locations for secondary/ holiday homes. Through this high density of human presence and activity, the coastal zone concentrates pressures on the environment.

172. The total length of the Mediterranean coasts is more than 57,000 km (UNEP-GRID, 2017). Many of the major cities in Mediterranean countries are located on the coast. The share of urban population increased steadily across the region, standing at or above 70% in over half the countries (Algeria, France, Greece, Israel, Italy, Lebanon, Libya, Spain, Malta, Tunisia, Türkiye) in 2021. Egypt is the only Mediterranean country where rural population (around 57% in 2021) still prevails, while the shares of rural and urban population are about the same in Bosnia and Herzegovina (World Bank, 2022).

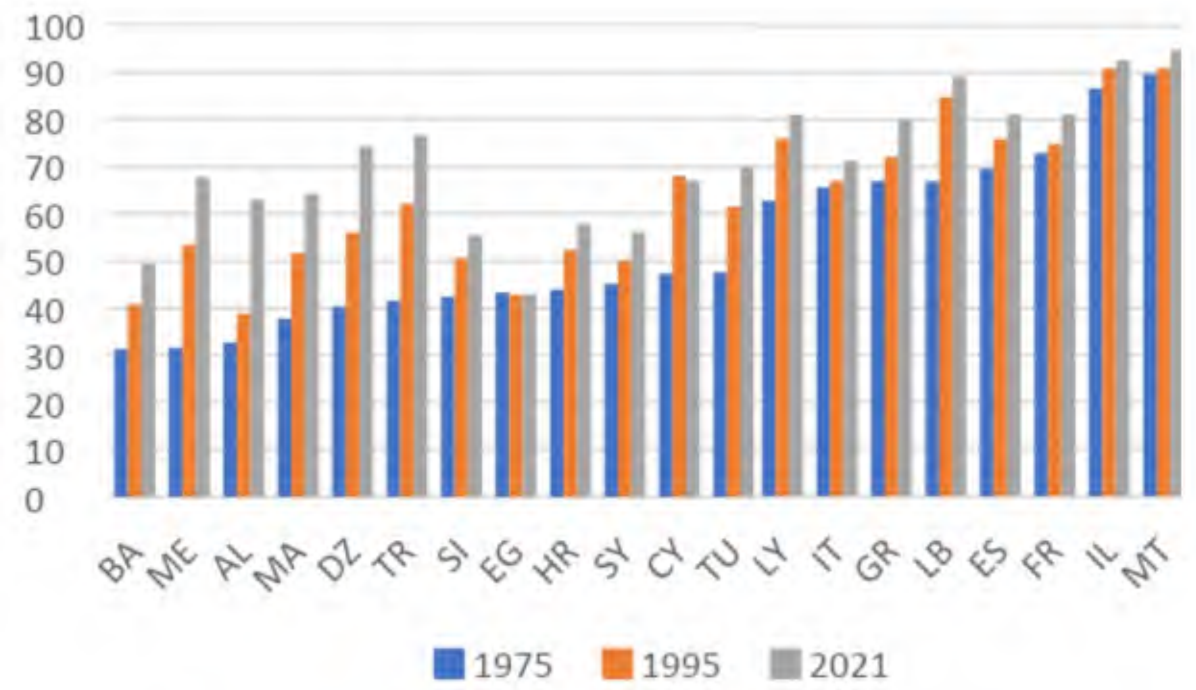

Figure 21: Shares of urban population across the Mediterranean 1975 – 2021
Source: World Development Indicators | DataBank (worldbank.org), accessed November 2022.

173. Approximately one third of the total Mediterranean population (170 – 180 million in 2021) lives in coastal areas. Shares of coastal population range from 5% in Slovenia to 100% in island countries (Cyprus, Malta) and Monaco. Population densities in coastal areas have continued to increase at unsustainable rates over the last decade. Rapid growth of urban and peri-urban areas is recorded all over the Mediterranean.

174. Intensification of coastal uses is at the origin of many impacts that alter the invaluable capital that is the Mediterranean, leading to increased fragmentation of landscapes, disrupting ecological continuity and degrading the environment's capacity to provide ecosystem services to society. It also makes coastal zones highly vulnerable to sea level rise, storm surges, flooding and erosion (UNEP/MAP and Plan Bleu, 2020; Grimes et al., 2022).

175. A detailed analysis of the location and extent of the habitats potentially impacted by hydrographic alterations, the length of coastline subject to physical disturbance due to the influence of human-made structures, and land cover change is given in the 2023 MED QSR chapter on coast and hydrography.

1.1.1 1.2.5.10 Fertiliser and pesticide use in agriculture

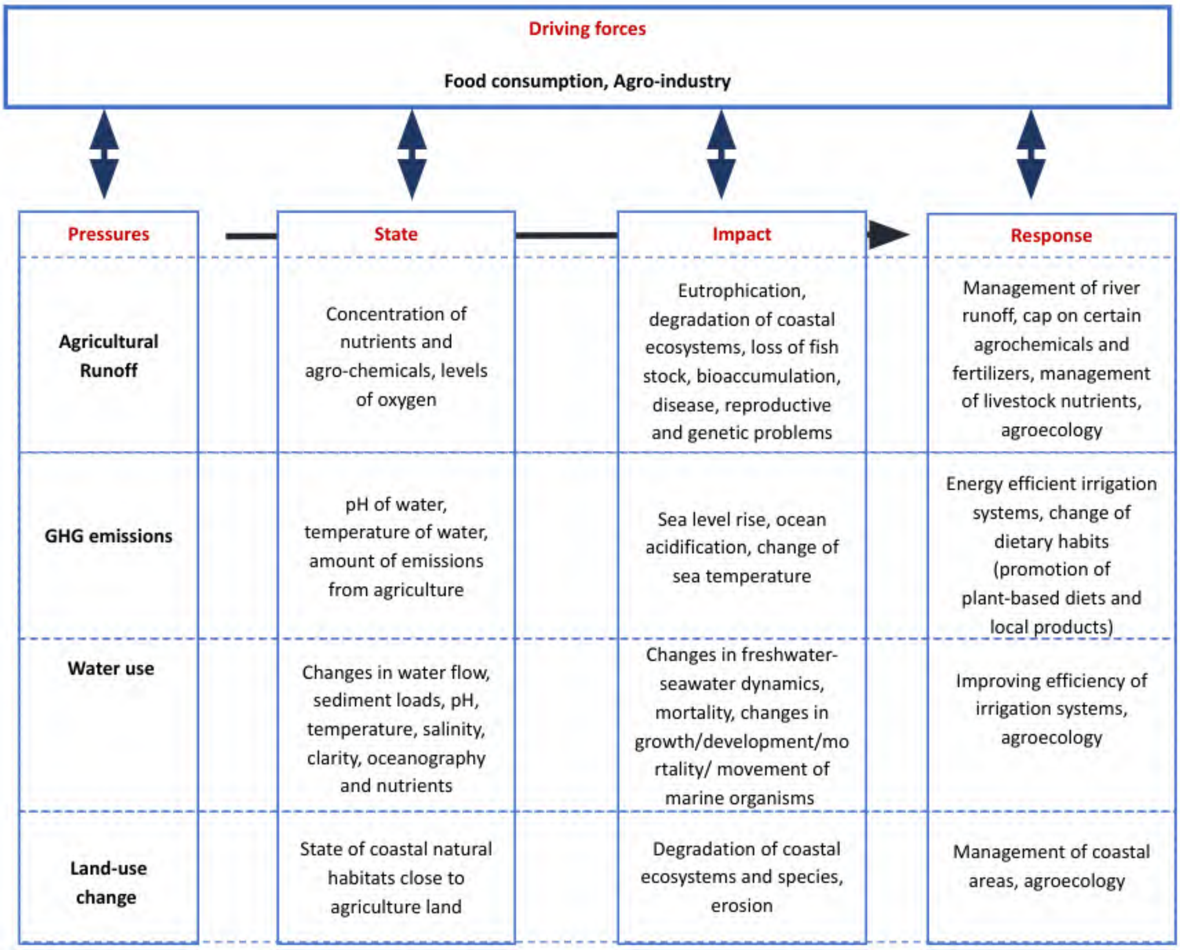

Figure 22: Pressures exerted by agriculture on the marine environment
(Source: Based on UNEP/MAP and Plan Bleu, 2020)

176. The main impacts of agriculture on the marine environment are due to the runoff of nutrients and agro-chemicals into the sea. Disaggregation of the impact from different sources of land-based pollution is difficult and there is no quantitative data concerning the effect of agriculture on the environment of the Mediterranean Sea. The runoff of inorganic nitrogen and phosphorus fertilizers leads to eutrophication, which in turn negatively impacts coastal and marine ecosystems. The runoff and infiltration of pesticides into the sea affect the marine environment at a slower pace by bioaccumulation higher up the food chain (UNEP/MAP and Plan Bleu, 2020).

177. In 2020, fertilizer consumption in kg/ha of arable land ranged from 7 kg/ha in Syrian Arab Republic to 473 kg/ha in Egypt, with half of the Mediterranean countries being above and half of the Mediterranean countries being below the world average fertilizer consumption of 146 kg/ha of arable land (World Bank, 2023).

Table 10: Fertilizer consumption in kg/ha of arable land, in Mediterranean countries, 2017-2020

Country	2017	2018	2019	2020
AL	100	67	94	101
BA	106	85	87	90
CY	175	158	188	163
DZ	21	21	21	21
EG	574	522	495	473
ES	155	158	157	167
FR	178	172	157	169
GR	130	135	141	150
HR	214	221	212	200
IL	230	241	231	140
IT	130	130	128	136
LB	293	275	279	249
LY	26	16	19	15
MA	60	63	65	58
MC	no data	no data	no data	no data
ME	234	247	252	307
ML	93	89	96	127
SI	257	262	255	256
SY	3	2	7	7
TN	49	57	57	57
TR	132	110	126	150
World	141	140	138	146

Source: World Bank, 2023

178. The consumption of pesticides in the Mediterranean basin varies largely between countries. In 2020, the average use of pesticides in kilograms per hectare of cropland ranged from 0.3 kg/ha in the Syrian Arab Republic to 14.5 kg/ha in Israel. Almost two thirds of the Mediterranean countries showed pesticide consumption above the world average of 1.8 kg/ha (FAOstat, 2023). Pesticides, especially if used irrationally, can lead to animal and human health problems such as the inability to reproduce normally in certain animal species, or cancer, neurological effects, diabetes, respiratory diseases, foetal diseases, and genetic disorders in humans who have been directly or indirectly exposed to certain pesticides (UNEP/MAP and Plan Bleu, 2020). Managing this type of pollution is particularly difficult because of its diffuse nature and largely unknown combined effects of multiple types of pesticides and their life cycles in the terrestrial and marine environment.

Table 11: Use of pesticides in kg/ha of cultivated land, in Mediterranean countries, 2017-2020 (Source: FAOstat, 2023).

	2017	**2018**	**2019**	**2020**
AL	0.9	0.6	1.1	1.1
BA	2.2	2.3	2.2	2.4
CY	9.7	9.6	10.3	9.2
DZ	0.7	0.7	0.7	0.7
EG	2.6	2.9	2.9	2.9
ES	3.6	3.3	2.6	2.6
FR	3.6	4.5	2.9	3.4
GR	2.6	3.5	3.4	3.3
HR	1.8	1.9	1.7	1.7
IL	14.3	15.2	14.6	14.5
IT	6.1	5.9	5.2	6.1
LB	6.6	6.7	6.7	6.7
LY	0.3	0.4	0.4	0.4
MA	1.4	1.4	1.6	1.5
ME	6.2	6.2	6.1	6.2
SI	4.6	5.0	4.2	4.1
SY	0.3	0.3	0.3	0.3
TN	0.5	0.7	0.7	0.7
TR	2.3	2.6	2.2	2.3
World	1.9	1.8	1.8	1.8

Table 12: Agricultural use of pesticides in tons (Source: FAOstat, 2023)

	2017	**2018**	**2019**	**2020**
AL	6,067	6,067	6,067	6,067
BA	2,517	2,545	2,514	2,723
CY	1,163	1,246	1,271	1,218
DZ	615	442	730	757
EG	9,988	11,352	11,352	11,352
ES	60,896	55,223	43,337	43,337
FR	70,604	85,072	54,381	65,216
GR	8,503	11,199	11,032	10,475
HR	1,570	1,677	1,558	1,644
IL	6,881	7,322	6,983	6,983
IT	56,641	54,153	48,567	56,556
LB	1,816	1,816	1,816	1,816
LY	649	788	788	788
MA	13,697	13,697	13,697	13,697
ME	91	91	91	91
MT	98	89	102	102
SI	1,087	1,172	972	949
SY	1,422	1,422	1,422	1,422
TN	2,670	3,211	3,511	3,511
TR	54,098	60,020	51,297	53,672

A need to anticipate emerging and fast-growing new activities

179. Faced with the lack of space along coastlines and the pressure of emerging maritime activities, the permanent occupation and exploitation of the sea is developing from the coast to offshore: creation of artificial islands, ports, and wind farms, telecommunications and energy cables as well as pipelines; exploration and exploitation of until now untouched marine resources, represent a new field of experimentation, development, impact and potential conflict. The increasing presence of infrastructure at Sea, and particularly infrastructure of strategic importance for energy and data/communications supply, also comes with a need for countries to protect this infrastructure in a generally tense geopolitical and security context faced in the Mediterranean. Therefore, some of the activities at Sea are likely to trigger the emergence of other potentially polluting activities at Sea, including surveillance activities and potentially military interventions. New activities at Sea seldomly limit their presence and impact to the Sea because they need to be connected to the shore in order to allow use of their products on land (energy, minerals, landing terminals and hinterland infrastructure onshore, …). All of these activities modify - at least temporarily - the marine and/or coastal environment. Making these activities compatible with GES, already in the planning phase, is therefore essential for the achievement of GES in the Mediterranean.

Knowledge gaps

180. This chapter provides an analysis of the main socio-economic components that influence the Mediterranean coastal and marine environment. Analysis is based on available data from a number of different sources, such as UN system data, data from international organisations, and relevant scientific articles. The absence of a comprehensive monitoring system of socio-economic characteristics and the sustainability of economic activities makes it difficult to establish clear links between the quality status of the Mediterranean Sea (analysed in the following chapters) and the social and economic pillars of sustainable development (analysed in this chapter). In particular, while a certain level of information on demographic, economic and employment has been collected, literature review did not adequately inform the level of environmental and social sustainability of human activities that impact the coastal and marine environment. A knowledge gap remains in measuring to what extent human activities are compatible or in line with the objective of achieving GES and clear sustainability indicators of human activities are generally lacking.

Regional cooperation

181. The Barcelona Convention, adopted in 1976, was the first legally binding instrument for the environmental protection of the Mediterranean Sea. Its provisions and thematic protocols provided the legal basis for the progressive development of a wide framework for regional cooperation to which the Mediterranean countries and the European Union adhered.

182. In addition to its legal texts, the Barcelona Convention system has other consultation and cooperation frameworks adopted by the Contracting Parties to assist them and coordinate their efforts in implementing the Convention and its Protocols.

183. The Mediterranean Commission on Sustainable Development (MCSD): The MCSD is an advisory body to the Contracting Parties aimed at assisting them in their efforts to integrate environmental issues in their socioeconomic programmes and to promote sustainable development policies in the Mediterranean region and countries. Serving as a forum for experience sharing and peer learning, the MCSD is unique in its composition since it includes not only government representatives but also local authorities, socio-economic actors, non-governmental organizations, intergovernmental organizations, the scientific community and parliamentarians. All the Commission members participate in its deliberations on an equal footing.

184. The Contracting Parties also adopted a series of legislations, national and regional strategies and action plans aimed at guiding their efforts in addressing issue of relevance for the objectives of the Convention and its Protocols. These regional strategies and action plans offer various opportunities for cooperation, exchange of experience and mutual assistance among the Contracting Parties and for partnership with other Inter-Governmental organizations as well as with a wide range of civil society and non-governmental organisations.

185. Promoting partnership and cooperation with relevant regional and global institutions and actors is among the key guiding principles followed by the Mediterranean Action Plan (MAP) Coordinating Unit and the Regional Activity Centres. Over the years, they have sought to foster existing partnerships and to enter into new ones in line with the priorities set by the Contracting Parties to the Barcelona Convention and its Protocols. In this context, the UNEP/MAP Coordinating Unit has a long-standing cooperation with a number of key regional and international organizations, and with many of them put in place Memoranda of Understanding and/or follows other cooperation modalities:

- ✓ Agreement on the Conservation of Cetaceans of the Black, Mediterranean Sea Sea and contiguous Atlantic Area (ACCOBAMS)
- ✓ Baltic Marine Environment Protection Commission (HELCOM)
- ✓ Basel, Rotterdam, and Stockholm (BRS) Conventions
- ✓ European Environment Agency (EEA)
- ✓ Food and Agriculture Organization of the United Nations (FAO)
- ✓ General Fisheries Commission for the Mediterranean (GFCM)
- ✓ Global Environment Facility (GEF)
- ✓ International Atomic Energy Agency (IAEA)
- ✓ International Maritime Organization (IMO)
- ✓ International Union for Conservation of Nature (IUCN)
- ✓ London Convention and Protocol
- ✓ London Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter
- ✓ OSPAR Commission
- ✓ Permanent Secretariat of the Commission on the Protection of the Black Sea Against Pollution (BSC PS)
- ✓ UNEP Regional Seas programme
- ✓ Union for the Mediterranean (UfM)
- ✓ United National Development Programme (UNDP)
- ✓ United Nations Educational Scientific and Cultural Organization (UNESCO)
- ✓ World Bank

186. During the period between the 2017 and 2023 Med QSRs a clear improvement is recorded in the coordination between regional organizations operating in the Mediterranean in relation to the preservation of the marine environment and the sustainable use of its biodiversity and living resources. Within this framework, memoranda of collaboration have been established between organizations with a view to promoting consultation and harmonization of activities to avoid duplication and to increase the complementarity of their intervention. In addition, projects involving several regional organizations have been implemented thanks to financial support provided by intergovernmental donors and private foundations. Such projects concerned various important issues for the marine environment of the Mediterranean such as marine litter, marine underwater noise, incidental catches of vulnerable species, habitat preservation and endangered species.

2. Mediterranean Quality Status Assessments

2.1 Pollution and Marine Litter

2.1.1 Pollution

Key messages related to Ecological Objectives 5 and 9

The Aegean – Levantine Sea Sub-region
Aegean Sea Sub-division

187. **EO 5 - CI 13 (DIN – Dissolved inorganic nitrogen and TP – total phosphorus) and CI 14 (Chla – Chlorophyll a):** Available literature indicates the presence of drivers and pressures with impacts related to eutrophication in the two areas found in non-good status in the present assessment, i.e., in the 1 non-good status subSAUs out of 16 subSAUs, as elaborated in 3.1.3. The non-good status in the Izmir province is related to the Izmir Bay and the southern coast of the province. Drivers that could impact eutrophication are: i) urban wastewater discharge, although many treatment plants were put into operation; ii) agriculture; iii) riverine discharge: Küçük, Menderes, Bakırçay and Gediz rivers, as the most important rivers of the Aegean Region. The main tributary of the Gediz River ,and the main streams feeding it, are considered to be under pressure in terms of point and diffuse pollution; iv) tourism; v) port operations: Izmir Port is the largest port in Turkeye after Mersin Port and vi) aquaculture. There are 66 fish farms, and 8 mussel farms operating on the coasts of İzmir province. In addition, available literature indicates the presence of drivers and pressures with impacts related to eutrophication in other areas of the AEGS which were classified in non-good status in the present assessment (see below assessment findings), for example, the Saronikos Gulf and Elfesis Bay, with extensive urbanization, industry and port activities and the Thermaikos Gulf impacted by agricultural discharges from the heavily polluted Axios River, and fish and shellfish mariculture.

188. **EO 9 – CI 17 (TM, Σ_{16}PAHs, Σ_5PAHs and Σ_7PCBs in sediments):** Using CHASE+, the AEGS was classified as in-GES for TM in sediments when the contribution of the two very limited affected areas (Elfesis Bay and inner Saronikos Gulf and area near Aliaga and Yenisakran) were not taken into account (see below assessment findings). It was not possible to classify the AEGS sub-division for Σ_{16} PAHs due to insufficient data while for Σ_5 the AEGS was classified as non-GES. It was not possible to classify the AEGS regarding Σ_7 PCBs in sediments due to insufficient data.

189. Regarding TM in sediments, one of the very limited non-GES areas was the Elfsis Bay/ inner Saronikos Gulf. Drivers and pressures in the area are extensive urbanization (metropolitan areas of Athens), Port activities and maritime traffic (Piraeus port), Industries located in the coastal area of the Elefsis Bay, such as oil refineries, steel and cement industries, and shipyards, Discharges of wastewater treatment plant. TM pollution decreased from 1999 to 2018 in some areas due to environmental policy enforcement combined with technological improvements by big industrial polluters (Karageorgis et al., 2020 and references therein). A second limited non-GES area was near Aliaga and Yenisakran. Possible drivers and pressures are port operations, industry, tourism and agriculture Further to input provided by Turkiye[43], the possible drives and pressures are mapped in the expanded area of the Balıkesir district and the Izmir province, where stations were classified as non-GES in this assessment. Those include: i) Urban waste water pressure due to increased population during the touristic summer seasons; ii) Port operations: Izmir Port is the largest port in Turkiye after Mersin Port; iii) Aquaculture is also present at some locations along the coast; iv) Agriculture also generates some pressures; v) Riverine inputs where the main streams generate pressures in terms of point and diffuse pollution.

[43] Submitted after the Meeting of CORMON Pollution that took place in Athens, 1-2 March 2023

190. It was not possible to classify the AEGS Sub-division regarding data for Σ16 PAHs in sediment due to insufficient data. There are indications that the offshore zone is in GES while the enclosed areas might be found as non-GES. Regarding Σ5 PAHs in sediments, the AEGS was classified as non-GES. The same limited areas classified as non-GES for TM in sediments are also non-GES for Σ5 PAHs, with the same drivers and pressures as for TM. Additional stations were found non-GES in the northern and central part of the AEGS, mainly in enclosed areas that are more sensitive to land-based sources pollutants.

191. The AEGS Sub-division could not be classified regarding assessment of Σ_7 PCBs in sediments due to lack of data. An affected, non-GES area was identified in the coast around Aliaga, Yenisakran and Candarli, as for TM. Possible drivers and pressures are port operations, industry, tourism and agriculture.

192. IMPACTS. No data on biota were available for the AEGS. Drivers and pressures that can impact biota were found in the AEGS.

193. **CI 18 - Level of pollution effects of key contaminants where a cause-and-effect relationship has been established:** Although drivers that could exert pressure and cause impact on CI 18, were identified in the AEGS, no data were available at IMAP-IS to check for impacts in biota. Only two relevant studies in the scientific literature reported data on biomarkers in the AEGS, both for Türkiye. Both showed indications of possible effect of TM and/or pesticides on the molluscs *Mytilus galloprovincialis* and *T. decussatus* collected from Homa Lagoon (Aegean Sea) (Uluturhan et al. 2019) and in the fish *M. barbatus, B. boops and T. trachurus* collected off the coast of Türkiye (Dogan et al., 2022).

194. **CI 20 - Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood:** See DPSIR assessment for the LEVS sub-division.

195. **CI 21 - Percentage of intestinal enterococci concentration measurements within established standards:** See DPSIR assessment for the LEVS Sub-division.

<u>*Levantine Sea Sub-division*</u>

196. **EO5 - CI 13 (DIN – Dissolved inorganic nitrogen and TP – total phosphorus) and CI 14 (Chla – Chlorophyll a):** Drivers that could impact CIs 13 and 14 are present in the LEVS: Agriculture, Tourism and maritime activities, Coastal urbanization, Sewage discharge, Seawater Desalination, Ports operation and maritime traffic, gas and oil exploration.

197. The complete GES assessment of the AEL Sub-region for CIs 13 and 14 was impossible given the lack of quality-assured, homogenous data that prevented the application of both EQR and simplified EQR assessment methodologies. Therefore, at this stage of 2023 MED QSR preparation, the assessment of eutrophication was performed by evaluating data only for Chl*a* available from the remote sensing COPERNICUS data by applying the simplified G/M comparison assessment methodology (see below assessment findings). The assessment results show that all evaluated assessment zones can be considered in good status regarding satellite derived Chl*a*.

198. Detailed examination showed that only 1 out of 18 SAUs, in the open waters (OW), was classified in non-good status. The SAU is located in the easternmost part of the southern Levantine Sea. The drivers and pressures in this SAU that could impact CI 14 are related to the area being one of the most densely populated areas in the world. Moreover, untreated or partially treated wastewater are discharged along the shoreline, polluting the coastal zone (Abualtayef et al., 2016).

199. **EO 9 – CI 17 (TM in sediments and biota, Σ_{16}PAHs, Σ_5PAHs and Σ_7PCBs in sediments):** Using CHASE+, the northern and eastern (NE) LEVS was classified as in-GES for TM in sediments, when the contribution of the two very limited affected areas (off Haifa and off Beirut, see

below see below assessment findings) were not taken into account. No assessment could be performed for the southern LEVS as no data were available. The NE LEVS was in-GES for Σ_{16} PAHs in sediments in Israel, Greece and Lebanon and in-GES for Σ_5 PAHs in sediments in Israel, Greece and Türkiye. The LEVS could not be classified based on assessment of Σ_7 PCBs in sediments due to lack of data and their uneven spatial distribution.

200. Regarding TM in sediments, non-GES stations were identified across the NE LEVS as follows: 1) In Israel, Northern Haifa Bay was non-GES (moderate status) and the main element contributing to this classification was Hg. The area is known to be still contaminated by legacy Hg, a pressure resulting from industry driver by ways of contaminated wastewater discharge. Even though there was a vast improvement following pollution abatement measures (Herut et al, 2016, 2021), the area is still contaminated; 2) In Lebanon, the main area in non-GES (moderate and poor) was off Beirut, in particular the Dora region, followed by area in the North Lebanon, with Cd and Hg concentrations contributing equally to the moderate classification. In Beirut, the drivers contributing to the pressures and state of the coast are urban development and industry, discharge of wastewater through marine outfalls and by riverine discharge of the Beirut River. In addition, dumpsites are present in the Dora region (Ghosn et al., 2020). Tripoli, in northern Lebanon, is known for its artisanal fishing and boat maintenance activities (Ghosn et al., 2020), the latter a driver for TM introduction.

201. Stations in moderate status regarding TM in sediments were found in Cyprus in Larnaka Bay, off Zygi and in Chrisochou Bay Possible drivers are maritime activities and port operations among others. In Greece, two stations were found in moderate status (Koufonisi (S. Crete), Kastelorizo), with Pb and Cd concentrations contributing to this classification. Possible drivers are maritime activities and traffic, and fishing. In Türkiye, 4 stations were classified as in moderate status: Akkuyu, Taşucu, Anamur, Göksu River mouth. Possible drivers are agriculture, marine activities, riverine discharge.

202. Although the areas with data for Σ_{16} PAH in sediments were overall characterized as in-GES, two geographically limited areas with non-GES status were identified. In Israel, at stations close to the locations of drilled wells for gas exploration (Astrahan et al., 2017). The driver was defined as maritime activities, offshore platforms of gas exploration. In Lebanon, off in Beirut. The same drivers contributing to the status of TM in sediments apply also for Σ_{16} PAH.

203. The LEVS sub-division could not be classified based on assessment of Σ_7 PCBs in sediments due to lack of data and their uneven spatial distribution. The Dora region off Beirut was affected with possible drivers similar to TM in sediments: urban development and industry, discharge of wastewater through marine outfalls and by riverine discharge of the Beirut River.

204. IMPACTS. Although drivers and pressures and non-GES statuses were identified for the CI 17 in the LEVS, essentially no impact was detected in the environmental status classification fish and the NE LEVS was classified as in-GES for TM in *M. barbatus*. The only non-GES station (1 out of 15) in poor status was located off Paphos, Cyprus and this classification was due to the concentration of Hg. No data were available for TM in sediments in this area. It should be emphasized, that concentrations not in-GES do not necessarily imply a biotic effect.

205. **CI 18- Level of pollution effects of key contaminants where a cause and effect relationship has been established:** Although drivers that could exert pressure and cause impact on CI18, were identified in the LEVS, no data were available at IMAP-IS to check for impacts in biota. Only two relevant studies in the scientific literature reported data on biomarkers in the LEVS. Both showed indications of possible effect of TM on various biomarkers in the mussel *Ruditapes* decussatus from Port Said (Egypt) (Gabr et al. 2020) and in the fish *M. barbatus, B. boops and T. trachurus* off the coast of Türkiye (Dogan et al., 2022).

206. **CI 20 - Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood:** The CI 20 DPSIR analysis was performed at the level of the entire AEL Sub-region due to the lack of

data for the separate analysis of LEVS and AEGS Sub-divisions. Drivers that could exert pressure and cause impact on CI 20 were detected in the AEL. The examination of CI 17 results showed no impact on biota in the LEVS and while no data were reported for biota in the AEGS. In addition, data reported to IMAP-IS for CI 17 for biota in the LEVS were examined based on the concentration limits for the regulated contaminants in the EU, concentrations higher than those used for the CI 17 assessment. No impact was detected on CI 20.

207. Out of the 23 studies found in the literature for the AEL, 87% reported concentrations of TM and organic contaminants below the concentration limits for the regulated contaminants in the EU, 4% reported concentrations above the limits but without risk to human health and 9% reported concentrations above the limits for the regulated contaminants with probable risk to human health.

208. **CI 21 - Percentage of intestinal enterococci concentration measurements within established standards:** The CI21 DPSIR analysis was performed at the level of the entire AEL Sub-region due to the lack of data for the separate analysis of LEVS and AEGS Sub-divisions. Drivers that could exert pressure and cause impact on CI 21 are present in the AEL, among them: Urban coastal development, Tourism, sporting and recreational activities; ports and maritime works, maritime activities. However, data were available only for Israel (2021) and Lebanon in 2019-2021 in the LEVS. All stations in Israel were in excellent category. In Lebanon, 4 out of 38 stations were classified in bad category, all in the Beirut area. Possible drivers are urban development and industry, discharge of wastewater through marine outfalls and by riverine discharge.

The Adriatic Sea Sub-region

209. **EO 5 – CI 13 (DIN – Dissolved inorganic nitrogen and TP – total phosphorus) and CI 14 (Chla – Chlorophyll a):** The detailed status assessment results show that all the SAUs achieve GES conditions (high and good status). For all three parameters, the results show that all SAUs and sub-SAUs are in GES. The only exceptions are the results for TP in a part of CAS in the Italian offshore coast (Abruzzo region), and the TP on the SAS coastal and offshore zones (Apulia region), that were classified in moderate status. The Abruzzo and Apulia regions were identified as having aquaculture and coastal and maritime tourism (Gissi et al., 2017). Both drivers were identified as high impact to CIs 13 and 14 (Table I, Annex IV (CH 3)). Nutrients might be introduced to the area causing pressure and have the possibility to cause eutrophication and impact habitats and biodiversity. In the case of moderate status for TP, it was a localized effect, not affecting the overall assessment status and all SAUs fall under the GES status (high, good). A natural process of nitrogen limitation in the area and subsequent accumulation of phosphorus may be an additional explanation to the moderate assessment. Although the two drivers, aquaculture and coastal and maritime tourism, are present in other areas of the Adriatic Sea, they did not impact CI 13 nor CI 14, as represented by the available data.

210. **EO 9 – CI 17 (TM in sediments and biota, Σ_{16}PAHs in sediments and Σ_7PCBs in sediments and biota):** Overall, the aggregation of the chemical parameters data per SAU in the Adriatic Sub-region classified 80% of the SAUs as in GES (High or Good status), and 20% of the SAUs as non-GES under moderate status.

211. The detailed status assessment results per contaminant per SAU at the 1st level of assessment (no aggregation or integration) showed that in most cases (80% of SAUs) GES conditions are achieved; 9% of the SAUs are classified in moderate status, 6% in poor status and 5% in bad status.

212. For the sediment matrix, the highest contamination is observed from PCBs, PAHs and Hg resulting in non-GES status for 60%, 57% and 27 % of the sub-SAUs, respectively. For the mussels matrix, the highest contamination is observed from PCBs which results in 39% of sub-SAUs in non-GES status.

213. In the NAS, 19% of sub-SAUs are classified as non-GES. The most affected sub-SAUs in the NAS are HRO-0313-BAZ, HRO-0412-PULP and HRO-0423-RILP in Croatia; Emiglia-Romana', 'Fruili-Venezia-Giulia-1' and 'Veneto-1' in Italy. Also, offshore SAUs IT-NAS-O and MAD-Sl-MRU-12 are affected. The NAS subdivision suffers from Hg contamination (moderate status) in sediments and mussels and PCBs (poor status) contamination in sediments.

214. In the CAS, 12% of the SAUs are classified as non-GES. The most affected sub-SAUs are HRO-0313-KASP, HRO-0313-KZ, HRO-0423-KOR in Croatia. The CAS sub-division suffers from Hg (poor status) and PCBs (moderate status) contamination in mussels.

215. In the SAS, 22 % of the SAUs are classified as non-GES. The most affected SAUs are HRO-0313-ZUC, HRO-0423-MOP and HRO-0313-ZUC in Croatia; and MNE-1-N, MNE-1-C, MNE-1-S, MNE-Kotor, in Montenegro which are found in poor or bad conditions regarding several contaminants. The SAS sub-division is affected by Pb (moderate status) and PCBs (moderate status) contamination in mussels.

216. The main drivers that could put pressure on TM in sediments are industry (waste discharge and dumping of waste), tourism (litter, domestic waste water discharge), ports and maritime works (accidental discharges, dredging), shipping traffic (accidental discharges, solid waste disposal). Shipping traffic is extensive in the Adriatic Sea. In addition, Gissi et al., 2017 identified coastal and maritime tourism in Abruzzo, Apulia, Emilia Romagna, Marche, Molise, Veneto and Slovenia, although tourism is well developed in Croatia as well. They also identified dumping area for dredging in Emilia Romagna. See also Annex V (CH 3) with an extensive study on the DPSIR in the Adriatic Sea.

217. In the southern Adriatic Sea, Albania's coast and offshore SAUs are non-GES concerning Hg in sediments. In Montenegro, Hg, Pb, Σ_{16}PAHs and Σ_7PCBs in sediments were classified as non-GES in the central coastal SAU as well in the Kotor Bay. The project GEF (*Global Environment Facility):* Adriatic Implementation of the Ecosystem Approach in the Adriatic Sea through Marine Spatial Planning, examined in detail the DPSIR elements for Albania and Montenegro marine environment. Those support the results of the NEAT assessment achieved with IMAP monitoring data. In Albania, about 15% of the coastline is urbanized, and tourism is increasing (drivers and pressure). Status. The initial assessment of pollution shows established significant concentrations of mercury and organochlorinated compounds in some of the assessed areas on the northern and central coast (status). In Montenegro, about 32.5% of the coastline is urbanized, while tourism consists mainly beach goers. Nearshore activities, such as shipyards and ports are also of concern (drivers and pressures). Status. The preliminary assessment of pollution shows higher concentration of contaminants in the coastal area, particularly in Boka Kotorska Bay. The levels of some contaminants exceed the established limit, specifically legacy pollutants such as heavy metals and organohalogen compounds in sediments.

218. IMPACTS. Although drivers and pressures and non-GES statuses were identified for CI 17 in the Adriatic Sea, a few impacts were detected in the environmental status classification of the biota. Moreover, the non-GES status of a contaminant in the biota usually did not correspond to a non-GES status for the contaminant in sediment in the same sub-SAU. In the NAS, sub-SAUs for biota were in non-GES status for Hg and PCBs, with no corresponding non-GES status in the sediment or no data for PCBs in sediments. In 3 instances there was a correspondence between non-GES status for Hg in biota and sediment. In several sub-SAUs, Pb in sediments were non-GES while in-GES in biota. In the CAS there was no correspondence between the status of the sediments and the status of the biota. In the SAS, for 2 sub-SAUs, non-GES status for Pb in sediments corresponds to non-GES status for Pb in biota.

219. **CI 18 - Level of pollution effects of key contaminants where a cause and effect relationship has been established:** Although drivers, that could exert pressure and cause impact on CI 18, were identified in the Adriatic Sea, no data were available at IMAP-IS to check for impacts in biota. One study from the scientific literature reported impact of PAHs on some of the biomarkers

measured in the specimens of the fish *Mullus barbatus* collected in an important fishery area in the North Adriatic Sea coming from Rimini to Ancona at a depth of 70 m (Frapiccini et al. 2020).

220. **CI 20 - Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood:** Drivers that could exert pressure and cause impact on CI 20 were detected in the Adriatic Sea Sub-region. The examination of CI 17 results showed no impact on biota. In additions, data reported to IMAP-IS for CI 17 for biota were examined based on the concentration limits for the regulated contaminants in the EU, concentrations higher than those used for the CI 17 assessment. No impact was detected on CI 20.

221. Out of the 25 studies found in the literature, 80% reported concentrations of TM and organic contaminants below the concentration limits for the regulated contaminants in the EU, and 8% reported concentrations above the limits but without risk to human health. Possible impact was detected in 12% of the studies that reported concentrations above the limits for the regulated contaminants with probable risk to human health.

222. **CI 21 - Percentage of intestinal enterococci concentration measurements within established standards:** Drivers that could exert pressure and cause impact on CI21 were detected in the Adriatic Sea, and among them the following: Tourism, sporting and recreational activities; ports and maritime works, maritime activities. However, essentially no impact was detected. Most of the bathing waters in the Adriatic were in the excellent and good GES classifications. A small percentage of bathing waters were classified as poor: 1.7% in Italy and 3.5% in Albania.

The Central Mediterranean Sea Sub-region

223. **EO 5 - CI 13 (DIN – Dissolved inorganic nitrogen and TP – total phosphorus) and CI 14 (Chla – Chlorophyll a):** The complete GES assessment of the CEN Sub-region for CIs 13 and 14 was impossible given the lack of quality-assured, homogenous data that prevented the application of both EQR and simplified EQR assessment methodologies. Therefore, the assessment of eutrophication was performed by applying the simplified G/M comparison assessment for evaluation of Chl *a* available from the remote sensing COPERNICUS data (see below assessment findings).

224. The assessment results show that despite the good status assigned to the assessment zones, the 7 out of 36 sub-SAUs are in the good status i.e., GREA, GREAMB, GREPAT, LBY_E, LBY_W, LBY_W; TUN_B in the Eastern and the Southern parts of the CEN Sub-region.

225. The subSAUs in Greece are located in Bays as are Ambracian Gulf (GREAMB), with pressure mainly from agriculture and Gulf of Patras (GREPAT) with pressures that include harbor operations, industries and agriculture. The more Northern subSAU (GREA) is probably influenced by the local sources of pollution (Igumenitsa port and intense aquaculture).

226. Along the Lybian coast, the influenced marine waters are in the western part of Libyan OW (subSAU LBYW), influenced by waters coming from the Gulf of Gabes where human activities contributed to the impact of eutrophication and by the city of Tripoli; in the eastern part of CW (subSAU LBYE). Several pressures that cause impacts of eutrophication are present in the Gulf of Gabes i.e., the subSAU TUNB located in CW: i) Large hurban center, ii) untreated domestic discharges, iii) industrial discharges, among them phosphogypsum, iv) agrochemical industry, v) agriculture.

227. **EO 9 – CI 17 (TM, Σ16PAHs, and Σ5PAHs in sediments)**: It was not possible to classify the Sub-region based on the CHASE+ application due to very limited available data and they uneven areal distribution in the CEN. The assessment was performed by station. Most of the stations were in-GES with respect to TM in sediments. Stations with non-GES status for Σ_{16}PAHs and Σ_{5}PAHs in sediments were identified.

228. Non-GES stations regarding Σ_5PAHs in sediments were located at the north-eastern and south-eastern part of Malta, in particular at the Port il- Kbir off Valetta and at the Operational Wied Ghammieq. Drivers and pressures in these areas are industrial plants and marine traffic. Non-GES stations were also located at the in the Gulf of Patras, Gulf or Corinth and in Kerkyraiki.

229. IMPACTS. Drivers and pressures and non-GES statuses were identified for the CI17 in the CEN. However, there were almost no data for contaminants in biota in the CEN. Eight samples of *M. galloprovincialis* were in-GES for TM and 5 samples of *M. barbatus* were classified as non-GES for Hg.

230. **CI 18 - Level of pollution effects of key contaminants where a cause and effect relationship has been established:** Although drivers that could exert pressure and cause impact on CI18, were identified in the CEN, no data were available at IMAP-IS to check for impacts in biota.

231. Examination of the scientific literature on the impact of pollution on biota biomarkers in the CEN found 5 studies for Tunisia and 1 from Italy. Drivers and pressures reported in the studies, encompassed the whole range of them: domestic and industrial discharges, agricultural and riverine runoff, fisheries, harbor and marina utilization, maritime activities, tourism. Studies demonstrated that, in addition to anthropogenic stressors, biomarker responses were influenced also by seasonality, tissue analyzed, spawning status, and on species identity.

232. It should be emphasized that the studies used different biomarkers, with different biota species, measuring in different tissues, and different methodologies. The biomarkers studied were not listed by IMAP, and if listed, not analyzed in the organ or tissue as required by IMAP. Most of the studies measured various biomarkers in the same station, with some showing an effect and others not. All the studies below reported an impact on some of the biomarkers. Therefore, the text below addresses only the areas and species studied, and possible specific drivers, if available, with the knowledge that impact was detected in some of the biomarkers.

233. Tunisia. One mesocosm experiment was performed in Mytilus spp. exposed to sediment contaminated by PAH and TM collected from the Zarzis area (Ghribi et al. 2020), while the effects of hydrocarbons were studied in the mollusc *Ruditapes decussatus* collected from the southern Lagoon of Tunis (Mansour et al. 2021). The effect of TM on the mollusc *Patella caerulea* was studied in specimens collected from 4 sites in the CEN (Zaidi et al. 2022). The effect of microplastic ingestion was studied in the fish *Serranus scriba* collected from 6 sites along the Tunisian coast (Zitouni et al. 2020) and on the seaworm *Hediste diversicolor* collected from 8 sites along the Tunisian coast (Missawi et al. 2020).

234. Italy. The effect of plastic ingestion was studies in the fish *Trachurus trachurus* collected for the Sicily straits (Chenet et al. 2021).

235. **CI 20 - Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood:** Drivers that could exert pressure and cause impact on CI 20 were detected in the CEN. TM data were present for Hg in 5 specimens of *M. barbatus* in IMAP-IS. The concentrations were higher than the thresholds for CI17 but lower than the limits for the regulated Hg in the EU. No studies were found in the literature.

236. **CI 21 - Percentage of intestinal enterococci concentration measurements within established standards.** Drivers that could exert pressure and cause impact on CI 21 are present in the CEN, among them: Urban coastal development, Tourism, sporting and recreational activities; ports and maritime works, maritime activities. No data were available for CI 21 in IMAP-IS.

The Western Mediterranean Sea Sub-region

237. **EO5 – CI 13 (DIN – Dissolved inorganic nitrogen and TP – total phosphorus) and CI 14 (Chl*a* – Chlorophyll a):** The complete GES assessment of the WMS Sub-region for CIs 13 and 14 was impossible given the lack of quality-assured, homogenous data that prevented the application of both EQR and simplified EQR assessment methodologies. Therefore, the assessment of Common Indicator 14: Chl *a* was undertaken in the three Sub-divisions of the Western Mediterranean Sub-region as follows: i) in the Central Sub-division of the Mediterranean Sea Sub-region (CWMS): the Waters of France and the Southern part of the Central CWMS; the Alboran (ALB) and the Levantine Balearic (LEV-BAL) Sub-division: the Waters of Spain by applying the Simplified G/M comparison assessment methodology on the satellite-derived Chl *a* data; and ii) the Tyrrhenian Sea Sub-division and part of the CWMS: the Waters of Italy by applying both the Simplified G/M comparison assessment methodology on the satellite-derived Chl *a* data and the simplified EQR assessment methodology on *in situ* measured Chl a data.

238. Despite the good status assigned to the assessment zones, the assessment findings indicate some sub-SAUs in non-good status. The present assessment of the waters of Spain (see below assessment findings) showed there are 8 out of 70 subSAUs which are non-good status (the evaluation was performed on 70 out of 149 SubSAUs), and which are located close to the Mar Menor; in the Segura River mouth; near Valencia; close to the Ebro River mouth; one area close to the French border; and on the Mallorca Island in the Alcudia Gulf. There is a slight difference between the thresholds calculated from the satellite-derived data used for the present assessment and the assessment criteria calculated from *in situ* measurements (see below assessment findings), which resulted in the regional assessment findings which do not fully match the eutrophication evaluation performed by Spain by applying the assessment criteria calculated from *in situ* measurements. In the waters of Italy, there are 9 out of 54 subSAUs that are in non-good status, and they are located as follows: in front of the Arno River mouth; in front of the Tiber River mouth; close to the Napoli urban agglomeration and SW part of Sardinia Island. In the waters of France, there is 1 subSAU (Golfe de Porto Vecchio) out of the 46 SubSAU in non-good status. For four subSAUs located in the FRD_E Assessment Zone and two in the Corsica Island assessment zone (FRE), the assessment was reconsidered as in good status. In fact, a discrepancy that appeared between the national and sub-regional assessments was addressed further to the justification provided by France which is based on i) the presence of WT I in water body DC04; ii) the presence of WT IIIW in water bodies DC06A; DC07I; DC08B; EC01C; EC04B and DC04; iii) the specific national knowledge of the local hydrological and environmental conditions. Among these 6 water masses, four are located in the FRD-E assessment zone namely DC04 (Golfe de Fos), DC06A (Petite Rade de Marseille), DC07I (Cap de L'estéral – Cap de Brégançon) and DC08B (Ouest Fréjus- Saint Raphaël). Two water masses are located in Corsica Island (FRE) and correspond to EC04B (Golfe D'Ajaccio) and EC01C (Golfe de Saint Florent). Water mass DC04 (Golfe de Fos) is a highly modified water mass characterised by a high spatial heterogeneity in chl *a* distribution. For other water masses (DC06A, DC07I and DC08B; EF04B and EC01C in Corsica), hydrodynamic studies revealed a very low annual renewal of water masses thus explaining slight accumulation of low phytoplankton biomass levels (Ganzin et al. 2010[44])

239. The below findings derived from literature sources support the assessment findings as presented in assessment findings which indicate a few spatial assessment units in non-good status[45].

[44] https://archimer.ifremer.fr/doc/00028/13931/11104.pdf
[45] The present assessment undertaken at the regional level, by using the satellite-derived Chl *a* data, indicates also weakened status in a few assessment areas along the coast of France, however, national authorities found that some regional assessment findings do not fully match the national assessments based on the use of *in situ* measurements. A presence of non-optimal matching of the regional and national assessments was also expressed by the authorities of Spain.

Drivers and pressures with impacts on eutrophication are found in the WMS[46]. The Spanish Mediterranean coastal zone may be affected by eutrophication mainly due to anthropogenic pressures, like agriculture (e.g., in Ebro Delta, rice field cultivation covers up to 65% of the area resulting in outputs of inorganic nutrients to nearby bays through drainage channels and the IMAP sub-SAUs ES100MSPFC32 in the vicinity was likely non-GES), but also by aquaculture, tourism, construction of harbors, intense urbanization, and industrialization. In French Mediterranean coast, the Gulf of Lion is one of the most historically known areas as influenced by natural and anthropogenic inputs of nutrients, receiving a large inputs of rural, urbanized, and industrialized discharges through the Rhone River. However, all sub-SAUs in the area were classified as in good status. The northern coasts of the Balearic Archipelago may be affected by the productivity imported from the Gulf of Lion, showing slightly higher concentration in the offshore north-eastern waters. Indeed, IMAP sub-SAU ES110MSPFMAMCp02 on the Mallorca Island in the Alcudia Gulf was classified as likely non-GES.

240. The Italian Western Mediterranean coast may be affected by riverine discharge e,g., the Arno river (subSAUs ITCWTCD and ITOWTCDoff Livorno), and the Tiber River (sub-SAUs ITCWLZ and ITOWLZC, Rome), as well as by the extensive population, tourism, port operations and industries, like the area of Naples (sub-SAUs ITOWCMC, ITOWCMD, ITCWCMC and ITCWCMD).

241. The Mediterranean Sea hosts around 400 coastal lagoons covering a surface of over 640 000 ha, that are important drivers for regional economies by way of fisheries, aquaculture, tourism, recreation and increased urbanization. One example of a well-studied lagoon is the Mar Menor located in the region of Murcia. The drivers and pressures on Mar Menor include tourism and agriculture along its shoreline and drainage area. In the present assessment the IMAP subSAU. ES070MSPF010300030, located close to the Mar Menor and IMAP subSAU ES080MSPFC017 located near the Segura River mouth were classified in non-good status. In addition, the area of the Gulf of Oristano in western Sardinia, is connected to the Cabras lagoon and may be influence by it (sub-SAU ITCWSDWB).

242. The present regional assessment using satellite-derived Chl *a* classified in non-good status one sub SAU EC03B close to Golfe de Porto Vecchio, located along the northern part of Corsica coast. As elaborated in the assessment findings, the assignment of non-good status can be explained in the context of the low number of pixels integrated into the assessment based on the use of the satellite-derived data along with the water properties complexified with sediment resuspension resulted in the uncertain computation of the mean Chl-a values. Additionally, the enclosed feature of the Gulf of Porto Vecchio with very low water renewal contributes to relatively high Chl concentrations observed in the area[47].

243. Mariculture is also well developed in Italian waters, for example off Genoa and in the Gulf of Follonica, the latter south of Livorno that was classified in non-good status in the present assessment (subSAUs ITCWTCD and ITOWTCD).

244. Although the non-good status was not found in the present assessment of the Southern part of the CWMS, it must be recognized that the assessment was impossible at the level of the finest spatial assessment units (subSAUs) due to the absence of finer water bodies delineation and related water typology characterization as for other Sub-divisions in the WMS. Given a less confidential assessment in this part of the WMS, some specific examples of drivers and pressures were mapped

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[46] Agriculture (runoff and riverine discharge), industry (land based sources; industrial wastewater discharge), aquaculture (coastal shellfish and fish farming activities), coastal urbanization and tourism (domestic wastewater discharge), seawater desalination, ports and maritime operations (dredging).

[47] Giret O., Mayot H., Porcheray C., Salou K., Le Bourhis K. (2023). Bilan des schémas régionaux de développement de l'aquaculture marine. Cerema – DIRM Méditerranée. 38 p.

from the scientific literature. The Oran harbor (Algeria) which receives the discharge of wastewater, while the Ghazaouet harbor is exposed to chemicals coming mainly from industrial activities. In addition, the high rate of urbanization around the harbor contributes to anthropogenic contamination (Kaddour et al. 2021). Algeria also has seawater desalination plants along its shoreline such as the Bousfer desalination plant in Oran Bay and the Beni Saf desalination plant.

245. **EO 9 - CI 17 (TM in sediments and biota (*M. galloprovincialis*) (ALBS); TM, Σ_{16}PAHs and Σ_7PCBs in sediments and biota (TYRS); TM, Σ_{16}PAHs and Σ_7PCBs in sediments and biota (CWMS)):** The assessment was conducted using NEAT in the ALBS and the TYRS Sub-divisions. A simplified application of NEAT (1st level, without any further spatial integration) was applied to the CWMS. Data were available only for some SAUs for the northern coast sub-division (Spain, France, Italy). No data were available for the southern CWMS coast (Algeria and Tunisia). The WMS assessment was made for the coastal zone, as 91% of data were coastal.

246. Overall, the Alboran Sea (ALBS) and the Tyrrhenian Sea (TYRS) were classified as in GES, in good status regarding all available parameters and SAUs. In the Central Western Mediterranean (CWMS) Sub-division, 6 out of 7 SAUs were classified in high or good statuses and one SAU was classified as non-GES, in moderate status regarding all available parameters.

247. A detailed examination of these classifications is presented here-below.

248. ALBS. The ALBS Sub-division was in GES (high and good statuses) for TM in sediments and for Cd and Pb in biota, and non-GES (moderate status) for Hg in biota sampled along the Spanish coast. In addition, off Morocco, one SAU was in moderate status for Cd in sediments and one in moderate status for Pb in sediments.

249. TYRS. The TYRS Sub-division was in GES (high and good statuses) for TM, Σ_{16}PAHs and Σ_7PCBs in sediments and biota. For the Italian coast several non-GES parameters were identified for some SAUs, as follows: one SAU was in moderate status regarding Cd and Hg in sediments, one SAU in moderate status for Cd in sediments and in poor status for Hg in sediments, and one SAU in moderate status for Cd and Σ_7PCBs.

250. CWMS. Non-GES SAUs for several parameters were identified in the CWMS sub-division as follows: One SAU with moderate Pb in sediment in Spain; in France, one SAU with poor status of Hg in sediments, moderate status for Cd and Hg in biota and poor status for Σ_{16}PAHs in biota; 2 SAUs with poor and moderate statuses for Σ_{16}PAHs in biota; in Italy, one SAU with moderate status for Cd in sediment and poor status for Σ_{16}PAHs and Σ_7PCBs in sediments.

251. Drivers and pressures are found in the WMS: Large Ports and maritime traffic, Coastal urbanization, Tourism, Riverine discharge, Agriculture and aquaculture, Desalination. Some specific examples for drivers and pressures can be found in the scientific literature.

252. IMPACTS. Drivers and pressures and non-GES statuses were identified for CI17 in the WMS however, essentially no impact was detected in the environmental status classification of biota. In the CWMS, for France, moderate status was found for Hg and Pb in biota, at the same SAU with poor status for Hg in the sediment. In addition, moderate and poor statuses were assigned to Σ_{16}PAHs in biota in three SAUs. No concentration of Σ_{16}PAHs in sediment were reported. In the ALBS, for Spain, Hg in biota was in moderate classification. No concentration was reported for Hg in the sediment. It should be emphasized, that concentrations not in-GES do not necessarily imply a biotic effect.

253. **CI 18 - Level of pollution effects of key contaminants where a cause and effect relationship has been established:** Although drivers that could exert pressure and cause impact on CI18, were identified in the WMS, no data were available at IMAP-IS to check for impacts in biota.

254. Examination of the scientific literature on the impact of pollution on biota biomarkers in the WMS found 4 relevant studies from Algeria, 2 from Italy, 5 from Spain and 4 from Tunisia. Drivers and pressures reported in the studies, encompassed the whole range of them: domestic and industrial discharges, agricultural and riverine runoff, fisheries, harbor and marina utilization, maritime activities, tourism. Studies demonstrated that, in addition to anthropogenic stressors, biomarker responses were influenced also by seasonality, tissue analyzed, spawning status, and on species identity.

255. It should be emphasized that the studies used different biomarkers, with different biota species, measuring in different tissues, and different methodologies. The biomarkers studied were not listed by IMAP, and if listed, not analyzed in the organ or tissue as required by IMAP. Most of the studies measured various biomarkers in the same station, with some showing an effect and others not. All the studies below reported an impact on <u>some</u> of the biomarkers. Therefore, the text below addresses only the areas and species studied, and possible specific drivers, if available, with the knowledge that impact was detected in some of the biomarkers.

256. Algeria: Mussel *Donax trunculus* from Annaba Bay, from 2 impacted sites (Sidi Salem and Echatt) and one reference site (El Battah) (Amamra et al. 2019); fish, *Mullus barbatus* from two impacted sites (Oran, Ghazaouet) and a control site (Kristel), along the Algerian west coast (Kaddour et al. 2021); mussel *Perna perna* transplanted to three sites in the Gulf of Annaba (Laouati et al. 2021); mussel *Patella rustica* from four sites (3 affected and one reference) off the Bousfer desalination plant (Oran Bay, Algeria) (Benaissa et al. 2020).

257. Italy: Fish *Parablennius Sanguinolentus* collected from the port of Bagnara Calabra on the western Calabrian coast of Italy and from a reference site, Jancuia Cove. Stressor – pesticides. (Parrino et al. 2020); mussel, *Mytilus galloprovincialis*, and fish, *Mullus barbatus, Pagellus erythrinus* and *Diplodus vulgaris*, from different stations at the Bay of Pozzuoli, within the Gulf of Naples. Stressors: TM and PAHs (Morroni et al. 2020).

258. Spain: Three studies conducted near Integrated Multi-Trophic Aquaculture cages in Palma de Majorca as possible driver: two with *Mytilus galloprovincialis*, (Capo et al. 2021; Rios-Fuster et al. 2022) and one with the fish *Sparus aurata* (Capó et al. 2022). In addition, fish, *Seriola dumerili* collected around the Pityusic Islands, (Eivissa and Formentera; Balearic Islands) (Solomando et al. 2022); and European anchovy (*Engraulis encrasicolus*) collected at three areas off Catalonia (Spain): Barcelona, Tarragona and Blanes (Rodríguez-Romeu et al., 2022).

259. Tunisia: Scallop *Flexopecten glaber* were collected from the entrance to the Bizerte Lagoon and a site located near Menzel Abderrahmen, contaminated by inputs from the surrounded industrial manufactories and urban agglomerations (Telahigue et al. 2022); polychaete *Perinereis cultrifera* collected from the port of Rades and the Punic port of Carthage, S2 (Bouhedi et al. 2021); fish *Serranus scriba* were sampled from 6 sites along the Tunisian coast (2 WMS and 4 CEN). Stressor, microplastic ingestion as a potential vector for the transmission of adsorbed environmental chemicals to marine organisms (Zitouni et al. 2020); seaworm (*Hediste diversicolor)* from eight sites along the Tunisian coasts (2 WMS and 6 CEN), affected by different anthropogenic stresses. Stressor analyzed – microplastic ingestion (Missawi et al. 2020).

260. **CI 20 - Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood:** Drivers that could exert pressure and cause impact on CI 20 were detected in the Western Mediterranean Sea. The examination of CI 17 results showed no impact on biota. In additions, data reported to IMAP-IS for CI 17 for biota were examined based on the concentration limits for the regulated contaminants in the EU, concentrations higher than those used for the CI17 assessment. No impact was detected on CI-20.

261. Out of the 37 studies found in the literature, 78% reported concentrations of TM and organic contaminants below the concentration limits for the regulated contaminants in the EU and 11% reported concentrations above the limits but without risk to human health. Possible impact was detected in 11% of the studies that reported concentrations above the limits for the regulated contaminants with probable risk to human health.

262. **CI 21 - Percentage of intestinal enterococci concentration measurements within established standards**: Drivers that could exert pressure and cause impact on CI 21 were detected in the Western Mediterranean Sea, and among them the following: Tourism, sporting and recreational activities; ports and maritime works, maritime activities. However, essentially no impact was detected. Most of the bathing waters in Spain, France and Italy were in the excellent and good GES classifications. A small percentage of bathing waters were classified as poor category: 0.1% in Spain, 1% in France, 1.7% in Italy. In Morocco, 20 out of 131 stations (15%) were classified as in bad status. Data were not available for Algeria and Tunisia.

Quality status assessments of the Mediterranean regarding Common Indicators of Ecological Objectives 5 and 9

263. In the region of Mediterranean Sea, four main sub-regions have been recognized for practical reasons and for the purpose of the UNEP/MAP 2011 Initial Integrated Assessment and the Med QSR 2017 assessment, namely: the Western Mediterranean Sea, the Adriatic Sea, the Central Mediterranean, and the Aegean and Levantine Seas in the Eastern Mediterranean part. The sub-divisions (i.e., subareas/seas) for IMAP Pollution Cluster have been initially identified according to availability of database sources for the purpose of development of the assessment criteria for pollution and the assessments within the preparation of the 2017 MED QSR.

264. Sub-divisions were further analyzed to support optimal application of the assessment criteria in the four Mediterranean sub-regions by considering data aggregation for update of the assessment criteria, as well as relevant sources. The nesting scheme of the Mediterranean sub-regions and sub-divisions aggregation is as follows: (i) coastal/ onshore waters; (ii) national sub-divisions; (iii) regional sub-divisions; (iv) sub-regions; (v) Mediterranean Region.

265. The distribution of the assessment methodologies used for assessment of IMAP CIs 13, 14, 17, 18, 19 , 20, 21, as well as for assessment of IMAP Candidate Common Indicators 26 and 27 in the four Mediterranean sub-regions and related sub-divisions is shown in Table 3.1.2.1.

Table 3.1.2.1. The methodologies used for assessment of the four Mediterranean Sub-regions

CIs 13&14		
Sub-region	**Sub-division**	**Methodology**
Aegean and Levantine Seas (AEL)	Aegean Sea (AEGS)	G/M comparison
	Levantine Sea (LEVS)	G/M comparison
Adriatic Sea (ADR)	North Adriatic (NAS) *	IMAP NEAT assessment methodology
	Central Adriatic (CAS) *	
	South Adriatic (SAS) *	
Central Mediterranean Sea (CEN)	Central Mediterranean (CENS)	G/M comparison
	Ionian Sea (IONS)	G/M comparison
Western Mediterranean Sea (WMS)	Alboran Sea (ALBS) and Levantine – Balearic Sea (LAVS-BAL) Sea Sub-division	G/M comparison
	Central Western Mediterranean Sea (CWMS): Central and Southern Parts	
	Tyrrhenian Sea (TYRS)	G/M comparison and EQR assessment
CI 17		
Sub-region	**Sub-division**	**Methodology**
Aegean and Levantine Seas (AEL)	Aegean Sea (AEGS)	CHASE+ assessment methodology
	Levantine Sea (LEVS)	
Adriatic Sea (ADR)	North Adriatic (NAS) *	IMAP NEAT assessment methodology
	Central Adriatic (CAS)*	
	South Adriatic (SAS) *	
Central Mediterranean Sea (CEN)	Central Mediterranean Sea (CENS)	CHASE+ assessment methodology
	Ionian Sea (IONS)	
Western Mediterranean Sea (WMS)	Alboran Sea (ALBS)	IMAP NEAT assessment methodology
	Central Western Mediterranean Sea (CWMS)	
	Tyrrhenian Sea (TYRS)	
CI 18		
The four Mediterranean Sub-regions: AEL, ADR, CEN and WMS		The assessment approach for biological effects based on the use of the literature sources only
CI 19		
Aegean and Levantine Seas (AEL)	Aegean Sea (AEGS)	CHASE-like approach applied, considering frequency of spill occurrence trend.
	Levantine Sea (LEVS)	
Adriatic Sea (ADR)	North Adriatic (NAS)	
	Centrale Adriatic (CAS)	
	South Adriatic (SAS)	
Central Mediterranean Sea (CEN)	Central Mediterranean Sea (CENS)	
	Ionian Sea (IONS)	
Western Mediterranean Sea (WMS)	Alboran Sea (ALBS)	
	Central Western Mediterranean Sea (CWMS)	
	Tyrrhenian Sea (TYRS)	

CI 20	
The four Mediterranean Sub-regions: AEL, ADR, CEN and WMS	The assessment approach for contaminants in seafood based on the concentration limits for the contaminants regulated in EU Regulations
CI 21	
The four Mediterranean Sub-regions: AEL, ADR, CEN and WMS	The assessment approach for bathing water quality based on complementary use of the assessment results as presented in the Assessment report from the European Environment Agency (EEA) on the State of Bathing Water Quality in 2020 and the assessment of monitoring data reported for IMAP
cCI 26	
The four Mediterranean Sub-regions: AEL, ADR, CEN and WMS	The adapted exposure metrics and assessment methodology as provided in the document “Setting of EU Threshold Values for impulsive underwater sound – Recommendations” from the Technical Group on Underwater Noise (TG Noise), available at this URL The adaption of the assessment methodology was undertaken further to the proposal of the IMAP Guidance Factsheet for cCI 26.
cCI 27	
The four Mediterranean Sub-regions: AEL, ADR, CEN and WMS	The adapted exposure metrics and assessment methodology as provided in the document “Setting of EU Threshold Values for continuous underwater sound – Recommendations” from the Technical Group on Underwater Noise (TG Noise), available at this URL The adaption of the assessment methodology was undertaken further to the proposal of the IMAP Guidance Factsheet for cCI 27.

* Referred to as NAS (Northern Adriatic Sea), CAS (Central Adriatic Sea) and SAS (Southern Adriatic Sea) in NEAT assessment, instead of NADR (North Adriatic), MADR (Middle Adriatic) and SADR (South Adriatic), respectively.

Assessment of IMAP Common Indicators 13 and 14

Geographical scale of the assessment	Sub-regional based on integration and aggregation of the assessments at sub-division levels
Contributing countries	Croatia, Italy, Slovenia and Montenegro
Mid-Term Strategy (MTS) Core Theme	Enabling Programme 6: Towards Monitoring, Assessment, Knowledge and Vision of the Mediterranean Sea and Coast for Informed Decision-Making
Ecological Objective	EO9. Contaminants cause no significant impact on coastal and marine ecosystems and human health
IMAP Common Indicators	CI13. Key nutrients concentration in water column CI14. Chlorophyll-a concentration in water column
GES Definition (UNEP/MED WG 473/7) (2019)	**CI 13**: Concentrations of nutrients in the euphotic layer are in line with prevailing physiographic, geographic and climate conditions **CI 14**: Natural levels of algal biomass, water transparency and oxygen concentrations in line with prevailing physiographic, geographic and weather conditions
GES Targets (UNEP/MED WG 473/7) (2019)	**CI 13** • Reference nutrients concentrations according to the local hydrological, chemical and morphological characteristics of the un-impacted marine region. • Decreasing trend of nutrients concentrations in water column of human impacted areas, statistically defined. • Reduction of BOD emissions from land-based sources. • Reduction of nutrients emissions from land-based sources **CI 14** • Chlorophyll a concentration in high-risk areas below thresholds • Decreasing trend in chl-a concentrations in high risk areas affected
GES Operational Objective (UNEP/MED WG473/7) (2019)	**CI 13** Human introduction of nutrients in the marine environment is not conducive to eutrophication **CI 14** Direct and indirect effects of nutrient over-enrichment are prevented

The IMAP Environmental Assessment of the Aegean and Levantine Seas Sub-region (AEL)

266. Given the lack of quality-assured, homogenous data prevented the application of both the EQR and the simplified EQR assessment methodologies, the assessment of eutrophication within the preparation of the 2023 MED QSR was undertaken in the sub-divisions of the Aegean-Levantine Sea (AEL), the Central Mediterranean Sea (CEN) and the Western Mediterranean Sea (WMS) by evaluating only data for Chla available from the remote sensing sources, whereby the typology-related assessment was impossible to apply.

267. The application of the Simplified methodology based on G/M comparison in the AEL Sub-region relied on the use of COPERNICUS data for Chl*a* obtained by remote sensing.

Along with the application of the IMAP NEAT GES assessment methodology in the Adriatic Sea Sub-region, the application of the Ecological quality ratio (EQR); the Simplified EQR methodology, and the Simplified methodology based on G/M comparison was also explored in another three Mediterranean Sub-regions with insufficient data for the IMAP NEAT GES assessment.

The ecological quality ratio (EQR) is a dimensionless measure of the observed value of an indicator compared with reference conditions. The ratio goes from 0 (large deviation) to 1 (when the observed value is equal or better than the reference conditions).

The application of the EQR method was found relevant for assessment of IMAP Common Indicators 13 & 14 where full set assessment criteria for Chl*a*, DIN and TP exist. Typology related assessment needs to be performed.

Given the lack of data reported by the CPs, this methodology was impossible to apply within the preparation of the 2023 MED QSR. However, key aspects of this methodology, as presented here-below, are developed for future application within the implementation of IMAP.

The EQR, which is set as the relative deviation from the reference conditions (RC), must be calculated for every boundary value using the simple equation:

$$EQR_{actual} = RC/Chl\mathit{a}_{annual\ G\text{-}mean} \qquad (1)$$

where for Chl$a_{annual\ G_mean}$, the Chl*a* concentrations defined for every boundary value must be used.

As Chl*a* concentrations are derived using non-linear relationships, the corresponding EQRs are not on a linear equidistant scale. To calculate the EQRs values normalized (Anon, 2005) to the scale from 0 to 1 (EQR_{norm}) and set them equidistantly, with respect to the calculated values designated as EQR*actual*, the following conversion functions need to be used:

Chl*a* - $EQR_{norm} = 0.2586 \ln(EQR_{actual}) + 0.9471$	for Type I coastal waters	(2)
TP - $EQR_{norm} = 0.3183 \ln(EQR_{actual}) + 0.9521$	for Type I coastal waters	(3)
Chl*a* - $EQR_{norm} = 0.1824 \ln(EQR_{actual}) + 1.0253$	for Type I open waters	(4)
DIN - $EQR_{norm} = 0.1216 \ln(EQR_{actual}) + 1.0209$	for Type I open waters	(5)
Chl*a* - $EQR_{norm} = 0.1488 \ln(EQR_{actual}) + 1.0385$	for Type I Montenegro	(6)
DIN - $EQR_{norm} = 0.0966 \ln(EQR_{actual}) + 1.0378$	for Type I Montenegro	(7)
Chl*a* - $EQRnorm = 0.246 \ln(EQRactual) + 0.981$	for Type II A Adriatic coastal waters	(8)
TP - $EQRnorm = 0.333 \ln(EQRactual) + 0.979$	for Type II A Adriatic coastal waters	(9)

The actual and normalized EQRs for all boundary values of Types I, and II A Adriatic are shown in Tables I and II, Annex II (CH 2), respectively.

Finally, for each considered variable, sampling station or area is classified in GES or non-GES, comparing the EQR value of the indicator to the class boundary value.

The application of the simplified EQR methodology was found relevant where complementary data availability i.e. *in situ* and from remote sensing is found for Chla only and the typology related assessment is not possible to apply. Given the lack of homogenous quality assured data reported by the CPs even for Chla only, an application of the simplified EQR method was impossible for any sub-region/sub-division within the preparation of the 2023 MED QSR.

For the application of the simplified EQR method within the IMAP implementation, thresholds need to be used to define the boundary limits between an acceptable and unacceptable environmental status (i.e., Good Environmental Status (GES) or non-Good Environmental Status (non-GES)). In the absence of the assessment criteria for nutrients, application of the simplified EQR method is foreseen by relying on the experiences gained in the Baltic Sea (Andersen et al. 2011; HELCOM 2010). For an indicator showing a positive response (i.e., nutrients and Chl*a*), it indicates that the threshold has an upper limit of +50 % deviation from reference conditions. Setting the threshold to 50 % implies that low levels of disturbance (defined as less than +50 % deviation), resulting from human activity, are considered acceptable, while moderate (i.e., greater than +50 %) deviations are not considered acceptable for the water body in question.

Given the lack of quality-assured homogenous data prevented the application of NEAT, EQR and simplified EQR assessment methodologies, the assessments within the 2023 MED QSR were prepared only by evaluating data available for Chla from remote sensing sources, whereby the typology-related assessment is impossible to apply. The application of **the simplified methodology based on G/M comparison** relied on the use of satellite-derived data for Chl*a* (e.g. COPERNICUS, ARGANS, SMED algorithm).

Data were aggregated as a 5-year geometric mean and normalized in order to ensure their comparability between the areas of assessment. For normalization, the bestNormalize package in R was used. The best normalization transformation was identified as the Ordered Quantile normalizing transformation (Bartlett, 1947, Beasley et al., 2009). From the normalized values, the following values are back-transformed: the 10^{th} percentile as the reference condition, the 50^{th} percentile as the mean value of the distribution, and the 85^{th} percentile ~ mean +1 SD that represents the G/M threshold.

Finally, each considered observation point or area was classified in GES or non-GES status, comparing the value of the indicator to the boundary limit between G/M i.e. back transformed the 85^{th} percentile of the normalized distribution.

Available data.

268. A detailed data analysis was performed in order to decide on applying the assessment methodologies that can be found optimal for specific sub-region/sub-division in the present circumstances related to the lack of data reporting. Table 3.1.3.1.1 informs on data availability in AEL by considering data reported by the Contracting Parties by 31st October, the cut-off date for data reporting. Figure 3.1.3.1.1 shows the locations of sampling stations in the AEL Sub-region.

Table 3.1.3.1.1. Data availability by country and year for the Aegean Levantine Sea (AEL) Sub-region showing data reported by the CPs for the assessment of EO5 (CI13 and CI14) up to 31st Oct 2022.

Country	Year	Amon	Ntri	Ntra	Phos	Tphs	Slca	Cphl	Temp	Psal	Doxy
Cyprus	2016	182	172	197	89	-	17	180	205	203	186
	2017	38	15	48	14	-	28	141	150	150	131
	2018	39	27	41	41	-	36	56	93	91	109
	2019	45	22	49	49	-	49	37	38	38	62
	2020	84	67	82	82	-	39	86	72	71	72
	2021	-	-	-	-	-	-	136	112	112	107
Greece	2016-2021	No data provided									
Egypt	2016-2021	No data provided									
Israel	2017	15	15	15	15	-	15	15	15	15	15
	2018	14	14	14	14	-	14	14	13	13	13
	2019	14	14	14	14	-	14	14	14	14	14
	2020	14	14	14	14	-	14	14	14	14	14
Lebanon	2017	-	225	225	225	-	-	195	224	224	-
	2018	-	286	286	286	-	-	247	285	285	-
	2019	-	547	547	547	-	40	386	538	538	-
	2020	-	268	268	268	-	-	160	268	268	-
	2021	-	291	291	291	-	-	154	291	291	-
Syria	2016-2021	No data provided									
Turkiye	2016	342	209	341	342	341	342	209	342	342	307
	2019	1460	1055	1479	1138	1545	972	1052	994	17713	1558

Amon - Ammonium; Ntri- Nitrite; Ntra – Nitrate; Phos – Orthophosphate; Tphs—Total phosphorous; Slca – Orthosilicate; Cphl – Chlorophyll *a*; Temp – Temperature; Psal – Salinity; Doxy – Dissolved Oxygen.

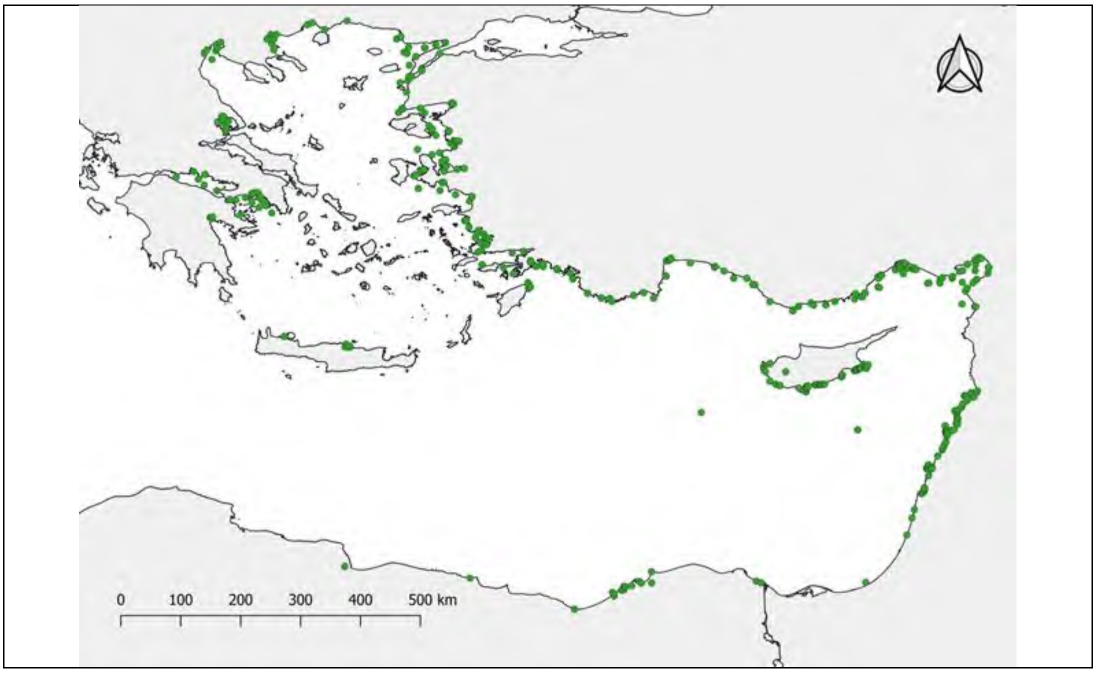

Figure 3.1.3.1.1. The locations of sampling stations in the AEL Sub-region

269. Given the lack of homogenous and quality assured data reported in line with IMAP requirements, as shown in Table 3.1.3.1.1, it was necessary to explore the use of alternative data sources. The COPERNICUS source was found relevant regarding the existence of a systematic repository of remote sensing data for Chl a. Using only Chl a data, with a good geographical coverage (1 x 1 km) and high sensing frequency (daily), it was possible to tentatively develop a simple assessment method, by applying ecological rules and a comparison of the obtained values to the defined G/M threshold. Chlorophyll a data for the Levantine Sea Sub-division, comprising of 22 million records, and for the Aegean Sea Sub-division, comprising of 20 million records, were downloaded from the Copernicus web-site[48.]

270. For the Levantine Sea the Copernicus product with ID: OCEANCOLOUR_MED_BGC_MY_009_78 was downloaded for the period from Apr 2016 to Mar 2021. It consists of Level 4 monthly values of Chlorophyll a concentration (CHL) with a resolution of 1 x 1 km. The file format is NetCDF-4 (.nc).

271. For the Aegean Sea the Copernicus product with ID: OCEANCOLOUR_MED_BGC_MY_009_144 was downloaded for the period from Jan 2016 to Dec 2020. It consists of Level 4 monthly values of Chlorophyll a concentration (CHL) with a resolution of 1 x 1 km. The file format is NetCDF-4 (.nc).

272. Data elaboration was performed by using R, an open-source language widely used for statistical analysis and graphical presentation (R Development Core Team, 2022)[49]. Maps are elaborated using QGIS 3.28, an open-source GIS tool.

273. For every point of the grid (Figure 3.1.3.1.2.a and b), a GM annual value was calculated, as required in the COMMISSION DECISION (EU) 2018/229[50]. The parameter values were expressed in µg/l of Chlorophyll a, for the geometric mean (GM) calculated over the year in at least a five-year period. These GM annual values were later used as a metric for the development of the assessment criteria for the present CI 14 assessment.

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[48] https://data.marine.copernicus.eu/product/OCEANCOLOUR_MED_BGC_L4_NRT_009_142/description

[49] R Development Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0. http://www.R-project.org

[50] Commission Decision (EU) 2018/229 of 12 February 2018 establishing, pursuant to Directive 2000/60/EC of the European Parliament and of the Council, the values of the Member State monitoring system classifications as a result of the intercalibration

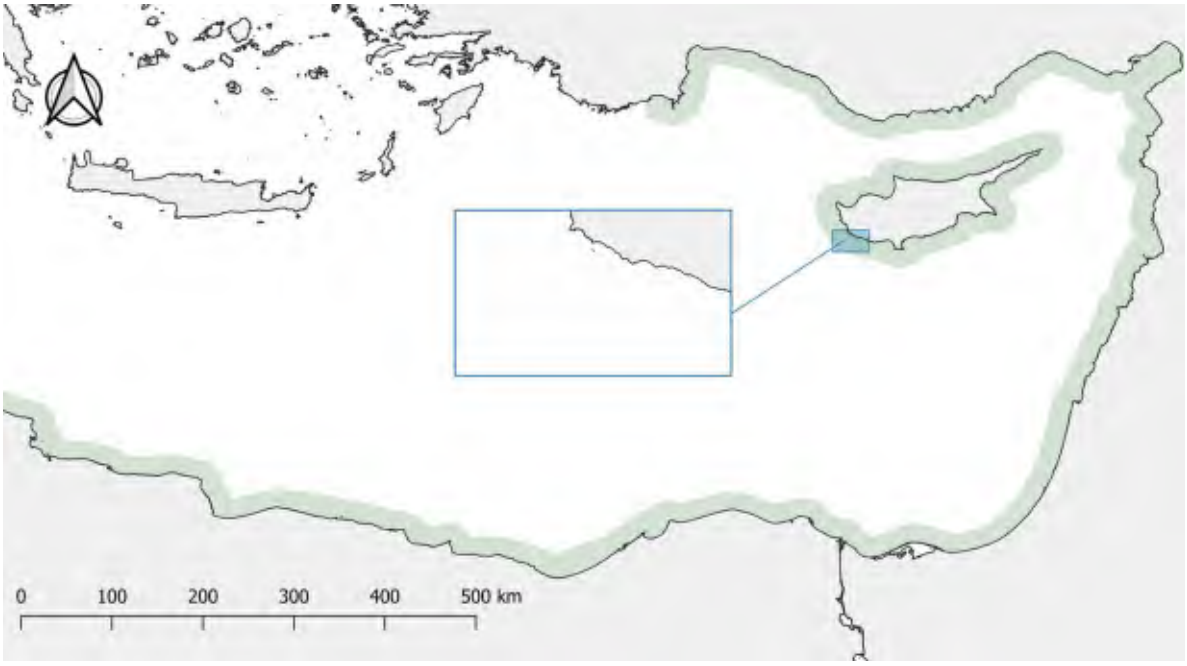


Figure 3.1.3.1.2.a. The Levantine Sea Sub-region: The dots in the assessment zones represent data in the grid (1 x 1 km). In the small rectangle a detailed view of the sensing grid is presented.

Figure 3.1.3.1.2.b. The Aegean Sea Sub-division: The dots in the assessment zones represent data in the grid (1 x 1 km). The blue lines demark the three spatial assessment units set within the Aegean Sea Sub-division for the purpose of data grouping for the present assessment.

Setting the areas of assessment.

274. Following the rationale of the IMAP national monitoring programmes related to distribution of the monitoring stations, as well as the rules for integration and aggregation of the assessment products, in the Levantine Sea Sub-divisions for the purposes of the present work the two zones of assessment were defined, i.e., : i) the coastal zone and ii) the offshore zone; and given the lack of information on water typologies present in national waters, for the present assessment in the Aegean Sea Sub-division only the coastal zone was assessed.

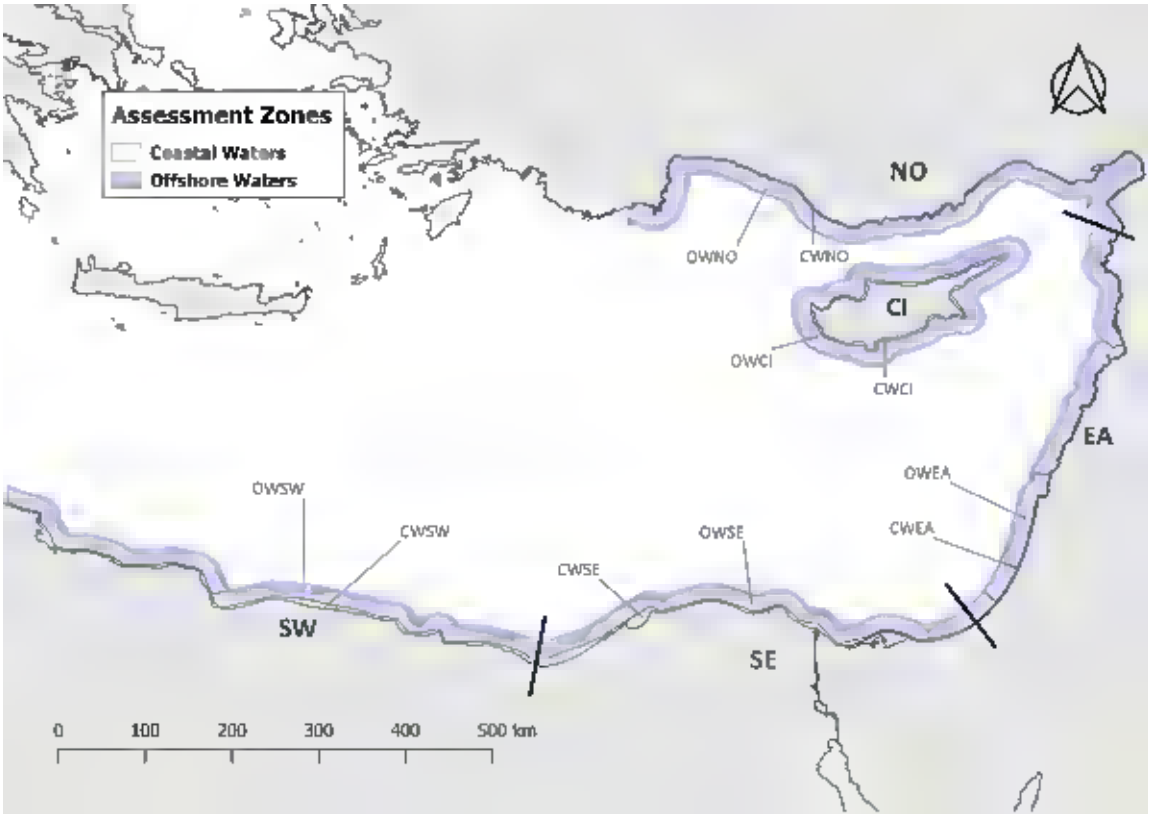
275. For purpose the of present work, it should also be recalled that GIS layers collected from different sources (International Hydrographic Organization – IHO Seas subdivisions, European Environment Information and Observation Network – EIONET (WFD delimitation (2018)); VLIZ marine subregions.

Levantine Sea

276. The principle of the NEAT IMAP GES assessment methodology applied in the Adriatic Sea Sub-region, as well as in the Western Mediterranean Sea Sub-region regarding CI 17, for setting of the spatial assessment units (SAUs) within the two main assessment zones along the IMAP nesting scheme, was also followed for setting the coastal (CW) and the offshore monitoring zones (OW) in the Levantine Sea Sub-division. The CW included internal waters and one Nautical Mile outward. The offshore waters in the LEV start at the outward border of CW and extend to 20 km outward given this coverage corresponds to the area where national monitoring programmes are performed as shown in Figure 22: Pressures exerted by agriculture on the marine environment.

277. The AZ were divided between the five areas Northern, Eastern, Cyprus Island and the two Southern (West and East), which delimitations are shown on Figure 3.1.3.1.3. (upper map). It resulted in eight SAUs (i.e., CWNO – Northern CW; OWNO – Northern OW; CWEA – Eastern CW; OWEA – Eastern OW; Cyprus Island CW – CWCI; Cyprus Island OW – OWCI; Southern East CW – CWSE; Southern East OW – OWSE; Southern West CW – CWSW; and Southern West OW – OWSW). The finest IMAP SAUs were further set on the base of nested assessment areas (AZs, five areas) by considering the national areas of monitoring and hydrographic characteristics.

278. The finest IMAP sub SAUs set in the Levantine Sea Sub-division for the purpose of the present CI 14 assessment are depicted in. Figure 3.1.3.1.3 (lower map), including their nesting in the two main assessment zones i.e. CW and OW of the Levantine Sea Sub-division.



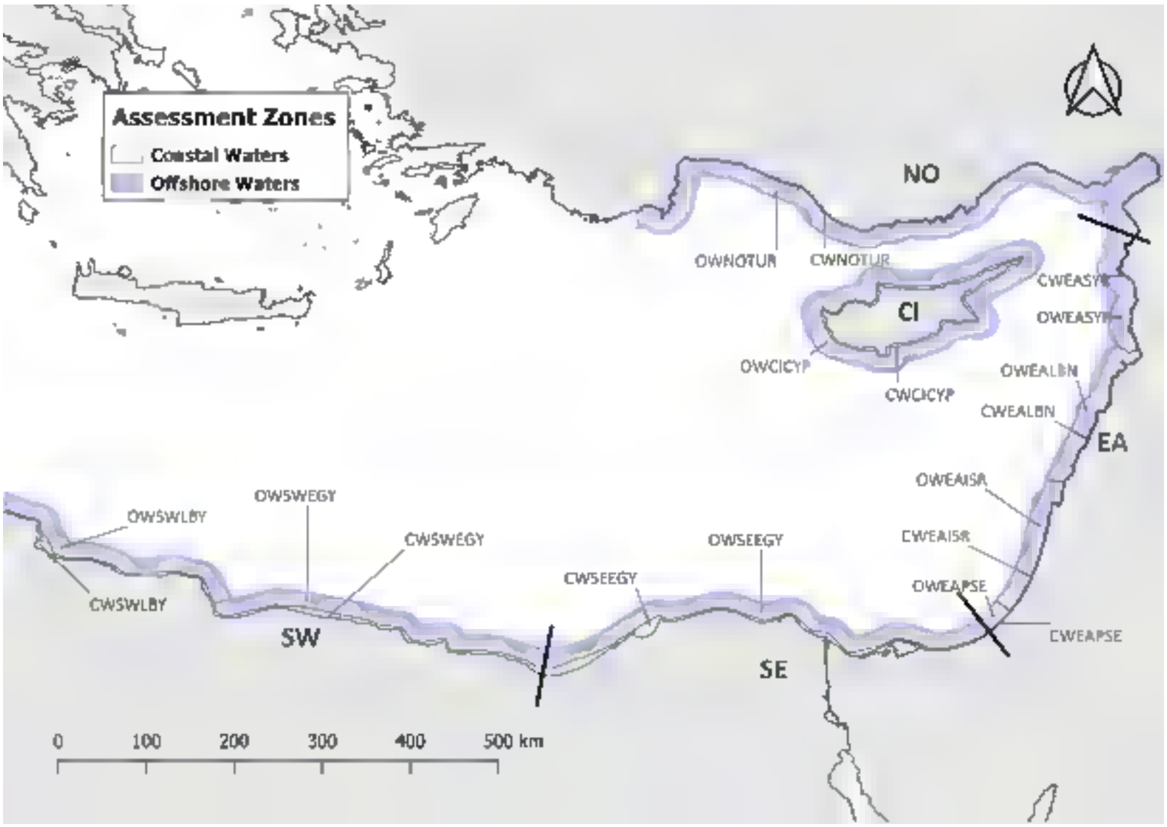


Figure 3.1.3.1.3.a. The nesting of IMAP spatial assessment units set in the coastal (CW) and the offshore assessment (OW) zones of the Levantine Sea Sub-division by SAU (upper map); and depiction of the finest IMAP subSAUs (lower map).

Aegean Sea

279. In addition, available literature indicates waters in front of Mersin and in the Iskenderun Bay as impacted areas. A slight impact can also be identified along the coast of Israel and in the OW in the southern part of the Eastern Levantine Sea, as well as in front of Port Said and Alexandria. The influence of the Nile River through the river Delta is weak and confirms the changes in the area caused by construction of the Aswan dam. There is also an indication of a coastal impact in the Tobruk area in the waters of Libya.

280. The Coastal Assessment Zone was divided into three spatial assessment units (SAUs) within the Aegean Sea Subdivision: the North Aegean (NA), the Central Aegean (CA) and the South Aegean (SA) as shown in Figure 3.1.3.1.3.b. Then the finest spatial assessment units (sub SAUs) were obtained in the three SAUs by taking account of the definition of the Greek (EIONET) and the Turkish[51] national waterbodies for assessment of eutrophication.

281. The finest IMAP subSAUs set in the Aegean Sea Sub-division for the purpose of the present CI 14 assessment are depicted Figure 3.1.3.1.3.b. It shows their nesting in the Aegean Sea Sub-division. Namely, the following sub SAUs were set: i) 8 along the coast of Greece: AEG_C_ARG, AEG_C_ISL, AEG_C_SOR, AEG_N_HAL, AEG_N_HAL_O, AEG_N_ISL, AEG_N_THE and AEG_S_KRE; and 7 along the coast of Turkiye EGE_C, EGE_S, EGE04, EGE09, AEG_N, EGE_N and EGE13_2.

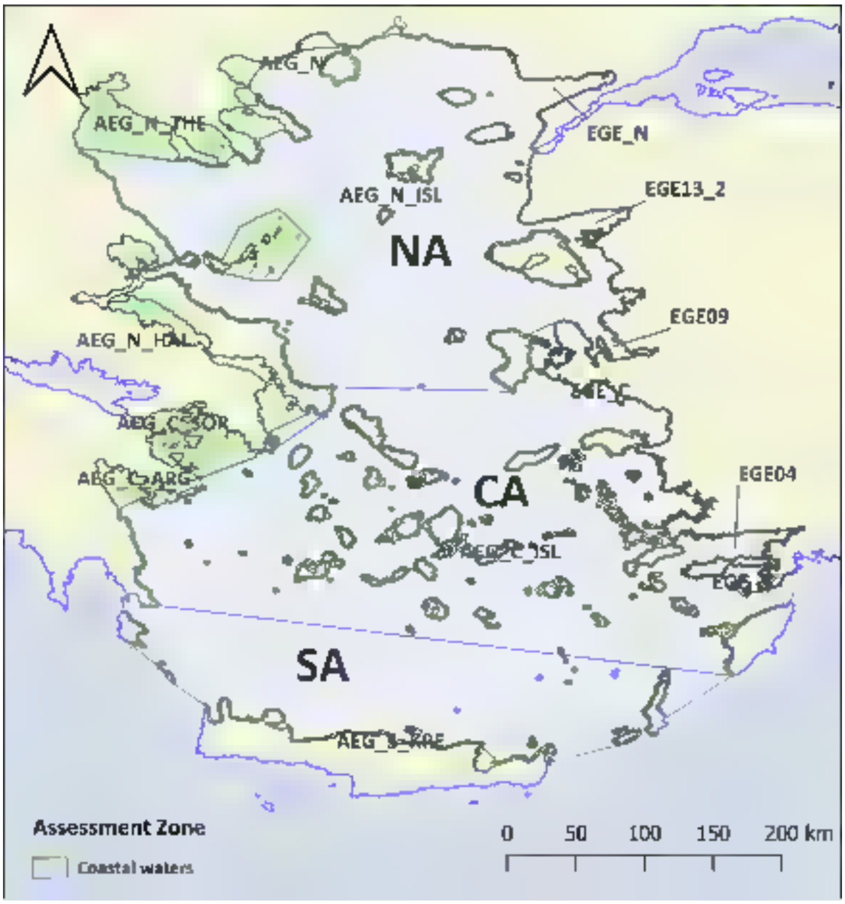


Figure 3.1.3.1.3.b. The nesting of the finest IMAP spatial assessment units (sub SAUs) in the coastal (CW) zone of the Aegean Sea Sub-division.

[51] NEAT, BEAST, Lusival Index, Ecological Quality Index Evaluation Report of Turkish Eagean Coasts

<u>Setting the good/non-good boundary value/threshold for the Simplified G/M comparison assessment methodology application in the AEL Sub-region</u>

282. The definition of baseline and threshold values for IMAP CIs 13 and 14 in the Mediterranean Sea is an ongoing process. The setting of GES-nonGES boundary limits within GES assessment of the Adriatic Sea Sub-region for IMAP CIs 13 and 14 were based on the boundary and reference values defined for TP and DIN, and updated ones for Chl a.

283. The attributes were added to all new satellite derived Chl*a* data points in order to allow their use for calculation of the assessment criteria by the CW and OW, and SAUs in the Levantine Sea Sub-division, and by the CW and SAUs in the Aegean Sea Sub-division.

284. The use of a new parameter for assessment i.e. satellite derived Chl*a* imposes calculation of a new set of assessment criteria given absence of any tested relationship of the satellite derived Chl*a* data with *in situ* measured Chl*a* data based on effects-pressures relationship. Namely, the use of reference and boundary water types related values[52], , was impossible for the present work.

285. In order to calculate the assessment criteria applicable within the present work, the annual GM values for satellite derived Chl*a* data were normalized using the R package *bestNormalize*. Then, the normalization process was tested for usual normalisation transformation, log x, boxcox, yeojohnson and Ordered Quantile normalizing transformation (orderNorm). The best normalisation was obtained with *orderNorm()*, and it was used for calculation of the assessment criteria applied to deliver the present CI 14 assessment.

286. For the assessment of CI 14, the Reference conditions (RC) were calculated from the normalized values and were represented by the 10th percentile. For setting the G/M threshold, a modification of the rule applied in the Baltic Sea (Andersen et al. 2011[53]; HELCOM 2010[54]) was applied within the present work given the 50th percentile represents the mean value of the distribution, and the 85th percentile ~ mean +1 SD represents the G/M threshold. It was necessary to use this criterion given expert - based analysis of the satellite derived Chl*a* preliminary indicates that most of the assessed waters are in the high status.

287. The transformation of percentile to z-scores were obtained using the pnorm() an qnorm() functions in R. The RC values (oN10) and the G/M thresholds (oN85) were calculated from the normalized values through the predict function. The results of calculation are presented in Table 3.1.3.1.2.a, and are obtained by the AZs and SAUs set in the Levantine Sea Sub-division, and in Table 3.1.3..1.2.b in the Aegean Sea Sub-division. In the absence of information on water typologies present in national waters, the assessment criteria were provided only at the level of SAUs.

[52] The water typology was applied as set by the Decision IG.23/6 of COP 20 (MED QSR)

[53] Andersen, J. H., Axe, P., Backer, H., Carstensen, J., Claussen, U., Fleming-Lehtinen, V., et al. (2011). Getting the measure of eutrophication in the Baltic Sea: towards improved assessment principles and methods. Biogeochemistry, 106(2), 137–156.

[54] HELCOM. (2010). Ecosystem health of the Baltic Sea 2003-2007: HELCOM Initial Holistic Assessment.

Table 3.1.3.1.2 a.: Reference conditions (oN10) and G/M threshold (oN85) set by IMAP Assessment zones (AZ) and Spatial Assessment Units (SAU) in the Levantine Sea Sub-division.

AZ	SAU	oN50	oN50+50	oN90	oN10	oN85	oN25
CW	CI	0,047	0,071	0,075	0,034	0,065	0,039
CW	EA	0,462	0,692	1,762	0,125	1,402	0,209
CW	NO	0,152	0,227	2,156	0,066	1,454	0,089
CW	SE	1,769	2,653	5,675	0,059	4,773	0,174
CW	SW	0,038	0,056	0,161	0,025	0,104	0,029
OW	CI	0,039	0,059	0,051	0,029	0,049	0,034
OW	EA	0,061	0,092	0,142	0,042	0,110	0,051
OW	NO	0,064	0,095	0,170	0,044	0,140	0,052
OW	SE	0,227	0,341	1,495	0,042	0,990	0,093
OW	SW	0,031	0,047	0,037	0,023	0,035	0,028

oN50 – Mean, oN50+50 – Mean + 50%, oN90 – 90th percentile, oN10 – 10th percentile, oN85 – 85th percentile, oN25 – 25th percentile

Table 3.1.3.1.2. b. Reference conditions (oN10) and G/M threshold (oN85) set by IMAP Assessment zones (AZ) and Spatial Assessment Units (SAU) in the Aegean Sea Sub-division.

AZ	SAU	oN50	oN50+50	oN90	oN10	oN85	oN25
CW	CA	0,074	0,111	0,142	0,053	0,12	0,06
CW	NA	0,126	0,189	0,625	0,085	0,436	0,097
CW	SA	0,056	0,084	0,079	0,046	0,07	0,051

oN50 – Mean, oN50+50 – Mean + 50%, oN90 – 90th percentile, oN10 – 10th percentile, oN85 – 85th percentile, oN25 – 25th percentile

288. By selecting the 85th percentile of the normalized distribution as G/M boundary limit, therefore as the limit between the acceptable and the unacceptable statuses i.e. good and non-good , the compatibility of the present classification was achieved with a five classes GES/non GES scale set in the Adriatic Sea Sub-region. It should be noted that the two status classes i.e., good and non-good are assigned to the units assessed by applying the simplified G/M assessment methodology. Since the assessment findings are based on the use of only one parameter i.e., Chl-a, and therefore, the integrated consideration of the minimum of parameters needed to assess the good environmental status for IMAP CIs 13 and 14 was impossible, only classification in good and non-good status was provided.

Results of the Simplified G/M comparison assessment methodology application in the LEVS.

a) The Levantine Sea (LEVS) Sub-division

289. Upon setting the reference conditions and the G/M threshold, each observation point, or area were classified in good or non- good status , by comparing the value of the indicator i.e., the satellite derived Chla to the G/M threshold, i.e. the back transformed 85th percentile of normalized distribution.

290. The results of CI 14 assessment using the satellite derived Chla data are presented in Tables 3.1.3.1.3.a. and 3.1.3.1.4.a., and Figure LEVS 3.1.3.1.5.E. The good status corresponds to the RC conditions, as well as to the values below the 85th percentile of normalized distribution set as good/non good statusboundary (i.e. blue coloured cells in the last column of Tables 3.1.3.1.3.a and 3.1.3.1.4.a). The good status corresponds to the class above G/M boundary limit (i.e. red coloured cell in the last column of Table 3.1.3.1.4.a.).

291. The assessment results show that all evaluated assessment zones can be considered in good status regarding assessment of the satellite derived Chla data. Further to good status assigned to the assessment zones, it can be preliminary found that only 1 out of 18 subSAUs is in non-good status. However, it must be noted that the present subSAUs are set at an insufficient level of fineness for a reliable assessment (Table 3.1.3.1.4 and Figure LEVS 3.1.3.1.5.E). This subSAU in non-good status is located in the OW in the southern part of the Eastern Levantine Sea. The local sources of pollution are probably the main driver contributing to the weakened status of this subSAU.

292. In addition, available literature indicates waters in front of Mersin and in the Iskenderun Bay as impacted areas. A slight impact can also be identified along the coast of Israel and in the OW in the southern part of the Eastern Levantine Sea, as well as in front of Port Said and Alexandria. The influence of the Nile River through the river Delta is weak and confirms the changes in the area caused by construction of the Aswan dam. There is also an indication of a coastal impact in the Tobruk area in the waters of Libya.

Figure AEL 3.1.3.1.5.E: The assessment results for CI 14 in the Levantine Sea Sub-division by applying he simplified G/M method at the level of SAUs.

Table 3.1.3.1.3.a. Results of the assessment (G_NG.oN85 – the good status corresponds to all values below the 85th percentile set as G/M i.e., good/noon-good boundary limit) of the Levantine Sea Sub-division by Assessment Zones (AZ) and Spatial Assessment Units (SAUs). Blue coloured SAUs indicate good status.

AZ	SAU	CHL_N	CHL_GM	oN50	oN50+50	oN10	oN85	G_NG.oN85
CW	CI	677	0,050	0,047	0,071	0,034	0,065	G
CW	EA	257	0,458	0,462	0,692	0,125	1,402	G
CW	NO	163	0,199	0,152	0,227	0,066	1,454	G
CW	SE	853	1,111	1,769	2,653	0,059	4,773	G
CW	SW	1281	0,050	0,038	0,056	0,025	0,104	G
OW	CI	10383	0,040	0,039	0,059	0,029	0,049	G
OW	EA	9178	0,074	0,061	0,092	0,042	0,110	G
OW	NO	12598	0,083	0,064	0,095	0,044	0,140	G
OW	SE	7568	0,331	0,227	0,341	0,042	0,990	G
OW	SW	10458	0,032	0,031	0,047	0,023	0,035	G

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions)

Table 3.1.3.1.4.a. Result of the assessment (G_NG.oN85- the good status corresponds to all values below the 85th percentile set as G/M i.e., good/noon-good boundary limit) of the Levantine Sea Sub-division for the finest Spatial Assessment Units (SAUs). Blue coloured SAUs indicate good status; Red coloured SAU indicates non-good status.

AZ	SAU	subSAUs	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
CW	CI	CWCICYP	677	0,050	0,071	0,034	0,065	G
CW	EA	CWEAISR	95	0,498	0,692	0,125	1,402	G
CW	EA	CWEALBN	91	0,360	0,692	0,125	1,402	G
CW	EA	CWEAPSE	26	1,362	0,692	0,125	1,402	G
CW	EA	CWEASYR	45	0,331	0,692	0,125	1,402	G
CW	NO	CWNOTUR	163	0,199	0,227	0,066	1,454	G
CW	SE	CWSEEGY	853	1,111	2,653	0,059	4,773	G
CW	SW	CWSWEGY	725	0,035	0,056	0,025	0,104	G
CW	SW	CWSWLBY	556	0,080	0,056	0,025	0,104	G
OW	CI	OWCICYP	10383	0,040	0,059	0,029	0,049	G
OW	EA	OWEAISR	2724	0,086	0,092	0,042	0,11	G

AZ	SAU	subSAUs	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
OW	EA	OWEALBN	3243	0,067	0,092	0,042	0,11	**G**
OW	EA	OWEAPSE	486	0,158	0,092	0,042	0,11	**NG**
OW	EA	OWEASYR	2725	0,062	0,092	0,042	0,11	**G**
OW	NO	OWNOTUR	12598	0,083	0,095	0,044	0,14	**G**
OW	SE	OWSEEGY	7568	0,331	0,341	0,042	0,99	**G**
OW	SW	OWSWEGY	5843	0,030	0,047	0,023	0,035	**G**
OW	SW	OWSWLBY	4615	0,033	0,047	0,023	0,035	**G**

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5 year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10^{th} percentile (Reference conditions);

b) The Aegean Sea (AEGS) Sub-division

293. The assessment results show that all three evaluated assessment zones can be considered in good status regarding assessment of the satellite derived Chla data. Further to this likely good status assigned to the assessment zones, it can be preliminary found that only 2 out of 16 subSAUs are in noon-good status. However, it must be noted that the present subSAUs are set at an insufficient level of fineness for a reliable assessment (Table 3.1.3.1.4.b, and Figure AEL 3.1.3.1.5.E). The following two non-good status subSAUs are located in the CA SAU in the waters of Turkiye in the Aegean Sea: EGE09 (Izmir Bay) and EGE_C (coast strip south of Izmir Bay). The local sources of pollution are probably the main driver contributing to the weakened status of these two subSAUs.

294. In addition, available literature indicates the presence of drivers and pressures with impacts related to eutrophication in the areas as elaborated here-below.

295. In the Saronikos Gulf and Elfesis Bay, there is evidence of a few following drivers and pressures: i) extensive urbanization in the metropolitan areas of Athens and Piraeus hosting about 1/3 of the Greek population; ii) port activities and maritime traffic (Piraeus port); and iii) industries located in the coastal area of the Elefsis Bay, such as oil refineries, steel and cement industries, and shipyards. Since 2012, the eastern Elefsis Bay receives treated domestic and industrial wastewaters from the Thriasio wastewater treatment plant. The small island of Psyttaleia hosts the wastewater treatment plant of metropolitan Athens, however with pre-treatment, primary and secondary treatment, including biological nitrogen removal, and sludge treatment. Treated wastewaters are discharged into the Inner Saronikos Gulf via a system of three pipelines to the south of the island, at 62m depth (Karageorgis et al., 2020 and references therein).

296. Similarly, the national assessment by applying the NEAT tool to Saronikos Gulf[55] classified this area into good status, with the pelagic habitat components contributing strongly to its overall environmental status. Sediment, benthic fauna and vegetation, mammals and alien species were the most impacted ecological components in Saronikos Gulf. The most affected areas, Elefsis Bay and Psittalia (wastewater submarine outfall), were assessed as in poor and moderate status, respectively.

297. There are also other areas where certain impacts are registered. In the Thessaloniki Bay, these are the Thessaloniki harbour, impacted by industrial, treated or partly treated sewage discharges; the Inner Thermaikos Gulf impacted by agricultural discharges from the heavily polluted Axios River, and fish and shellfish mariculture; as well as the Evoikos Gulf impacted by agriculture, mariculture, and industry. Industrial discharges, port activities, sewage discharges, aquaculture activities, and fishing are the most important pressures affecting the coastal areas of Greece. In fact, mariculture seems to have the highest impacts, and is followed by fishing, other activities and industrial discharges (Pavlidou et al., 2015).

298. A review of the existing pressures and assessment was provided by Turkiye56. The analysis indicated the following drivers and pressures relevant to EO5: i) tourism population density; ii) urban wastewater; iii) agriculture; and iv) port operations, especially in Port of Izmir.

[55] Pavlidou, A., Simboura, N., Pagou, K. et al., (2019) Using a holistic ecosystem-integrated approach to assess the environmental status of Saronikos Gulf, Eastern Mediterranean, Ecological Indicators, 96 (1), 336-350.
[56] Submitted after the Meeting of CORMON Pollution that took place in Athens, 1-2 March 2023

299. As for the Levantine Sea Sub-division, the results of the present CI 14 assessment in the Aegean Sea Sub-division represents only an indication of possible good/non-good status at the level of sub SAUs, whereby they are not set at the same level of spatial finesse.

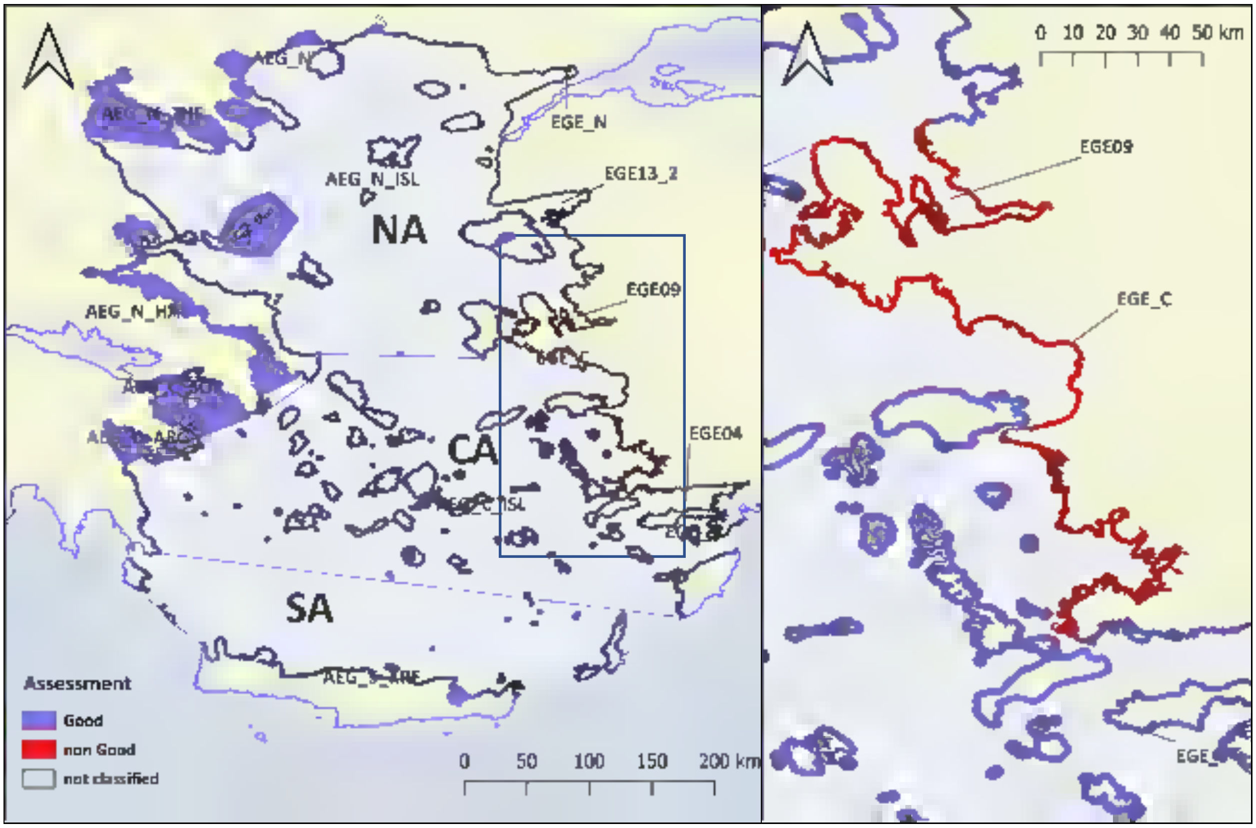


Figure AEL 3.1.3.1.5.E: The assessment results for CI 14 in the Aegean Sea Sub-division by applying the simplified G/M method on the satellite-derived COPERNICUS data at the level of subSAUs.

Table 3.1.3.1.3.b. Results of the assessment (G_NG.oN85 – the good status corresponds to all values below the 85th percentile set as G/M i.e., good/noon-good boundary limit) of the Aegean Sea Sub-division by Assessment Zones (AZ) and Spatial Assessment Units (SAUs). Blue coloured SAUs indicate likely GES.

AZ	SAU	CHL_N	CHL_GM	oN50	oN50+50	oN10	oN85	G_NG.oN85
CW	NA	53613	-	0,126	0,189	0,085	0,436	G
CW	CA	39229	0,093	0,074	0,111	0,053	0,12	G
CW	SA	5091	0,062	0,056	0,084	0,046	0,07	G

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions)

Table 3.1.3.1.4. b. Result of the assessment (G_NG.oN85- the good status corresponds to all values below the 85th percentile set as G/M i.e., good/noon-good boundary limit) of the Aegean Sea Sub-division for the finest Spatial Assessment Units (subSAUs). Blue coloured SAUs indicate good status; Red coloured SAU indicates non-good status.

Country	SAU	subSAUs	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
GRE	CA	AEG_C_ARG	5190	0,095	0,111	0,053	0,12	G
GRE	CA	AEG_C_ISL	19245	0,066	0,111	0,053	0,12	G
GRE	CA	AEG_C_SOR	10338	0,115	0,111	0,053	0,12	G
GRE	NA	AEG_N_HAL	11469	0,315	0,189	0,085	0,436	G
GRE	NA	AEG_N_HAL_O	943	0,156	0,189	0,085	0,436	G
GRE	NA	AEG_N_ISL	15510	-	0,189	0,085	0,436	G
GRE	NA	AEG_N_THE	12128	0,279	0,189	0,085	0,436	G
GRE	SA	AEG_S_KRE	5091	0,062	0,084	0,046	0,07	G
TUR	CA	EGE_C	2032	0,324	0,111	0,053	0,12	NG
TUR	CA	EGE_S	711	0,058	0,111	0,053	0,12	G
TUR	CA	EGE04	748	0,068	0,111	0,053	0,12	G
TUR	CA	EGE09	965	1,057	0,111	0,053	0,12	NG
TUR	NA	AEG_N	11192	0,228	0,189	0,085	0,436	G
TUR	NA	EGE_N	1759	0,405	0,189	0,085	0,436	G
TUR	NA	EGE13_2	612	0,238	0,189	0,085	0,436	G

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions);

The IMAP GES Assessment of the Adriatic Sea Sub-region (ADR)

300. The GES assessment of EO 5 is provided at IMAP CIs 13 and14 level per TP, DIN and Chl a, as mandatory parameters measured within monitoring of these two indicators. Other parameters were not considered given lack of data reported by the CPs. The results of aggregation and integration within the nested scheme are provided at i) the IMAP national SAUs & subSAUs, as the finest level; ii) the IMAP coastal and offshore assessment zones of SubDivisions (NAS-1, NAS-12, CAS-1, CAS-12, SAS-1, SAS-12); iii) the sub-division level (NAS, CAS, SAS) and iv) the sub-regional level (the Adriatic Sea). Given Albania, Bosnia and Herzegovina, and Greece faced the lack of data for CIs 13 and 14, they were not considered in the GES assessment for IMAP EO5.

The comparison and harmonization of the assessment methodologies applied for IMAP CI 14: By selecting the 85th percentile of the normalized distribution as G/M boundary limit, therefore as the limit between the acceptable and the unacceptable statuses i.e. GES and non GES/ good and non-good, the compatibility of the classification within application of the Simplified assessment methodology based on G/M comparison was achieved with a five classes GES/non GES scale set for IMAP NEAT GES assessment of the Adriatic Sea Sub-region. The harmonization was achieved to the maximum possible extent given the Simplified assessment methodology based on G/M comparison and NEAT GES assessment methodology are different methodologies which application across the Mediterranean Sub-regions/Sub-divisions was conditioned with the statuses of data reported by the CPs.
Therefore, the bias assessment of CI 14 within the 2023 MED QSR was avoided as the Simplified G/M method relay on the assessment criteria corresponding to RC and G/M as stated in the Decision 22/7 on Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria . Based on statistical calculations and related selection of the 85th percentile ~ mean +1 SD represents the G/M threshold, the synchronization was achieved to the maximal possible extent between the classification statuses assigned in the AEL, CEN and WMS , and those in the Adriatic Sea Sub-region .
Assessment classification for harmonized IMAP/NEAT and IMAP/Simplified G/M assessment methodologies application for CIs14 in the Mediterannean Sea sub-regions:

	GES			non-GES		
IMAP/NEAT	RC	High	Good	Moderate	Poor	Bad
Boundary limits and normalized NEAT scores	< RC/H limit, not in score scale	1 < score ≤ 0.8	0.8<score≤ 0.6	0.6<score ≤ 0.4	0.4< score ≤0.2	Score<0.2
IMAP/Simplified G/M						
Boundary limits*	≤10th %	>10th% CHL_GM ≤85th%		CHL_GM >85th %		
G/nG threshold			G/M			
*** Percentile are calculated from normalized (with Ordered Quantile transformation) annual geometric mean (for at list 5 year)**						

Available data.

301. Data reported to the IMAP Pilot Info System by the Contracting Parties bordering the Adriatic Sea i.e. Croatia, Italy, Montenegro, and Slovenia for the period 2015-2020, as shown in Table 3.1.3.2.1, were used for the sub-regional assessment for Chl a, TP and DIN, within present NEAT GES assessment

for IMAP CIs 13 and14. Data reported by Albania, Bosnia and Herzegovina and Greece were missing or were insufficient or not reported in line with mandatory data standards. [57]

302. Data elaboration was done only for the surface layer as the main layer of eutrophication impact. Namely, freshwaters are the main pressure driver and mostly contribute to the stratification of the water column, therefore they confine the newly fetched nutrients mainly to the surface layer.

Table 3.1.3.2.1: Data availability by country and year for the Adriatic Sea (ADR) Sub-region showing data reported by the CPs for the assessment of EO5 (CI 13 and CI 14) up to 31st Oct 2022.

Country	Year	Amon	Ntri	Ntra	Phos	Tphs	Slca	Cphl	Temp	Psal	Doxy
Albania	2016-2021	No data provided									
Bosnia and Herzegovina	2016	12	12	12	12	12	12	12	12	12	12
	2017	4	4	4	4	4	4	4	4	4	4
	2018	4	4	4	4	4	4	4	4	4	4
	2019	12	12	12	12	12	12	12	12	12	12
	2020	5	5	5	5	5	5	5	5	5	5
	2021	3	3	3	-	3	3	3	3	3	3
Croatia	2016	72	72	72	72	72	72	72	63	63	63
	2017	144	144	144	144	144	144	144	132	132	132
	2018	94	94	94	94	94	94	94	83	83	83
	2019	216	216	216	216	216	216	216	203	203	203
	2020	177	177	177	177	177	177	177	165	165	165
	2021	-	-	-	-	-	-	-	-	-	-
Greece	2016-2021	No data provided									
Italy	2016	803	803	803	803	803	803	17171	17180	17180	17171
	2017	783	783	783	777	777	783	15612	15631	15632	15631
	2018	809	809	809	809	809	807	16669	16670	16670	16670
	2019	729	729	729	729	729	728	15995	16020	16020	16020
	2020	-	-	-	-	-	-	430	430	430	430
	2021	-	-	-	-	-	-	-	-	-	-
Montenegro	2016	80	80	80	80	80	80	80	80	80	80
	2017	82	82	82	82	82	82	82	82	82	82
	2018	103	103	103	103	103	103	103	103	103	103
	2019	116	116	116	116	116	116	116	116	116	116
	2020	-	-	-	-	-	-	-	-	-	-
	2021	-	-	-	-	-	-	-	-	-	-
Slovenia	2016	99	99	99	99	99	99	99	99	99	99
	2017	160	160	160	160	160	160	160	288	288	288
	2018	184	184	184	184	184	184	184	296	296	296
	2019	160	160	160	160	160	160	160	240	240	240
	2020	141	141	141	141	141	141	162	165	165	165
	2021	150	150	150	150	150	150	180	180	180	180

Amon - Ammonium; Ntri- Nitrite; Ntra – Nitrate; Phos – Orthophosphate; Tphs—Total phosphorous; Slca – Orthosilicate; Cphl – Chlorophyll *a*; Temp – Temperature; Psal – Salinity; Doxy – Dissolved Oxygen.

[57] UNEP/MED WG. 550/15, Table IV in Annex VIII (CH 4.2.2 & 4.3.2) provides the spatial distribution of monitoring stations for IMAP CIs13&14 by the spatial assessment units (SAUs, km2)) in the Adriatic Sea Sub-region; Table V in Annex VIII (CH 4.2.2 & 4.3.2) provides the detailed temporal coverage of the monitoring data collected for the Adriatic Sea shown against the finest areas of assessment (IMAP subSAUs), including the years of data collected per SAU.

303. For the application of the NEAT software for assessment of CIs 13&14, data were grouped per parameters, ecosystem and SAUs in all the Adriatic sub-divisions (NAS, CAS, SAS). Average concentrations (geometric means) and respective geometric standard deviation, and standard error of geometric means were then calculated in the respective groups as presented here-below.

The NEAT GES Assessment of IMAP CIs 13&14:
The geometric mean (*GM*) is defined as the n[th] root of the product of n numbers, i.e., for a set of numbers x_1, x_2, ..., x_n, the geometric mean is defined as

$$GM[x] = \left(\prod x_i\right)^{\frac{1}{n}} \qquad (1)$$

or, equivalently, as the arithmetic mean (*AM*) in logscale:

$$GM[x] = e^{AM[\log x]} \qquad (2)$$

The geometric standard deviation (GSD) is calculated as the regular statistic on the log data, $SD[logx]$ then rescaled back:

$$GSD[x] = e^{SD[\log x]} \qquad (3)$$

The standard error of geometric mean (SEGM): Since the through mean of the population (μ_G) is not normally known the sample mean $GM[x]$ is used, but then, like with the regular standard deviation and error formulas N−1 instead of N is used:

$$SEGM[x, N] = \frac{GM[x]}{\sqrt{N-1}} SD[\log x] \qquad (4)$$

A difference between EO9/CI 17 and EO5/CIS 13&14 must be noted. For the NEAT assessment different metrics were used. For CI 17 as a measure of central tendency, the arithmetic mean and standard error were used, on opposite to the use of geometric mean and the standard error of geometric mean for CIs 13&14. It was necessary given the assessment criteria for EO5 were developed by applying the later metrics.

The integration of the areas of assessment and assessment results by applying the 4 levels nesting approach.

304. For setting the IMAP areas of assessment for IMAP CIs 13 and 14, the 4 levels nesting approach was followed as elaborated for IMAP CI 17 (amended for the purpose of CIs 13 and 14) and presented here-below. However, the finest areas of assessment set for CI 17 were further adjusted to serve the purpose of EO5 assessment. One additional GIS layer was created within 3rd step of nesting scheme. This layer shows a distribution of the water classes within the coastal and offshore zones. It was overlaid on the IMAP sub-SAUs defined for IMAP CI 17, which resulted in an adjustment of the finest areas of assessment for IMAP CIs 13 and 14. In that regard, distribution of the finest areas of assessment is mainly related to the scientific knowledge which takes into account the specifics of the monitoring and assessment of national waters. Where it was possible, the distribution of water types existing in the Adriatic Sea Sub-region (I, IIA and IIIW) also guided the adjustment of the finest areas of assessment for IMAP EO5. Namely, the three types of water are mainly discriminated by freshwater content which on the other side is correlated with the pressures from land. This leaded to a separate aggregation of the assessment results per water types in order to get the status of CIs 13 and 14 in different water types for all SAUs. Accordingly, details on setting the finest areas of assessment for IMAP EO 5 were provided per countries.

305. After setting the finest IMAP areas of assessment, their nesting within three sub-divisions of the Adriatic Sea sub-region was undertaken in the same manner applied for IMAP CI 17. The approach followed for the nesting of the areas is 4 levels nesting scheme (1 - being the finest level, 4 - the highest):

a) 1st level provided nesting of all national IMAP SAUs and subSAUs within the two key IMAP assessment zones per country i.e. coastal and offshore zone;
b) 2nd level provided nesting of the assessment areas set in IMAP assessment zones i.e. the coastal and offshore zones, on the subdivision level i.e. i) NAS coastal (NAS-1), NAS offshore (NAS-12); ii) CAS coastal (CAS-1), CAS offshore (CAS-12); iii) SAS coastal (SAS-1), SAS offshore (SAS-12);
c) 3rd level provided nesting of the areas of assessment within the 3 subdivisions (NAS, CAS, SAS);
d) 4th level provided nesting of the areas of assessment within the Adriatic Sea Sub Region.

306. This nesting scheme is shown schematically in Figure 3.1.3.2.1**.**

307. Further to spatial analysis of the monitoring stations distribution, along with recognition of corresponding monitoring and assessment areas, as well as optimal nesting of the finest areas of assessment, the scope of all Adriatic SAUs and subSAUs were defined. All of them were introduced in the NEAT tool along with their respective codes and surface of the areas (km2).

308. Within each SAU under ‘habitats’ the water types are introduced. Under ‘ecosystem component’ the 3 measured parameters i.e. DIN, TP and Chl a are assigned.

309. For each SAU and ‘Ecological Component’ and ‘Habitat’ (Water type), geometric mean and standard error of the geometric mean per parameter are inserted.

310. Boundary limits and class threshold values per SAU per parameter and per matrix (i.e. NEAT habitat) are applied. The tool obligatory requires 2 limits which define the best and the worse conditions and one threshold discriminating between GES-nonGES status. A five classes assessment scale ‘High-Good-Moderate-Poor-Bad’ is then produced. The GES-nGES threshold discriminates between the Good-Moderate classes. Details on boundary limits and threshold values are given in Chapter 4 and in Tables 4 and 5.

Setting the GES/non-GES boundary value/threshold for the IMAP NEAT GES Assessment in the ADR.

311. The definition of baselines and threshold values for IMAP CIs 13 and 14 in the Mediterranean Sea is an ongoing process. The setting of GES-nonGES boundaries within NEAT GES assessment for IMAP CIs 13 and 14 are based on the boundary values defined for TP and DIN, and updated ones for chlorophyll a, in the Adriatic Sea, as approved by the Meeting of CorMon on Pollution Monitoring (17 and 30 May 2022).

312. Following the methodology applied for setting GES-nonGES threshold for IMAP CI17, the NEAT GES assessment of IMAP CIs 13 and 14 in the Adritic Sea sub-region considers that the range of concentrations equal to or below the G/M values corresponds to the good environmental status i.e. in GES, and the range of concentrations above the G/M values corresponds to non-good environmental status i.e. non-GES. This principle was also used for application of the traffic light approach within the 2017 MED QSR.

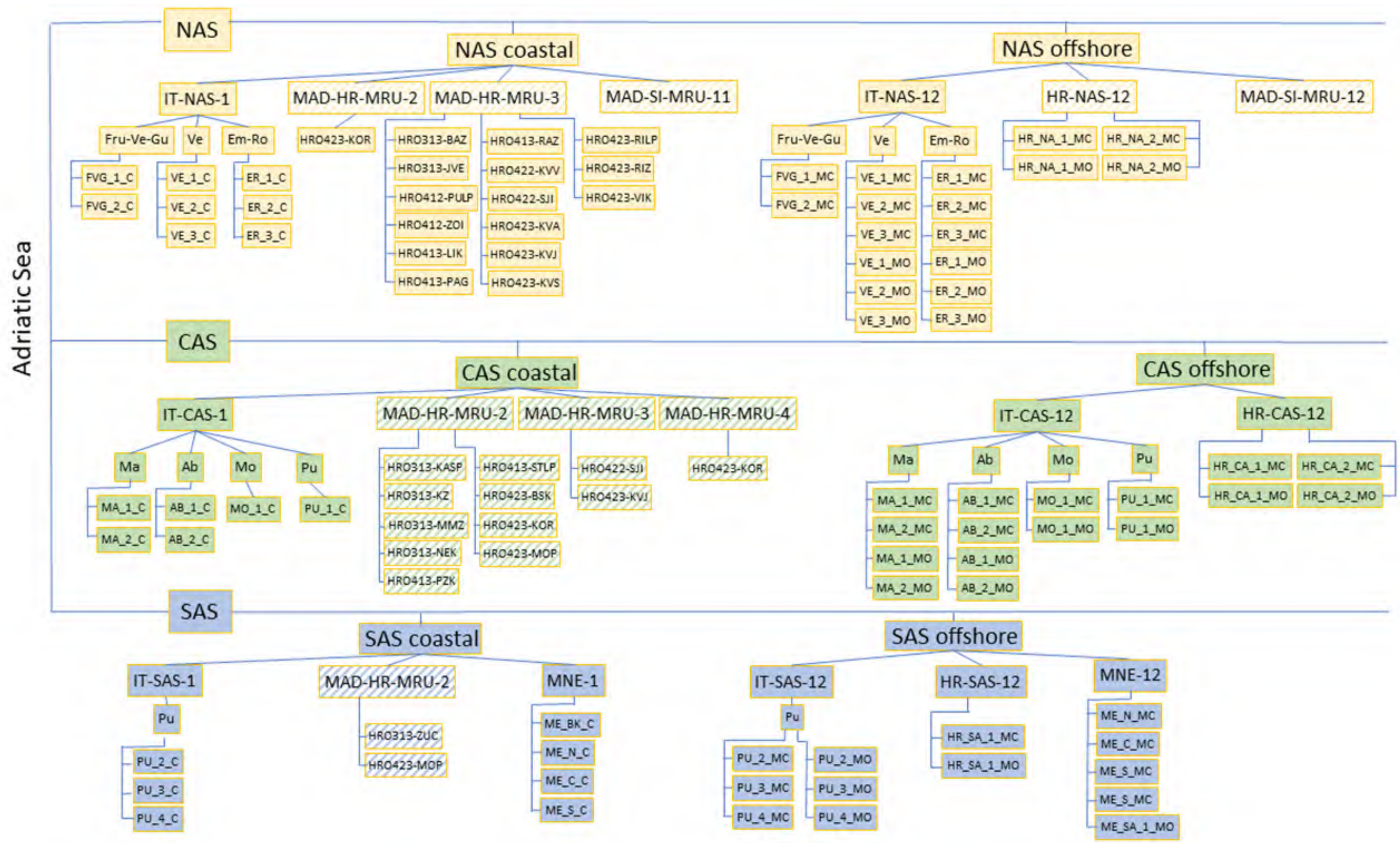


Figure 3.1.3.2.1: The nesting scheme of the SAUs defined for the Adriatic Sea based on the available information. Shaded boxes correspond to official MRUs declared by the countries that are EU MSs and that were decided to be used as IMAP SAUs.

313. The use of NEAT tool for IMAP GES status requires in total five status classes i.e. high, good, moderate, poor, bad, in order to optimally discriminate the status related to different classes. The NEAT application also requires the two boundary limit values for the best and worse conditions (these are not threshold values but minimum and maximum values that determine the scale of the GES assessment) and one threshold value for the GES – nonGES status. These are mandatory by the tool which then produces five status classes linearly, depending on the distance of the concentrations from the two boundary limit values and the GES-nonGES threshold.

314. The two boundary limit values were applied: i) Reference Conditions (RC); and ii) for maximum concentration of nutrients and chlorophyll a, the value calculated from the relationship (equation) of DIN and TP (the parameters of CI 13) with a value of 8 that is supposed to be highest one for TRIX (as internal standard). For CI14 (Chla) the equation is related to the pressure variable in our case DIN and TP where possible. All the equations and boundary values by water type are given in Table 3.1.3.2.2.

315. In line with such defined the two boundary limits, the following five status classes are produced: i) the high status (H) referring to RC (best conditions) < good status; ii) the good status (G); iii) the moderate status (M); iv) the poor status (P); v) the bad status (B) referring to values > than poor state and < than the maximum concentration. The five classes are divided by the boundary between them as follows: H/G; G/M (also the GES-nonGES threshold); M/P; and P/B.

Table 3.1.3.2.2: Boundary limits of the NEAT GES Cis 13 & 14 assessment scale and threshold values between five status classes.

Type	**Equation**	RC	H/G	**G/M**	M/P	P/B	Worst
Coastal							
I	**[TRIX]**		4.25	**5.25**	6.25	7	8
	[TP] = exp [(TRIX – 6.064)/1.349]	0.19	0.26	**0.55**	1.15	2.00	4.20
	[Chla] = 10.591 [TP]^1.237	1.4	2.01	**5.02**	12.56	24.99	62.5
IIA	**[TRIX]**	-	4	**5**	6	7	8
	[TP] = exp [(TRIX – 6.148)/1.583]	0.16	0.26	**0.48**	0.91	1.71	3.2
	[Chla] = 3.978 [TP]^1.347	0.33	0.64	**1.50**	3.51	8.21	19.2
IIIW	**[TRIX]**	2	3	**4**	5	6	7
	[TP] = exp [(TRIX – 6.148)/1.583]	0.07	0.14	**0.26**	0.48	0.91	1.7
	[Chla] = 3.978 [TP]^1.347	0.12	0.27	**0.64**	1.50	3.51	8.2
Offshore							
I	**[TRIX]**		4.25	**5.25**	6.25	7	8
	[DIN] = 10^[(TRIX – 3.08)/1.61]	0.15*; 0.29**	5.33	**22.28**	93.1	272	1 137
	[Chla] = 0.4295 [DIN]^0.64	0.21*; 0.66**	1.25	**3.13**	7.82	15.53	38.79
IIA	**[TRIX]**	-	4	**5**	6	7	8
	[TP] = exp [(TRIX – 6.148)/1.583]	0.16	0.26	**0.48**	0.91	1.71	3.22
	[Chla] = 3.978 [TP]^1.347	0.33	0.64	**1.50**	3.51	8.21	19.23
IIIW	**[TRIX]**	2	3	**4**	5	6	7
	[TP] = exp [(TRIX – 6.148)/1.583]	0.07	0.14	**0.26**	0.48	0.91	1.71
	[Chla] = 3.978 [TP]^1.347	0.12	0.27	**0.64**	1.50	3.51	8.21

*ME; **HR. IT

316. Data (i.e. average values), as well as limits and threshold values are normalized by NEAT in a scale of 0 to 1 to be comparable among parameters and to facilitate aggregation on the CI or EO level.

317. Threshold concentrations are normalized in a 0 to 1 scale as follows:
$0 \leq$ bad $< 0.2 \leq$ poor $< 0.4 \leq$ moderate $< 0.6 \leq$ good $< 0.8 \leq$ high ≤ 1

318. The NEAT tool further aggregates data by calculating the average of normalized values of indicators (DIN, TP; Chla) on the SAU level. This can be done either per each indicator per habitat separately or for all indicators i.e. parameters per habitats within the specific SAU. The first option leads to one value for each indicator separately for the specific SAU.

319. The process is then repeated for all nested SAUs (in a weighted or non- weighted mode). At the end one NEAT value for the highest area of assessment is obtained (i.e. for the Adriatic Sea) either for all ecosystem components i.e, indicators/parameters assessed (TP, DIN – CI 13, chl a – CI 14) separately, or for all ecosystem components by habitat (water). In the weighted mode a weighting factor based on the surface area of each SAU is used.

320. The NEAT values are values between 0 to 1 and correspond to an overall assessment status per contaminant according to the 5-class scale.

321. The decision rule of GES/ non-GES is by comparison to the boundary class defined by the G/M threshold, and this is above/below Good (0.6).

Results of the IMAP NEAT GES Assessment of CIs 13 and 14 in the ADR.

322. Detailed assessment results for EO5 are provided per TP, DIN and Chl a, as mandatory parameters measured for CIs 13 and 14 level and also spatially integrated within the nested scheme at i) the IMAP national SAUs & sub-SAUs, as the finest level; ii) the IMAP coastal and offshore assessment zones of SubDivisions (NAS-1, NAS-12, CAS-1, CAS-12, SAS-1, SAS-12); iii) the sub-division level (NAS, CAS, SAS) and iv) the sub-regional level (Adriatic Sea) are presented in Table 3.1.3.2.3.

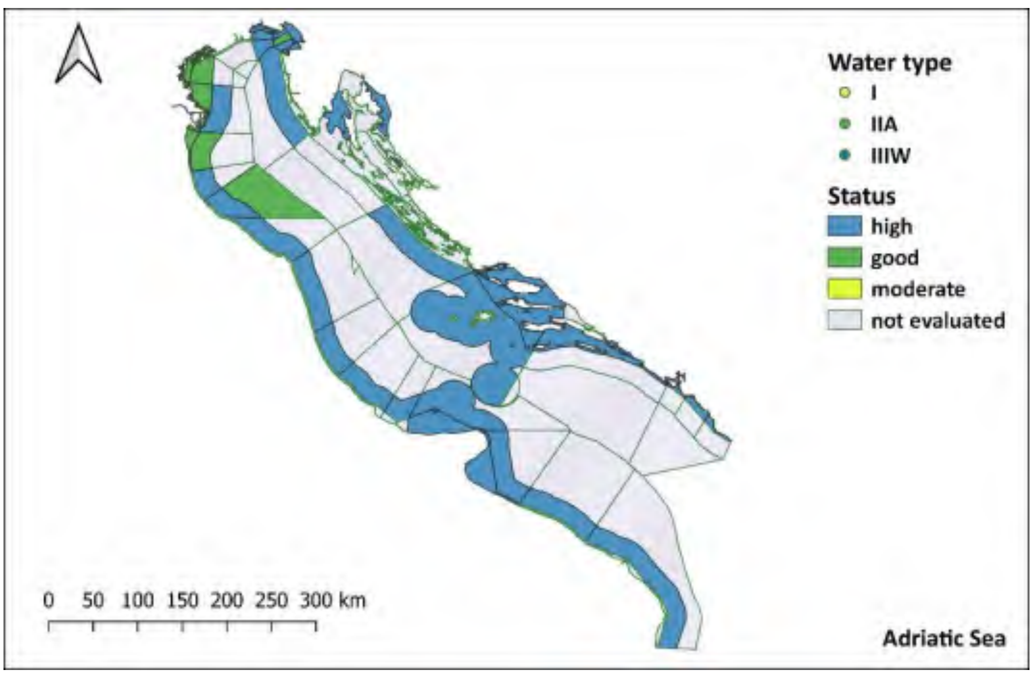
323. The aggregation of TP, DIN and Chl a was undertaken to obtain one status value (NEAT value) for all the levels of the nesting scheme. The aggregation of the assessment findings for these three parameters resulted in the NEAT value per specific SAUs. Then NEAT values per SAUs were spatially integrated to the sub-divisions and regional levels. Data matrix in Table 3.1.3.2.3 shows the results per indicator for all nesting levels. The integrated results for the sub-divisions (NAS, CAS, SAS) are shown in bold. The NEAT classes are marked per all three parameters to show the status.

324. Along with the aggregation of the parameters per SAUs, the NEAT tool has the possibility to provide assessment results by aggregating data per habitat in this case water types and then to provide their spatial integration within the nested scheme. This possibility was not used for the present assessment since the water types are more relevant in the coastal waters and less in the offshore waters. The final integrated result per SAUs (NEAT value) are expected to be the same irrespective of the two ways of aggregation of the assessment results (i.e. per indicator or per habitat).

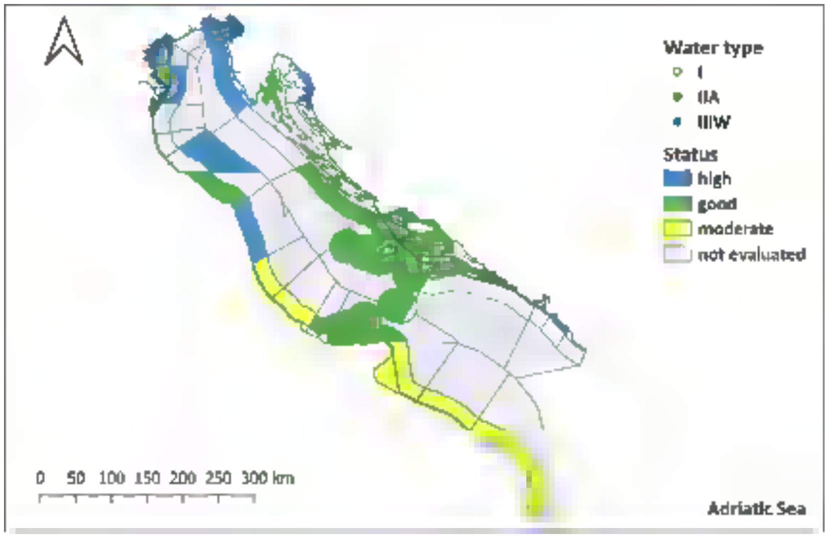
325. The detailed status assessment results show that all the SAUs achieve GES conditions (high, good status) that is indicated by the blue and green cells in Table 3.1.3.2.3. The GES status per assessment units and parameter is also shown on Figure 3.1.3.2.2. For all three parameters (CI 13 – DIN, TP and CI 14 – Chla), the results show that all SAUs and subSAUs are in GES. The only exception is the results for TP in a part of CAS and the SAS along the Italian coast, where a few subSAUs (AB_1_MC,

AB_2_MC, PU_2_MC, PU_3_MC, PU_4_MC) are in moderate status. The assessment status for TP was possible for the whole Adriatic Sea given data availability at the level of subSAUs. The results of TP assessment indicate that probably an accumulation of phosphorus is present in the area. It is necessary to explore if the problem is related to nitrogen limitation of the area and subsequent accumulation of phosphorus, or a local source of pollution contribute to the generation of the pressure on marine environment. Non-GES status of a few subSAUs do not affect the overall assessment status and all SAUs fall under the GES status (high, good). The absence of some SAUs evaluation is related to the decision of the countries to monitor areas that are found relevant for the assessment of eutrophication and therefore excluding the areas where problems were not historically observed.

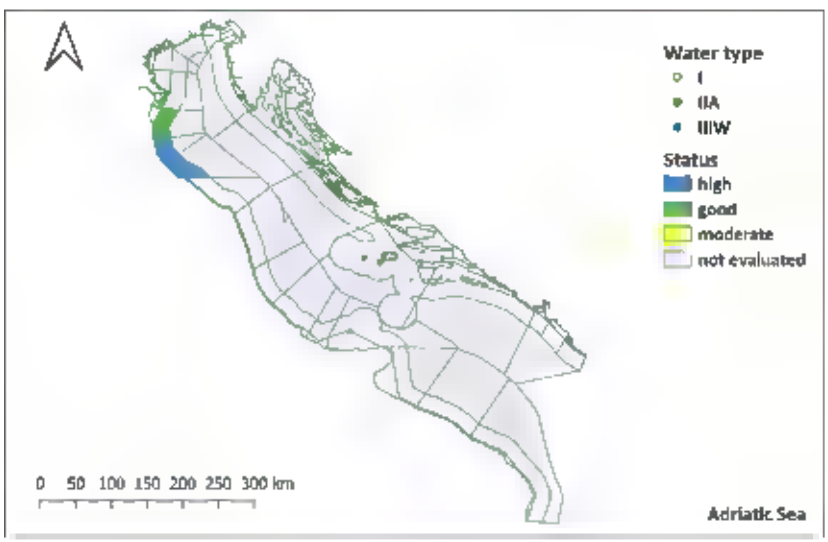
326. As observed for IMAP CI17, the present integrated assessment status results produced by applying the NEAT tool on the sub-division (NAS, CAS, SAS) and/or the Adriatic Sub-region level can only be considered as an example of how the tool works (4th and 3rd nesting levels). This is related to the fact that many SAUs lack data (blank cells in Table 3.1.3.2.3). The lack of data can be related to the recognition that many CPs monitor an area of interest, therefore excluding the areas where problems were not historically observed. However, the assessment per SAUs and integrated assessment on the two key nesting IMAP assessment zones i.e., coastal and offshore (NAS-1, NAS-12; CAS-1, CAS-12; SAS-1, SAS-12) (1st and 2nd nesting levels) can be considered more detailed for decision making.



Chl *a*



TP



DIN

Figure 3.1.3.2.2: The NEAT assessment results for IMAP CI13 (TP, DIN) and CI14 (Chl *a*), in the Adriatic Sea. Blank area corresponds to non-assessed subSAUs.

Table 3.1.3.2.3. Status assessment results of the NEAT tool applied on the Adriatic nesting scheme for the assessment of IMAP CIs 13 and 14. The various levels of spatial integration (nesting) are marked in bold. Blank cells denote absence of data. The % confidence is based on the sensitivity analysis.

SAU	Area	Total SAU weight	NEAT value	Status class	Confidence	CI14_Chla	CI13-TP	CI13-DIN
Adriatic Sea	**128180**	**0**	**0.815**	**high**	**99.8**	**0.954**	**0.673**	**0.845**
Northern Adriatic Sea	**30865**	**0**	**0.888**	**high**	**100.0**	**0.892**	**0.890**	**0.84**
NAS-1	**9130**	**0**	**0.866**	**high**	**100.0**	**0.896**	**0.837**	
MAD-HR-MRU-3	6302	0	0.900	high	100.0	0.952	0.847	
HRO313-JVE	73	0						
HRO313-BAZ	4	0	0.787	good	56.9	0.760	0.814	
HRO412-PULP	7	0						
HRO412-ZOI	467	0						
HRO413-LIK	7	0						
HRO413-PAG	30	0.001	0.898	high	100.0	1.000	0.795	
HRO413-RAZ	10	0						
HRO422-KVV	494	0						
HRO422-SJI	1924	0						
HRO423-KVA	687	0.029	0.848	high	90.2	0.919	0.777	
HRO423-KVJ	1089	0						
HRO423-KVS	577	0						
HRO423-RILP	6	0						
HRO423-RIZ	475	0						
HRO423-VIK	455	0.019	0.979	high	100.0	1.000	0.958	
IT-NAS-1	2576	0	0.783	good	92.7	0.759	0.806	
IT-Em-Ro-1	372	0	0.682	good	99.6	0.757	0.608	
ER_1_C	254	0.003	0.682	good	99.6	0.757	0.608	
ER_2_C	64	0						
ER_3_C	54	0						
IT-Fr-Ve-Gi-1	560	0	0.958	high	100.0	0.917	1.000	
FVG_1_C	277	0.002	0.916	high	100.0	0.832	1.000	
FVG_2_C	283	0.002	1.000	high	100.0	1.000	1.000	

SAU	Area	Total SAU weight	NEAT value	Status class	Confidence	CI14_Chla	CI13-TP	CI13-DIN
IT-Ve-1	1646	0	0.746	good	100.0	0.706	0.785	
VE_1_C	88	0						
VE_2_C	905	0.008	0.792	good	63.5	0.755	0.828	
VE_3_C	653	0.005	0.682	good	99.9	0.638	0.726	
MAD-Sl-MRU-11	85	0.001	0.923	high	100.0	0.903	0.942	
MAD-HR-MRU-2	166	0						
HRO423-KOR	166	0						
NAS-12	**21735**	**0**	**0.897**	**high**	**100.0**	**0.890**	**0.917**	**0.840**
IT-NAS-12	11141	0	0.832	high	98.8	0.777	0.898	0.840
IT-Em-Ro-12	7144	0	0.814	high	82.3	0.750	0.888	0.840
ER_1_MC	858	0.009	0.752	good	99.4	0.735		0.770
ER_2_MC	586	0.006	0.824	high	92.8	0.805		0.860
ER_3_MC	893	0.010	0.869	high	100.0			0.869
ER_3_MO	2888	0.031	0.814	high	67.9	0.739	0.888	
ER_2_MO	600	0						
ER_1_MO	1319	0						
IT-Fr-Ve-Gi-12	410	0	0.945	high	100.0	0.890	1.000	
FVG_1_MC	139	0.001	0.895	high	100.0	0.791	1.000	
FVG_2_MC	271	0.002	0.971	high	100.0	0.941	1.000	
IT-Ve-12	3588	0	0.854	high	95.9	0.811	0.898	
VE_1_MC	714	0						
VE_2_MC	467	0						
VE_3_MC	1041	0.028	0.854	high	95.9	0.811	0.898	
VE_1_MO	234	0						
VE_2_MO	190	0						
VE_3_MO	941	0						
MAD-Sl-MRU-12	129	0.001	0.935	high	100.0	0.870	1.000	
HR-NAS-12	10465	0	0.965	high	100.0	1.000	0.930	
HR_NA_1_MC	2057	0.082	0.965	high	100.0	1.000	0.930	
HR_NA_2_MC	2183	0						

SAU	Area	Total SAU weight	NEAT value	Status class	Confidence	CI14_Chla	CI13-TP	CI13-DIN
HR_NA_1_MO	2566	0						
HR_NA_2_MO	3659	0						
Central Adriatic	**48802**	**0**	**0.832**	**high**	**100.0**	**0.984**	**0.680**	
CAS-1	**7582**	**0**	**0.853**	**high**	**100.0**	**0.995**	**0.712**	
MAD-HR-MRU-2	5240	0	0.870	high	100.0	0.994	0.747	
HRO313-NEK	253	0						
HRO313-KASP	44	0.001	0.783	good	66.7	0.750	0.816	
HRO313-KZ	34	0	0.938	high	100.0	0.991	0.886	
HRO313-MMZ	56	0						
HRO413-PZK	196	0						
HRO413-STLP	1	0						
HRO423-BSK	613	0.008	0.844	high	91.1	0.985	0.702	
HRO423-KOR	1564	0						
HRO423-MOP	2480	0.033	0.877	high	100.0	1.000	0.755	
IT-CAS-1	2091	0	0.811	high	66.6	1.000	0.623	
IT-Ab-1	282	0						
AB_1_C	103	0						
AB_2_C	179	0						
IT-Ma-1	320	0						
MA_1_C	172	0						
MA_2_C	148	0						
IT-Mo-1	229	0						
MO_1_C	229	0						
IT-Ap-1	1261	0	0.811	high	66.6	1.000	0.623	
PU_1_C	1261	0.017	0.811	high	66.6	1.000	0.623	
MAD-HR-MRU-4	184	0						
HRO422-VIS	184	0						
MAD-HR-MRU-3	67	0						
HRO422-SJI	14	0						
HRO423-KVJ	53	0						

SAU	Area	Total SAU weight	NEAT value	Status class	Confidence	CI14_Chla	CI13-TP	CI13-DIN
CAS-12	**41219**	**0**	**0.828**	**high**	**100.0**	**0.981**	**0.674**	
HR-CAS-12	18797	0	0.845	high	100.0	1.000	0.691	
HR_CA_1_MC	2337	0.034	0.852	high	94.6	1.000	0.703	
HR_CA_2_MC	7745	0.113	0.843	high	100.0	1.000	0.687	
HR_CA_1_MO	5328	0						
HR_CA_2_MO	3388	0						
IT-CAS-12	22422	0	0.813	high	90.4	0.966	0.661	
IT-Ab-12	7526	0	0.719	good	100.0	1.000	0.438	
AB_1_MC	1056	0.027	0.705	good	100.0	1.000	0.411	
AB_2_MC	1250	0.032	0.731	good	100.0	1.000	0.461	
AB_1_MO	2480	0						
AB_2_MO	2741	0						
IT-Ap-12	5096	0	0.842	high	87.9	1.000	0.685	
PU_1_MC	2618	0.04	0.842	high	87.9	1.000	0.685	
PU_1_MO	2478	0						
IT-Ma-12	8097	0	0.871	high	100.0	0.907	0.835	
MA_1_MC	1480	0.03	0.822	high	90.0	0.870	0.775	
MA_2_MC	1629	0.033	0.915	high	100.0	0.941	0.890	
MA_1_MO	1391	0						
MA_2_MO	3597	0						
IT-Mo-12	1702	0	0.868	high	100.0	0.992	0.745	
MO_1_MC	654	0.013	0.868	high	100.0	0.992	0.745	
MO_1_MO	1048	0						
Southern Adriatic Sea	**48514**	**0**	**0.753**	**good**	**99.9**	**0.963**	**0.540**	**0.920**
SAS-1	**4793**	**0**	**0.765**	**good**	**98.7**	**0.928**	**0.583**	**0.920**
MAD-HR-MRU-2	1769	0	0.813	high	59.7	0.989	0.637	
HRO313-ZUC	13	0						
HRO423-MOP	1756	0.016	0.813	high	59.7	0.989	0.637	
IT-SAS-1 (Ap-1)	1810	0	0.677	good	99.8	0.869	0.485	
PU_2_C	1140	0.016	0.677	good	99.8	0.869	0.485	

SAU	Area	Total SAU weight	NEAT value	Status class	Confidence	CI14_Chla	CI13-TP	CI13-DIN
PU_3_C	172	0						
PU_4_C	498	0						
MNE-SAS-1	568	0	0.892	high	100.0	0.920	0.823	0.920
MNE-1-N	86	0.001	0.828	high	85.0	0.852	0.804	
MNE-1-C	246	0.002	0.884	high	100.0	0.937	0.830	
MNE-1-S	151	0.001	0.945	high	100.0	0.956		0.933
MNE-Kotor	85	0.001	0.887	high	100.0	0.877		0.896
AL-SAS-1	646	0						
SAS-12	**43721**	**0**	**0.752**	**good**	**99.5**	**0.967**	**0.536**	
IT-SAS-12	22695	0	0.752	good	99.5	0.967	0.536	
PU_2_MC	1753	0.084	0.729	good	93.9	0.928	0.530	
PU_3_MC	1760	0.085	0.702	good	99.9	0.940	0.465	
PU_4_MC	3581	0.172	0.787	good	81.2	1.000	0.574	
PU_2_MO	2619	0						
PU_3_MO	6066	0						
PU_4_MO	6915	0						
MNE-SAS-12	5772	0						
MNE-12-N	468	0						
MNE-12-C	653	0						
MNE-12-S	781	0						
ME_SA_1_MO	3870	0						
AL-SAS-12	716	0						
MAD-EL-MS-AD	2253	0						
HR-SAS-12	12286	0						
HR_SA_1_MC	3397	0						
HR_SA_1_MO	8889	0						

327. The final GES assessment findings for all the IMAP SAUs in the Adriatic Sea, as provided in Table 3.1.3.2.3. are shown by the respective colour in the maps included in Figures ADR 3.1.3.2.1.E-ADR 3.1.3.2.5.E. The maps depict the integrated NEAT value for each SAU i.e. aggregated NEAT value for the three parameters assessed i.e., TP, DIN and chlorophyll a.

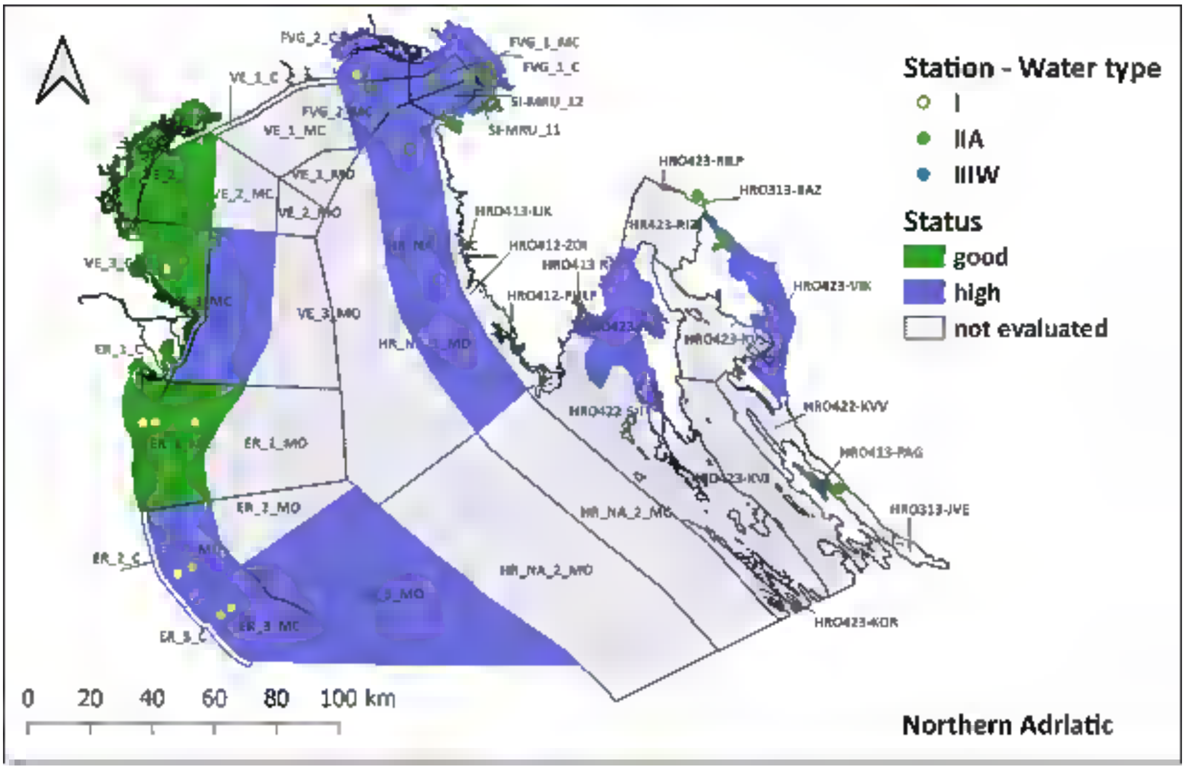


Figure ADR 3.1.3.2.3.E: The NEAT assessment results for IMAP CIs 13 and 14 in the North Adriatic Sea. All IMAP SAUs are in GES characterized by High or Good status. Blank area corresponds to not evaluated subSAUs.

328. The overall status of IMAP CI 13 and CI 14 regarding the three parameters assessed i.e. TP, DIN and chlorophyll a, on the sub-division level for NAS, is Good and in GES. Thirteen out of 20 SAUs are classified under High status and six under Good.

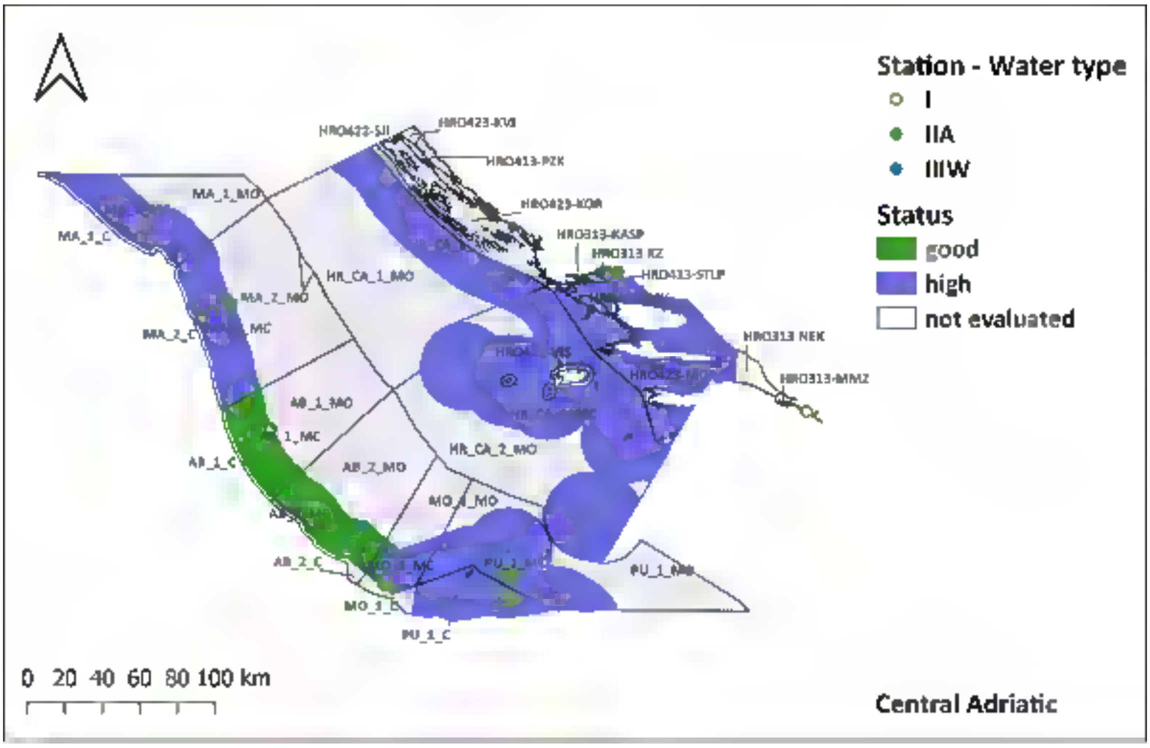


Figure ADR 3.1.3.2.4.E: The NEAT assessment results for IMAP CIs 13 and 14 in the Central Adriatic Sea. All IMAP SAUs are in GES, characterized by High or Good status.

329. The overall status of IMAP CIs 13 and 14 CI14 regarding the three parameters assessed i.e. TP, DIN and chlorophyll a, on the sub-division level for CAS is High and in GES. Nine out of fourteen SAUs are classified under High status and five under Good.

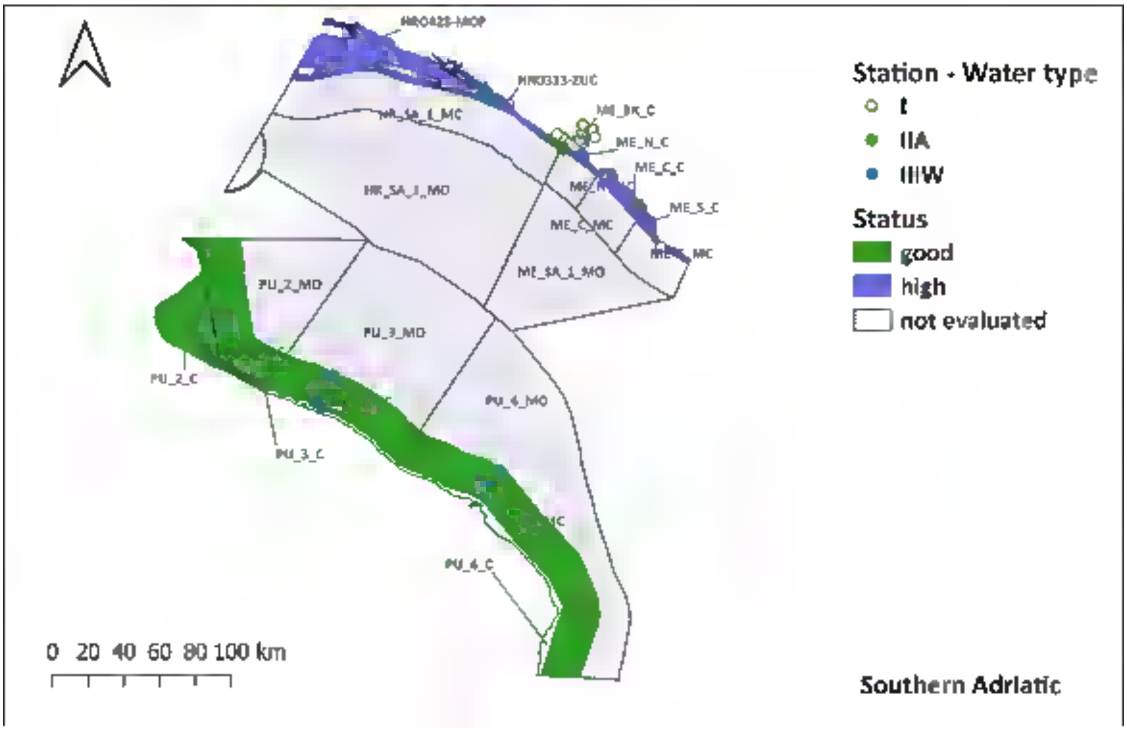


Figure ADR 3.1.3.2.5.E: The NEAT assessment results for IMAP CIs 13 and 14 in the South Adriatic Sea. All IMAP SAUs are in GES, characterized by High or Good status. Blank area corresponds to no available data.

330. The overall status for CIs 13 and 14 on the sub-division level for SAS, CI 14 regarding the three parameters assessed i.e. TP, DIN and chlorophyll a, is in GES. Four out of 14 SAUs are classified under Good conditions the rest under High. The Good status is observed along the Italian coast

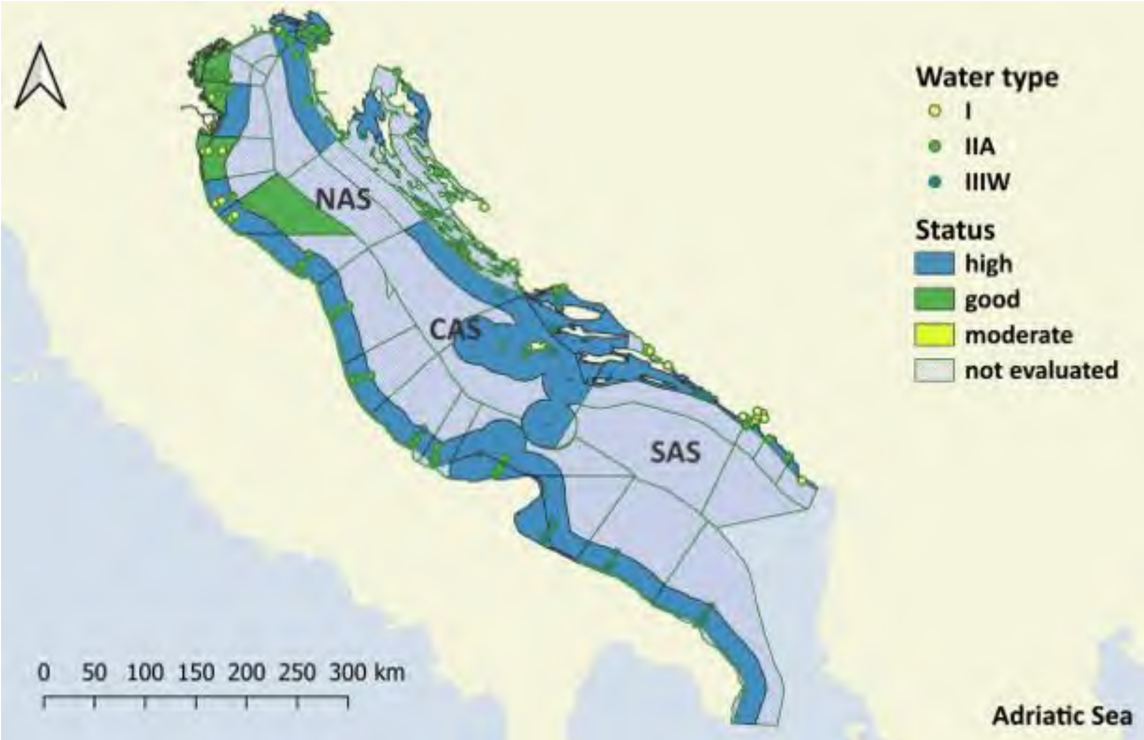


Figure ADR 3.1.3.2.6.E: The NEAT assessment results for CIs 13 and 14 in the Adriatic Sea sub-region. Aggregation of all contaminants per sub-SAU. Blank area corresponds to not evaluated subSAUs due to no available data or not established monitoring.

The IMAP Environmental Assessment of the Central Mediterranean Sea (CEN) Sub-region

331. Given the lack of quality-assured, homogenous data prevented the application of both EQR and simplified EQR assessment methodologies, the assessment of eutrophication within the preparation of the 2023 MED QSR was undertaken in the sub-divisions of the Aegean-Levantine Sea (AEL), the Ionian Sea and Central Mediterranean Sea (CEN) and the Western Mediterranean Sea (WMS) by evaluating only data for Chla available from the remote sensing sources, whereby the typology-related assessment was impossible to apply.

332. The application of the Simplified G/M comparison assessment methodology for Common Indicator 14 in the CEN relied on the use of COPERNICUS data for Chl a obtained by remote sensing.

Available data.

333. The application of the Simplified G/M comparison assessment methodology for Common Indicator 14 in the CEN relied on the use of COPERNICUS data for Chl a obtained by remote sensing.

334. A detailed data analysis was performed for the Central Mediterranean Sea Sub-region (CEN) in order to decide on the assessment methodologies that can be found optimal at the level of Sub-divisions given the present circumstances related to the lack of data reporting.

335. Table 3.1.3.3.1. informs on data availability in CEN by considering data reported in IMAP IS by 31st October, the cut-off date for data reporting. Figure 3.1.3.3.1.a. shows the locations of sampling stations in the WMS Sub-region.

Table 3.1.3.3.1: Data availability by country and year for the Central Mediterranean Sea Sub-region (CEN) Sub-region showing data reported by the CPs for the assessment of EO5 (CI 13 and CI 14) up to 31st Oct 2022.

Country	Year	Amon	Ntri	Ntra	Phos	Tphs	Slca	Cphl	Temp	Psal	Doxy
Greece	2016-2021	No data provided									
Italy	2016	By 31st October 2022, Italy reported data relevant to the Central Mediterranean Sea Sub-region, in 4 data files with all together 260 208 data points up to 2018-2019 On 16 Dec 2022 data for 2020 were also provided. Without building of a dedicated quality assured database, it is impossible to analyse data availability and ensure their use for the assessment. It should be noted that quantum of data reported guarantees a near monthly sampling frequency on 11 profiles with 4 stations.									
	2017										
	2018										
	2019										
	2020										
	2021										
Libya	2016-2021	No data provided									
Malta	2016	-	-	-	-	-	-	-	-	-	-
	2017	93	93	107	93	93	93	263	263	263	263
	2018	165	165	186	165	165	165	480	481	481	473
	2019	59	59	66	59	59	59	78	77	77	77
	2020	-	-	-	-	-	-	-	-	-	-
	2021	-	-	-	-	-	-	-	-	-	-
Tunisia	2016-2021	No data provided									

Amon - Ammonium; Ntri- Nitrite; Ntra – Nitrate; Phos – Orthophosphate; Tphs—Total phosphorous; Slca – Orthosilicate; Cphl – Chlorophyll *a*; Temp – Temperature; Psal – Salinity; Doxy – Dissolved Oxygen.

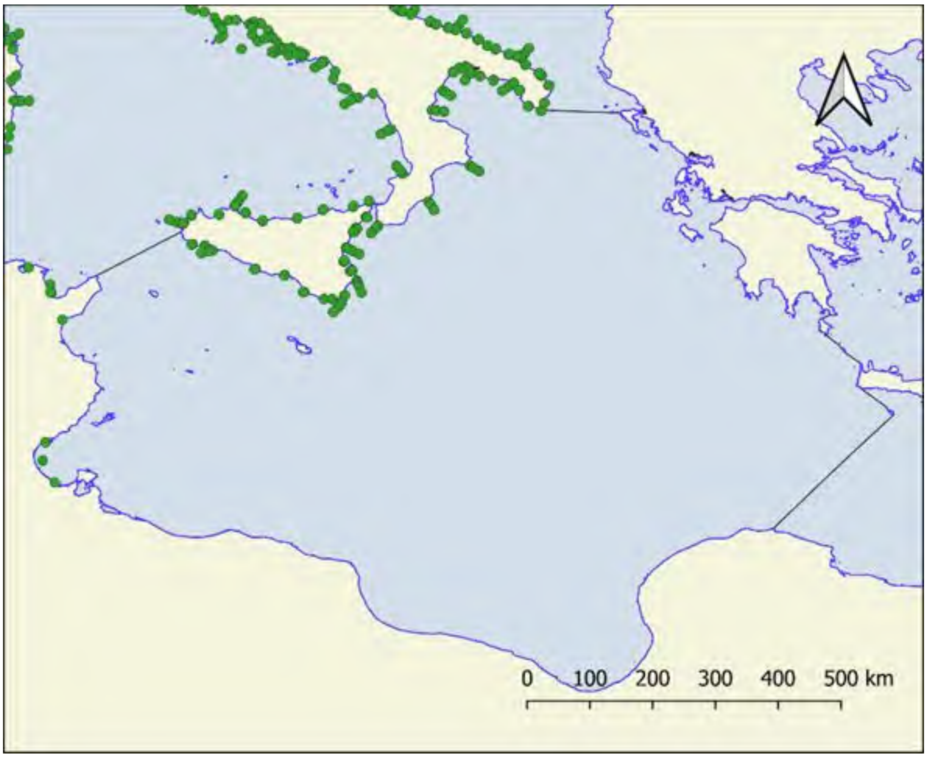


Figure 3.1.3.3.1.a. The locations of sampling stations in the CEN Sub-region.

336. As elaborated above for the AEL, in the CEN there was also the lack of homogenous and quality assured data reported in line with IMAP requirements, as shown in Table 3.1.3.3.1. Therefore, the Copernicus source was found relevant regarding the existence of a systematic repository of remote

sensing data for Chl a, with a good geographical coverage (1 x 1 km) and high sensing frequency (daily).

337. Chlorophyll a data for the CEN were downloaded from the Copernicus site (OCEANCOLOUR_MED_BGC_L4_MY_009_144).

338. The Copernicus product with ID: OCEANCOLOUR_MED_BGC_MY_009_144 was downloaded for the period from Jan 2016 to Dec 2021. It consists of Level 4 monthly values of Chlorophyll a concentration (CHL) with a resolution of 1 x 1 km. The file format is NetCDF-4 (.nc).

339. Data elaboration was performed by using R, an open-source language widely used for statistical analysis and graphical presentation (R Development Core Team, 2023)58. Maps are elaborated using QGIS 3.30, an open-source GIS tool. For the elaboration all relevant R

340. After download from the Copernicus site, as NetCDF file- .nc, data were transferred to R data table using the tidync package. The transfer and data elaboration were very time demanding as the dataset comprise 52 358 577 records.

341. For every point of the grid (Figure 3.1.3.3.1.b), a geometric annual mean (GM) was calculated (Attila et al, 2018)59. The parameter values were expressed in μg/L of Chl *a*, for the *GM* calculated over the year in at least a five-year period as required in the COMMISSION DECISION (EU) 2018/229[60] . These *GM* annual values were later used as a metric for the development of the assessment criteria and present assessment of CI 14.

Setting the areas of assessment.

342. The application of the Simplified G/M comparison assessment methodology for Common Indicator 14 in the CEN relied on the use of COPERNICUS data for Chl a obtained by remote sensing.

343. The two zones of assessment were defined in the CEN for the purpose of the present work: i) the coastal zone and ii) the offshore zone.

344. The GIS layers for the Assessment Areas were provided by France and Spain, as well as from other relevant sources (International Hydrographic Organization – IHO Seas subdivisions, European Environment Information and Observation Network – EIONET (WFD delimitation (2018)); VLIZ marine subregions).

[58] R Development Core Team (2023). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0. http://www.R-project.org

[59]Attila, J., Kauppila, P., Kallio, K.Y., Alasalmi, H., Keto, V., Bruun, E and Koponen, S. Applicability of Earth Observation chlorophyll-a data in assessment of water status via MERIS — With implications for the use of OLCI sensors. Remote Sensing of Environment 212 (2018) 273–287. https://doi.org/10.1016/j.rse.2018.02.043

[60] Commission Decision (EU) 2018/229 of 12 February 2018 establishing, pursuant to Directive 2000/60/EC of the European Parliament and of the Council, the values of the Member State monitoring system classifications as a result of the intercalibration.

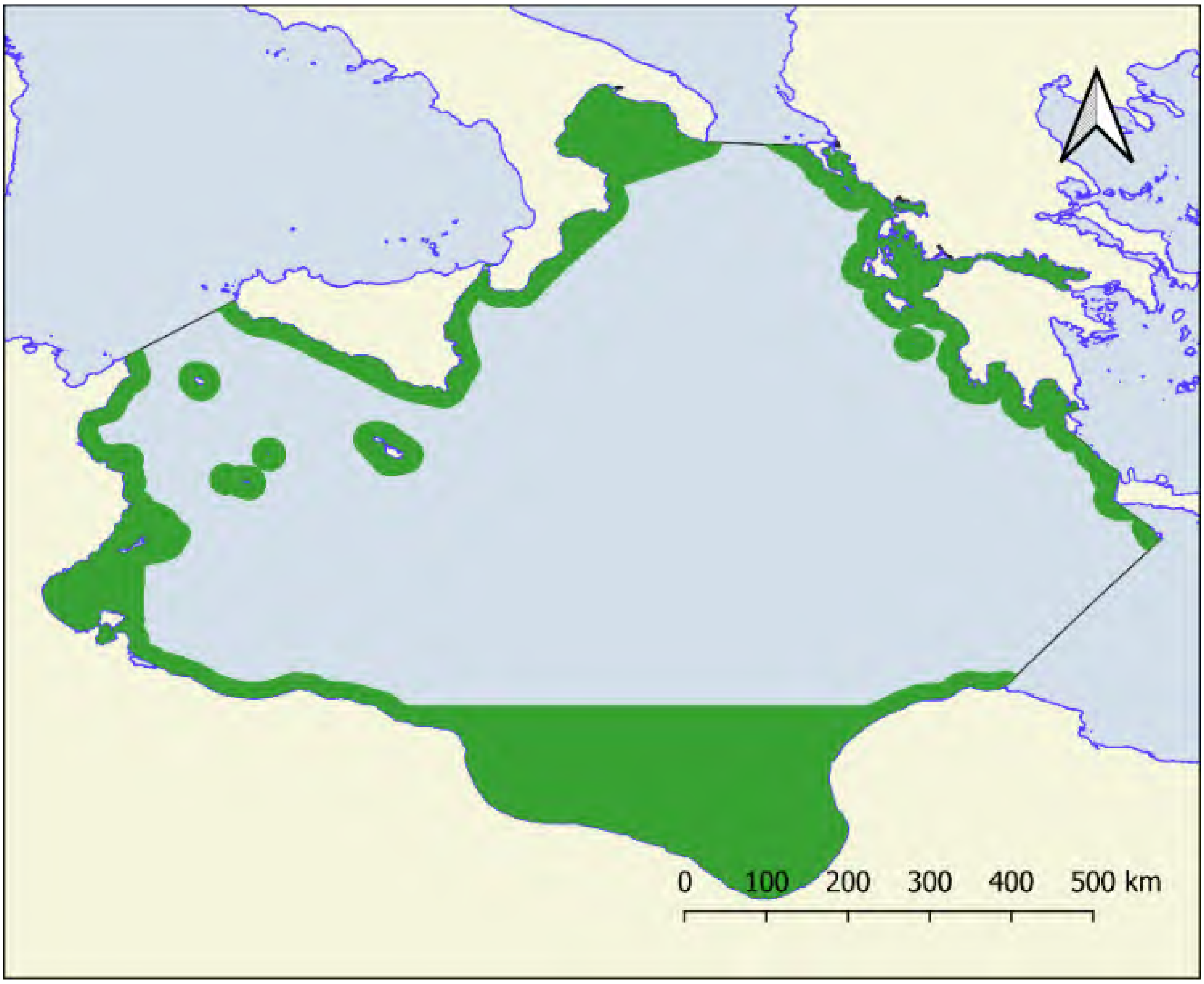


Figure 3.1.3.3.1.b The CEN Sub-region: The dots in the assessment zones represent data in the grid (1 x 1 km).

345. The principle of the NEAT IMAP assessment methodology applied in the Adriatic Sea Sub-region, as well as in the Western Mediterranean Sea Sub-region regarding CI 17, for setting of the spatial assessment units (SAUs) within the two main assessment zones along the IMAP nesting scheme, was also followed for setting of the coastal (CW) and the offshore monitoring zones (OW) in the CEN Sub-region. The CW included internal waters and one Nautical Mile outward. The offshore waters in the CEN start at the outward border of CW and extend to 20 km outward given this coverage corresponds to the area where national monitoring programmes are performed as shown in Figure 3.1.3.3.1.a.

346. Within the two Sub-divisions i.e., the Central Mediterranean Sea and the Ionian Sea, the CW and OW AZs were divided in the four areas: Northern, Western, Eastern and Southern, which delimitations are shown on Figure 3 (upper map). It resulted in eight SAUs (i.e., CW_NCEN – Northern CW; OW_NCEN – Northern OW; CW_WCEN – Western CW; OW_WCEN – Western OW; CW_ECEN – Eastern CW; OW_ECEN – Eastern OW; Southern CW – CW_SCEN and Southern OW – OW_SCEN). The finest IMAP subSAUs were further set on the base of nested assessment areas (AZs, four areas) by considering the national areas of monitoring and hydrographic characteristics.

347. The finest IMAP subSAUs set in the CEN Sub-region for the purpose of the present CI 14 assessment are depicted in Figure 3.1.3.3.2 (lower map) along their nesting in the two main assessment zones i.e., CW and OW of the CEN Sub-region.

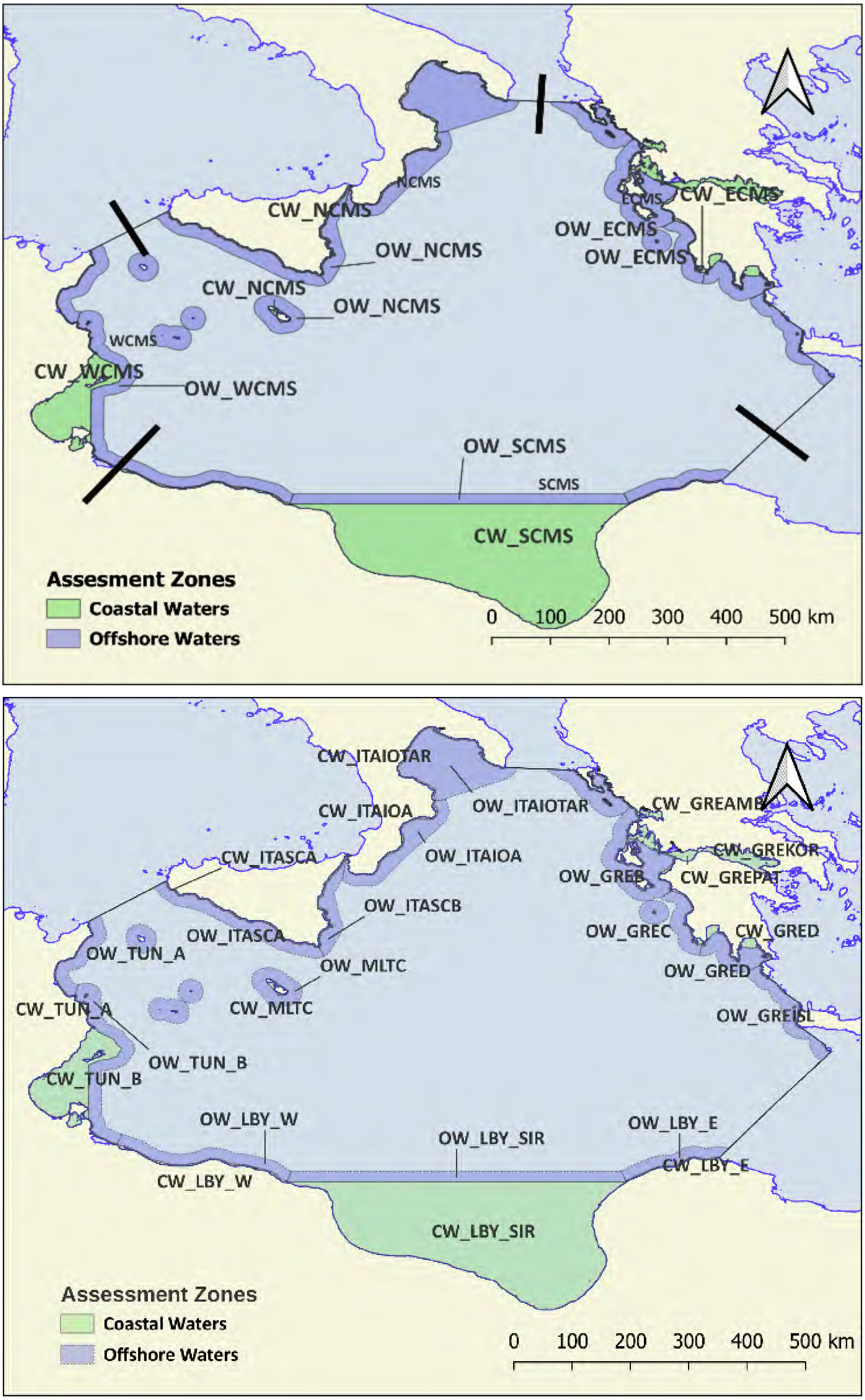


Figure 3.1.3.3.2. The nesting of IMAP SAUs set in the coastal (CW) and the offshore assessment (OW) zones for the CEN (upper map); and depiction of the finest IMAP subSAUs (lower map).

Setting the good/non good boundary value/threshold for the Simplified G/M comparison assessment methodology application in the CEN Sub-region.

348. The same approach for the statistical elaboration of satellite-derived Chla and the methodology for calculation of the assessment criteria were applied in the CEN, as elaborated above for the AEL. In order to calculate the assessment criteria applicable within the present work, the annual GM values were calculated. The results of calculation are presented in Table 3.1.3.3.2 and are obtained by the AZs and SAUs. As for the AEL, the two status classes i.e. good and non-good are assigned to the units assessed in the CEN by applying the simplified G/M assessment methodology since the assessment findings are based on the use of only one parameter and therefore, the integrated consideration of the minimum of parameters needed to assess the good environmental status for IMAP CIs 13 and 14 i.e. the GES was impossible.

Table 3.1.3.3.2: Reference conditions (oN10) and G/M threshold (oN85) set by IMAP Assessment zones (AZ) and Spatial Assessment Units (SAU) in the CEN Sub-region.

AZ	SAU	CHL_N	oN50	oN50+50	oN90	oN10	oN85	oN25
CW	CW_ECEN	17376	0,147	0,221	0,351	0,06	0,264	0,081
CW	CW_NCEN	4618	0,329	0,493	0,957	0,102	0,78	0,182
CW	CW_SCEN	298502	0,038	0,057	0,064	0,034	0,053	0,036
CW	CW_WCEN	41726	1,209	1,813	4,859	0,275	3,844	0,555
OW	OW_ECEN	98360	0,058	0,086	0,08	0,049	0,071	0,053
OW	OW_NCEN	152883	0,091	0,136	0,143	0,061	0,127	0,073
OW	OW_SCEN	80305	0,039	0,059	0,083	0,035	0,072	0,036
OW	OW_WCEN	46725	0,142	0,213	0,789	0,091	0,497	0,103

CHL_N – Number of calculated GM annual values, oN50 – Mean, oN50+50 – Mean + 50%, oN90 – 90th percentile, oN10 – 10th percentile, oN85 – 85th percentile, oN25 – 25th percentile

Results of the Simplified G/M comparison assessment methodology application in the CEN Sub-region

349. The results of CI 14 assessment using the satellite derived Chl a data are presented in Tables 3.1.3.3.3 and 3.1.3.3.4, and Figure CEN 3.1.3.3.3.E. The good status corresponds to the RC conditions, as well as to the values below the 85th percentile of normalized distribution set as G/M i.e., good/non-good boundary limit (i.e., blue coloured cells in the last column of Tables 3.1.3.3.3 and 3.1.3.3.4). The non-good status corresponds to the class above G/M boundary limit (i.e., red coloured cells in the last column of Table 3.1.3.3.4).

350. The assessment results show that all evaluated assessment zones can be considered likely in good status regarding the assessment of the satellite-derived Chl *a* data. Further to this good status assigned to the assessment zones, it can be preliminarily found that 7 out of 36 subSAUs are likely in non-good status. However, it must be noted that the subSAUs are set at an insufficient level of fineness for a reliable assessment (Tables 3.1.3.3.3 and 3.1.3.3.4). The likely non-good status subSAUs (GREA, GREAMB, GREPAT, LBY_E, LBY_W, LBY_W; TUN_B) are in the Eastern and the Southern parts of the CEN Sub-region.

351. The subSAU GREAMB is located in Ambracian Gulf and subSAU GREPAT in Gulf of Patras. These sites were also classified as moderate or a poor status by Greek research studies61. In subSAU GREAMB, the highest GM value of Chl a was observed (4,8 µg/L). The Northern subSAU GREA is probably influenced by the local sources of pollution (Igumenitsa port and intense aquaculture). The level of the finesse of the subSAU definition contributes to the lower confidence of the assessment findings, i.e., the assessment of the larger area is less confident. A finer-designed approach will contribute to a more accurate assessment of the local processes, contributing to the understanding of the very localized problem.

352. Along the coast of Libya, the marine waters impacted by eutrophication are located in the western part of Libyan OW (subSAU LBYW) and in the eastern part of CW (subSAU LBYE). It must be noticed that the G/M threshold for the Libyan waters is very low which questions the evaluation of the Southern part of the CEN Sub-region. The western part of the coast of Libya is influenced by the waters coming from the Gulf of Gabes where human activities contribute to the impacts of eutrophication[62]. The local influence of Tripoli should also be taken into account.

353. Further to calculations undertaken for the Gulf of Gabes, the subSAU TUNB located in CW can be indicated as an area in good status. However, it must be recognized that using the 50th percentile for the development of the assessment criteria is not applicable in heavily impacted areas, such as the Gulf of Gabes. Therefore, an adjustment by using the 25th percentile of the calculated values resulted in the classification of the subSAU TUNB in non-good status, as also recognized in the existing literature.

354. The results of the present CI 14 assessment in the Central Mediterranean Sea Sub-region represent only an indication of possible good/non-good status at the level of the subSAUs, whereby they are not set at the same level of spatial finesse.

[61] Simboura et al. (2015) Assessment of the environmental status in the Hellenic coastal waters (Eastern Mediterranean): from the Water Framework Directive to the Marine Strategy Framework Directive. Medit. Mar. Sci., 16/1, 46-64
[62] Annabi-Trabelsi, N., Guermazi, W., Leignel, V., Al-Enezi, Y., Karam, Q., Ali Mohammad Ayadi, H., Belmonte, G. (2022). Effects of Eutrophication on Plankton Abundance and Composition in the Gulf of Gabès (Mediterranean Sea, Tunisia). Water. 14. 2230. 10.3390/w14142230.

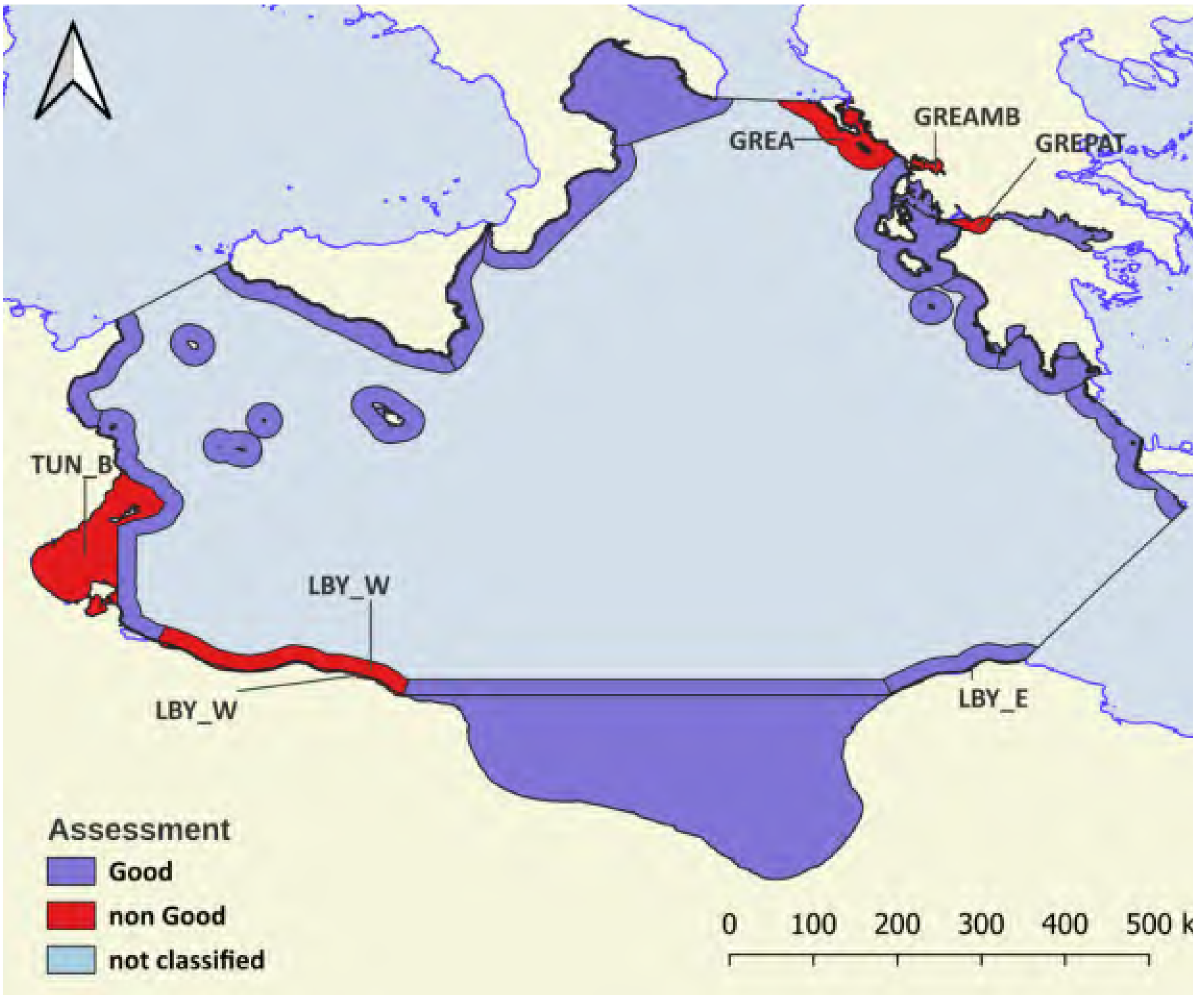


Figure CEN 3.1.3.3.3.E: The assessment results for CI 14 in the CEN Sub-region by applying the simplified G/M method at the level of subSAUs.

Table 3.1.3.3.3. Results of the assessment (G_NG.oN85 - the good status corresponds to all values below the 85th percentile set as G/M i.e., good/non-good boundary limit) of the CEN Sub-region by Assessment Zones (AZ) and Spatial Assessment Units (SAUs). Blue coloured SAUs indicate good status.

AZ	SAU	CHL_N	CHL_GM	oN50	oN50+50	oN10	oN85	G_NG.oN85
CW	CW_ECEN	26254	0,174	0,147	0,221	0,060	0,264	G
CW	CW_NCEN	8893	0,330	0,329	0,493	0,102	0,78	G
CW	CW_SCEN	300536	0,045	0,038	0,057	0,034	0,053	G
CW	CW_WCEN	44184	1,297	1,209	1,813	0,275	3,844	G
OW	OW_ECEN	99313	0,061	0,058	0,086	0,049	0,071	G
OW	OW_NCEN	154096	0,094	0,091	0,136	0,061	0,127	G
OW	OW_SCEN	80305	0,049	0,039	0,059	0,035	0,072	G
OW	OW_WCEN	46845	0,198	0,142	0,213	0,091	0,497	G

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions)

Table 3.1.3.3.4. Result of the assessment (G_NG.oN85- the good status corresponds to all values below the 85th percentile set as G/M i.e., good/non-good boundary limit) of the CEN Sub-region for the finest Spatial Assessment Units (subSAUs). Blue coloured subSAUs indicate good status; Red coloured status indicate non-good status.

Coun.	AZ	SAU	subSAU	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
GRE	CW	CW_ECEN	GREA	1702	0,167	0,221	0,06	0,264	G
GRE	CW	CW_ECEN	GREAMB	1303	4,8	0,221	0,06	0,264	NG
GRE	CW	CW_ECEN	GREB	6773	0,122	0,221	0,06	0,264	G
GRE	CW	CW_ECEN	GREC	1214	0,129	0,221	0,06	0,264	G
GRE	CW	CW_ECEN	GRED	3753	0,091	0,221	0,06	0,264	G
GRE	CW	CW_ECEN	GREISL	998	0,056	0,221	0,06	0,264	G
GRE	CW	CW_ECEN	GREKOR	8157	0,191	0,221	0,06	0,264	G
GRE	CW	CW_ECEN	GREPAT	2354	0,31	0,221	0,06	0,264	NG
ITA	CW	CW_NCEN	ITAIOA	1421	0,227	0,493	0,102	0,78	G
ITA	CW	CW_NCEN	ITAIOTAR	2630	0,382	0,493	0,102	0,78	G
ITA	CW	CW_NCEN	ITASCA	2784	0,615	0,493	0,102	0,78	G
ITA	CW	CW_NCEN	ITASCB	1535	0,198	0,493	0,102	0,78	G
MLT	CW	CW_NCEN	MLTC	523	0,071	0,493	0,102	0,78	G

Coun.	AZ	SAU	subSAU	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
LBY	CW	CW_SCEN	LBY_E	1170	0,097	0,057	0,034	0,053	NG
LBY	CW	CW_SCEN	LBY_SIR	296417	0,044	0,057	0,034	0,053	G
LBY	CW	CW_SCEN	LBY_W	2949	0,348	0,057	0,034	0,053	NG
TUN	CW	CW_WCEN	TUN_A	995	0,431	1,813	0,275	3,844	G
TUN	CW	CW_WCEN	TUN_B	43189	1,33	1,813	0,275	3,844	NG
GRE	OW	OW_ECEN	GREA	16138	0,076	0,086	0,049	0,071	NG
GRE	OW	OW_ECEN	GREB	32001	0,068	0,086	0,049	0,071	G
GRE	OW	OW_ECEN	GREC	18781	0,056	0,086	0,049	0,071	G
GRE	OW	OW_ECEN	GRED	14808	0,055	0,086	0,049	0,071	G
GRE	OW	OW_ECEN	GREISL	17585	0,05	0,086	0,049	0,071	G
ITA	OW	OW_NCEN	ITAIOA	23686	0,092	0,136	0,061	0,127	G
ITA	OW	OW_NCEN	ITAIOTAR	53598	0,114	0,136	0,061	0,127	G
ITA	OW	OW_NCEN	ITASCA	25605	0,112	0,136	0,061	0,127	G
ITA	OW	OW_NCEN	ITASCAI	22978	0,07	0,136	0,061	0,127	G
ITA	OW	OW_NCEN	ITASCB	13608	0,095	0,136	0,061	0,127	G
MLT	OW	OW_NCEN	MLTC	14621	0,057	0,136	0,061	0,127	G
LBY	OW	OW_SCEN	LBY_E	13675	0,04	0,059	0,035	0,072	G
LBY	OW	OW_SCEN	LBY_SIR	43480	0,038	0,059	0,035	0,072	G
LBY	OW	OW_SCEN	LBY_W	23150	0,089	0,059	0,035	0,072	NG
TUN	OW	OW_WCEN	TUN_A	14645	0,11	0,213	0,091	0,497	G
TUN	OW	OW_WCEN	TUN_B	32200	0,258	0,213	0,091	0,497	G

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5 year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions);

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355. Given the lack of quality-assured, the assessment of Common Indicator 4: Chl a was undertaken in the three Sub-divisions of the Western Mediterranean Sub-region as follows: i) in the Central Sub-division of the Western Mediterranean Sea Sub-region (CWMS): the Waters of France; the Alboran (ALB) and the Levantine-Balearic (LEV-BAL) Sub-division: the Waters of Spain, and the Southern part of the Central Western Mediterranean Sea Sub-division: the Waters of Algeria, Morocco and Tunisia, by applying the Simplified G/M comparison assessment methodology on the satellite-derived Chl a data; and ii) the Tyrrhenian Sea Sub-division and part of CWMS Sub-division: the Waters of Italy by applying both the Simplified G/M comparison assessment methodology on the satellite-derived Chl a data and the simplified EQR assessment methodology on in situ measured data.

356. The assessment of the Common Indicator CI 14, based on the simplified G/M comparison method applied on the satellite-derived Chl a data, was harmonized at the level of the WMS.This simplified method has the advantage to overcome the lack of in situ data, relying on satellite-derived products for surface Chl a concentration at a daily frequency. Even though this assessment is useful to provide a picture at the regional scale, in some cases finer methods are available at the local scale. For the sake of consistency with scientific work undertaken at the national level, the assessment of the French part of CWMS, as well as assessment of the Spanish waters, also takes account of the comparison between the regional and national assessments, whereby in the case of discrepancy, precedence was given to the national scientific expertise[63].

Available data.

357. A detailed data analysis was performed for the Western Mediterranean Sea (WMS) in order to decide on the assessment methodologies that can be found optimal at the level of Sub-divisions given the present circumstances related to the lack of data reporting.

358. Table 3.1.3.4.1. informs on data availability in WMS by considering data reported in IMAP IS by 31st October, the cut-off date for data reporting. Figure 3.1.3.4.1 shows the locations of sampling stations in the WMS Sub-region

[63] HERLORY O., BRIAND J. M., BOUCHOUCHA M., DEROLEZ V., MUNARON D., CIMITERRA N., TOMASINO C., GONZALEZ J.-L., GIRAUD A., BOISSERY P. (2022) Directive Cadre sur l'Eau. Bassin Rhône Méditerranée Corse - Année 2021. RST.ODE/UL/LER-PAC/22-11. 89pp. https://archimer.ifremer.fr/doc/00820/93161/99746.pdf

Table 3.1.3.4.1. Data availability by country and year for the Western Mediterranean Sea Sub-region (WMS) Sub-region showing data reported by the CPs for the assessment of EO5 (CI 13 and CI 14) up to 31st Oct 2022.

<table>
<tr><th>Country</th><th>Year</th><th>Amon</th><th>Ntri</th><th>Ntra</th><th>Phos</th><th>Tphs</th><th>Slca</th><th>Cphl</th><th>Temp</th><th>Psal</th><th>Doxy</th></tr>
<tr><td>Algeria</td><td>2016-2021</td><td colspan="10">No data provided</td></tr>
<tr><td>France</td><td>2016</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>-</td><td>130</td><td>179</td><td>179</td><td>74</td></tr>
<tr><td></td><td>2017</td><td>66</td><td>-</td><td>66</td><td>66</td><td>-</td><td>43</td><td>130</td><td>324</td><td>340</td><td>116</td></tr>
<tr><td></td><td>2018</td><td>56</td><td>-</td><td>56</td><td>56</td><td>-</td><td>56</td><td>129</td><td>326</td><td>326</td><td>108</td></tr>
<tr><td></td><td>2019</td><td>126</td><td>-</td><td>126</td><td>126</td><td>-</td><td>126</td><td>126</td><td>344</td><td>342</td><td>117</td></tr>
<tr><td></td><td>2020</td><td>102</td><td>-</td><td>102</td><td>102</td><td>-</td><td>95</td><td>120</td><td>349</td><td>350</td><td>129</td></tr>
<tr><td>Morocco</td><td>2016-2021</td><td colspan="10">No valid data provided</td></tr>
<tr><td>Italy</td><td>2015-2020</td><td colspan="10">By 31st October 2022, Italy reported data relevant to the WMS Sub-region, in 4 data files with all together 1,081,853 data points up to 2019. On 17 Nov 2022 data for 2020 were also provided. It should be noted that quantum of data reported guarantees a near monthly sampling frequency on 27 profiles with 4 stations in the 5-year period. All IMAP mandatory parameters were measured.</td></tr>
<tr><td>Spain</td><td>2019</td><td>8</td><td>86</td><td>86</td><td>95</td><td>-</td><td>-</td><td>95</td><td>95</td><td>95</td><td>95</td></tr>
<tr><td></td><td>2020</td><td>306</td><td>311</td><td>311</td><td>295</td><td>-</td><td>-</td><td>290</td><td>304</td><td>304</td><td>310</td></tr>
<tr><td></td><td>2021</td><td>300</td><td>300</td><td>300</td><td>141</td><td>-</td><td>-</td><td>294</td><td>302</td><td>302</td><td>302</td></tr>
<tr><td></td><td>2022</td><td>274</td><td>322</td><td>322</td><td>168</td><td>-</td><td>-</td><td>291</td><td>318</td><td>318</td><td>318</td></tr>
<tr><td>Tunisia</td><td>2016-2021</td><td colspan="10">No data provided</td></tr>
</table>

Amon - Ammonium; Ntri- Nitrite; Ntra – Nitrate; Phos – Orthophosphate; Tphs—Total phosphorous; Slca – Orthosilicate; Cphl – Chlorophyll *a*; Temp – temperature; Psal – Salinity; Doxy – Dissolved Oxygen.

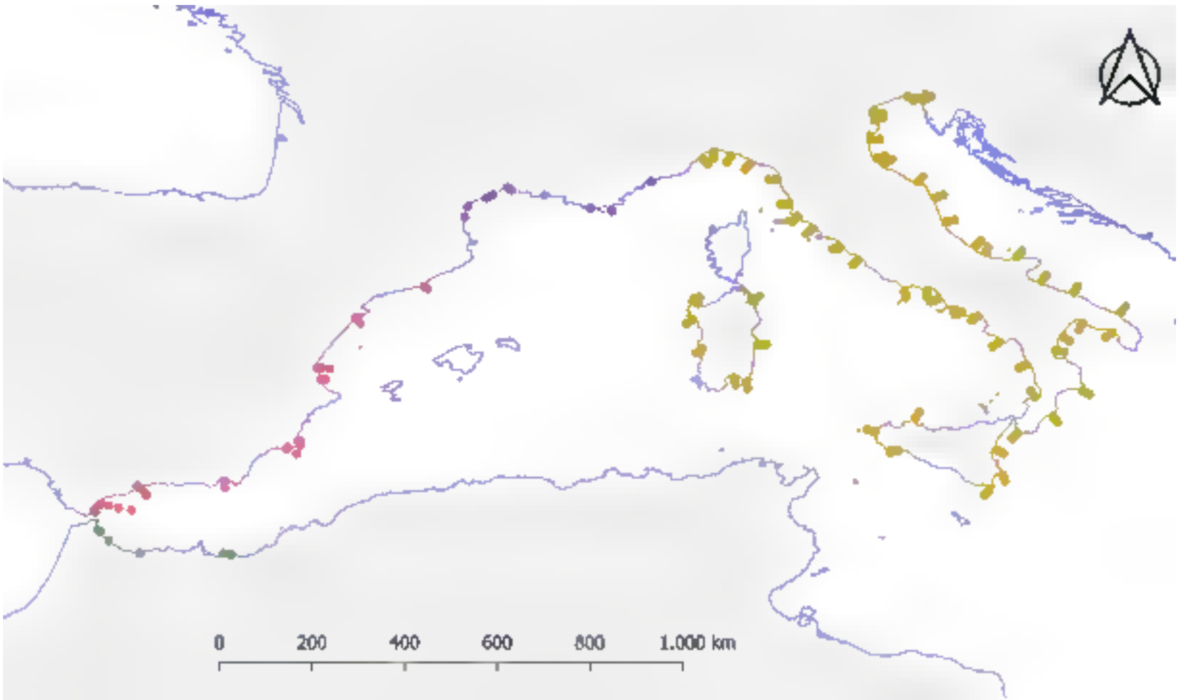

Figure 3.1.3.4.1. The locations of sampling stations in the WMS Sub-region

359. As explained for the AEL and CEN, given the above explained status of data reported in the WMS, in particular the lack of homogenous and quality assured data reported in line with IMAP requirements, the use of alternative data sources i.e. the satellite-derived data was explored. For Spanish waters, remote sensing data for surface Chl a concentrations in the Alboran Sea and the Levantine-Balearic Sub-divisions were received from the SMED algorithm (Gómez-Jakobsen et al,

2018), by combining data from the sensors MODIS-Aqua and VIIRS-SNPP in a coherent way, according with the procedure published in Gómez-Jakobsen et al. 2022. Chl a data for French waters were provided by ARGANS France. Data sets consists of Level 4 monthly values of concentration of Chl a with a resolution of 1 x 1 km for the period from April 2016 to March 2021. The file format was NetCDF-4 (.nc). Chl a concentration data were daily evaluated via the OC5 algorithm developed by IFREMER and maintained/improved by ARGANS.

360. For the Southern part of the Central Western Mediterranean Sea Sub-division, data were also provided by ARGANS France.

361. For Italian waters, the Copernicus satellite Chl*a* dataset were used. The Copernicus services - the Mediterranean Sea Ocean Satellite Observations, the Italian National Research Council (CNR – Rome, Italy), elaborated the Bio-Geo_Chemical (BGC) regional datasets. Chl a concentration (CHL) were evaluated via region-specific algorithms (Case 1 waters: Volpe et al., 201964, with new coefficients; Case 2 waters, Berthon and Zibordi, 2004[65]), and the interpolated gap-free Chl concentration (to provide a ”“cloud free”″ product) was estimated by means of a modified version of the DINEOF algorithm (Volpe et al., 2018[66]).

362. Using only satellite-derived Chl *a* data, with a good geographical coverage (1 x 1 km) and high sensing frequency (daily), a simple assessment methodology was applied based on the ecological rules and a comparison of the obtained values to the defined Good/Moderate (G/M) boundary.

363. Data elaboration was performed by using R, an open-source language widely used for statistical analysis and graphical presentation (R Development Core Team, 2022)[67.] Maps are elaborated using QGIS 3.28, an open-source GIS tool.

364. The transfer and data elaboration were time demanding as data were comprised of i) 8,840,786 data records for the Spanish waters; and ii) 17,319 data points and 1,059,486 observations for the French Waters, and 31,507 data points and 1,941,429 observations for the Southern part of the CWMS, altogether extracted from a WMS dataset consisting of 46,277,527 observations. For the elaboration of Tyrrhenian data 64,851 data point were used pertaining to 3,678,959 observation and extracted from 22,269,588 observations.

365. The parameter values were expressed in μg/L of Chl a, for the geometric mean (GM) calculated over the year in at least a five-year period as required in the COMMISSION DECISION (EU) 2018/22968. These GM annual values were later used as a metric for the development of the

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64 Volpe, G., Colella, S., Brando, V. E., Forneris, V., Padula, F. L., Cicco, A. D., ... & Santoleri, R. (2019). Mediterranean ocean colour Level 3 operational multi-sensor processing. Ocean Science, 15(1), 127-146

[65] Berthon, J.-F., Zibordi, G. (2004) Bio-optical relationships for the northern Adriatic Sea. Int. J. Remote Sens., 25, 1527-1532.

[66]Volpe, G., Buongiorno Nardelli, B., Colella, S., Pisano, A. and Santoleri, R. (2018). An Operational Interpolated Ocean Colour Product in the Mediterranean Sea, in New Frontiers in Operational Oceanography, edited by E. P. Chassignet, A. Pascual, J. Tintorè, and J. Verron, pp. 227–244

[67] R Development Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0. http://www.R-project.org

[68] Commission Decision (EU) 2018/229 of 12 February 2018 establishing, pursuant to Directive 2000/60/EC of the European Parliament and of the Council, the values of the Member State monitoring system classifications as a result of the intercalibration.

assessment criteria and present assessment of CI 14. An annual GM[69] value was calculated for every point of the satellite derived Chl a data grid as shown in Figure 3.1.3.4.2.a. for the French waters; Figure 3.1.3.4.2.b. for the Southern part of the WMS; Figure 3.1.3.4.2.c. for the Spanish waters and Figure 3.1.3.4.2.d. for the Italian wasters.

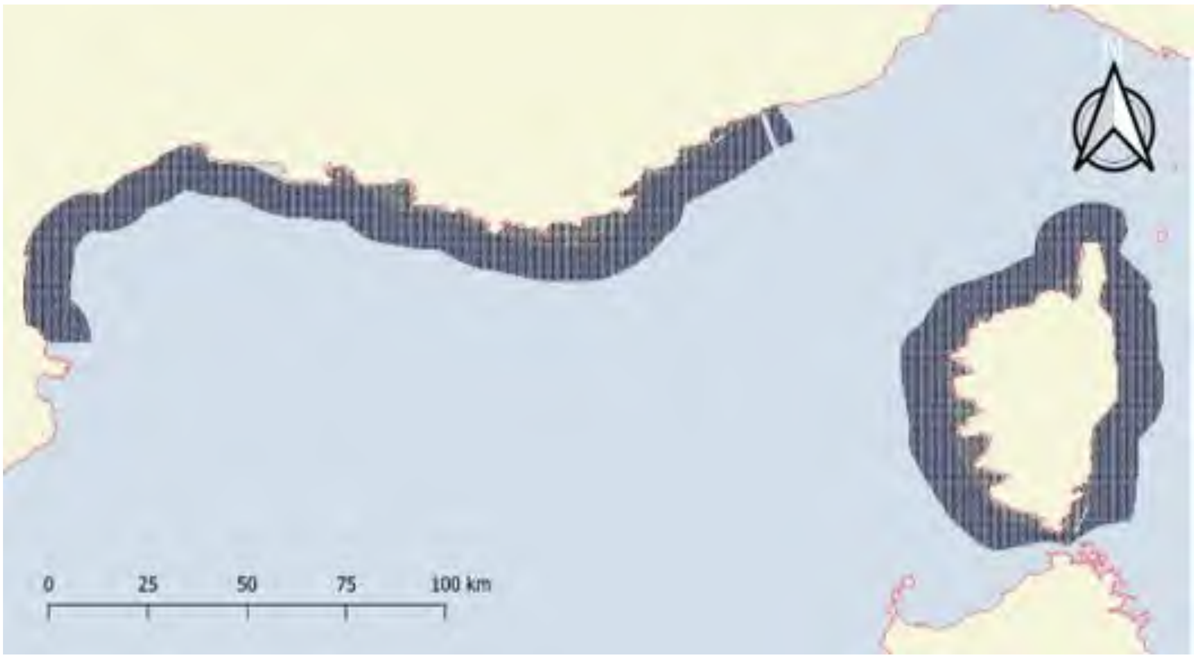

Figure 3.1.3.4.2.a. The French part of the Central Western Mediterranean Sea Sub-division (CWMS): The dots in the Assessment Zones represent data in the grid (1 x 1 km).

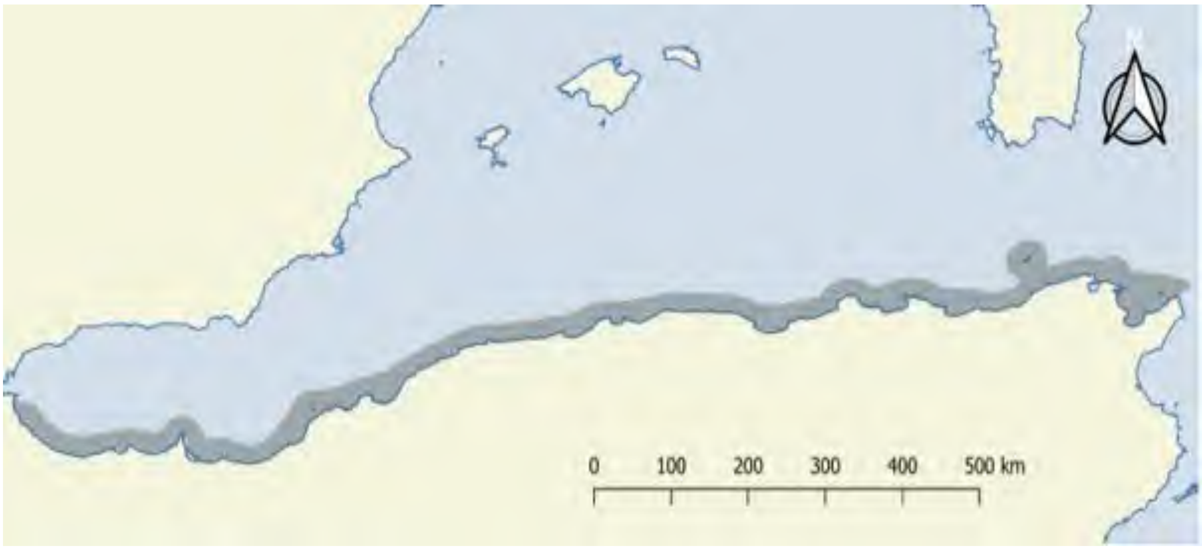

Figure 3.1.3.4.2.b. The Southern part of the Central Western Mediterranean Sea Sub-division (CWMS) - the Waters of Algeria, Morocco and Tunisia: The dots in the Assessment Zones represent data in the grid (1 x 1 km).

[69] Attila, J., Kauppila, P., Kallio, K.Y., Alasalmi, H., Keto, V., Bruun, E and Koponen, S. Applicability of Earth Observation chlorophyll-a data in assessment of water status via MERIS — With implications for the use of OLCI sensors. Remote Sensing of Environment 212 (2018) 273–287. https://doi.org/10.1016/j.rse.2018.02.043

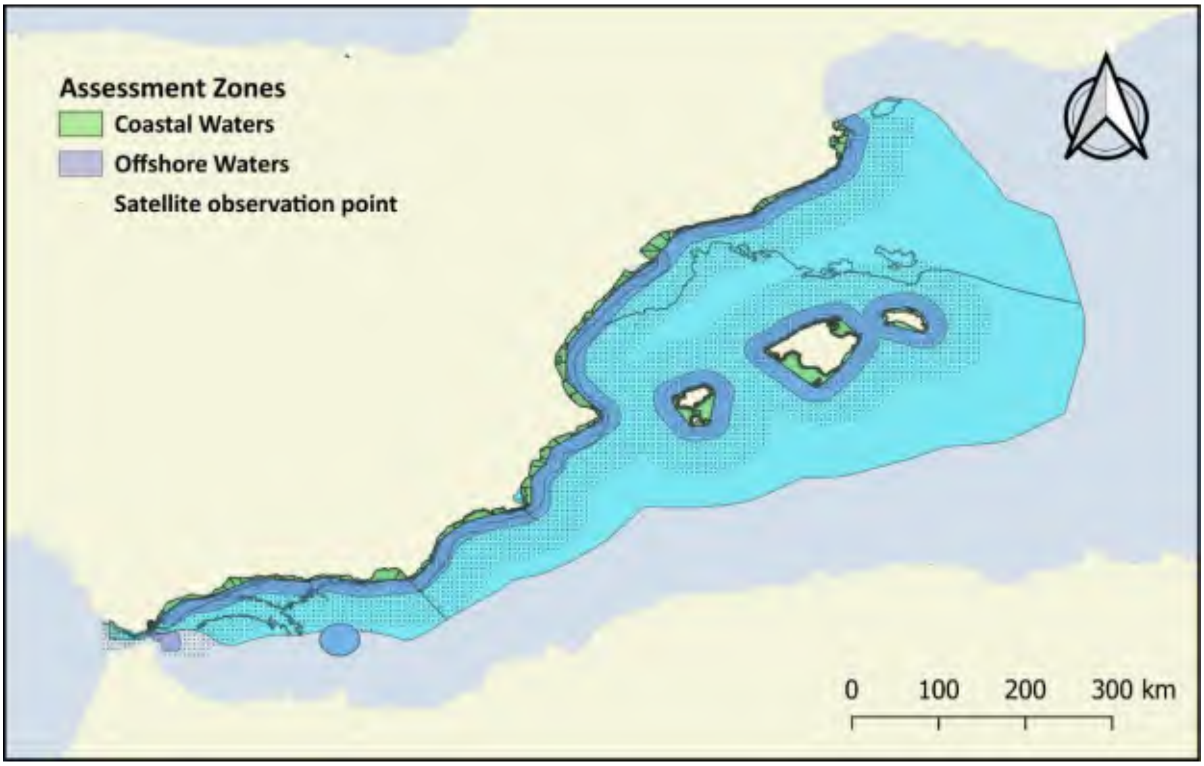

Figure 3.1.3.4.2.c. The Spanish assessment zones in the Alboran Sea and the Levantine - Balearic Sea Subdivision: The dots in the assessment zones represent data in the grid (1 x 1 km) near the coast and in the open waters (4 x 4 km).

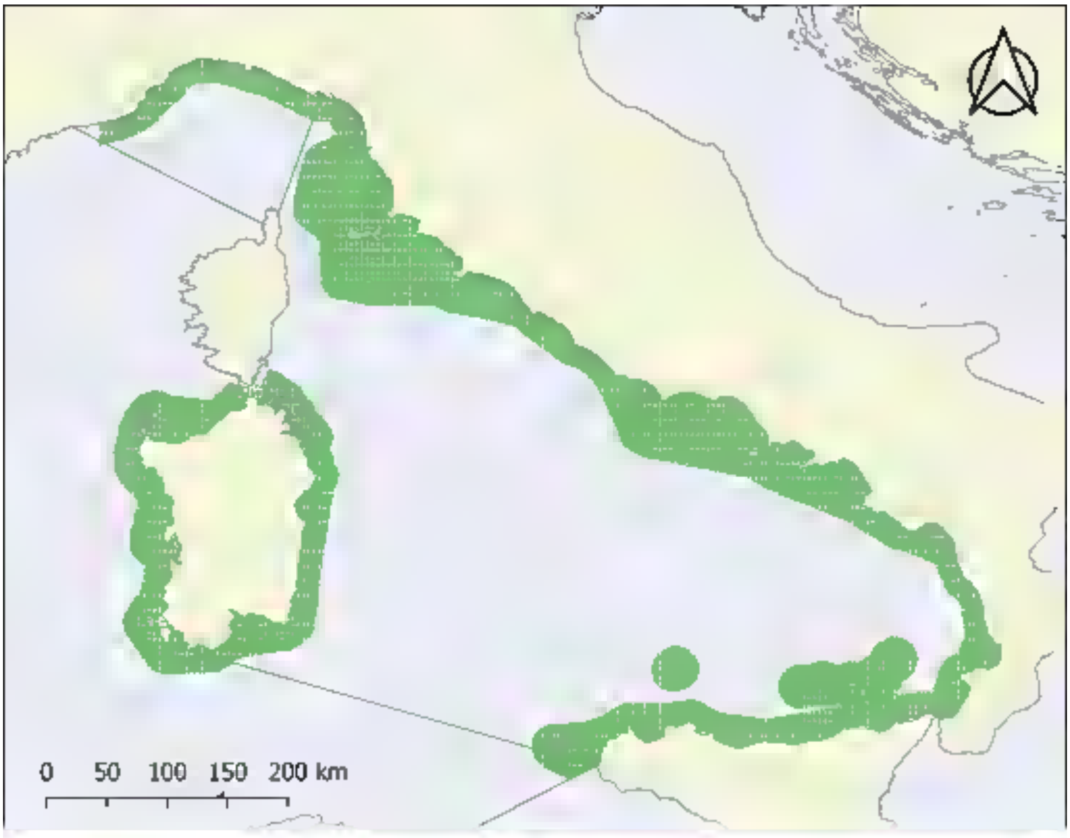

Figure 3.1.3.4.2.d. The Tyrrhenian Sea Sub-division and Italian part of the Central Western Mediterranean Sea Sub-division: The dots in the assessment zones represent data in the grid 1 x 1 km.

Setting the areas of assessment.

366. The two zones of assessment were defined in the Western Mediterranean Sea Sub-divisions for the purposes of the present work: i) the coastal zone and ii) the offshore zone by applying the same approach as applied to the AEL and the CEN Sub-regions.

367. The principle of the NEAT IMAP GES assessment methodology was also followed for setting of the coastal (CW) and the offshore monitoring zones (OW) in the Western Mediterranean Sea Sub-divisions. The CW included internal waters and one Nautical Mile outward. The offshore waters start at the outward border of CW and extend to 20 km outward given there is no eutrophication issues further in offshore70, but also due to correspondence of this coverage to the area where national monitoring programmes are performed (as shown in Figure 3.1.3.4.1.). In addition, the IMAP Spatial Assessment Units (SAUs) were set in the waters of Spain by taking account of the specific circulation pattern in the Spanish waters which influences the biogeochemical processes in the area.

368. The GIS layers for the Assessment Areas were provided by France and Spain, as well as from other relevant sources (International Hydrographic Organization – IHO Seas subdivisions, European Environment Information and Observation Network – EIONET (WFD delimitation (2018)); VLIZ marine subregions).

369. The French Offshore Waters (OW) were divided in the FRD_E (East of Rhone waters) and the FRD_W (West of Rhone waters) as shown in Figure 3.1.3.4.3.a - upper map. For the French Coastal Waters (CW), the division to water bodies (WB) set for implementation of the EU WFD was also used for setting IMAP SAUs and subSAUs. Consequently, the WFDs coding was used for present work (Figure 3.1.3.4.3.a - lower map). The finest IMAP subSAUs set in the French part of the CWMS for the purpose of the present CI 14 assessment are nested in the two main assessment zones i.e., CW and OW of the French part of the CWMS (Figure 3.1.3.4.3.a)

[70] See Lefebvre and Devreker 2020

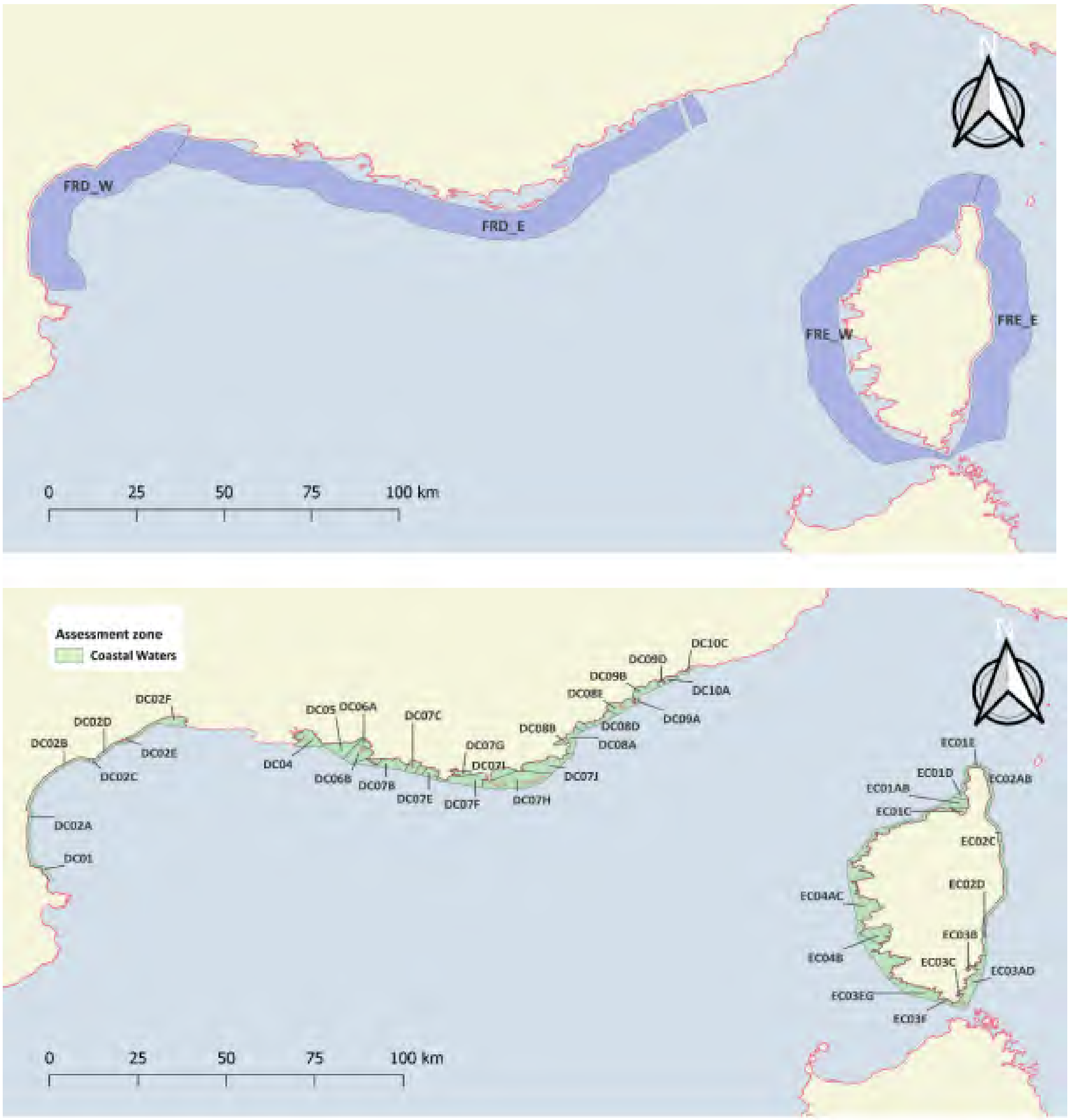

Figure 3.1.3.4.3.a. The nesting of the finest IMAP subSAUs set for the French OW assessment zone (upper map); and depiction of the finest IMAP subSAUs set in CW assessment zone (lower map). For setting IMAP subSAUs along the coast of France, the WFD water bodies were considered.

370. The IMAP Spatial Assessment Units (SAUs) were set in the waters of Spain by taking account of the specific circulation pattern in the Alboran Sea which influences the biogeochemical processes in the area, as shown in Figure 3.1.3.4.3.b1. (Sánchez-Garrido and Nadal, 2022[71]).

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[71] Sanchez-Garrido JC and Nadal I (2022) The Alboran Sea circulation and its biological response: A review. Front. Mar. Sci. 9:933390. doi: 10.3389/fmars.2022.933390

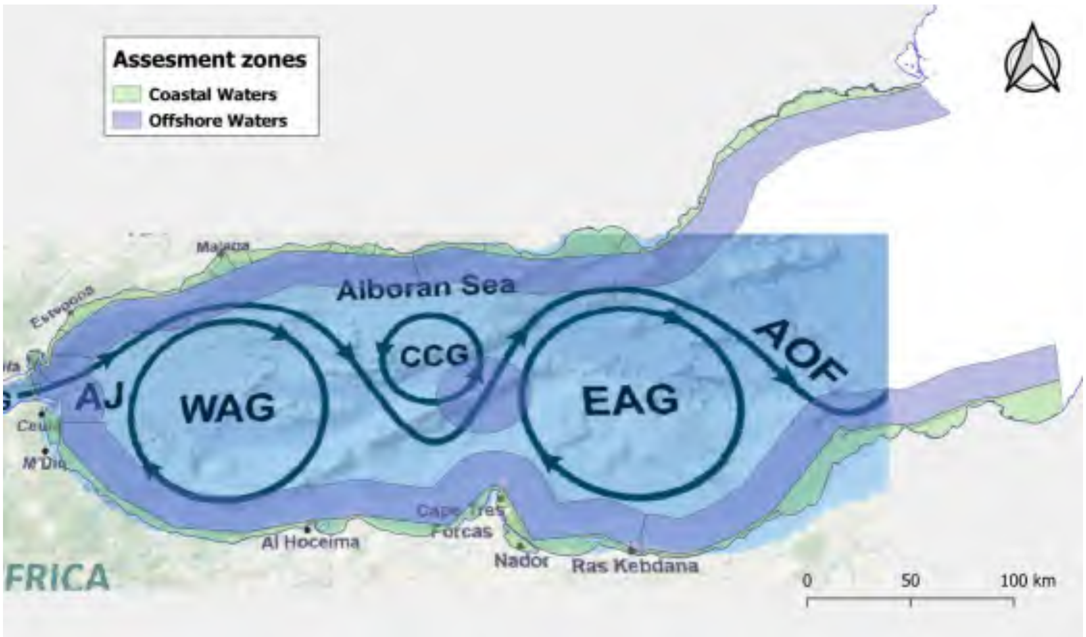

Figure 3.1.3.4.3.b1. A circulation scheme superimposed on the CW and OW assessment zones in the Alboran Sea Sub-division (Sánchez-Garrido and Nadal, 2022)

371. The Spanish OWs were divided in the ESPE (East of Motril) and the ESPW (West of Motril) in the ALB Subdivision, and ESPL (mainland) and ESPI (islands) of the LEV-BAL Subdivision, as shown in Figure 3.1.3.4.3. b2**.**. For the Spanish CW, the division to water bodies (WB) set for implementation of the WFD was also used for setting IMAP SAUs by considering an input submitted by the national authorities. Consequently, the WFDs coding was used for present work Figure 3.1.3.4.3.b3). The MSFD Assessment Water Units of Spain were considered as well as proposed by the national authorities (Figure 3.1.3.4.3.b4).

372. The finest IMAP SAUs set in the ALB and LEV-BAL Sub-divisions for the purpose of the present CI 14 assessment are nested in the CW of the ALB and LEV-BAL Subdivisions (Figure 3.1.3.4.3.b3).

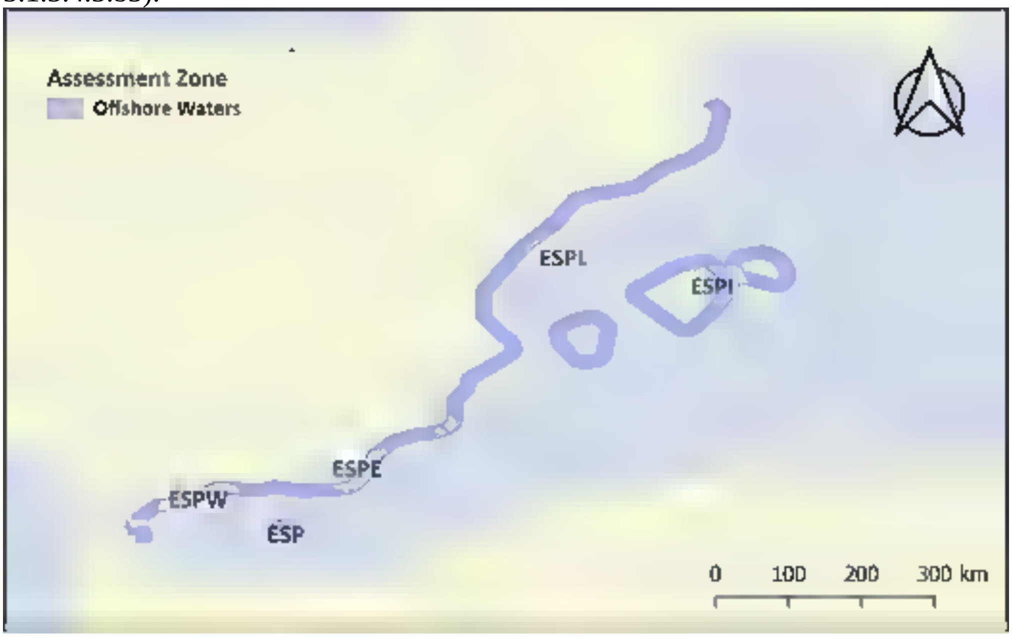

Figure 3.1.3.4.3. b2. The nesting of the finest IMAP SAUs, as set for the ALB and LEV-BAL subdivisions in the OW assessment zone.

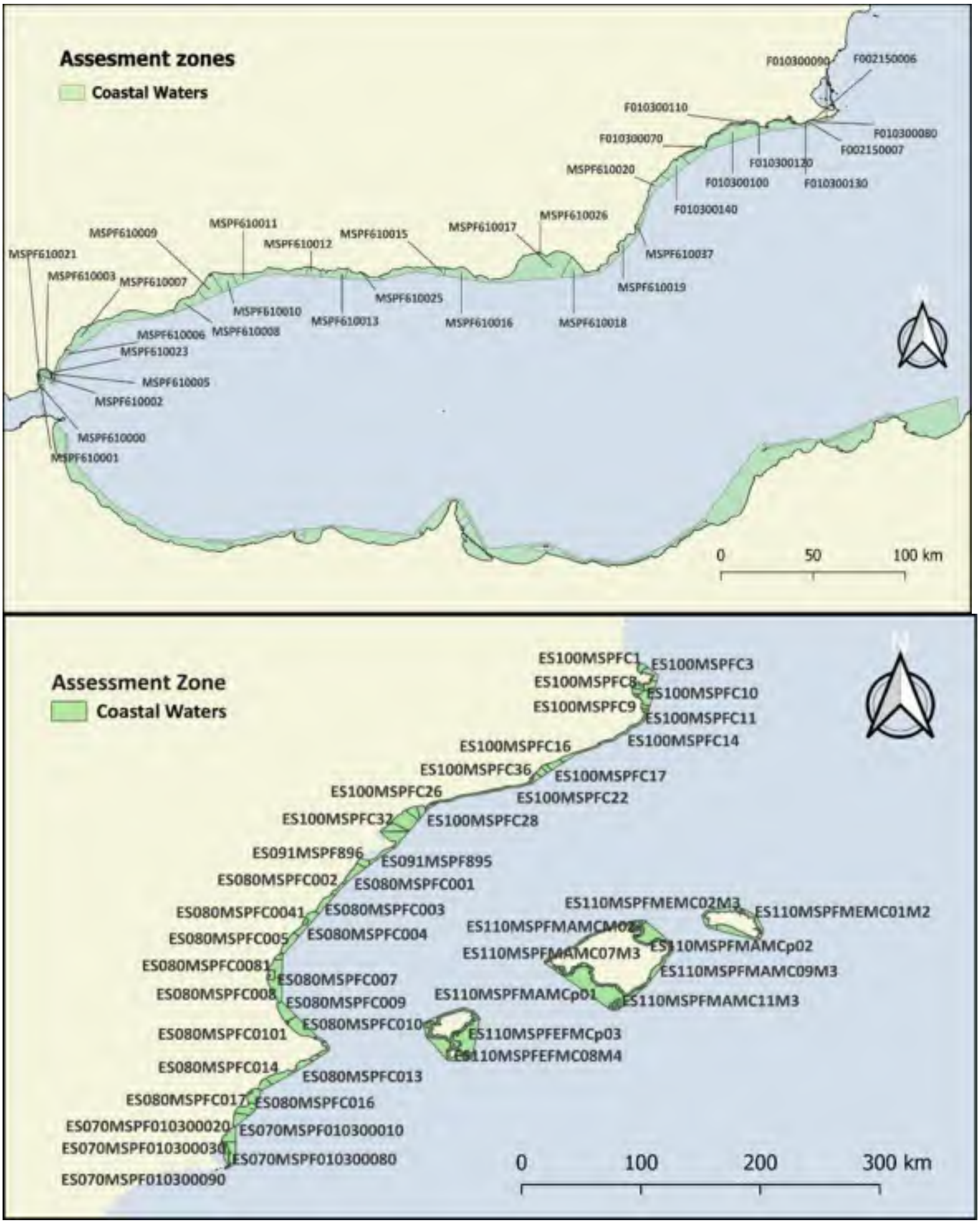

Figure 3.1.3.4.3.b3. The nesting of the finest IMAP SAUs set for the ALB Sub-division (upper map) and for the LEV-BAL Sub-division (lower map), in CW assessment zone. For setting IMAP SAUs along the coast of Spain, the WFD water bodies were considered in order to determine dominating assessment water typology for setting the assessment criteria.

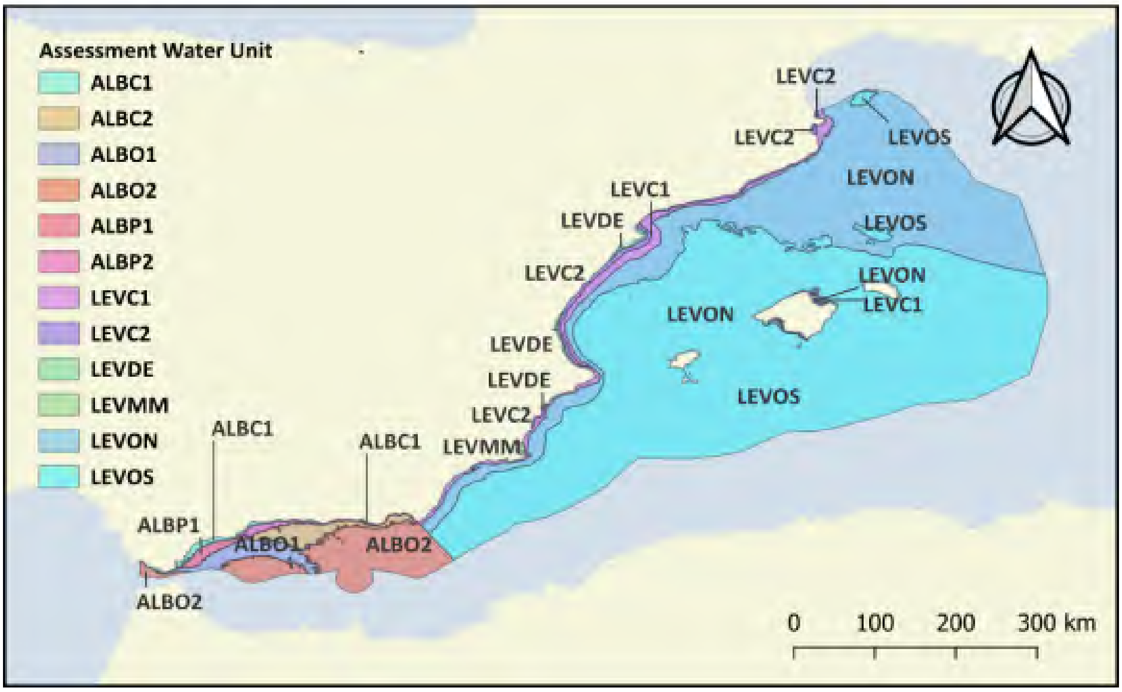

Figure 3.1.3.4.3.b4. The MSFD Assessment Water Units of Spain.

373. The Moroccan Coastal (CW) and Offshore Waters (OW) were divided in the 4 SAUs i.e., the CW and OW MAR_W (West of the Cape of the Three Forks) and the CW and OW MAR_E (East of the Cape of the Three Forks). The Western part of the Moroccan CW and OW mainly encompasses the Western Alboran Gyre (Sánchez-Garrido and Nadal, 2022)[72]. For the Algerian CW and OW, division in the SAUs follows the delimitation of the coastal river basins. For each AZ, the following nine SAUs were obtained: ORAN_W, ORAN_C; ORAN_E, DAHRA, ALGIERS; ALGIERS_E, CONSTANTINE_W, CONSTANTINE_C and CONSTANTIE_E. The Tunisian CW and OW in the WMS were divided in the four SAUs i.e., the CW and OW TUN_WMS_W (west of Cap Blanc) and the CW and OW TUN_WMS_E (east of Cap Blanc). The eastern SAUs are influenced by the Bizerte Lagoon and the Gulf of Tunis.

374. The IMAP SAUs set in the Southern part of the WMS for the purpose of the present CI 14 assessment are nested in the two main assessment zones i.e. CW and OW of the Southern part of the CWMS Sub-division (Figure 3.1.3.4.3.c).

[72] Sanchez-Garrido, J.C., Nadal, I. (2022) The Alboran Sea circulation and its biological response: A review. Front. Mar. Sci. 9:933390. doi: 10.3389/fmars.2022.933390

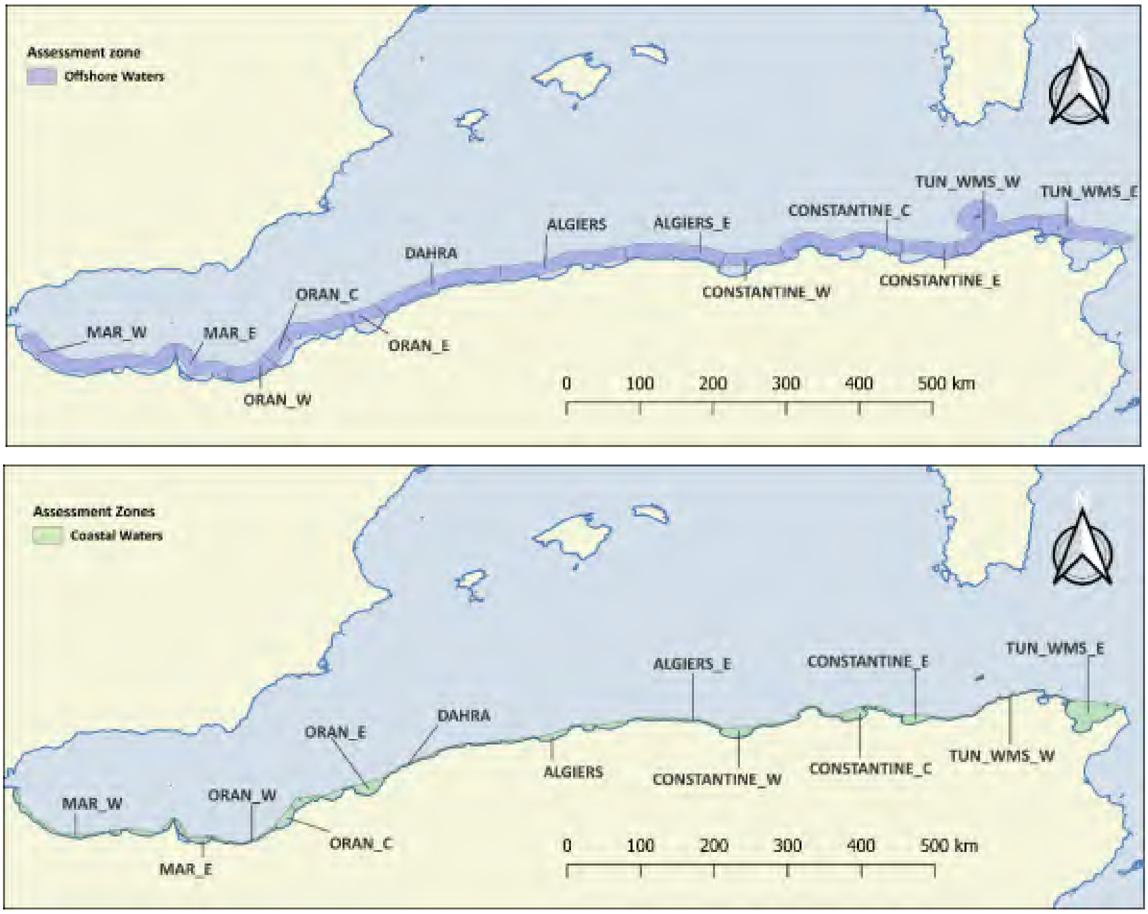

Figure 3.1.3.4.3.c. The nesting of the IMAP SAUs set for the OW assessment zone (upper map) in the Southern part of the CWMS Sub-division; and depiction of the IMAP SAUs set in CW assessment zone (lower map).

375. The Italian Coastal (CW) and Offshore (OW) waters were divided in eight assessment units (SAUs) located North of Civitavecchia (IT_TYR_N), out of the main Tyrrhenian circulation patterns); and South of Civitavecchia (IT_TYR_S), as shown in Figure 11 (upper map). For the Sardinia Island, the assessment units are IT_ISL_W (West coast) and IT_ISL_E (East coast). To obtain the codes of eight SAUs, the prefix AZ was added resulting in the following coding of the SAUs: CW_IT_TYR_N, OW_IT_TYR_N, etc.

376. Figure 3.1.3.4.3.d. depicts the finest IMAP subSAUs nesting in the two main assessment zones i.e., CW and OW.

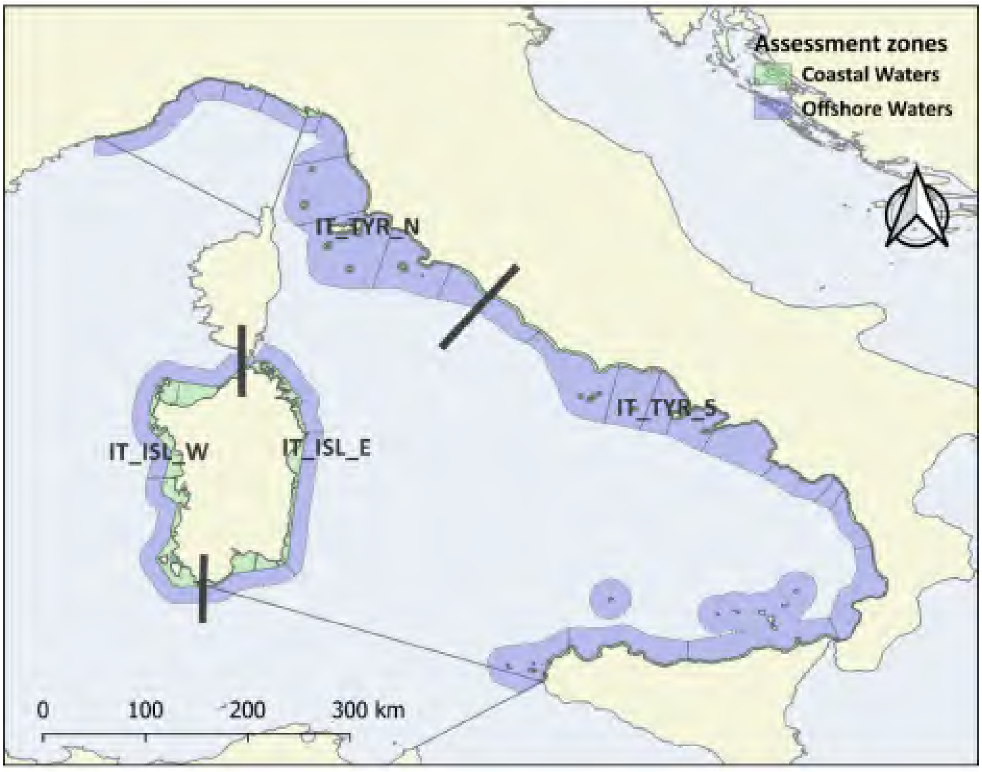

Figure 3.1.3.4.3.d. The nesting of the IMAP SAUs set for OW and CW in the Tyrrhenian and Italian part of the CWMS Sub-division (upper map); and depiction of the finest IMAP subSAUs (lower map).

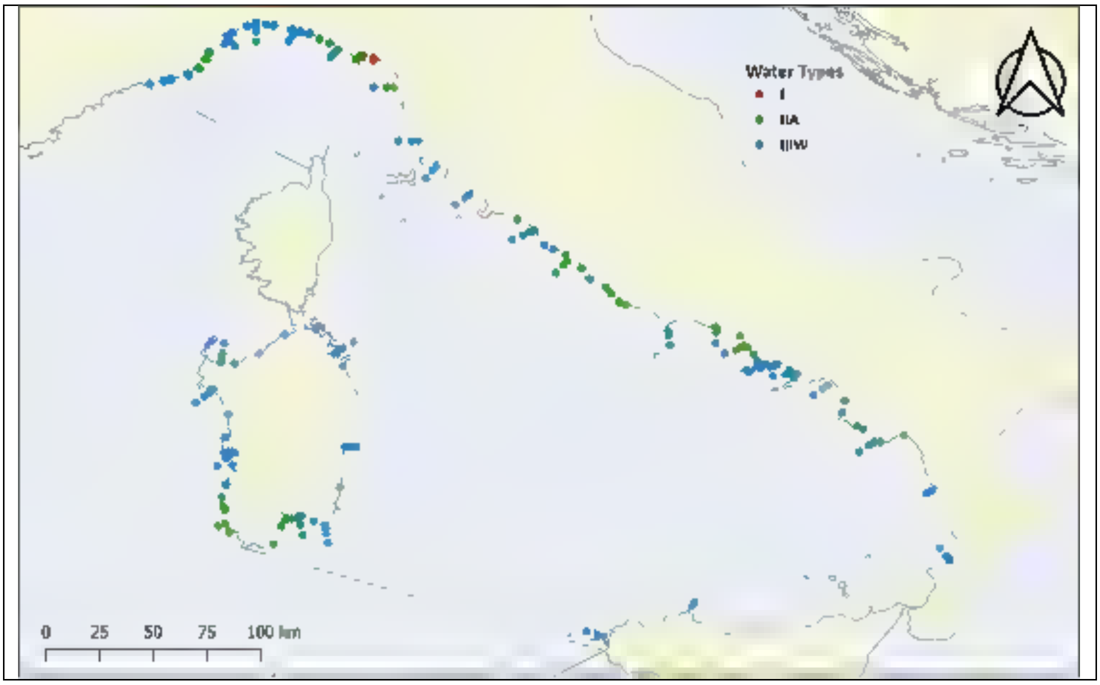

Figure 3.1.3.4.3.d: The water types along the Tyrrhenian Sea Sub-division and part of the CWMS:

The Waters of Italy.

Setting the good/non good boundary value/threshold for the Simplified G/M comparison assessment methodology application in the WMS Sub-region

377. Given the use of reference and boundary water types related values, as set by the Decision IG.23/6 of COP 20 (MED QSR), was impossible for the present work in the Western Mediterranean Sea Sub-region, the calculation of the assessment criteria applicable within the present work was undertaken, along with the normalized transformation (as elaborated above for the AEL Sub-region and for the CEN). Namely, the use of a new parameter for assessment i.e., the satellite derived Chl a imposes calculation of a new set of assessment criteria if there is no tested relationship of the satellite derived Chl a data with in situ measured Chl a data based on effects-pressures relationship. Namely, the use of reference and boundary water types related values, as set by the Decision IG.23/6 of COP 20 (MED QSR), was impossible for the present work based on the use of the satellite-derived data.

378. As explained above, setting the threshold to 50 % implies that low levels of disturbance (defined as less than +50 % deviation) resulting from human activity are considered acceptable, while moderate (i.e., greater than +50 %) deviations are not considered acceptable for the water body in question. A further modification to this rule was applied within the present work in the Western Mediterranean Sea Sub-region given the 50th percentile represents the mean value of the distribution, and the 85th percentile ~ mean +1 SD represents the G/M threshold.

379. For the French part of the CWMS, an additional modification to the above rule was applied further to the recent expert-based analysis of the satellite derived products for Chla, realised at the local scale of coastal water masses[73], over the period 2016-2021. It indicates that most coastal waters are in either good or very good status regarding Chl *a* concentrations. Although waters above the G/M threshold (oN85), set for satellite derived chl *a* data, should be classified as non-good, in the present

[73] Technical justification provided by France

case they were classified as good if the calculated values were very close to the G/M threshold (oN85) by taking account of the water masses features. In addition, the status assigned by applying the criteria as provided in Table 3.1.3.4.2 was adjusted further to the justification provided by France in relation to the national assessments derived by applying the G/nonG back transformed threshold based on *in situ* measurements i.e., the national assessment criteria which correspond to 90^{th} percentile transformed to G/M, as also provided by UNEP/MAP Decision 22/7.

380. The transformation of percentile to z-scores were obtained using the pnorm() an qnorm() functions in R. The RC values (oN10) and the G/M thresholds (oN85) were calculated from the normalized values through the predict function. The assessment criteria calculation as presented in Tables 4.2.4.2; 4.2.4.3, 4.2.4.4. and 4.2.4.5.a. show the results obtained by the Assessment zones and SAUs.

381. To obtain the assessment criteria for the subSAUs in Spanish waters, they are paired with the assessment water types (AWT), considering that the predominant AWT in the subSAU determined the selection of the assessment criteria. The codes assigned to AWTs are the same as the codes of the MSFD AWUs. At the SAU level, many AWTs coexist, and therefore, different strategies must be considered; for example, one strategy can be to consider that if no more than 10% of subSAUs, normalized by their surface are in non-good status, then the SAU related to these subSAUs is considered in non-good status.

382. As it is elaborated above, there is a difference between the thresholds calculated from the satellite-derived data used for the present assessment and the assessment criteria calculated from in situ measurements, i.e., both national thresholds of Spain which are in compliance with the Marine Strategy Framework Directive (2008/56/EC) and Water Framework Directive (2000/60/EC), and the assessment criteria as adopted by IMAP Decision 22/7. Given this difference, the regional assessment findings do not fully match the eutrophication evaluation performed by Spain by applying the assessment criteria calculated from in situ measurements[74].

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[74] https://www.miteco.gob.es/es/costas/temas/proteccion-medio-marino/estrategias-marinas/

Table 3.1.3.4.2: Reference conditions (oN10) and G/M threshold (oN85) set by IMAP spatial assessment units in the French part of the CWMS Sub-division. Dominant water type out of all Water Types (WT) assigned to different sub-SAUs within related SAUs are also presented. Table shows the Coastal water masses typology (WT) and corresponding G/M threshold (oN85), based on the use of satellite-derived Chl *a* data, as well as back transformed G/M threshold based on *in situ* measurements i.e., the national assessment criteria which correspond to 90th percentile transformed to G/M, as also provided in UNEP/MAP Decision 22/7.

AZ	SAU	WT	oN50	oN50+50	oN90	oN10	oN85	oN25	good/non-good	
									P90	**GM**
		I							10	4,12
CW	FRD_E	IIIW	0,258	0,388	0,562	0,193	0,415	0,22	1,89	0,78
CW	FRD_W	IIA	1,039	1,558	1,544	0,612	1,409	0,772	3,5	1,44
CW	FRE_E	III Isl.	0,212	0,318	0,414	0,161	0,327	0,185	1,22	0,50
CW	FRE_W	III Isl.	0,168	0,253	0,251	0,133	0,222	0,147	1,22	0,50
OW	FRD_E	IIIW	0,228	0,343	0,676	0,189	0,589	0,207	1,89	0,78
OW	FRD_W	IIA	0,447	0,67	0,757	0,321	0,674	0,372	3,5	1,44
OW	FRE_E	III Isl.	0,16	0,24	0,187	0,144	0,179	0,15	1,22	0,50
OW	FRE_W	III Isl.	0,158	0,237	0,186	0,14	0,181	0,148	1,22	0,50

oN50 – Mean, oN50+50 – Mean + 50%, oN90 – 90th percentile, oN10 – 10th percentile, oN85 – 85th percentile i.e. G/M threshold based on use of satellite-derived data, oN25 – 25th percentile; P90 – G/M threshold from 90th percentile of *in situ* measurements ; GM - G/M threshold set as GM back transformed from 90th percentile of *in situ* measurements.

Table 3.1.3.4.3. Reference conditions (oN10) and G/M threshold (oN85) calculated from satellite-derived Chl *a* data and set by Spanish Water Types. The codes assigned to the assessment water types (AWT) are the same as the codes of the MSFD AWUs. oN85 represents G/M boundary threshold calculated from the satellite-derived Chl *a* data (shared by Spain). P90 represents 90th percentile back transformed from oN85. FP90 represents G/M threshold calculated from the satellite-derived Chl *a* data (as shared by Spain) by using 90th percentile annual values and applying the same calculation method as for calculation of oN85. ESP represents national G/M threshold values of Spain, expressed as 90th percentile, and calculated from *in situ* measurements (national reports for ALB and LEV-BAL as shared by Spain). There are no significant differences between thresholds calculated from satellite-derived data and thresholds calculated from *in situ* measured data, although they cannot be identical.

AWT	oN50	oN50+50	oN90	oN10	oN85	oN25	P90	FP90	ESP
ALBC1	0,702	1,052	0,957	0,544	0,915	0,617	2,218	2,403	2,47
ALBC2	0,297	0,445	0,407	0,241	0,378	0,258	0,916	0,942	1,65
ALBO1	0,332	0,498	0,390	0,261	0,379	0,288	0,919	0,579	1,99
ALBO2	0,225	0,338	0,293	0,177	0,276	0,198	0,669	0,539	0,68
ALBP1	0,465	0,698	0,612	0,377	0,569	0,419	1,379	1,186	2,89
ALBP2	0,448	0,673	0,611	0,327	0,571	0,376	1,384	1,542	2,03
LEVC1	0,269	0,404	0,374	0,192	0,347	0,226	0,841	0,714	1,80
LEVC2	0,498	0,746	0,711	0,375	0,658	0,420	1,595	0,976	2,00
LEVDE	0,823	1,234	0,949	0,741	0,944	0,769	2,289	1,236	2,30
LEVON	0,179	0,269	0,230	0,139	0,218	0,157	0,529	0,435	0,60
LEVOS	0,123	0,184	0,158	0,103	0,150	0,110	0,364	0,312	0,26

oN50 – Mean, oN50+50 – Mean + 50%, oN90 – 90th percentile, oN10 – 10th percentile, oN85 – 85th percentile, oN25 – 25th percentile, P90 – 90th perc. back transformed from oN85, FP90 – 90th perc. calculated from mean annual values of the 90th perc., ESP – 90th perc. represents G/M threshold values calculated from in situ measurements for the Spanish waters

Table 3.1.3.4.4.: Reference conditions (oN10) and G/M threshold (oN85) set by IMAP spatial assessment units in the Southern part of the CWMS.

Country	AZ	oN50	oN50+50	oN90	oN10	oN85	oN25
MAR	CW	6017	0,449	0,674	0,713	0,277	0,637
MAR	OW	22360	0,294	0,441	0,389	0,227	0,363
DZA	CW	20982	0,319	0,478	0,74	0,205	0,592
DZA	OW	73665	0,21	0,316	0,283	0,167	0,267
TUN	CW	8787	0,229	0,344	0,577	0,162	0,477
TUN	OW	25350	0,162	0,243	0,208	0,132	0,193

oN50 – Mean, oN50+50 – Mean + 50%, oN90 – 90th percentile, oN10 – 10th percentile, oN85 – 85th percentile i.e., G/M threshold based on use of satellite-derived Chl *a* data, oN25 – 25th percentile

Table 3.1.3.4.5.a.: Reference conditions (oN10) and G/M threshold (oN85) set by IMAP SAUs in the Italian waters in the Tyrrhenian Sea and the part of CWMS.

AZ	SAU	oN50	oN50+50	oN90	oN10	oN85	oN25
CW	CW_ITA_ISL_E	0,095	0,142	0,213	0,067	0,151	0,074
CW	CW_ITA_ISL_W	0,104	0,156	0,225	0,079	0,169	0,087
CW	CW_ITA_TYR_N	0,348	0,522	1,074	0,085	0,882	0,117
CW	CW_ITA_TYR_S	0,263	0,395	1,389	0,085	1,124	0,121
OW	OW_ITA_ISL_E	0,074	0,112	0,099	0,059	0,095	0,063
OW	OW_ITA_ISL_W	0,083	0,124	0,102	0,068	0,098	0,075
OW	OW_ITA_TYR_N	0,095	0,143	0,209	0,079	0,156	0,084
OW	OW_ITA_TYR_S	0,077	0,116	0,146	0,061	0,111	0,067

oN50 – Mean, oN50+50 – Mean + 50%, oN90 – 90th percentile, oN10 – 10th percentile, oN85 – 85th percentile i.e., G/M threshold based on use of satellite-derived Chl *a* data, oN25 – 25th percentile

383. As explained above, the compatibility of the present classification was achieved with a five classes GES/non GES scale set in the Adriatic Sea Sub-region.

An application of the EQR Methodology in the Tyrrhenian Sea Sub-division and part of the CWMS: the Waters of Italy

384. The EQR assessment methodology was applied on in situ Chl a data reported by Italy to IMAP IS. However, in situ data available for nutrients were not evaluated given the lack of assessment criteria developed for nutrients in the Tyrrhenian Sea. The application of the EQR methodology was also based on typology related assessments. The water type was determined as a five-year arithmetic mean of salinity and compared to the ranges as shown in Table 3.1.3.4.5.b. The water types distribution in the Tyrrhenian Sea is presented in Figure 3.1.3.4.3.d.

385. The likely GES or likely non GES classes are assigned to the assessment units for the assessment of the Tyrrhenian Sea Sub-division and part of the CWMS by applying the EQR assessment methodology. Namely, an application of this methodology allows the use of the reference conditions and boundaries for the five ecological quality classes and therefore supports the assessment undertaken to be considered as the assessment of good environmental status. Although only one parameter was assessed the assessment is considered likely GES/non-GES given the finest discrimination of the assessment classes is possible by application of the EQR. As explained above, for the application of the simplified G/M comparison, the two status classes i.e. good and non-good expressed as good and moderate status (i.e. G/M) are assigned to the units assessed regarding Chl *a*, as only one parameter assessed.

Table 3.1.3.4.5.b: Major coastal water types with density and salinity boundary

	Type I	Type IIA Tyrrhenian	Type IIIW
σ_t (density)	<25	25<d<27	>27
S (salinity)	<34.5	34.5<S<37.5	>37.5

386. The actual and normalized EQRs for all boundaries of Water Types I and II A in the Tyrrhenian Sea are shown in Tables 3.1.3.4.5.c and d, respectively.

Table 3.1.3.4.5.c: Reference conditions and boundaries of ecological quality classes expressed by different parameters for Water Type I in coastal and open waters of the Tyrrhenian Sea. Normalized EQRs were used for ecological quality assessment.

Boundaries	**TRIX**	**c(Chla_{aGM})/µg L^{-1}**	**Chla$_{aGM}$**	
			EQR$_{actual}$	**EQR$_{normalized}$**
RC		1.40	1.00	1.00
H/G	4.25	2.0	0.70	0.85
G/M	**5.25**	**5.0**	**0.28**	**0.62**
M/P	6.25	12.6	0.11	0.38
P/B	7	25.0	0.06	0.20

Table 3.1.3.4.5.d: Reference conditions and boundaries of ecological quality classes expressed by different parameters for Water Type IIA in coastal and open waters of the Tyrrhenian Sea. Normalized EQRs were used for ecological quality assessment.

Boundaries	**TRIX**	**c(Chla_{aGM})/µg L^{-1}**	**Chla$_{aGM}$**	
			EQR$_{actual}$	**EQR$_{normalized}$**
RC		0.32	1.00	1.00
H/G	4	0.48	0.66	0.84
G/M	**5**	**1.2**	**0.27**	**0.62**
M/P	6	2.9	0.11	0.40
P/B	7	7.3	0.04	0.18

387. By applying the above shown assessment criteria, the assessed subSAU were classified in GES/non GES status, comparing the EQRnormalized to the G/M boundary of 0.62 set as the good/non good status boundary limit.

388. Contrarily to the five ecological classes approach adopted for Water Types I and II A in the Tyrrhenian Sea, a single threshold approach is used for Water Type III W. The GES/non GES threshold value applied was 0.48 µg/L representing an annual GM value of H/G boundary for Water Types II A.

Results of the Simplified G/M comparison assessment methodology application in the WMS Sub-region

389. As for the AEL and the CEN, the two status classes i.e. good and non-good are assigned to the units assessed in the WMS by applying the simplified G/M assessment methodology since the assessment findings are based on the use of only one parameter and therefore, the integrated consideration of the minimum of parameters needed to assess the good environmental status for IMAP CIs 13 and 14 i.e. the GES was impossible.

390. Upon setting the reference conditions and the G/M threshold, each observation point, or area were classified in good and non-good status , by comparing the value of the indicator i.e., the satellite derived Chla to the G/M threshold, i.e. the back transformed 85th percentile of normalized distribution.

391. In addition, to decide on good/non-good status in the French waters, the local scientific expertise regarding ecosystem functioning, water masses characteristics (hydrology, water renewal, confinement of the water mass) and satellite-derived product analyses were taken into account as provided by France.

The Central WMS Sub-division: The Waters of France

392. The results of CI 14 assessment using the satellite-derived Chl *a* data in the Central WMS Sub-division i.e., in the French waters are presented in Tables 3.1.3.4.6 and 3.1.3.4.7, and Figure WMS 3.1.3.4.4.E. Despite good status assigned to the assessment zones, it should be noted that in the French CW assessment zone, for which the finest SAUs were defined in line with WFD, one out of the 46 SubSAU namely EC03b (Golfe de Porto Vecchio) was in non-good status though the low number of pixels (n=13) included in the assessment reflects the high uncertainty associated to mean computation. The Gulf of Porto Vecchio is a small embayment characterised by the presence of both muddy and sandy sediments. In such shallow coastal environments, resuspension processes complexify water optical properties leading to overestimation of Chl *a* concentration when using satellite-derived products (Gohin et al. 2020[75]). Also, Ganzin et al. (2010) observed that satellite-derived products in the area can be 30% higher than the mean values computed over a 6-year period. Water renewal is also very low in this area making it more sensitive to pressures and basin derived inputs.

393. Six out of 46 SubSAUs were above the G/M threshold (oN85) but were still classified in good status given the calculated values were very close to the G/M threshold (oN85), and taking also account of the water masses features. For the present assessment, the national G/nonG back transformed values (90th percentile > GM, based on in situ measurements, corresponding to UNEP/MAP Decision 22/7) were also used. Amongst these 6 water masses, the four are located in the FRD-E assessment zone namely DC04 (Golfe de Fos), DC06A (Petite Rade de Marseille), DC07I (Cap de L'estéral – Cap de Brégançon) and DC08B (Ouest Fréjus- Saint Raphaël). The two revised water masses are located in Corsica Island (FRE) and correspond to EC04B (Golfe D'Ajaccio) and EC01C (Golfe de Saint Florent). Water mass DC04 (Golfe de Fos) is a highly modified water mass characterised by a high spatial heterogeneity in Chl *a* distribution. For other water masses (DC06A, DC07I and DC08B; EF04B and EC01C in Corsica), hydrodynamic studies revealed a very low annual renewal of water masses thus explaining slight accumulation of low phytoplankton biomass levels (Ganzin et al. 2010[76]).

394. The results of the present CI 14 assessment in the French part of the CWMS represent only an indication of possible good/non-good status at the level of the subSAUs, whereby subSAUs are not set at the same level of spatial finesse. Namely, the reliability of the assessment was negatively affected by the lack of data reported by the CPs in IMAP IS, and therefore impossibility to use the IMAP NEAT GES assessment as applied to the Adriatic Sea Sub-region.

[75] J. Mar. Sci. Eng. 2020, 8, 665; https://doi.org/10.3390/jmse8090665
[76] https://archimer.ifremer.fr/doc/00028/13931/11104.pdf

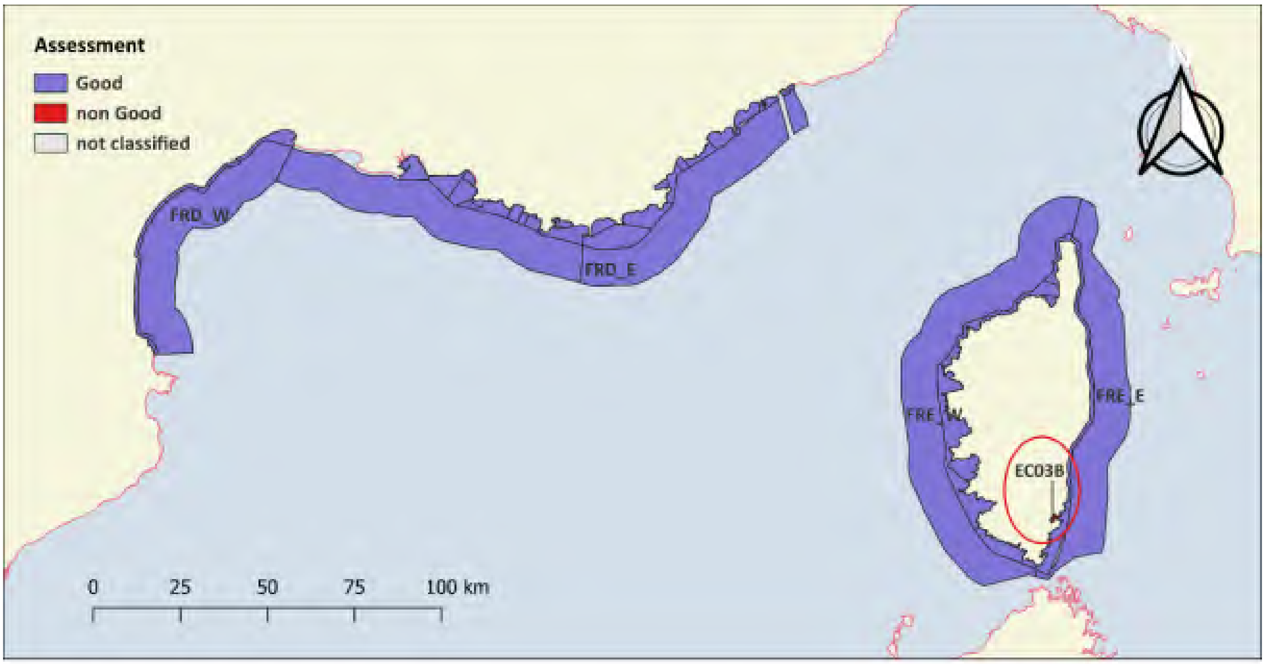

Figure WMS 3.1.3.4.4.E: The assessment results for CI 14 in the French waters of the CWMS.

Table 3.1.3.4.6.:Results of the assessment (G_NG.oN85 **-** the good status corresponding to all values below the 85th percentile set as good/non-good boundary limit) of the French part of the CWMS provided for the Assessment Zones (AZ) and Spatial Assessment Units (SAUs). Blue coloured AZs indicate good status.

Country	**AZ**	**SAU**	**CHL_N**	**CHL_GM**	**oN50**	**oN50+50**	**oN10**	**oN85**	**G_NG.oN85**
France	CW	FRD_E	8347	0,316	0,258	0,388	0,193	0,415	**G**
France	CW	FRD_W	1784	0,990	1,039	1,558	0,612	1,409	**G**
France	CW	FRE_E	2358	0,249	0,212	0,318	0,161	0,327	**G**
France	CW	FRE_W	5733	0,208	0,168	0,253	0,133	0,222	**G**
France	OW	FRD_E	30648	0,303	0,228	0,343	0,189	0,589	**G**
France	OW	FRD_W	13656	0,478	0,447	0,67	0,321	0,674	**G**
France	OW	FRE_E	16698	0,178	0,160	0,24	0,144	0,179	**G**
France	OW	FRE_W	24450	0,179	0,158	0,237	0,140	0,181	**G**

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions); oN85 – 85th percentile set as G/M threshold based on the use of satellite-derived Chl *a* data; G/NG oN85 - the good status corresponding to all values below the 85th percentile set as good/non-good boundary limit.

Table 3.1.3.4.7. Result of the assessment (G_NG.oN85- the good status corresponding to all values below the 85th percentile set as G/M i.e. good/non-good status boundary limit based on satellite-derived Chl *a* data) of the French coastal waters (CW) in the CWMS provided for the finest Spatial Assessment Units (SAUs). Blue coloured subSAUs indicate good status; Red coloured subSAU indicates non-good status. Light blue colour corresponds to subSAUs reconsidered as in good status following justification provided by French authorities; * - indicates the subSAUs reconsidered as in good status given the water mass typology, and WB evaluated as Type I; 90th percentile was used as included in the national assessment criteria, based on *in situ* measurements, further to the request and justification of local hydrological conditions (e.g. highly modified water mass characterised by a strong spatial heterogeneity but no eutrophication processes exist), as provided by French authorities (it corresponds to 90th percentile transformed to G/M, as provided in UNEP/MAP Decision 22/7); ** - indicates subSAUs reconsidered as in good status following expert-based justification provided by French authorities, and WBs are in WT IIIW; since the assessment values are close to the good/non-good boundary limit set by using satellite derived Chl *a* data i.e., oN85 – 85th percentile (G/NG oN85 threshold), the national assessment criteria, based on *in situ* measurements, were used further to the justification of local hydrological conditions (e.g. semi-enclosed bay or confined areas with very low annual water renewal, slight accumulation of phytoplankton biomass without eutrophication), as provided by French authorities (the national G/nG assessment criteria correspond to 90th percentile transformed to G/M, as provided in UNEP/MAP Decision 22/7).

Country	AZ	SAU	subSAUs (WFD_WB)	CHL_N	CHL_GM	oN50+50	oN10	oN85	G/nG	G_NG.oN85	G/nG**.
France	CW	FRD_W	DC01	162	0,545	1,558	0,612	1,409		**G**	
France	CW	FRD_W	DC02A	654	0,855	1,558	0,612	1,409		**G**	
France	CW	FRD_W	DC02B	149	1,375	1,558	0,612	1,409		**G**	
France	CW	FRD_W	DC02C	78	1,041	1,558	0,612	1,409		**G**	
France	CW	FRD_W	DC02D	135	0,947	1,558	0,612	1,409		**G**	
France	CW	FRD_W	DC02E	78	1,026	1,558	0,612	1,409		**G**	
France	CW	FRD_W	DC02F	528	1,297	1,558	0,612	1,409		**G**	
France	CW		DC04*	553	1,108				**4,12**	**G**	
France	CW	FRD_E	DC05	525	0,371	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC06A**	93	0,525	0,388	0,193	0,415	**0,780**	**NG**	**G**
France	CW	FRD_E	DC06B	586	0,411	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC07A	61	0,290	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC07B	547	0,261	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC07C	192	0,239	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC07D	114	0,236	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC07E	190	0,396	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC07F	685	0,302	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC07G	82	0,409	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC07H	1577	0,243	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC07I**	276	0,448	0,388	0,193	0,415	**0,780**	**NG**	**G**

Country	AZ	SAU	subSAUs (WFD_WB)	CHL_N	CHL_GM	oN50+50	oN10	oN85	G/nG	G_NG.oN85	G/nG**.
France	CW	FRD_E	DC07J	871	0,21	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC08A	385	0,287	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC08B**	119	0,470	0,388	0,193	0,415	**0,780**	**NG**	**G**
France	CW	FRD_E	DC08C	116	0,274	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC08D	298	0,242	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC08E	437	0,342	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC09A	30	0,275	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC09B	372	0,300	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC09C	53	0,226	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC09D	**NOT EVALUATED – NO CONSISTENT SATALLITE DATA**							
France	CW	FRD_E	DC10A	114	0,215	0,388	0,193	0,415		**G**	
France	CW	FRD_E	DC10C	71	0,252	0,388	0,193	0,415		**G**	
France	CW	FRE_W	EC01AB	1229	0,195	0,253	0,133	0,222		**G**	
France	CW	FRE_W	EC01C**	116	0,252	0,253	0,133	0,222	**0,500**	**NG**	**G**
France	CW	FRE_W	EC01D	144	0,189	0,253	0,133	0,222		**G**	
France	CW	FRE_W	EC01E	168	0,184	0,253	0,133	0,222		**G**	
France	CW	FRE_E	EC02AB	360	0,174	0,318	0,161	0,327		**G**	
France	CW	FRE_E	EC02C	240	0,273	0,318	0,161	0,327		**G**	
France	CW	FRE_E	EC02D	672	0,307	0,318	0,161	0,327		**G**	
France	CW	FRE_E	EC03AD	1056	0,234	0,318	0,161	0,327		**G**	
France	CW	FRE_E	EC03B	19	1,233	0,318	0,161	0,327		**NG**	
France	CW	FRE_E	EC03C	11	0,291	0,318	0,161	0,327		**G**	
France	CW	FRE_W	EC03EG	771	0,200	0,253	0,133	0,222		**G**	
France	CW	FRE_W	EC03F	**NOT EVALUATED – NO CONSISTENT SATALLITE DATA**							
France	CW	FRE_W	EC04AC	2715	0,205	0,253	0,133	0,222		**G**	
France	CW	FRE_W	EC04B**	590	0,272	0,253	0,133	0,222	**0,500**	**NG**	**G**

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions); oN85 – 85th percentile (G/M threshold)

The Alboran Sea and Levantine-Balearic Subdivision of the WMS: The Waters of Spain

395. The results of CI 14 assessment using the satellite-derived Chl a data in the Alboran Sea and Levantine-Balearic Subdivision of the WMA i.e., in the Spanish waters are presented in Tables 3.1.3.4.8. and 3.1.3.4.9., and Figure WMS 3.1.3.4.5.E.

396. The evaluation was performed on 70 out of 149 subSAUs. Despite good status assigned to the assessment zones, it should be noted that in the CW assessment zone, for which the finest subSAUs were defined in line with WFD, there are 8 out of 70 subSAUs which are in non-good status.

397. These 8 subSAUs are located as follows: one subSAU close to the Mar Menor (ES070MSPF010300030) one subSAU ES080MSPFC017 of the Segura River mouth; two subSAUs (ES080MSPFC006 and ES080MSPFC0081) near Valencia; two subSAUs ES080MSPFC001 and ES100MSPFC32 close to the Ebro River mouth; one subSAU ES100MSPFC3 close to the French border; and one subSAU ES110MSPFMAMCp02 on the Mallorca Island in the Alcudia Gulf.

398. The local sources of pollution are probably the main driver contributing to the weakened status of most non-good subSAUs. The most important problem that needs to be addressed is the non-good status in the Mallorca Island area. A more detailed analysis indicates that the ranges of observed values in the Islands area is very low 0,05-0,20 µg/L. At narrow ranges the statistics is not always performed in acceptable manner. This suggests a necessity to use the satellite-derived data in these areas with caution or different elaboration strategies need to be provided.

399. As it is explained above for setting the good/non-good boundary limit there is a slight difference between the thresholds calculated from the satellite-derived data used for the present assessment and the assessment criteria calculated from *in situ* measurements, which resulted in the regional assessment findings which do not fully match the eutrophication evaluation performed by Spain by applying the assessment criteria calculated from *in situ* measurements.

400. The results of the present CI 14 assessment in the ALB and LEV-BAL Sub-divisions of the WMS represent only an indication of possible good/non-good status at the level of subSAUs, whereby the subSAUs are not set at the same level of spatial finesse.

Figure WMS 3.1.3.4.5.E: The assessment results for CI 14 in the Alboran Sea and Levantine-Balearic Subdivision of the WMS.

Table 3.1.3.4.8. Result of the assessment (G_NG.oN85- the good status class corresponding to all values below the 85th percentile set as the good/non-good boundary limit) of the Spanish OW and CW in the ALB and LEV-BAL Subdivision at the level of Spatial Assessment Units (SAUs). Blue coloured SAUs indicate good status, Red coloured SAUs indicate noon-good status. For CW, as in the SAU a multiplicity of Assessment Water Types can coexist, further adjusted assessment approach was used. The SAU is in good status if less than 10 % of the area of the SAU is in non-good status. For the calculation of the affected area, the number of observation points (CHL_N) per SAU was used since these points represent the observation grid (1x1 km) and their surface is very close to the area of the SAU (expressed in km^2). The sum of the observation points in non-good (**∑N (NG)**), along with the percent of the SAU in non-good (%G/NG) from the total sum of the observation points (∑**N**) in SAU, were calculated.

AZ	**SAU**	**CHL_N**	**CHL_GM**	**oN50+50**	**oN10**	**oN85**	**G_NG.oN85**	
OW	ESPW	904	0,385	0,571	0,265	0,508	**G**	
OW	ESPE	1580	0,196	0,288	0,133	0,276	**G**	
OW	ESPL	3752	0,213	0,306	0,149	0,276	**G**	
OW	ESPI	3644	0,115	0,17	0,1	0,137	**G**	
		∑N	**∑N (NG$_{oN85}$)**	**%G/NG$_{oN85}$**	**∑N (NG$_{oN50+50}$)**	**%G/NG$_{oN50+50}$**	**G/NG$_{oN85}$**	**G/NG$_{oN50+50}$**
CW	ES060	532	0	0,0	0	0,0	**G**	**G**
CW	ES070	500	16	3,2	16	3,2	**G**	**G**
CW	ES080	540	80	14,8	40	7,4	**NG**	**G**
CW	ES091	104	0	0,0	0	0,0	**G**	**G**
CW	ES100	340	56	16,5	0	0,0	**NG**	**G**
CW	ES110	668	96	14,4	0	0,0	**NG**	**G**

Table 3.1.3.4.9. Result of the assessment (G_NG.oN85- the good status class corresponding to all values below the 85th percentile set as the good/non-good boundary limit) of the Spanish OW and CW in the ALB and LEV-BAL Subdivision at the level of the finest Spatial Assessment Units (subSAUs). Blue coloured subSAUs indicate good status, Red coloured subSAUs indicate non-good status.

AZ	SAU	subSAUs	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
OW	ESPW		904	0,385	0,571	0,265	0,508	G
OW	ESPE		1580	0,196	0,288	0,133	0,276	G
OW	ESPL		3752	0,213	0,306	0,149	0,276	G
OW	ESPI		3644	0,115	0,17	0,1	0,137	G
CW	ES060	ES060MSPF610007	72	0,765	1,178	0,577	0,959	G
CW	ES060	ES060MSPF610008	32	0,532	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610009	32	0,549	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610010	32	0,565	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610011	36	0,506	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610012	24	0,401	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610013	28	0,384	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610014	12	0,368	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610015	36	0,359	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610016	24	0,328	0,688	0,307	0,604	G
CW	ES060	ES060MSPF610017	148	0,286	0,378	0,213	0,39	G
CW	ES060	ES060MSPF610018	36	0,242	0,378	0,213	0,39	G
CW	ES060	ES060MSPF610019	12	0,19	0,36	0,165	0,309	G
CW	ES060	ES060MSPF610020	8	0,195	0,36	0,165	0,309	G
CW	ES070	ES070MSPF010300010	32	0,274	0,36	0,165	0,309	G
CW	ES070	ES070MSPF010300020	44	0,226	0,36	0,165	0,309	G
CW	ES070	ES070MSPF010300030	16	0,331	0,36	0,165	0,309	NG
CW	ES070	ES070MSPF010300080	112	0,227	0,36	0,165	0,309	G
CW	ES070	ES070MSPF010300080	112	0,227	0,36	0,165	0,309	G
CW	ES070	ES070MSPF010300100	152	0,18	0,36	0,165	0,309	G
CW	ES070	ES070MSPF010300140	32	0,19	0,36	0,165	0,309	G
CW	ES080	ES080MSPFC001	28	0,544	0,588	0,274	0,516	NG
CW	ES080	ES080MSPFC003	20	0,389	0,588	0,274	0,516	G
CW	ES080	ES080MSPFC004	52	0,41	0,588	0,274	0,516	G

AZ	SAU	subSAUs	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
CW	ES080	ES080MSPFC005	28	0,451	0,588	0,274	0,516	G
CW	ES080	ES080MSPFC006	12	0,541	0,588	0,274	0,516	NG
CW	ES080	ES080MSPFC007	40	0,377	0,588	0,274	0,516	G
CW	ES080	ES080MSPFC008	68	0,356	0,588	0,274	0,516	G
CW	ES080	ES080MSPFC0081	8	0,613	0,588	0,274	0,516	NG
CW	ES080	ES080MSPFC009	48	0,433	0,588	0,274	0,516	G
CW	ES080	ES080MSPFC010	96	0,366	0,588	0,274	0,516	G
CW	ES080	ES080MSPFC013	16	0,216	0,36	0,165	0,309	G
CW	ES080	ES080MSPFC014	36	0,184	0,36	0,165	0,309	G
CW	ES080	ES080MSPFC015	24	0,207	0,36	0,165	0,309	G
CW	ES080	ES080MSPFC016	32	0,26	0,36	0,165	0,309	G
CW	ES080	ES080MSPFC017	32	0,364	0,36	0,165	0,309	NG
CW	ES091	ES091MSPF894	72	0,523	0,904	0,334	0,775	G
CW	ES091	ES091MSPF895	16	0,77	0,904	0,334	0,775	G
CW	ES091	ES091MSPF896	16	0,658	0,904	0,334	0,775	G
CW	ES100	ES100MSPFC1	8	0,348	0,588	0,274	0,516	G
CW	ES100	ES100MSPFC10	52	0,283	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC12	4	0,268	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC14	4	0,269	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC17	16	0,272	0,588	0,274	0,516	G
CW	ES100	ES100MSPFC18	8	0,316	0,588	0,274	0,516	G
CW	ES100	ES100MSPFC19	12	0,314	0,588	0,274	0,516	G
CW	ES100	ES100MSPFC20	8	0,33	0,588	0,274	0,516	G
CW	ES100	ES100MSPFC28	4	0,283	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC29	20	0,305	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC3	32	0,314	0,36	0,165	0,309	NG
CW	ES100	ES100MSPFC30	28	0,278	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC31	68	0,26	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC32	24	0,355	0,36	0,165	0,309	NG
CW	ES100	ES100MSPFC5	32	0,268	0,36	0,165	0,309	G
CW	ES100	ES100MSPFC7	12	0,315	0,588	0,274	0,516	G

AZ	SAU	subSAUs	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
CW	ES100	ES100MSPFC8	8	0,312	0,588	0,274	0,516	G
CW	ES110	ES110MSPFEFMCp03	156	0,129	0,17	0,1	0,137	G
CW	ES110	ES110MSPFEFMCp04	104	0,126	0,17	0,1	0,137	G
CW	ES110	ES110MSPFEIMC01M2	4	0,114	0,17	0,1	0,137	G
CW	ES110	ES110MSPFEIMCp01	8	0,117	0,17	0,1	0,137	G
CW	ES110	ES110MSPFEIMCp02	4	0,121	0,17	0,1	0,137	G
CW	ES110	ES110MSPFFOMC09M3	8	0,126	0,17	0,1	0,137	G
CW	ES110	ES110MSPFMAMC01M2	4	0,103	0,17	0,1	0,137	G
CW	ES110	ES110MSPFMAMCp01	280	0,111	0,17	0,1	0,137	G
CW	ES110	ES110MSPFMAMCp02	96	0,144	0,17	0,1	0,137	NG
CW	ES110	ES110MSPFMEMC01M2	4	0,117	0,17	0,1	0,137	G

oN50+50 – Mean + 50%, oN10 – 10^{th} percentile – RC boundary, oN85 – 85^{th} percentile – G/M threshold

The Southern Part of the CWMS Sub-division: The Waters of Algeria, Morocco and Tunisia

401. All the SAUs assessed in the Southern part of the CWMS Sub-division were in good status (Tables 3.1.3.4.10. and 3.1.3.4.11., and Figure WMS 3.1.3.4.6.E). The non-good status which would correspond to the class above G/M boundary limit was not found in the assessment of the Southern part of WMS. It must be noted that the assessment was not possible at the level of the finest spatial assessment units i.e., subSAUs, as for other sub-divisions in the WMS, therefore, resulting in a less confidential assessment, given the absence of finer water bodies delineation and related water typology characterization.

402. The results of the present CI 14 assessment in the Southern part of the WMS represent only an indication of possible good/non-good status at the level of SAUs, whereby the SAUs are not set at the same level of spatial finesse. Namely, the reliability of the assessment was negatively affected by the lack of data reported by the CPs in IMAP IS, as well as the lack of finer water bodies delineation, and therefore impossibility to use the IMAP NEAT GES assessment as applied to the Adriatic Sea Sub-region.

403. Due to a less confidential assessment in this part of the WMS, some specific examples of drivers and pressures were mapped from the scientific literature, for example, the Oran harbor (Algeria) which receives the discharge of wastewater; the Ghazaouet harbour which is exposed to chemicals coming mainly from industrial activities; the shoreline such as Bousfer under the impact of the seawater desalination plant in Oran Bay and the Beni Saf desalination plant.

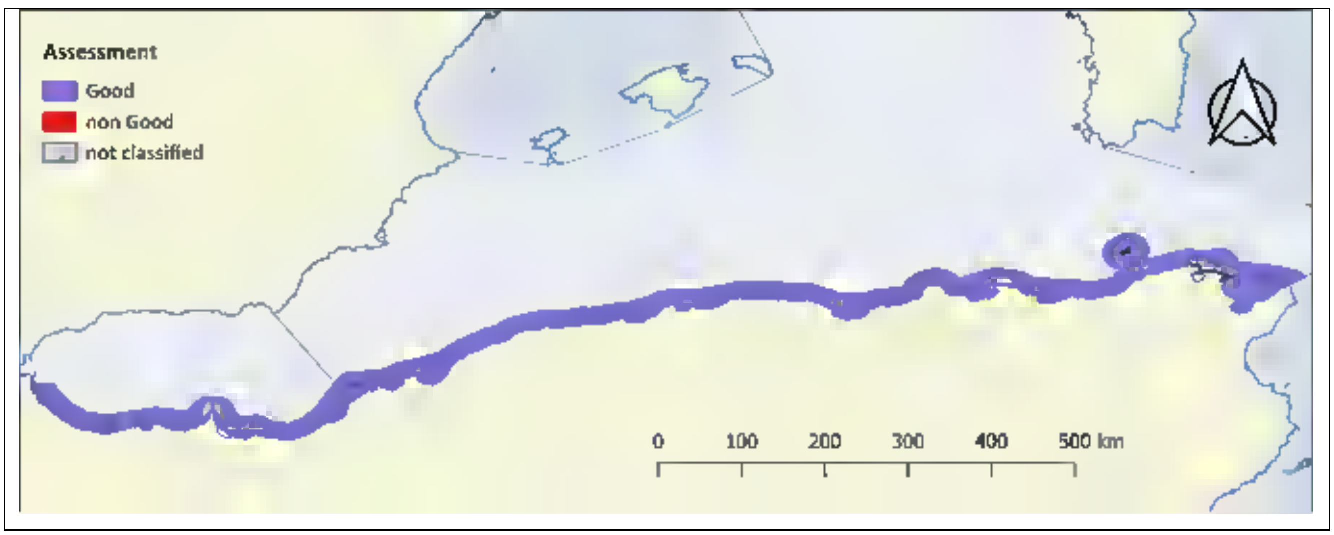

Figure WMS 3.1.3.4.6.E: The assessment results for CI 14 in the Southern Part of the CWMS.

Table 3.1.3.4.10. Results of the assessment (G_NG.oN85- the good status class corresponding to all values below the 85th percentile set as good/non-good boundary limit) of the Southern part of the CWMS provided for the Assessment Zones (AZ). Blue coloured AZs indicate good status.

Country	AZ	CHL_N	CHL_GM	oN50	oN50+50	oN10	oN85	G_NG.oN85
MAR	CW	6035	0,450	0,449	0,674	0,277	0,637	**G**
MAR	OW	22360	0,297	0,294	0,441	0,227	0,363	**G**
DZA	CW	21189	0,361	0,319	0,478	0,205	0,592	**G**
DZA	OW	73665	0,215	0,21	0,316	0,167	0,267	**G**
TUN	CW	8859	0,278	0,229	0,344	0,162	0,477	**G**
TUN	OW	25350	0,166	0,162	0,243	0,132	0,193	**G**

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions); oN85 – 85th percentile (G/NG threshold)

Table 3.1.3.4.11. Result of the assessment (G_NG.oN85- the good class corresponding to all values below the 85th percentile set as good/non-good boundary limit based on satellite-derived Chl *a* data) of the Southern part of the CWMS provided for the Spatial Assessment Units (SAUs). Blue coloured SAUs indicate the good status.

Country	AZ	SAU	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
MAR	CW	MAR_W	4345	0,499	0,674	0,277	0,637	**G**
MAR	CW	MAR_E	1690	0,343	0,674	0,277	0,637	**G**
MAR	OW	MAR_W	16070	0,320	0,441	0,227	0,363	**G**
MAR	OW	MAR_E	6290	0,245	0,441	0,227	0,363	**G**
DZA	CW	ORAN_W	648	0,43	0,478	0,205	0,592	**G**
DZA	CW	ORAN_C	3913	0,311	0,478	0,205	0,592	**G**
DZA	CW	ORAN_E	2226	0,368	0,478	0,205	0,592	**G**
DZA	CW	DAHRA	1565	0,523	0,478	0,205	0,592	**G**
DZA	CW	ALGIERS	3480	0,486	0,478	0,205	0,592	**G**
DZA	CW	ALGIERS_E	1315	0,346	0,478	0,205	0,592	**G**
DZA	CW	CONSTANTINE_W	2629	0,340	0,478	0,205	0,592	**G**
DZA	CW	CONSTANTINE_C	3483	0,261	0,478	0,205	0,592	**G**
DZA	CW	CONSTANTINE_E	1930	0,389	0,478	0,205	0,592	**G**
DZA	OW	ORAN_W	4380	0,237	0,316	0,167	0,267	**G**
DZA	OW	ORAN_C	9840	0,225	0,316	0,167	0,267	**G**

Country	AZ	SAU	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
DZA	OW	ORAN_E	2695	0,238	0,316	0,167	0,267	**G**
DZA	OW	DAHRA	12320	0,244	0,316	0,167	0,267	**G**
DZA	OW	ALGIERS	12050	0,232	0,316	0,167	0,267	**G**
DZA	OW	ALGIERS_E	9250	0,214	0,316	0,167	0,267	**G**
DZA	OW	CONSTANTINE_W	5685	0,202	0,316	0,167	0,267	**G**
DZA	OW	CONSTANTINE_C	12310	0,183	0,316	0,167	0,267	**G**
DZA	OW	CONSTANTINE_E	5135	0,171	0,316	0,167	0,267	**G**
TUN	CW	TUN_WMS_W	811	0,334	0,344	0,162	0,477	**G**
TUN	CW	TUN_WMS_E	8048	0,273	0,344	0,162	0,477	**G**
TUN	OW	TUN_WMS_W	15335	0,159	0,243	0,132	0,193	**G**
TUN	OW	TUN_WMS_E	10015	0,176	0,243	0,132	0,193	**G**

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions); oN85 – 85th percentile (G/NG threshold)

The Tyrrhenian Sea Sub-division and part of the CWMS: The Waters of Italy

404. Despite likely good status assigned to the assessment zones in the waters of Italy, there are 9 out of 54 subSAUs that are in non-good status (Tables 3.1.3.4.12. & 3.1.3.4.13, and Figure WMS 3.1.3.4.7.E).

405. These 9 subSAUs are located as follows: in front of the Arno River mouth (ITCWTCD and ITOWTCD); in front of the Tiber River mouth (ITCWLZ and ITOWLZC); close to the Napoli urban agglomeration (ITOWCMC, ITOWCMD, ITCWCMC and ITCWCMD) and SW part of Sardinia Island (ITCWSDWB). The evaluation shows the impact of the Arno and Tiber Rivers, the two main rivers in the area related to their nutrient inputs' contribution. Both the CW and OW are under impacts of the Napoli metropolitan area (4,250,000 residents), whereby the propagation of their effects toward the north is evident due to the water circulation77. The local effect of the Oristano lagoon, as anthropogenically heavily impacted area, probably contributes to the weakened classification of CW in SW Sardinia Island.

406. Further to the assessment of the CW in the area of Napoli, the subSAUs ITCWCMC and ITCWCMD can be indicated as in good status. However, it must be recognized that using the 50th percentile for the development of the assessment criteria is not applicable in heavily impacted areas, such as the heavily impacted urban coastal areas. Therefore, an adjustment by using the 25th percentile of the calculated values resulted in the classification of the subSAUs ITCWCMC and ITCWCMD B in non-good status, as also recognized in the existing literature sources.

407. Given the significant quantum of data reported in IMAP IS for the waters of Italy, the assessment results provided by the application of the simplified G/M comparison based on the use of satellite-derived Chl *a* data were complemented with the assessment results derived from the application of the EQR methodology.

408. The evaluation was possible only at the subSAU level since the SAU wider area of integration does not support the evaluation of different water types which coexist in the same space. Specifically, the water type IIIW cannot be evaluated by applying the EQR methodology, but by providing a simple comparison of the measured concentrations to a threshold. Namely, a five classes scale could not be set for water type IIIW since the discrimination limit between the two contiguous Chl a annual G_mean values would not allow for proper and safe classification (Giovanardi et al., 2018). Therefore, the boundary values for WT III are based on the H/G values for WT II. Mixing the assessment methods is not statistically permitted.

409. The results of assessment by applying the EQR methodology are presented in Table 3.1.3.4.14, and Figures WMS 3.1.3.4.8.E & 3.1.3.4.9.E. The 43 subSAUs were evaluated out of the 54 subSAUs. All evaluated subSAUs were in GES with the exception of one (ITCWLZC) located in front of the Tiber River mouth indicating the influence of freshwater input of nutrients in that area. As expected, a more accurate assessment is obtained at the level of monitoring stations. The non-GES is confirmed for the Tiber River mouth, both for CW and OW which are under the impact of the Napoli metropolitan area, as well as for CW in SW Sardinia Island close to Oristano lagoon which is an anthropogenically heavily impacted area.

[77] Iacono, R.; Napolitano, E.; Palma, M.; Sannino, G. The Tyrrhenian Sea Circulation: A Review of Recent Work. Sustainability 2021, 13, 6371. https://doi.org/10.3390/su13116371

410. The results obtained from an application of the simplified G/M comparison assessment methodology based on the use of satellite-derived Chl a data were confirmed by an application of the EQR methodology based on in situ Chl a data reported to IMAP IS, both at the level of subSAUs and monitoring stations. This confirms the accuracy of data obtained from the remote sensing for the assessment of EO5. This also encourages future decision-making regarding inclusion of an additional sub-indicator i.e., a parameter within the monitoring of CI 14. Namely, coupling of satellite-derived Chl *a* data with Chl *a* concentrations *in situ* measured would greatly enhance the IMAP monitoring and assessment.

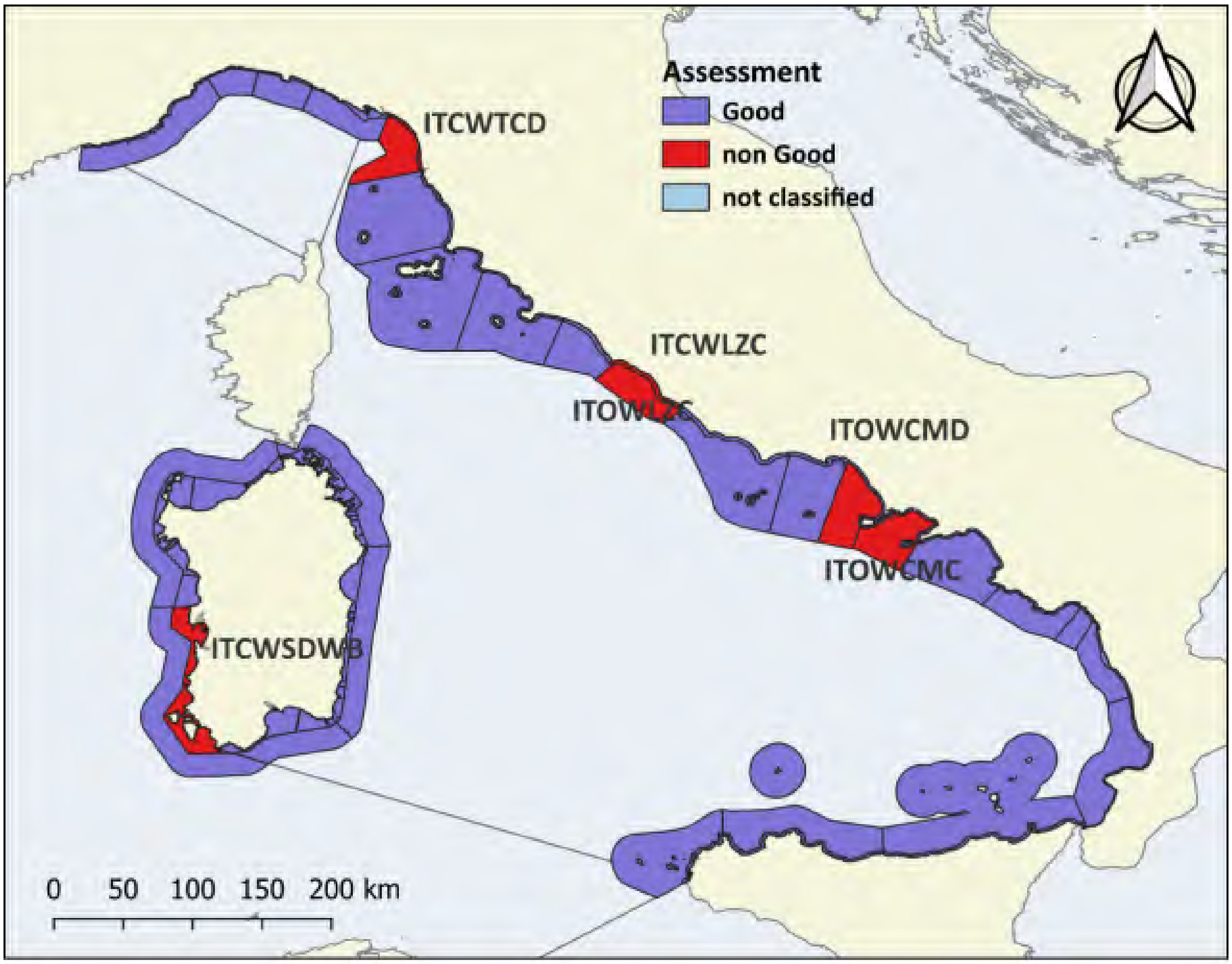

Figure WMS 3.1.3.4.7.E: The assessment results for CI 14 in the Italian waters in the Tyrrhenian Sea and the CWMS.

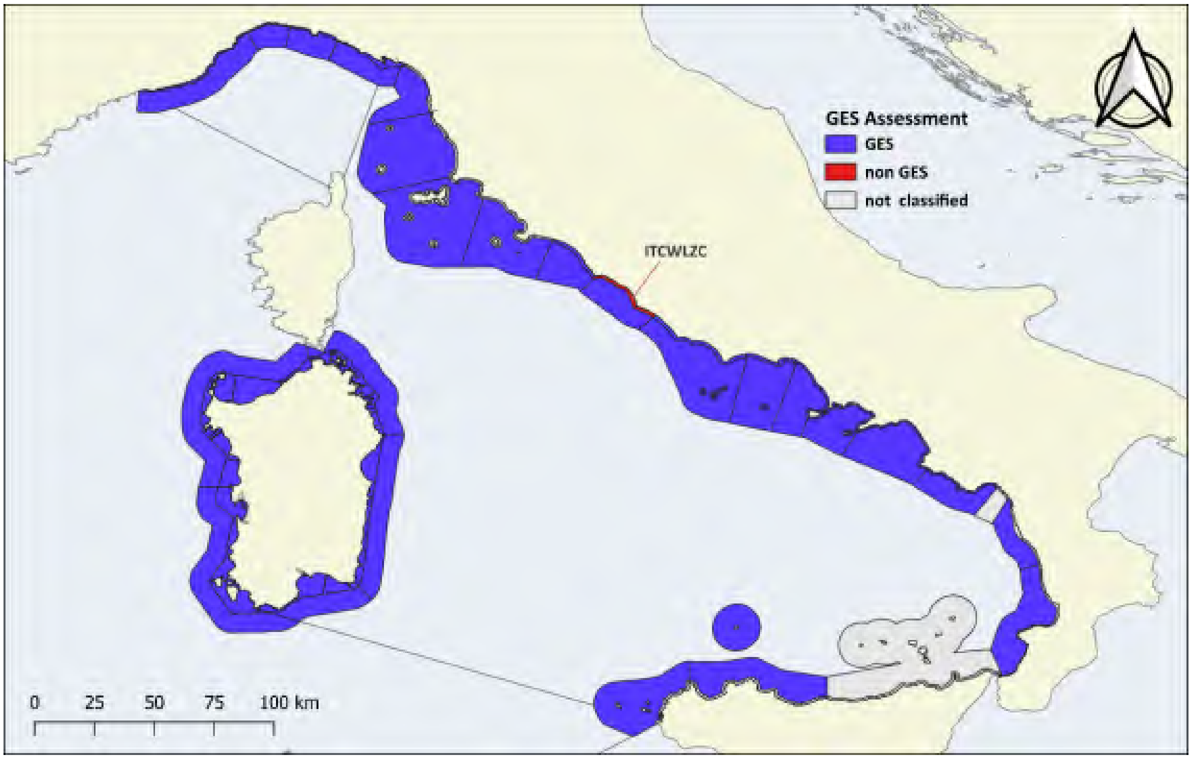

Figure WMS 3.1.3.4.8.E: Result of the GES assessment by applying the EQR methodology in the Italian waters in the Tyrrhenian Sea and CWMS at the level of subSAUs.

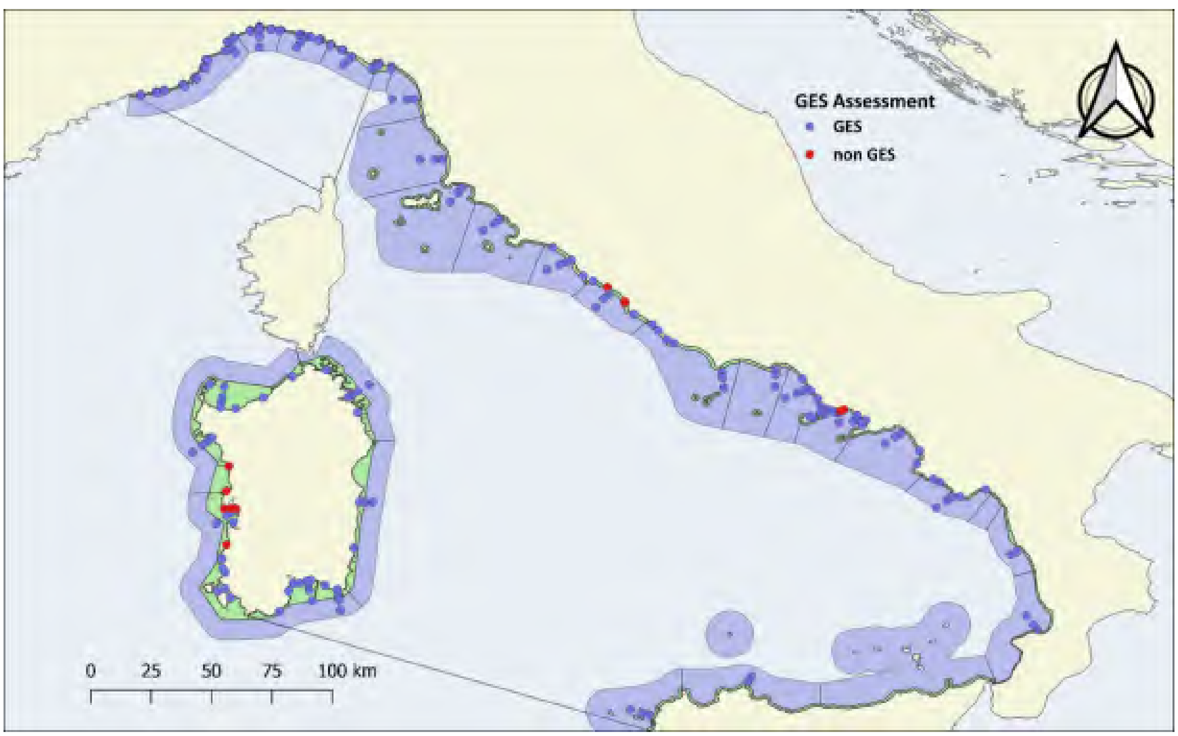

Figure WMS 3.1.3.4.9.E: Result of the GES assessment by applying the EQR method for the Italian part of the Tyrrhenian Sea and CWMS at the level of monitoring stations.

Table 3.1.3.4.12. Results of the assessment (G_NG.oN85- the good status class corresponding to all values below the 85th percentile set as the good/non-good boundary limit) for the Italian waters in the Tyrrhenian Sea and part of the CWMS provided at the level of the Spatial Assessment Units (SAUs). Blue coloured SAUs indicate good status.

AZ	SAU	CHL_N	CHL_GM	oN50	oN50+50	oN10	oN85	G_NG.oN85
CW	CW_ITA_ISL_E	8552	0,123	0,095	0,142	0,067	0,151	**G**
CW	CW_ITA_ISL_W	14080	0,141	0,104	0,156	0,079	0,169	**G**
CW	CW_ITA_TYR_N	5771	0,392	0,348	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_S	8772	0,319	0,263	0,395	0,085	1,124	**G**
OW	OW_ITA_ISL_E	24780	0,075	0,074	0,112	0,059	0,095	**G**
OW	OW_ITA_ISL_W	30285	0,084	0,083	0,124	0,068	0,098	**G**
OW	OW_ITA_TYR_N	85659	0,114	0,095	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_S	143789	0,088	0,077	0,116	0,061	0,111	**G**

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10th percentile (Reference conditions); oN85 – 85th percentile (G/NG threshold)

Table 3.1.3.4.13. Result of the assessment (G_NG.oN85- the good status class corresponding to all values below the 85th percentile set as the good/non-good boundary limit based on satellite derived Chl *a* data) for the Italian waters in the Tyrrhenian Sea and part of the CWMS at the level of the finest Spatial Assessment Units (subSAUs). Blue coloured subSAUs indicate good status. Red coloured SAUs indicate non-good status.

AZ	SAU	subSAU	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
CW	CW_ITA_ISL_E	ITCWSDEA	2259	0,121	0,142	0,067	0,151	**G**
CW	CW_ITA_ISL_E	ITCWSDEB	2887	0,109	0,142	0,067	0,151	**G**
CW	CW_ITA_ISL_E	ITCWSDEC	3406	0,137	0,142	0,067	0,151	**G**
CW	CW_ITA_ISL_W	ITCWSDWA	8314	0,116	0,156	0,079	0,169	**G**
CW	CW_ITA_ISL_W	ITCWSDWB	5766	0,185	0,156	0,079	0,169	**NG**
CW	CW_ITA_TYR_N	ITCWLGA	761	0,616	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_N	ITCWLGB	276	0,522	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_N	ITCWLGC	143	0,409	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_N	ITCWLGD	534	0,253	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_N	ITCWLZD	599	0,787	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_N	ITCWTCA	1014	0,43	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_N	ITCWTCB	1311	0,176	0,522	0,085	0,882	**G**

AZ	SAU	subSAU	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
CW	CW_ITA_TYR_N	ITCWTCC	789	0,317	0,522	0,085	0,882	**G**
CW	CW_ITA_TYR_N	ITCWTCD	344	1,730	0,522	0,085	0,882	**NG**
CW	CW_ITA_TYR_S	ITCWBCA	64	0,212	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWCMA	432	0,162	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWCMB	702	0,275	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWCMC	801	0,327	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWCMD	495	1,014	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWLBA	572	0,233	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWLBB	478	0,198	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWLZA	654	0,409	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWLZB	1468	0,390	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWLZC	844	1,253	0,395	0,085	1,124	**NG**
CW	CW_ITA_TYR_S	ITCWSCA	378	0,322	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWSCB	883	0,178	0,395	0,085	1,124	**G**
CW	CW_ITA_TYR_S	ITCWSCC	1001	0,133	0,395	0,085	1,124	**G**
OW	OW_ITA_ISL_E	ITOWSDEA	8730	0,090	0,112	0,059	0,095	**G**
OW	OW_ITA_ISL_E	ITOWSDEB	10495	0,066	0,112	0,059	0,095	**G**
OW	OW_ITA_ISL_E	ITOWSDEC	5555	0,072	0,112	0,059	0,095	**G**
OW	OW_ITA_ISL_W	ITOWSDWA	15955	0,084	0,124	0,068	0,098	**G**
OW	OW_ITA_ISL_W	ITOWSDWB	14330	0,083	0,124	0,068	0,098	**G**
OW	OW_ITA_TYR_N	ITOWLGA	4859	0,126	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWLGB	3545	0,109	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWLGC	2720	0,112	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWLGD	7785	0,105	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWLZD	5559	0,141	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWTCA	13450	0,116	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWTCB	22405	0,098	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWTCC	19399	0,098	0,143	0,079	0,156	**G**
OW	OW_ITA_TYR_N	ITOWTCD	5937	0,267	0,143	0,079	0,156	**NG**
OW	OW_ITA_TYR_S	ITOWBCA	1929	0,075	0,116	0,061	0,111	**G**

AZ	SAU	subSAU	CHL_N	CHL_GM	oN50+50	oN10	oN85	G_NG.oN85
OW	OW_ITA_TYR_S	ITOWCMA	5617	0,074	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWCMB	11225	0,094	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWCMC	6385	0,123	0,116	0,061	0,111	**NG**
OW	OW_ITA_TYR_S	ITOWCMD	7155	0,171	0,116	0,061	0,111	**NG**
OW	OW_ITA_TYR_S	ITOWLBA	10334	0,075	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWLBB	4301	0,071	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWLZA	10625	0,099	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWLZB	16280	0,100	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWLZC	5465	0,202	0,116	0,061	0,111	**NG**
OW	OW_ITA_TYR_S	ITOWSCA	12688	0,090	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWSCB	17915	0,074	0,116	0,061	0,111	**G**
OW	OW_ITA_TYR_S	ITOWSCC	33870	0,067	0,116	0,061	0,111	**G**

CHL_N – number of grid point in the SAU; CHL_GM – geometric mean (5-year average); oN50 – mean; oN50+50 – Mean + 50%; oN10 – 10^{th} percentile (Reference conditions); oN85 – 85^{th} percentile (G/NG threshold)

Table 3.1.3.4.14. Result of the assessment derived by application of the EQR methodology in the Tyrrhenian Sea and CWMS: the Waters of Italy provided at the level of the subSAUs. Blue-coloured subSAUs indicate likely in GES. Red-coloured subSAUs indicate likely in non-GES. Only the evaluated subSAUs are presented. For the present application of the EQR methodology, the following GES/non GES boundary values were applied: $EQR_{normalized}$ <0,62 – non GES; * type IIIW: GM > 0,48 non GES.

AZ	subSAU	CHL_GM/µg L^{-1}	$EQR_{normalized}$	GES/non GES
CW	ITCWCMA	0,131	1,00	G
CW	ITCWCMB	0,205	1,00	G
CW	ITCWCMC	0,529	0,74	G
CW	ITCWCMD	0,705	0,74	G
CW	ITCWLGA	0,241	0,99	G
CW	ITCWLGB	0,199	1,00	G
CW	ITCWLGC	0,247	0,97	G
CW	ITCWLGD	0,167	1,00	G
CW	ITCWLZA	0,347	0,94	G
CW	ITCWLZB	0,637	0,78	G
CW	ITCWLZC	0,994	0,53	NG
CW	ITCWLZD	0,478	0,69	G
CW	ITCWSDEA	0,116	1,00	G
CW	ITCWSDEB	0,098	1,00	G
CW	ITCWSDEC	0,045	1,00	G
CW	ITCWSDWA	0,139	0,93	G
CW	ITCWSDWB	0,624	0,83	G
OW	ITOWCMA	0,117	*	G
OW	ITOWCMB	0,151	*	G
OW	ITOWCMC	0,279	*	G
OW	ITOWCMD	0,260	0,87	G
OW	ITOWLBA	0,125	*	G
OW	ITOWLBB	0,094	*	G
OW	ITOWLGA	0,166	1,00	G
OW	ITOWLGB	0,185	*	G
OW	ITOWLGC	0,203	0,99	G
OW	ITOWLGD	0,195	0,98	G
OW	ITOWLZA	0,242	0,98	G
OW	ITOWLZB	0,251	0,95	G
OW	ITOWLZC	0,200	0,98	G
OW	ITOWLZD	0,173	0,63	G
OW	ITOWSCA	0,129	*	G
OW	ITOWSCB	0,082	*	G
OW	ITOWSDEA	0,164	*	G
OW	ITOWSDEB	0,170	*	G
OW	ITOWSDEC	0,034	*	G
OW	ITOWSDWA	0,153	*	G
OW	ITOWSDWB	0,217	*	G
OW	ITOWTCA	0,129	*	G
OW	ITOWTCB	0,138	*	G
OW	ITOWTCC	0,119	*	G
OW	ITOWTCD	0,295	0,93	G

Assessment of IMAP Common Indicator 17

Geographical scale of the assessment	The Sub-regions within the Mediterranean region based on integration and aggregation of the assessments at Sub-division levels
Contributing countries	In alphabetical order: Albania, Algeria*, Croatia. Cyprus, France, Greece. Israel, Italy, Lebanon, Malta, Montenegro. Morroco, Slovenia, Spain, Tunisia*, Türkiye (*data from the literature)
Mid-Term Strategy (MTS) Core Theme	Enabling Programme 6: Towards Monitoring, Assessment, Knowledge and Vision of the Mediterranean Sea and Coast for Informed Decision-Making
Ecological Objective	EO9. Contaminants cause no significant impact on coastal and marine ecosystems and human health
IMAP Common Indicator	CI17. Level of pollution is below a determined threshold defined for the area and species
GES Definition (UNEP/MED WG 473/7) (2019)	Level of pollution is below a determined threshold defined for the area and species
GES Targets (UNEP/MED WG 473/7) (2019)	• Concentrations of specific contaminants below Environmental Assessment Criteria (EACs) or below reference concentrations • No deterioration trend in contaminants concentrations in sediment and biota from human impacted areas, statistically defined • Reduction of contaminants emissions from land-based sources
GES Operational Objective (UNEP/MED WG473/7) (2019)	Concentration of priority contaminants is kept within acceptable limits and does not increase

The IMAP Environmental Assessment of the Aegean and Levantine Seas (AEL) Sub-region

411. The assessment of the of the Aegean and Levantine Seas (AEL) Sub-region is provided by using the CHASE+ (Chemical Status Assessment Tool) methodology for the Aegean Sea (AEGS) Sub-division and the Levantine Sea (LEVS) Sub-division.

412. Data were grouped per parameter, matrix, station location and sampling year. In the cases where a station was sampled during various years, and/or there were more than one data point for the station at a certain year, the average concentrations (i.e., arithmetic mean) were calculated and used in the CHASE+ assessment. Average concentrations were also used in the NEAT application in the ADR.

CHASE+ (Chemical Status Assessment Tool) methodology was tested and then applied for assessment of IMAP CI 17 further to its application by the European Environmental Agency (EEA) to assess environmental status categories for the European Seas (Andersen et al. 2016, EEA 2019)[78]. This assessment methodology uses just one threshold, compared to the two used in the traffic light system.

The first step in this tool is to calculate the ratio $C_{measured}/C_{threshold}$ (C is the concentration) called the contamination ratio (CR) for each assessment element in a matrix. Then a contamination score (CS) is calculated as follows[79]:

$$CS = \frac{1}{\sqrt{n}} \sum_{i=1}^{n} CR_i$$

where n is the number of elements assessed for each matrix.

Based on the contamination ratio (CR) or on contamination score (CS), the elements are assessed. In line with the results of assessments, the stations/areas can be classified into non problem area (NPA) and problem area (PA), by applying 5 categories: NPAhigh (CR or CS=0.0-0.5), NPAgood (CR or CS =0.5-1.0), PAmoderate (CR or CS =1.0-5.0), PApoor (CR or CS =5.0-10.0) and PAbad (CR or CS > 10.0). NPA areas are considered in GES while PA areas are considered as non-GES. The boundary limit of 1 between GES and non-GES is based on the choice that only values that are equal or below the threshold are considered in GES.

Both methodologies i.e. the NEAT and CHASE+ need to define decision rules to determine the quality status. One decision rule used is the "One out all out approach" (OOAO) that says that if one element of the assessment is not in good status, the whole area is described as not in GES. This decision rule is very stringent. An additional approach is based on setting a limit, such as a proportion (%) of elements, that should each be in GES for the area to be classified as in GES. Within the present work it was recommended that if at least 75% of the elements are in GES, the station should be considered in GES. The same recommendation was given when assessing certain areas or the whole Sub-region or Sub-division i.e., when 75% of the stations are in GES for a certain parameter, the whole Sub-region is in GES for this particular parameter and not the overall status of the Sub-region or Sub-division. This more lenient approach for the GES-non GES decision rule compensates for stricter thresholds applied within the CHASE+ methodology. This approach was discussed and approved by the Meeting of CorMon Pollution Monitoring, 2022, and therefore it is also applied in the 2023 MED QSR assessments.

a) The Aegean Sea (AEGS) Sub-division

Available data

413. Data for the AEGS were available only for the sediment matrix. Table 4.3.1.1.a summarizes the available data. Trace metals (TM – Cd, Hg and Pb) in sediments were reported for 32 stations by Türkiye (2018), while data for Cd and Pb were reported for 34 stations by Greece, i.e. for 5 stations in 2019 and 29 stations in 2020. In addition, Pb data were available for 28 stations located in the area of the Saronikos Gulf and Elefsis Bay for 2018 (Karageorgis et al. 2020a, Karageorgis et al. 2020b). Individual concentrations of each of the 16 required PAHs were reported by Greece (11 stations in 2019 and 10 stations in 2020) as well as for Σ_{16} PAHs. Data for Σ_5 PAHs[80] were reported by Türkiye for 32 stations

[78] Andersen, J.H., Murray, C., Larsen, M.M., Green, N., Høgåsen, T., Dahlgren, E., Garnaga-Budrė, G., Gustavson, K., Haarich, M., Kallenbach, E.M.F., Mannio, J., Strand, J. and Korpinen, S. (2016) Development and testing of a prototype tool for integrated assessment of chemical status in marine environments. Environmental Monitoring and Assessment 188(2), 115.
EEA (2019) Contaminants in Europe's Seas. Moving towards a clean, non-toxic marine environment. EEA Report No 25/2018.

[79] The contamination sum minimizes the problem of 'dilution' of high values when several substances from an area are analyzed, and takes to some extent possible synergistic effects of contaminants into account by using square root of 'n' instead of 'n'.

[80] Σ_5 PAHs is the sum of the concentrations of Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene and Benzo(ghi)perylene. Turkiye reported also the concentration of Σ_4PAHs that is the sum of the first 4 compounds in Σ_5 PAHs. Both Σ5 PAHs and Σ4 PAHs are non-mandatory parameters for CI 17, whereby Σ16 PAHs, is a mandatory parameter.

sampled in 2018. Concentrations of total PCBs (Σ_7 PCBs[81]), individual concentrations for each PCB congener, Lindane and Dieldrin were reported for 31 stations by Türkiye (2018).

414. Data were compiled from the IMAP-IS, as reported by 31st October 2022. As mentioned, additional data from the scientific literature were also used (Karageorgis et al., 2020 a,b).

Table 3.1.4.1.1.a. Data available for the assessment of the AEGS sub- division. Only data for the sediment matrix were available.

Source	IMAP-File	Country	Sub-division	Year	Cd	Hg	Pb	Σ_{16} PAHs	Σ_5 PAHs	Σ_7 PCBs	Lindane	Dieldrin
Sediment												
IMAP_IS	446	Turkiye	AEGS	2018	32	32	32	0	32	31	31	31
IMAP_IS	652	Greece	AEGS	2019	5	0	5	11	11	11	0	0
IMAP_IS	652	Greece	AEGS	2020	29	0	29	10	10	10	0	0
Lit[1]		Greece	AEGS	2018	0	0	28	0	0	0	0	0

[1]Karageorgis et al, 2020 a,b

415. Based on the available data, the assessment was performed for TM, Σ_{16} PAHs and Σ_7 PCBs in sediment. In addition, the AEGS was assessed based on Σ_5 PAHs as well. This is not a mandatory parameter but was included in the assessment given significant more data available for Σ_5 PAHs compared to Σ_{16} PAHs (53 vs 21 data points, respectively) encompassing a larger area of the AEGS. Therefore, we made an exception to possibly increase confidence of the assessment. When possible, a qualitative description was provided for the additional parameters or stations.

Setting the GES/non-GES boundary value/threshold for the CHASE+ application in the AEGS.

416. The thresholds used for the CHASE+ assessment methodology were the updated sub-regional BACs [82] . Table 4.3.1.2.a summarizes the thresholds values, the same ones used in the assessment of LEVS subdivision within the Aegean Levantine Seas Sub-region (AEL).

Table 3.1.4.1.2.a. Summary of the threshold values used in present pilot application for GES assessment of the Levantine and Aegean Seas sub-divisions. MedEACs are presented for comparison.

	AEL_BAC	MED_BAC	MedEAC
Sediments, µg/kg dry wt			
Cd	118	161	1200
Hg	47.3	75	150
Pb	23511	22500	46700
Σ_{16} PAHs	41	32	4022*
Σ_5 PAHs^	17.2	31.8	
Σ_7 PCBs	0.19	0.40	68+

* ERL value derived for the sum of 16 PAHs by Long et al., 1995, do not appear in the Decisions of COP. + sum of the individual MedEACs values of the 7 PCB compounds as they appear in Decision IG.23/6;^ Values are not set by Decision IG.22/7, therefore the BAC value for Σ_5 PAHs is calculated as a sum of the individual BAC values as provided for the 5 PAHs compounds.

[81] PCBs congeners 28,52,101,118,132,153,180
[82] MED_BACs were adopted by 2017 COP, while the use of sub-regional BACs within the preparation of the 2023 MED QSR was approved by the Meeting of CorMon Pollution held on 27 and 30 May 2022

Integration of the areas of assessment for the AEGS.

417. The locations of the sampling stations are presented in Figures AEGS 3.1.4.1.1.C - AEGS 3.1.4.1.4.C.

418. The locations of the sampling stations were sorted by group of contaminants. As explained above, data were available only for the sediment matrix. Data for TM, PAHs were reported by Türkiye at each of the 32 sampling stations, as well as for PCBs in sediments at 31 out of the 32 sampling stations. Data for Cd and Pb were reported by Greece at 34 stations and for PAHs at 15 of these stations. In addition, data for 6 stations with only PAHs concentration were reported. Additional data from the literature (Karageorgis et al., 2020) for Pb only were available for 28 stations.

419. Further to IMAP implementation, the monitoring stations were considered for grouping in the two main assessment zones i.e., the coastal (within 1 nm from the shore) and offshore zones. Twenty-one stations in Türkiye were coastal and 11 belonged to the offshore zone. In Greece, 35 stations were classified as coastal and 31 as offshore. Due to the limited number of data points, more so if dividing into coastal and offshore stations, the spatial nesting of stations in spatial assessment units (SAUs) to the level considered meaningful for IMAP CI 17 was not possible in AEGS. Spatial nesting would decrease the reliability and the representativeness of each station for the assessment of the Aegean Sea Sub-division. Therefore, at this stage, the assessment was based on specific stations irrespective of their positions either in offshore or coastal zones.

Results of the CHASE+ Assessment of CI 17 in the Aegean Sea Sub-division.

420. For each measured parameter at each station a contamination ratio (CR) was calculated. Thresholds were the updated sub-regional AEL_BACs (Table 3.1.4.1.2.a). CHASE+ methodology in the AEGS was provided without spatial integration and aggregation of the areas of assessment and assessment results. Instead, aggregation was possible only for TM in sediments, and only partially. A contamination score (CS) aggregating 2-3 metals was further calculated. Table 3.1.4.1.3.a. summarizes the results of the CHASE+ application.

Table 3.1.4.1.3.a. Number of data points and their percentage from the total number of data points in each category based on the CHASE+ tool, calculated using the new AEL_BACs..

CHASE+		**Blue High**	**Green Good**	**Yellow Moderate**	**Brown Poor**	**Red Bad**
		NPA or GES		**PA or non-GES**		
Sediment	Total number of data points					
		CS=0.0-0.5	**CS =0.5-1.0**	**CS =1.0-2**	**CS =2-5**	**CS >5**
Cd, Hg, Pb	94*	23	40	18	11	2
% from total number of data points		*24*	*43*	*19*	*12*	*2*
		CR=0.0-0.5	**CR=0.5-1.0**	**CR =1.0-2**	**CR =2-5**	**CR>5**
Σ_{16} PAHs	21	3	6	3	4	5
% from total number of data points		*14*	*29*	*14*	*19*	*24*
Σ_5 PAHs	53	19	9	7	10	8
% from total number of data points		*36*	*17*	*13*	*19*	*5*
Σ_7 PCBs	31	17	5	3	3	3
% from total number of data points		*55*	*16*	*10*	*10*	*10*

*32 stations reported all the 3 TMs, 34 only Cd and Pb and 28 only Pb.

Assessment of Trace metals in sediments of the AEGS.

421. The 16 stations classified as non-GES (out of the 31) were distributed in the northern and central part of the AEGS. Most stations were located in bays (Table 3.1.4.1.1.a; Figure AEGS 3.1.4.1.1.C), where usually the water exchange is slower than in open waters, promoting accumulation of land-based source contaminants. The 67 stations classified in GES (high and good status) were distributed along the whole AEGS sub-division (Figure AEGS 3.1.4.1.1.C).

422. Only for 32 stations data were reported for all the 3 TMs. For 34 stations data were reported only for Cd and Pb and for 28 stations only for Pb. A detailed examination of the CRs for the individual metals, found that mainly Pb and to a lesser degree Cd, contributed to the classification of 2 out of 94 stations, as in bad status. One was located in the inner Saronikos Gulf (CW36) and one in the Northern Aegean (CW54) (Figure AEGS 3.1.4.1.1.C). Eleven stations were classified as in poor status: 8 in the Elfsis Bay and inner Saronikos Gulf, due to elevated Pb concentrations, one (CW32) in the Elfsis Bay due to Pb and to a lesser degree Cd. Two stations, i.e. ALISW2, CABSSW1, in the vicinity of Aliaga and Yenisakran, were classified as poor mainly due to elevated Hg concentrations. Using CS, 18 stations were classified as moderate and they were distributed across the AEGS. No specific, demarcated area could be classified as non-GES based on these 18 stations. The 63 remaining stations were classified in the high and good statuses (in-GES). Six stations for which data were reported by Türkiye, defined as reference stations, were in the high status (2 stations) and in the good status of classification (4 stations).

423. Fifteen out of the 31 stations classified as non-GES were located in the Elfsis Bay and inner Saronikos Gulf, known to be impacted by anthropogenic activities . This area is the seaward boundary of the metropolitan areas of Athens and Piraeus port, hosting 1/3 of the current Greek population (3.2 million people; Census 2011). More than 40% of the Greek industries are located in the coastal area of the Elefsis Bay, including some of the biggest plants of the country, such as oil refineries, steel and cement industries, and shipyards (Karageorgis et al., 2020 and references therein). Increased concentrations of trace elements in this area, resulting from the discharges of domestic and industrial effluent, have been documented since the late 1970s. The major sources of pollution were identified as the Psyttaleia wastewater treatment plant, a fertilizer plant- operating in the Inner Saronikos Gulf until 1999, steel mills and shipyards in the Elefsis Bay. The contamination found in the bay has resulted in the accumulation of metals in mussel tissues, which followed a spatial gradient related to land-based sources. Karageorgis et al. 2020 found maximal Pb concentrations (in conjunction with Cu, Zn and As) in the Elefsis Bay and the Psyttaleia Island region, with N-S decreasing trends. Minor Pb enrichment was recorded at the deeper sector of the Outer Saronikos Gulf. A temporal (1999–2018) decrease in metal concentrations was found for 2 out of the 14 stations sampled in the Elefsis Bay. Several polluting industries have ceased their operation during the last decade. Therefore, the decreasing trend in the most industrialized part of the study area is connected to the reduction of metal discharges in the coastal environment. Furthermore, environmental policy enforcement combined with technological improvements by big industrial polluters, such as the steel-making industry have contributed to the improvement of sediment quality.

424. The 28 stations reported by Karageorgis et al. (2020 a,b) were located in a very limited area of the Saronikos and Elfesis Gulf, that correspond to about 0.5% of the total AEGS area. Moreover, they reported only the concentrations of Pb in sediments. This emphasis of a small area could introduce a bias in the whole sub-division assessment. Therefore, for comparison, the assessment was performed without taking these stations into consideration. The assessment found that 20% of the stations were in high status, 53% in good status, 20% in moderate status, 4% in poor status and 3% in bad status. In this case, 73% of the stations were classified in-GES, and the status of the AEGS remains marginally non-GES, therefore the exclusion of these stations did not change the overall assessment of the sub-division.

425. The whole AEGS is classified as non-GES (Figure AEGS 3.1.4.1.1.C). In brief, only 67% of the stations were in GES for TM in sediments. Therefore, by applying the decision rule agreed for CHASE + assessment methodology which recommends that only if at least 75% of the elements are in GES, the area should be considered in GES, the whole AEGS is classified as non-GES regarding TM in sediments. However, this is a result of the contribution from only 2 limited affected areas (1) the Elfesis Bay and inner Saronikos Gulf, and 2) the two stations near Aliaga and Yenisakran. When data from these affected areas, that constitute less than 1% of the AEGS, are not taken into account, then 82% of the stations (65 out of 79 stations) are in GES, and the AEGS sub-division can be classified as in GES. These 79 stations are distributed evenly across the AEGS sub-division, providing a good coverage of the sub-division.

Assessment of Σ_{16} PAHs and of Σ_5 PAHs in sediments of the AEGS

426. Σ_{16} PAHs in sediments: There were only 21 stations with data for Σ_{16} PAHs in sediments, and data for all of them were reported by Greece. It can be seen (Table 3.1.4.1.1.; Figure AEGS 3.1.4.1.2.C) that the stations located offshore are in-GES (8 stations, 38% of total stations), while the stations located in enclosed areas, except one, are classified as non-GES (12 stations, 57% of total stations). However, this is based on data from only 21 stations, which is not enough for a confident assessment. Additional data are needed to improve the assessment and to better delimit possible non-GES areas.

427. Σ_5 PAHs in sediments: There were only 21 stations with data for Σ_{16} PAHs in sediments, however Türkiye reported data for Σ_5 PAHs[83] for 32 stations. Although Σ_5 PAHs is not a mandatory parameter, the assessment based on it was performed due to significant more data availability for Σ_5 PAHs compared to Σ_{16} PAHs (53 vs 21 data points, respectively) encompassing a larger area of the AEGS. Therefore, an exception was made in order to increase confidence of the assessment.

428. For the stations with available data for Σ_{16} PAHs, the assessment performed using Σ_5 PAHs was identical to the assessment based on Σ_{16} PAHs (Figure AEGS 3.1.4.1.2.C), except for one station, CW41 that was now classified as in good status instead of in moderate status. Out of the 53 available stations, about half (28 stations, 53% of the total stations) were classified in-GES (high and good statuses) for Σ_5 PAHs in sediments, and about half (25 stations, 47% of the total stations) as not in-GES (moderate, poor and bad statuses) (Figure AEGS 3.1.4.1.3.C).

[83] Σ_4 PAHs was also reported, but it was decided to assess the status based on Σ_5 PAHs given it encompasses all 4 PAHs; Both Σ5 PAHs and Σ4 PAHs are non-mandatory parameters for CI 17, whereby Σ16 PAHs, is a mandatory parameter.

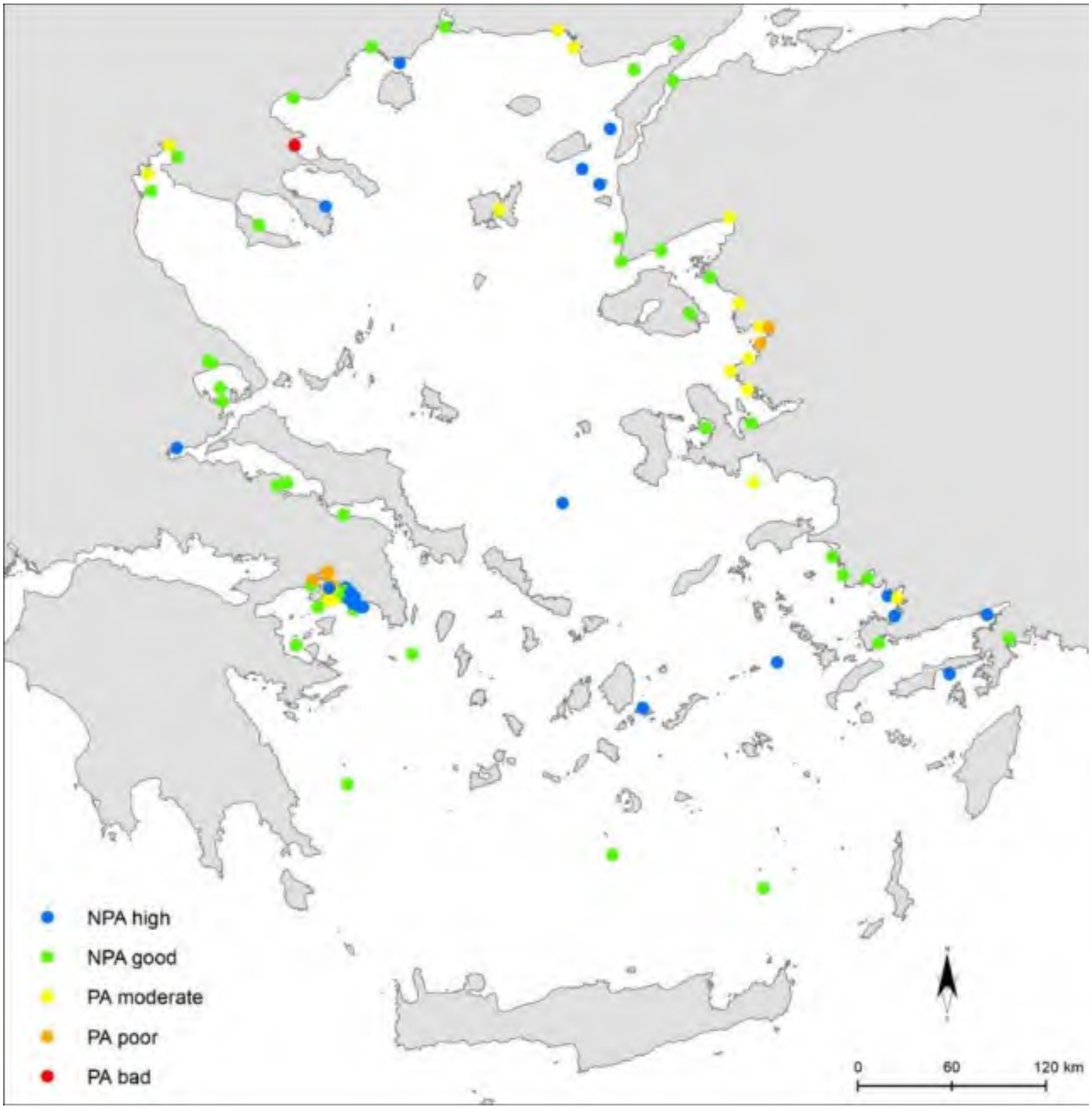

Figure AEGS 3.1.4.1.1.C. Results of the CHASE+ assessment methodology to assess the environmental status of TM in sediments in the AEGS, using AEL_BACs as thresholds. Stations in blue - NPAhigh (CS=0.0-0.5); stations in green- NPAgood (CS =0.5-1.0); Stations in yellow- PAmoderate (CS =1.0-2.0); stations in brown - PApoor (CS =2.0-5.0) and stations in red - PAbad (CS > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES.

429. Therefore, there are indications that AEGS might be classified as non-GES regarding Σ_5 PAHs in sediments. However, only 2 limited affected areas were identified in non-GES, similarly to the assessment of TM in sediments: 1) the Elfsis Bay and inner Saronikos Gulf and 2) the area encompassing the coast around Kucukkoy, Dikili, Candarli, Aliaga, and Yenisakran. The southern part of the AEGS can be classified as in GES, as all stations, except the two, were in high and good statuses (Figure AEGS 3.1.4.1.3.C).

430. It was not possible to classify the AEGS sub-division regarding data for Σ_{16} PAHs in sediments (Figure AEGS 3.1.4.1.2.C.). There are indications that the offshore zone is in GES while the enclosed areas might be found as non-GES. Additional data are needed to improve the assessment and delimit possible affected areas.

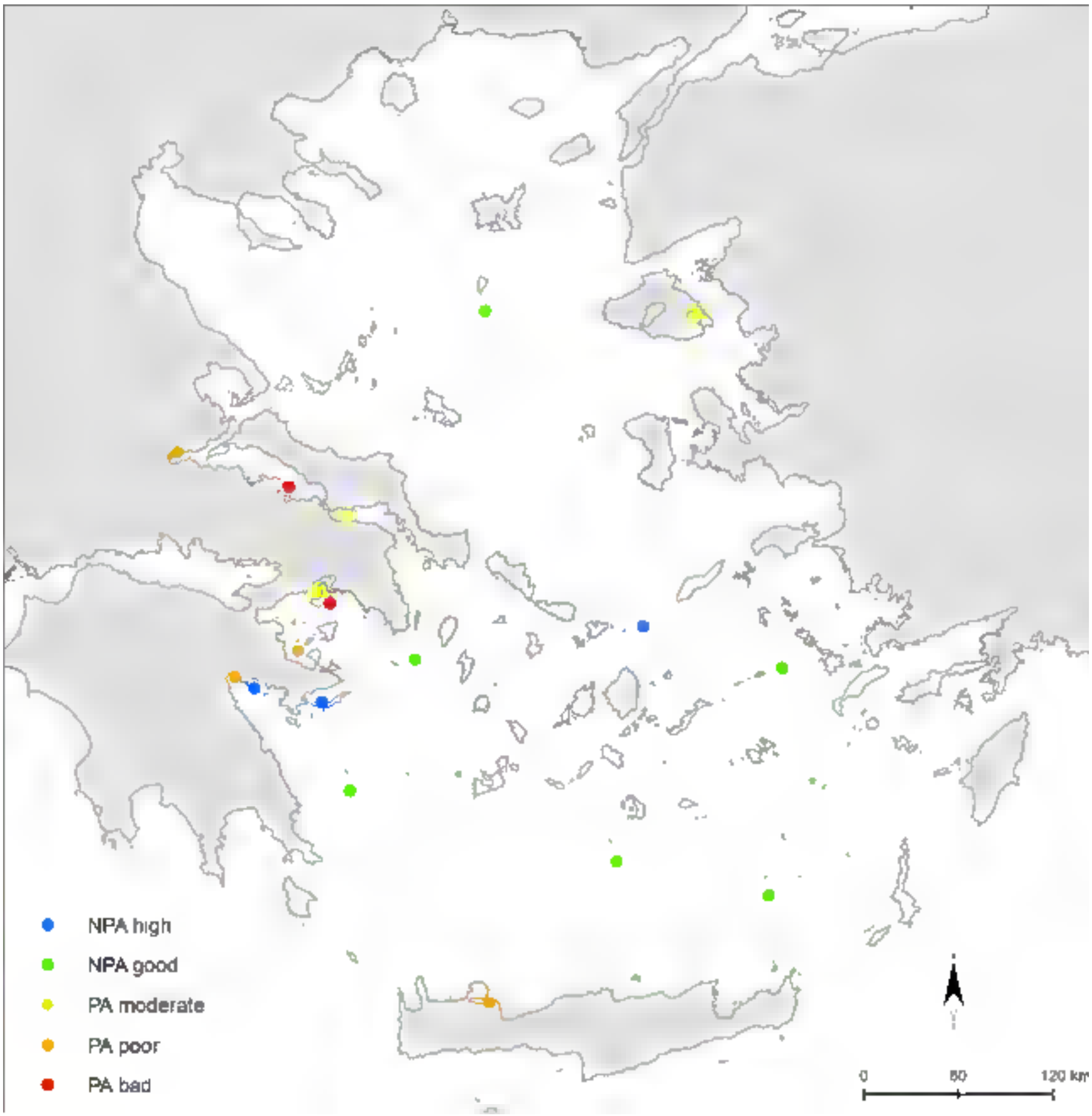

Figure AEGS 3.1.4.1.2.C. Results of the CHASE+ assessment methodology to assess the environmental status of Σ_{16} PAHs in sediments in the AEGS, using AEL_BACs as thresholds. Stations in blue - NPAhigh (CR=0.0-0.5); stations in green- NPAgood (CR =0.5-1.0); Stations in yellow- PAmoderate (CR =1.0-2.0); stations in brown - PApoor (CR =2.0-5.0) and stations in red - PAbad (CR > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES.

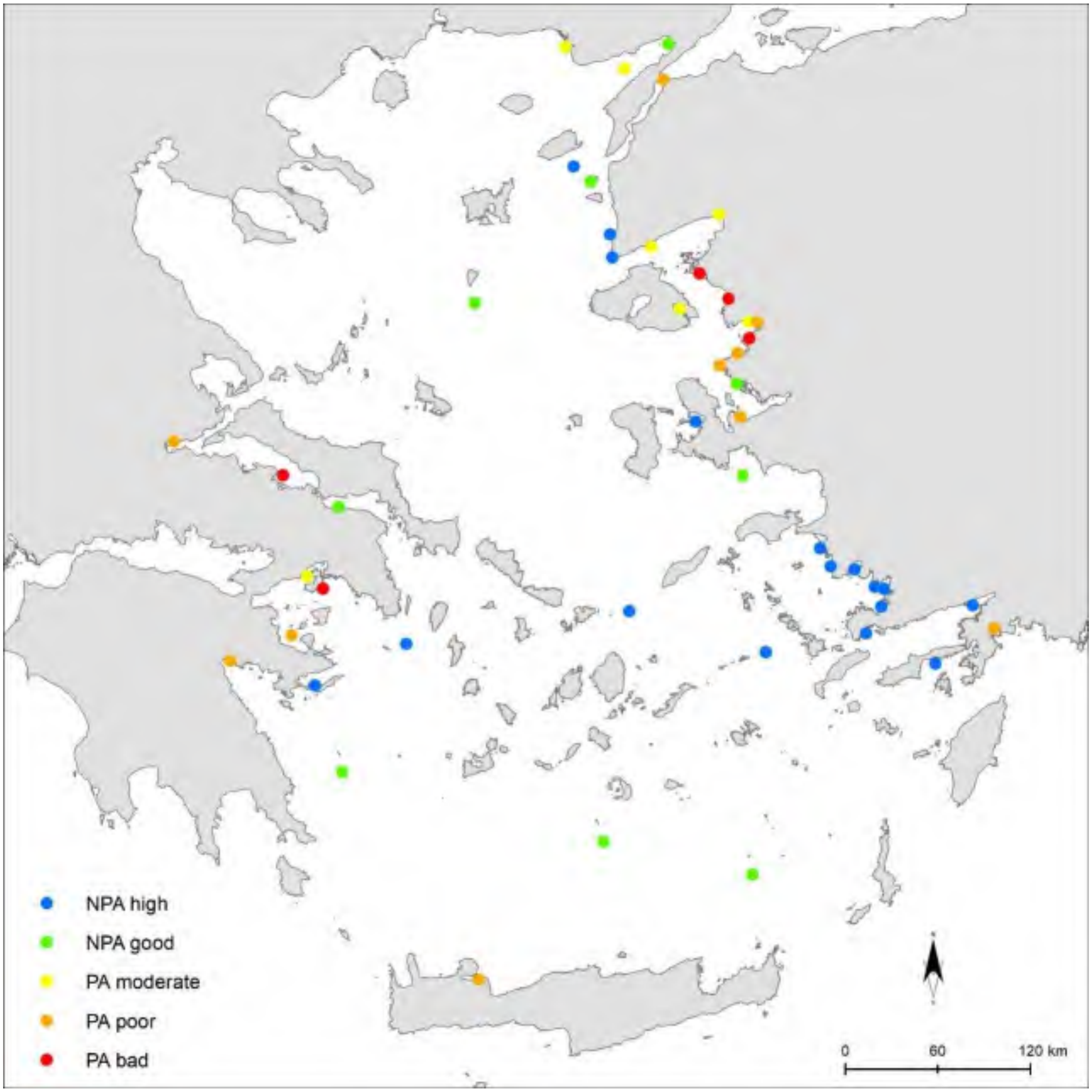

Figure AEGS 3.1.4.1.3.C. Results of the CHASE+ assessment methodology to assess the environmental status of Σ_5 PAHs in sediments in the AEGS, using AEL_BACs as thresholds. Criteria for Σ_5 PAHs were not adopted in Decisions IG.22/7 and IG.23/6 (COP 19 and COP 20) and not addressed in UNEP/MED WG. 533/3. Here we used the sum of the individual BAC values as provided for the 5 PAHs compounds in UNEP/MED WG. 533/3 as Σ_5 PAHs_BAC. Stations in blue - NPAhigh (CR=0.0-0.5); stations in green- NPAgood (CR =0.5-1.0); Stations in yellow- PAmoderate (CR =1.0-2.0); stations in brown - PApoor (CR =2.0-5.0) and stations in red - PAbad (CR > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES.

Assessment of Σ_7 PCBs in sediments of the AEGS

431. Data on PCBs were reported only by Türkiye. The northern (except station D7 in the Dardanelles Strait) and southern part of the coast were in GES regarding Σ_7 PCBs in sediments (22 stations, 71% from the total number of stations) **(**Figure AEGS 3.1.4.1.4.C). The mid area, encompassing the coast around Aliaga, Yenisakran and Candarli was classified as non-GES, in particular the stations inside the bay (9 stations, 29% from the total number of stations) which determined this area as an affected one. There are not enough data to classify the whole AEGS sub-division regarding data reported for Σ_7 PCBs in sediments.

432. The AEGS sub-division could not be classified regarding assessment of Σ_7 PCBs in sediments due to lack of data. An affected, non-GES area was identified in the coast around Aliaga, Yenisakran and Candarli. The north-eastern and south-eastern coast were in-GES regarding assessment of data on Σ_7 PCBs in sediments.

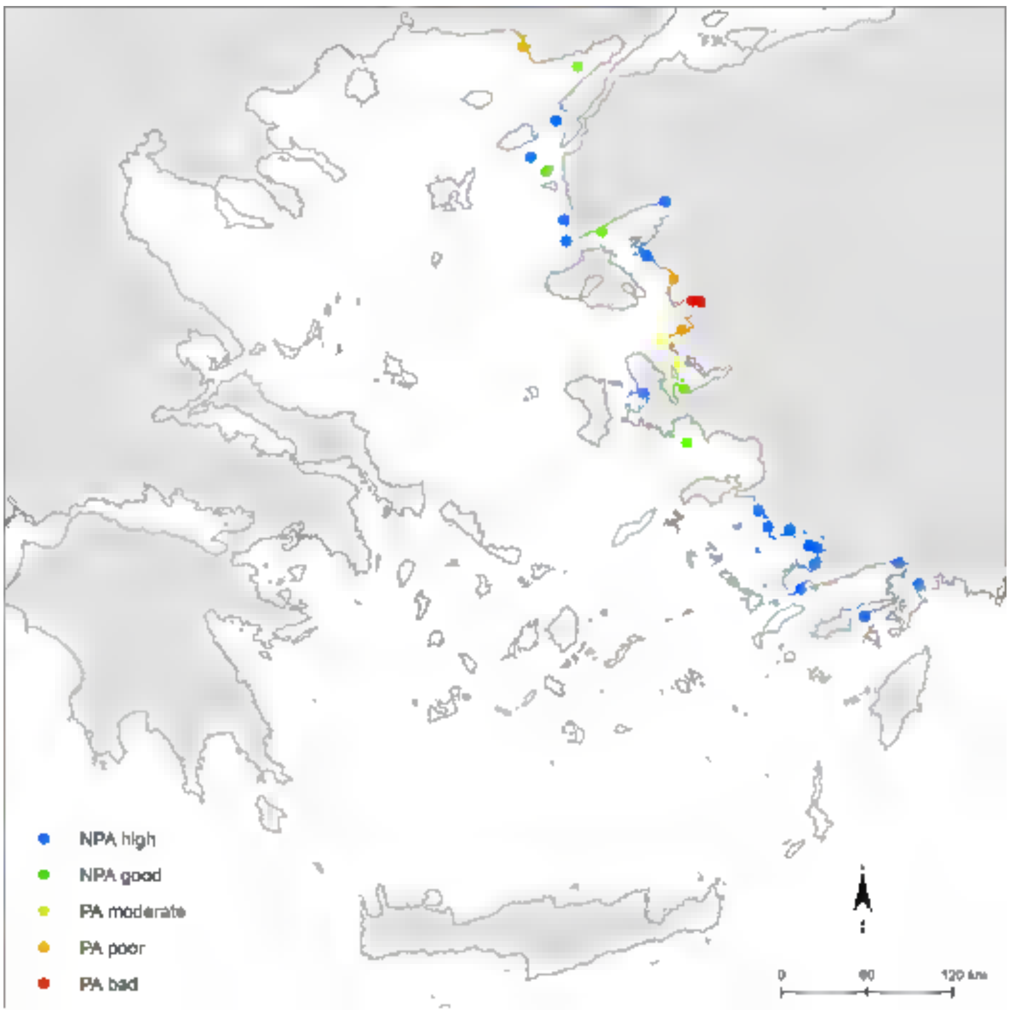

Figure AEGS 3.1.4.1.4.C. Results of the CHASE+ assessment methodology to assess the environmental status of Σ_7 PCBs in sediments in the AEGS, using AEL_BACs as thresholds. Stations in blue - NPAhigh (CR=0.0-0.5); stations in green- NPAgood (CR =0.5-1.0); Stations in yellow- PAmoderate (CR =1.0-2.0); stations in brown - PApoor (CR =2.0-5.0) and stations in red - PAbad (CR > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES.

Organochlorinated contaminants other than PCBs in sediments of the AEGS

433. Data for Organochlorinated contaminants were reported only by Türkiye. Dieldrin in all stations were below detection limit (reported as 0 μg/kg dry wt) while data for γ-HCH (Lindane) ranged from below detection limit to 0.14 μg/kg dry wt with an average and median concentration of 0.036 and 0.013 μg/kg dry wt, respectively. The BAC value is not set for Lindane. Only EAC of 3 μg/kg dry wt was adopted by Decision IG.22/7. The concentrations reported for Lindane were well below the EAC value.

434. Therefore, the AEGS sub-division could not be classified regarding assessment of Organochlorinated contaminants other than PCBs in sediments due to lack of data.

b) The Levantine Sea Sub-division (LEVS)

Available data.

435. The available data for the assessment of the Levantine Sea are presented in Table 3.1.4.1.1.b. Data were available for TM (Cd, Hg and Pb) in sediments as available for Cyprus, Greece, Israel, Lebanon, Türkiye; TM in the fish *M. barbatus* as available for Cyprus, Israel, Lebanon, Türkiye; PAHs in sediments as available for Greece, Israel, Lebanon and Türkiye; some PAH compounds for *M. barbatus* as available for Cyprus and Türkiye; organochlorinated contaminants in sediments as available for Lebanon and Türkiye; and organochlorinated contaminants in *M. barbatus* as available for Cyprus, Lebanon and Türkiye.

436. No data were available for the southern coast nor for the southern offshore area of the LEVS.

437. The most data were available for TM in sediments. There were 136 data points in the database, with 135 data points for Cd, 133 for Hg and 136 for Pb. Data for TM in *M. barbatus* were as follows: 83 data points for Cd, 85 data points for Hg and 53 data points for Pb. Data for PAHs in sediments were available for 112 stations. Data on total 16 PAHs (Σ_{16} PAHs) in sediments were reported for 75 stations while for 33 stations data available were for Σ_5 PAHs[84]. Data for some of the PAHs compounds in *M. barbatus* were reported in 18 specimens. Data for total PCBs (Σ_7 PCBs[85]) in sediments were available for 52 stations. Data for Lindane and Dieldrin in sediments were available for 33 stations. In *M. barbatus* data for Σ_7 PCBs, Lindane, Dieldrin, Hexachlorobenzene and p,p'DDE were available in 12 samples.

438. Data were compiled from the IMAP-IS, as reported by 31st October 2022. As mentioned, additional data from the scientific literature were also used (Astrahan et al. 2017, Ghosn et al, 2020).

[84] Σ_5 PAHs is the sum of the concentrations of Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene and Benzo(ghi)perylene. Turkiye reported also the concentration of Σ_4PAHs that is the sum of the first 4 compounds in Σ_5 PAHs. Both Σ_5 PAHs and Σ_4 PAHs are non-mandatory parameters for CI 17, whereby Σ_{16} PAHs, is a mandatory parameter.
[85] PCBs congeners 28,52,101,118,132,153,180

Table 3.1.4.1.1.b. Data availability by country and year for the assessment of EO 9 – CI 17 (contaminants) in the Levantine Sea Sub-division (LEVS) Sub-division of AEL, as available by up to 31st Oct 2022.

Source	IMAP_File	Country	Year	Cd	Hg	Pb	Σ_{16} PAHs	Σ_5 PAHs	Σ_7 PCBs	Lindane	Dieldrin
Sediment											
IMAP_IS	497	Cyprus	2017	7	7	7					
IMAP_IS	497[86]	Cyprus	2018	4	4	4					
IMAP_IS	634	Cyprus	2019	2	2	2		2			
IMAP_IS	634	Cyprus	2020	6	6	6		6			
IMAP_IS	634	Cyprus	2021	6	5	6					
IMAP_IS	652	Greece	2019	3	0	3	4*	4			
MED POL		Israel	2017	14	14	14					
IMAP_IS	585	Israel	2018	11	11	11					
IMAP_IS	531[87]	Israel	2019	16	16	16					
IMAP_IS	588	Israel	2020	14	14	14					
Lit[1]		Israel	2013&				52*	52			
IMAP_IS	118	Lebanon	2019	17	17	17	19		19		
Lit[2]		Lebanon	2017	2	3	3					
IMAP_IS	445	Türkiye	2018	33	33	33		33	33	33	33
M. barbatus											
IMAP_IS	636	Cyprus#	2020	6	6	6		6	8	8	8
IMAP_IS	636	Cyprus#	2021	8	8	8		6	4	4	4
IMAP_IS	585[88]	Israel	2018	13	13	0					
IMAP_IS	410	Israel	2019	7	7	0					
IMAP_IS	588	Israel	2020	10	12	0					
IMAP_IS	152	Lebanon	2019	14	14	14		6	3		
IMAP_IS	323	Türkiye	2015	25	25	25	25^				

[1]Astrahan et al. 2017; [2]Ghosn et al, 2020; * Data for individual concentrations for all congeners are available; ^Data for 8 congeners available for 25 samples in 5 stations; # Additional data available for Hexachlorobenzene and DDE(p,p'). & Data from 2013 were used because no newer data were available; In addition, the stations are located offshore, at depths deeper than 100 m, so that temporal changes are not expected.

439. Based on the available data, the assessment was performed for TM, Σ16 PAHs and Σ7 PCBs in sediment and for TM in M. barbatus. In addition, the LEVS was assessed regarding Σ5 PAHs as well. This is not a mandatory parameter, but it was included in the assessment given data availability for Türkiye, that increased the coverage of the assessment over a larger area of the LEVS. Therefore, an exception was made to possibly increase confidence of the assessment. When possible, a qualitative description was provided for the additional parameters or stations.

Setting the GES/non-GES boundary value/threshold for the CHASE+ application in the LEVS.

440. The thresholds used for the CHASE+ assessment methodology were the updated sub-regional BACs .If the Sub-regional BAC was not available, the regional MED_BACs were used as thresholds in the present assessment. Table 3.1.4.1.2.b. summarizes the thresholds values, the same ones used in the assessment of AEGS sub-division within the Aegean Levantine Seas Sub-region (AEL).

[86] Replaced IMAP file 125
[87] Replaced IMAP file 410
[88] Replaced IMAP file 71

Table 3.1.4.1.2.b. Summary of the threshold values used in present pilot application for GES assessment of the Levantine and Aegean Seas sub-divisions. MedEACs are presented for comparison.

	AEL_BAC	**MED_BAC**	**MedEAC**
Sediments, µg/kg dry wt			
Cd	118	161	1200
Hg	47.3	75	150
Pb	23511	22500	46700
Σ_{16} PAHs	41	32	4022*
Σ_5 PAHs^	17.2	31.8	
Σ_7 PCBs	0.19	0.40	68+
***M. barbatus*, µg/kg wet wt**			
Cd	7.2	7.8	50
Hg	67.4	81.2	1000
Pb	27	36.6	300

* ERL value derived for the sum of 16 PAHs by Long et al., 1995, do not appear in the Decisions of COP; + sum of the individual MedEACs values of the 7 PCB compounds as they appear in Decision IG.23/6;^Values are not set by Decision IG.23/6, therefore the BAC value for Σ5 PAHs is calculated as a sum of the individual BAC values as provided for the 5 PAHs compounds.

Integration of the areas of assessment for the LEVS

441. The locations of the sampling stations are presented in Figures LEVS 3.1.4.1.1.C– LEVS 3.1.4.1.5.C.

442. The locations of the sampling stations were sorted by group of contaminants. TM, PAH and Organochlorinated contaminants in sediments for Lebanon and Türkiye were determined in samples collected from the same stations at the same date. PAHs in sediments from Israel were collected from stations different from the stations sampled for TM in sediments and at a different date. The sampling sites for the fish *M. barbatus* in Lebanon, Israel and Türkiye were located in the areas close to the sediment samples, but did not encompass one specific station, only a fishing area. In Cyprus, one of the two sampling sites for the fish *M. barbatus* was located close to sediment stations and one far from sediment stations.

443. Further to IMAP implementation, the monitoring stations were considered for grouping in the two main assessment zones i.e., the coastal (within 1 nm from the shore) and offshore zones. The sampling stations for TM in sediments for Israel can be considered all coastal, except 2 stations that can be considered offshore stations. In Lebanon, 5 out of 20 stations can be considered offshore stations. In Cyprus, 8 stations can be considered coastal and 3 stations as offshore. In Greece, 1 station was coastal and 3 stations were offshore stations. In Türkiye, four stations can be considered offshore stations. The stations in Iskenderun Bay, Antalya Bay, the bay off Mersin and Erdemli and inlets can be considered coastal stations. No stations with data for PAHs in sediments in Israel can be considered coastal i.e. there were 52 stations that can be considered offshore stations. The grouping of stations for PAHs and organochlorinated contaminants in sediments for Lebanon and Türkiye was the same as for TM. TM in *M. barbatus* were determined in samples collected from stations that can be considered offshore stations in Israel, Cyprus and Lebanon. In Türkiye all stations can be considered coastal, with exception of one station that can be classified as offshore station. Due to the limited number of data points, more so if dividing into coastal and offshore stations, the spatial nesting of stations in spatial assessment units (SAUs) to the level considered meaningful for IMAP CI 17 was not possible in LEVS. Spatial nesting would decrease the reliability and the representativeness of each station for the assessment of the Levantine Sea Sub-division. Therefore, at this stage, the assessment was based on specific stations irrespective of their positions either in offshore or coastal zones.

Results of the CHASE+ Assessment of CI 17 in the Levantine Sea Basin

444. For each measured parameter at each station a contamination ratio (CR) was calculated. Thresholds were the updated sub-regional AEL_BACs (Table 3.1.4.1.2.b.). CHASE+ methodology in the LEVS was provided without spatial integration and aggregation of the areas of assessment and assessment results. Instead, aggregation was possible only for TM in sediments and in *M. barbatus*. A contamination score (CS) aggregating 2-3 metals was further calculated. Table 3.1.4.1.3.b. summarizes the results of the CHASE+ application.

Table 3.1.4.1.3.b. Number of data points and their percentage from the total number of data points in each category based on the CHASE+ tool, calculated using the new AEL_BACs.

CHASE+		**Blue High**	**Green Good**	**Yellow Moderate**	**Brown Poor**	**Red Bad**
		NPA or GES		**PA or non-GES**		
Sediment	Total number of data points					
		CS=0.0-0.5	**CS =0.5-1.0**	**CS =1.0-2**	**CS =2-5**	**CS >5**
*Cd, Hg, Pb	83	19	38	24	2	0
% from total number of data points		*23*	*46*	*29*	*2*	*0*
		CR=0.0-0.5	**CR=0.5-1.0**	**CR =1.0-2**	**CR =2-5**	**CR>5**
Σ_{16} PAHs	75	45	16	7	3	4
% from total number of data points		*60*	*21*	*10*	*4*	*5*
Σ_5 PAHs	97	75	13	8	1	0
% from total number of data points		*77*	*14*	*8*	*1*	*0*
Σ_7 PCBs	52	18	20	3	4	7
% from total number of data points		*35*	*38*	*6*	*8*	*13*
M. barbatus	Total number of data points					
		CS=0.0-0.5	**CS =0.5-1.0**	**CS =1.0-2**	**CS =2-5**	**CS >5**
Cd, Hg, Pb	15	11	3	0	1	0
% from total number of data points		*73*	*20*	*0*	*7*	*0*

* Without anomalous Cd concentrations for Cyprus

Assessment of Trace metals in sediments of the LEVS

445. Data were reported for all the 3 TMs in 80 stations, while for 3 stations data were reported only for Cd and Pb. However, the concentrations of Cd in Cyprus were much higher than the MedBACs and even higher than the MedEAC agreed upon in Decision IG.23/6 (Table 3.1.4.1.2.b). In consultation with national representatives and experts of Cyprus, it was explained that although anomalously high, the concentrations are natural, probably due to specific local minerology. Therefore, Cd concentrations in sediments from Cyprus were excluded from this updated assessment, as in the pilot assessment of the LEVS .

446. Out of the 83 stations, 57 (69%) were in-GES (high and good statuses) and 26 (31%) in non-GES classification. Out of the 26 non-GES stations, 24 were classified as in moderate status, with 4 stations borderline to good (green) status (CSs of 1.00-1.01) (Table 3.1.4.1.3.b; Figure LEVS 3.1.4.1.1.C.). Two stations were classified as in poor status. It should be mentioned that the moderate status is the least affected status among the 3 PA (corresponding to non-GES) classification. Examination of the CRs for the individual metals found that 21% of the stations were non-GES regarding Cd, 21% of the stations were non-GES regarding Hg and 7% of the stations were non-GES regarding Pb.

447. The non-GES stations were present in all the countries that reported data: Cyprus, Greece, Israel, Lebanon and Türkiye. A detailed examination of the CSs and CRs (Table 3.1.4.1.3.b) found that stations in moderate status in Cyprus were located in Larnaka Bay, off Zygi and in Chrisochou Bay. Pb concentration in sediments contributed to classification in the moderate status[89]. In Greece, two stations were found in moderate status (Koufonisi (S. Crete), Kastelorizo), with Pb and Cd concentrations contributing to this classification. In Israel, the area classified as moderate status was limited to the northern part of Haifa Bay and concentration of Hg contributed to this classification. The area is known to be still contaminated by legacy Hg, even though there was a vast improvement of the environmental status following pollution abatement measures (Herut et al, 2016, 2021). In Lebanon, the main area in moderate status was off Beirut, in particular the Dora region (with two station in bad status), followed by area in the North Lebanon, with Cd and Hg concentrations contributing equally to the moderate classification. The Beirut area is densely populated and industrialized (Ghosn et al., 2020). In Türkiye, 4 stations were classified as in moderate status: Akkuyu, Taşucu, Anamur, Göksu River mouth. The concentration of Hg contributed to this classification.

448. The decision rule for application of the CHASE + assessment methodology recommends that only if at least 75% of the stations are in-GES, the area should be considered in-GES. Therefore, the northern and eastern LEVS should be classified as non-GES regarding TM in sediments, i.e. in moderate status, as only 69% of the stations were in GES (Figure LEVS 3.1.4.1.1.C**)**.

449. This classification is a result of the contribution from the 2 very limited affected areas i.e., (1) seven stations in the Northern Haifa Bay, and 2) three stations in the Dora region (Beirut). When data from these affected areas, that constitute less than 0.1% of the LEVS, are not taken into account, then 78% of the stations (57 out of 73 stations) are in GES, and the northern and eastern LEVS can be classified as in GES. These 57 stations are distributed evenly across the northern and eastern LEVS, providing a good coverage of this area of the sub-division.

[89] Local minerology should be studied to decide if the high values are anthropogenic or originate from natural sources as for Cd

450. In brief, it can be stated that regarding TM in sediments, non-GES stations were identified across the northern and eastern LEVS and the area was assessed as non-GES, i.e., in moderate status. No assessment could be performed for the southern LEVS as no data were available. When the contribution of two very limited affected areas i.e. (1) the Northern Haifa Bay, and 2) the Dora region (Beirut) are not taken into account, the northern and eastern LEVS can be classified as in-GES

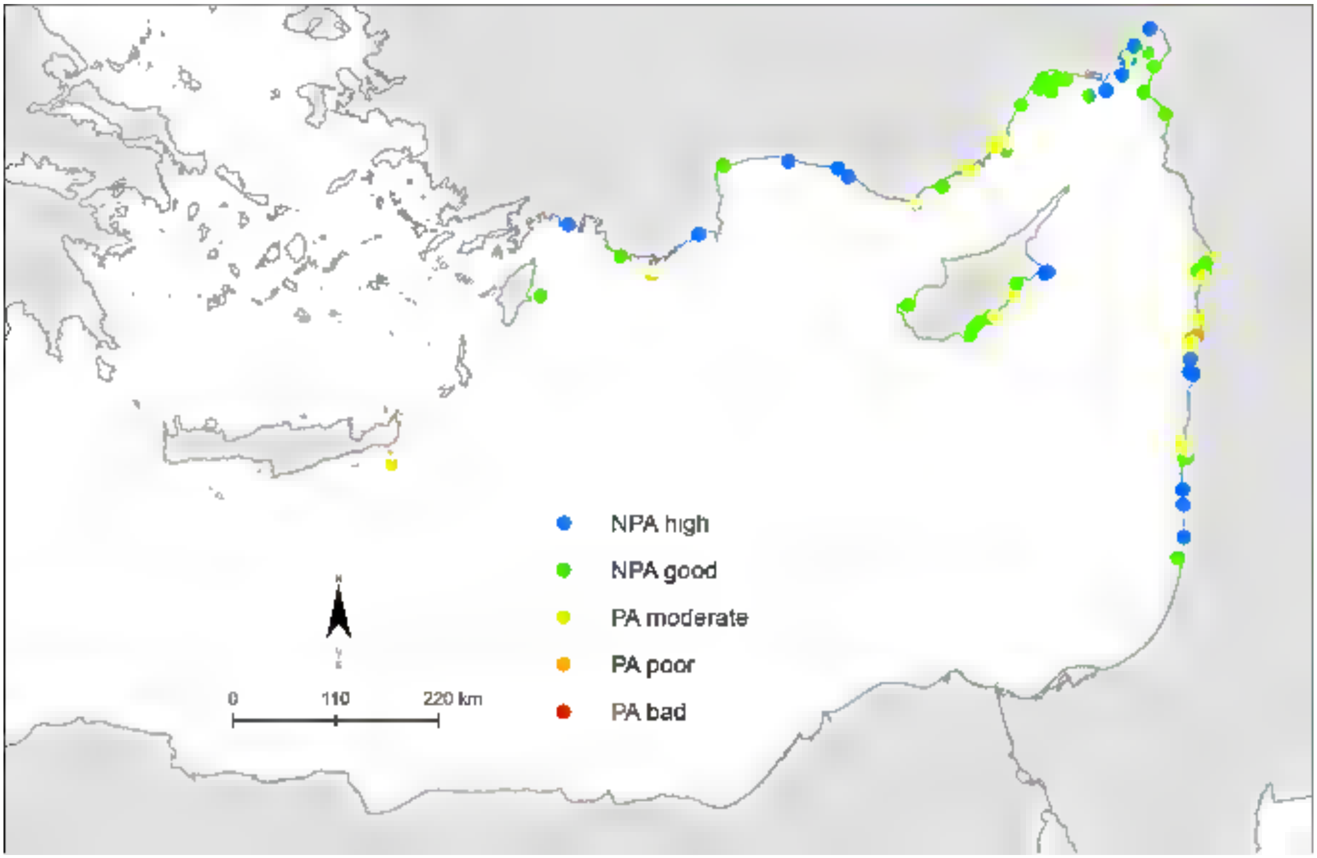

Figure LEVS 3.1.4.1.1.C. Results of the CHASE+ assessment methodology application to assess the environmental status of TM in sediments in the LEVS, using AEL_BACs as thresholds. Stations in blue - NPAhigh (CS=0.0-0.5); stations in green- NPAgood (CS =0.5-1.0); Stations in yellow- PAmoderate (CS =1.0-2.0); stations in brown - PApoor (CS =2.0-5.0) and stations in red - PAbad (CS > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES.

Assessment of Σ_{16} PAHs and of Σ_5 PAHs in sediments of the LEVS

451. Σ_{16} PAHs in sediments: There were 75 stations with data for Σ_{16} PAHs in sediments reported by Greece, Israel and Lebanon. Out of the 75 stations, 61 (81%) were classified in-GES in high and good statuses and 14 (19%) stations classified as non-GES (Table 3.1.4.1.3.b; Figure LEVS 3.1.4.1.2.C.). Out of the non-GES stations, 7 stations were classified as moderate, 3 stations as poor and 4 stations as in bad status.

452. There was no large specific area with non-GES status. Two small, geographically limited areas with non-GES status were identified i.e., one in Israel, at stations close to the locations of drilled wells for gas exploration (Astrahan et al., 2017) and one off in Beirut, in Lebanon. Two stations in Greece, off Lindos and Kastelorizo were also classified in moderate status.

453. Data on Σ_{16} PAHs in sediments were not distributed evenly across the LEVS, therefore the sub-division could not be assessed regarding Σ_{16} PAHs concentrations in sediments. As more than 75% of the stations were in GES it is possible to classify the areas with available data as in-GES. Given the limited data availability no conclusion could be provided on GES status at the level of the Levantine Sea Basin.
454. In brief, it can be stated that given the limited data availability, it was not possible to classify the LEVS Sub-division regarding data reported for Σ_{16} PAHs in sediments. As more than 75% of the stations were in GES, it is possible to classify the areas with available data as in-GES regarding Σ_{16} PAHs in sediments.

455. <u>Σ_5 PAHs in sediments:</u> There were 97 stations with data for Σ_5 PAHs in sediments, reported by Cyprus, Greece, Israel and Türkiye. Although Σ_5 PAHs is not a mandatory parameter for CI 17, the assessment based on it was performed due to significant more data availability for Σ_5 PAHs compared to Σ_{16} PAHs encompassing a larger assessment area of the LEVS. Therefore, an exception was made in order to increase confidence of the assessment. Out of the 97 available stations, 88 (91%) were classified as in-GES (75 stations in high status and 13 in good status) and 9 stations (9%) were classified as non-GES, 8 in moderate status and 1 in poor status (Table 3.1.4.1.3.b; Figure LEVS 3.1.4.1.3.C).Therefore, the northern and the eastern part of the LEVS can be classified as in-GES regarding Σ_5 PAHs in sediments.

456. In brief, it can be stated that the northern and the eastern part of the LEVS can be classified as in GES regarding Σ_5 PAHs in sediments.

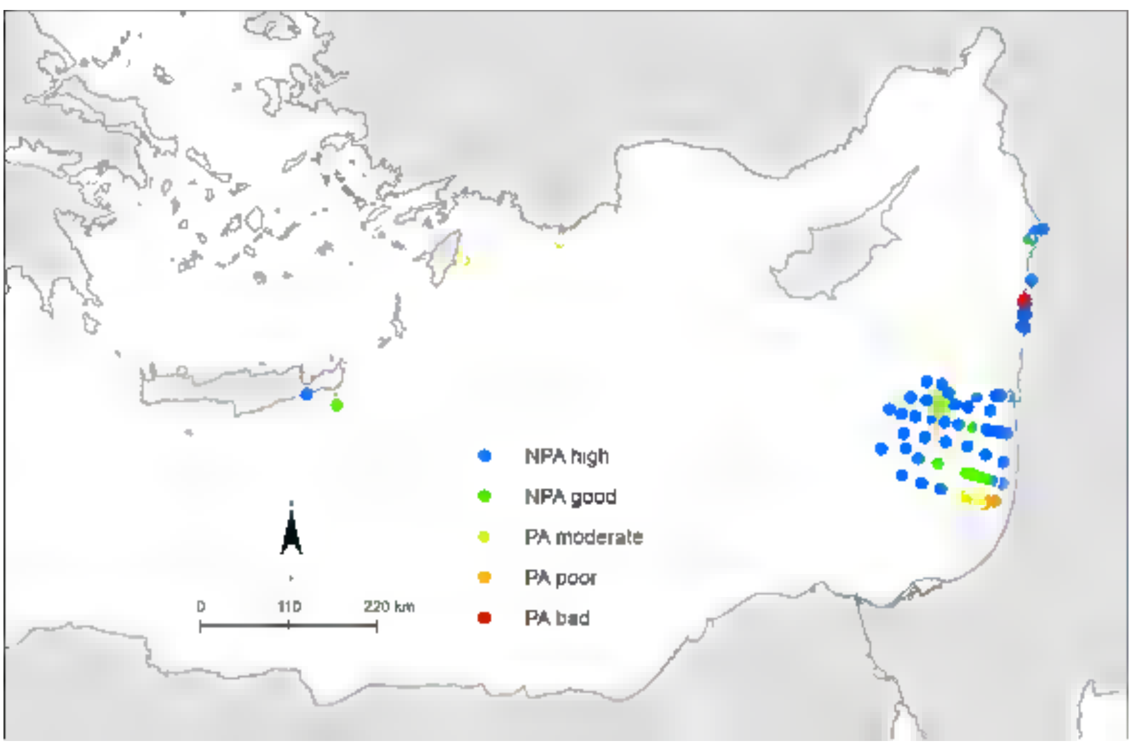

Figure LEVS 3.1.4.1.2.C. Results of the CHASE+ assessment methodology application to assess the environmental status of Σ_{16} PAHs in sediments in the LEVS, using AEL_BACs as thresholds. Stations in blue - NPAhigh (CR=0.0-0.5); stations in green- NPAgood (CR =0.5-1.0); Stations in yellow- PAmoderate (CR =1.0-2.0); stations in brown - PApoor (CR =2.0-5.0) and stations in red - PAbad (CR > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES.

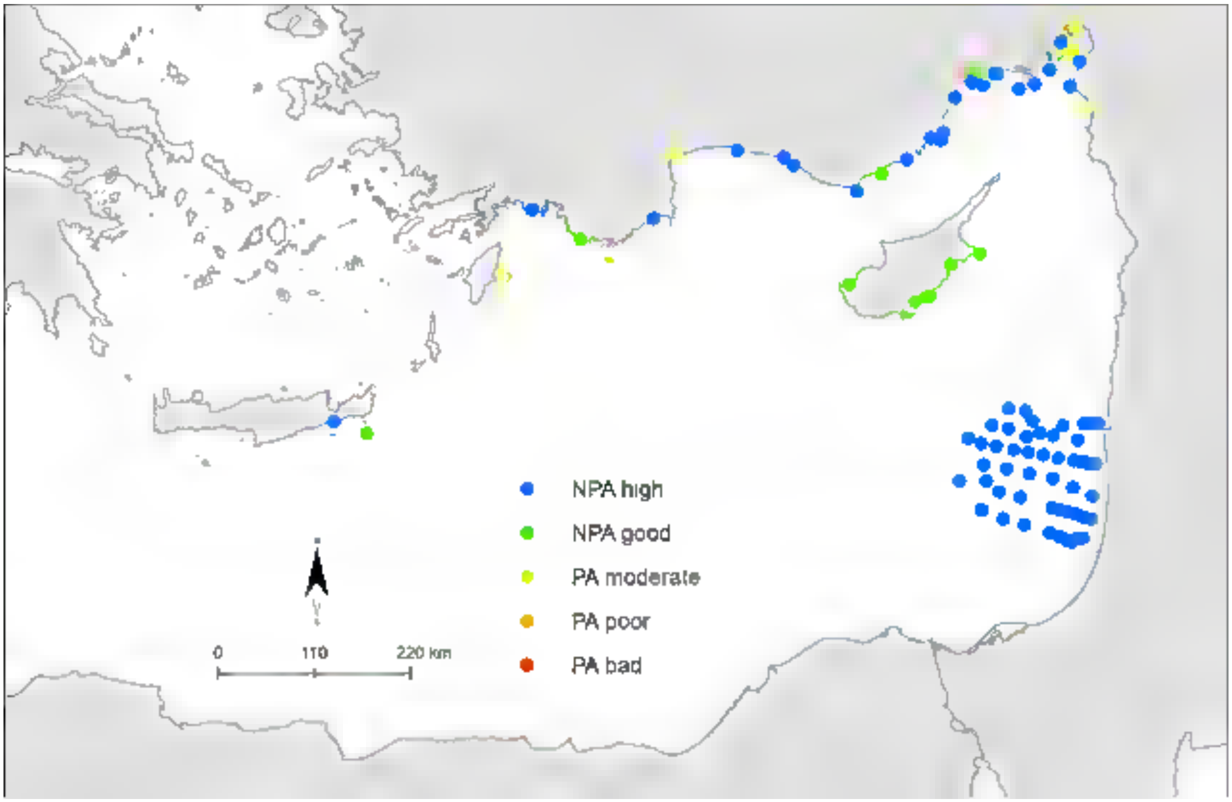

Figure LEVS 3.1.4.1.3.C. Results of the CHASE+ assessment methodology application to assess the environmental status of Σ_5 PAHs in sediments in the LEVS, using AEL_BACs as thresholds. Criteria for Σ_5 PAHs were not adopted in Decisions IG.22/7 and IG.23/6 (COP 19 and COP 20) and not addressed in UNEP/MED WG. 533/3. Here we used the sum of the individual BAC values as provided for the 5 PAHs compounds in UNEP/MED WG. 533/3 as Σ_5 PAHs_BAC. Stations in blue - NPAhigh (CR=0.0-0.5); stations in green- NPAgood (CR =0.5-1.0); Stations in yellow- PAmoderate (CR =1.0-2.0); stations in brown - PApoor (CR =2.0-5.0) and stations in red - PAbad (CR > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES.

Assessment of Σ7 PCBs in sediments and in M. barbatus of the LEVS

457. Data on Σ_7PCBs in sediments were reported only by Lebanon (19 stations) and Türkiye (33 stations). Out of the 52 stations, 38 (73%) were classified in-GES and 14 stations (27%) were classified as non-GES. Out of the non-GES stations, 3 were in moderate status, 4 in poor status and 7 in bad status (Table 3.1.4.1.3.b; Figure LEVS 3.1.4.1.4.C.).

458. Data on Σ7PCBs in 12 samples of M, barbatus were reported by Cyprus. All data were bdl,

459. The non-GES stations were located mainly at the Dora region (Beirut), as for TM in sediments, but also in additional stations. However, given the limited data availability no conclusion could be provided on environmental status of the LEVS concerning Σ_7 PCBs in sediments.

460. In brief, it can be stated that the LEVS sub-division could not be classified based on assessment of Σ_7 PCBs in sediments due to lack of data and their uneven spatial distribution for sediments and essentially no data for *M. barbatus*. A few affected areas for sediments could be indicated.

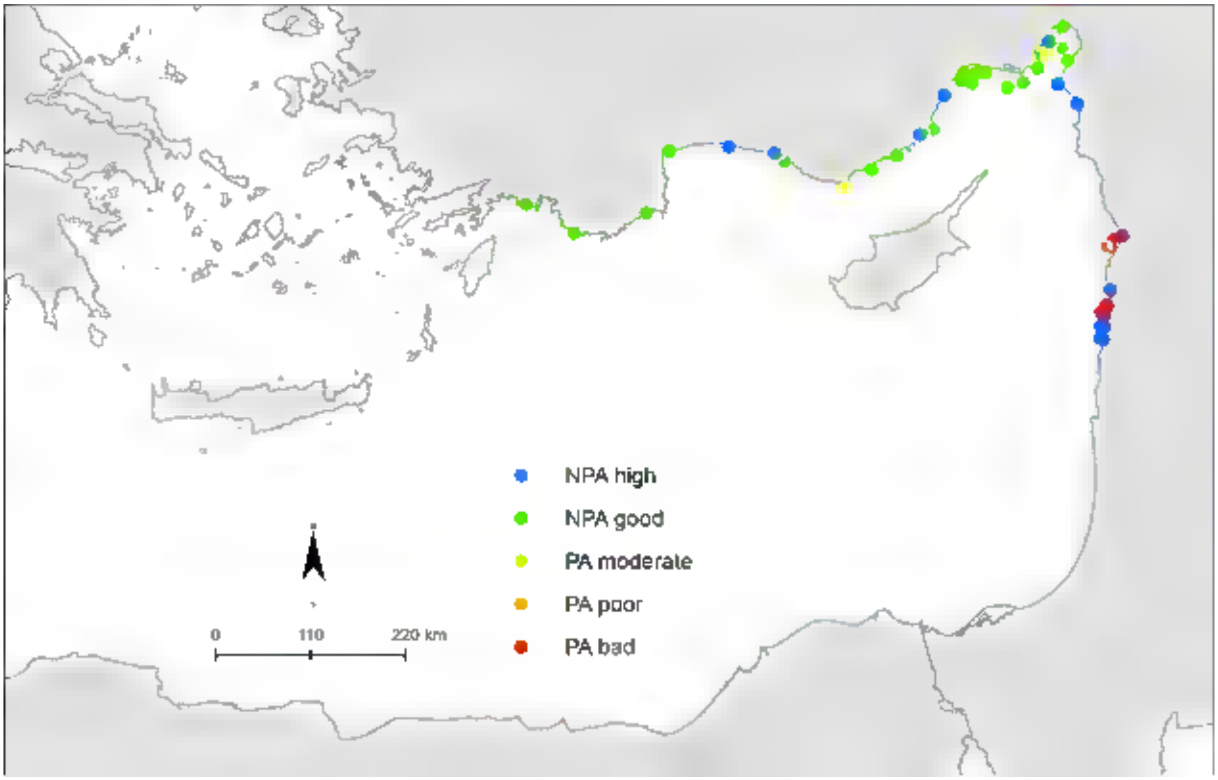

Figure LEVS 3.1.4.1.4.C. Results of the CHASE+ assessment methodology application to assess the environmental status of Σ_7 PCBs in sediments in the LEVS, using AEL_BACs as thresholds. Stations in blue - NPAhigh (CR=0.0-0.5); stations in green- NPAgood (CR =0.5-1.0); Stations in yellow-PAmoderate (CR =1.0-2.0); stations in brown - PApoor (CR =2.0-5.0) and stations in red - PAbad (CR > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES

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Assessment of Organochlorinated contaminants other than PCBs in sediments and M. barbatus of the LEVS

461. Sediment. Data for Organochlorinated contaminants other than PCBs were reported only by Türkiye. Dieldrin in all 33 stations were below detection limit (reported as 0 µg/kg dry wt) while data for γ-HCH (Lindane) ranged from below detection limit to 0.14 µg/kg dry wt with both average and median concentrations of 0.05 µg/kg dry wt. The BAC value is not set for Lindane. Only EAC of 3 µg/kg dry wt was adopted by Decision IG.22/7. The concentrations reported for Lindane were well below the EAC value.

462. *M. barbatus*. Cyprus reported concentrations of Dieldrin, Lindane, Hexachlorobenzene, p,p'DDE and Σ_7PCBs in 12 samples of *M. barbatus*. All data, except one data point for Σ_7PCBs were bdl. Lebanon reported 3 data points for total PCBs, with concentrations in the range of 122-306 µg/kg dry wt. No BACs were calculated for these organochlorinated contaminants in *M. barbatus* due to lack of data .

463. It can be concluded that the LEVS Sub-division could not be classified based on assessment of organochlorinated contaminants other than PCBs in sediments and in *M. barbatus*.

Assessment of Trace metals in M. barbatus of the LEVS

464. TM in *M. barbatus* were available at15 stations from Cyprus, Israel, Lebanon and Türkiye. As explained above, the CHASE+ assessment was performed based on average concentrations calculated for specimens sampled at the same station in different years.

465. Out of 15 stations, 14 (93%) were classified in-GES and 1 (7%) station as non-GES in poor status. The station in poor status was located off Paphos and this classification was due to the concentration of Hg.

466. The assessment of Trace metals in M. barbatus of the LEVS is shown in Figure LEVS 3.1.4.1.5.C.

467. The northern and the eastern part of the LEVS can be classified as in-GES concerning TM in *M. barbatus* (Figure LEVS 3.1.4.1.5.C).

468. In brief, it can be stated that the northern and the eastern part of the LEVS can be classified as in-GES concerning TM in *M. barbatus* (Figure LEVS 3.1.4.1.5.C).

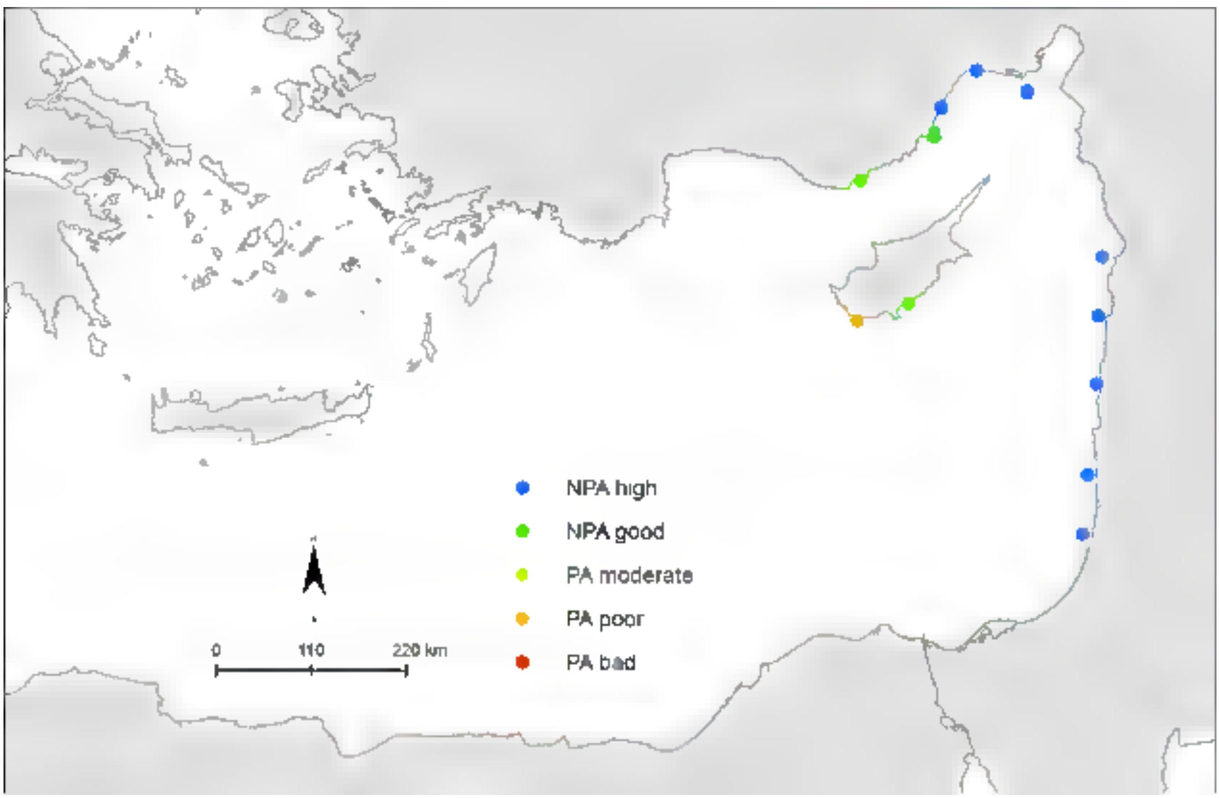

Figure LEVS 3.1.4.1.5.C. Results of the CHASE+ assessment methodology application to assess the environmental status of TM in *M. barbatus* in the LEVS, using AEL_BACs as thresholds. Stations in blue - NPAhigh (CS=0.0-0.5); stations in green- NPAgood (CS =0.5-1.0); Stations in yellow- PAmoderate (CS =1.0-2.0); stations in brown - PApoor (CS =2.0-5.0) and stations in red - PAbad (CS > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES.

2.1.1.1 The IMAP GES assessment of the Central Mediterranean (CEN) Sub-region

469. Due to insufficient data, the two sub-divisions of the CEN, the Ionian Sea (IONS) and Central Mediterranean Sea (CENS) were assessed together, by applying the CHASE+ (Chemical Status Assessment Tool) methodology, and stressing possible similarities/differences between them, if available.

<u>*Available data*</u>

470. Data for the CEN sub-region were very limited. Table 3.1.4.2.1.summarizes data availability. Trace metals (TM – Cd, Hg and Pb) in sediments were available for 22 stations in Malta, 12 for 2017 and 10 for 2018, belonging to the CENS sub-division, and data for Cd and Pb were available for 4 stations in Greece for 2020, 2 belonging to the IONS sub-division and 2 to the CENS. Concentrations of Σ_{16} PAHs in sediments were available for 21 stations in Greece (20 in the IONS, 1 in CENS), 18 from 2019 and 3 from 2018; and for 5 stations in Tunisia (CENS) for 2019 (Jebara et al. 2021). For Malta (CENS), data for Σ_5 PAHs[90] in sediments were available for 15 stations sampled in 2017 and 10 stations sampled in 2018. Concentrations of total PCBs. i.e. Σ_7 PCBs[91] and individual concentrations for each PCB congener, were reported in sediments for the same 5 stations in Tunisia as for Σ_{16} PAHs (Jebara et al. 2021). Malta reported concentrations of hexachlorobenzene in sediments for 22 stations. Data for trace metals in the fish *M. barbatus* were available for 3 samples from 2017 and 2 samples from 2019 in Malta (CENS). In addition, data for TM in the mussel *M. galloprovincialis* from 2016 and 2017 were retrieved from data reported by Italy to EMODNet: 4 samples with Cd and Pb concentrations and 8 with Hg concentrations.

Table 3.1.4.2.1. Data availability per year and country for the assessment of EO 9 – CI 17 (contaminants) in the Central Mediterranean (CEN) Sub-region, as available by 31st October 2022.

Source	IMAP-File	Country	Sub-division	Year	Cd	Hg	Pb	Σ_{16} PAHs	Σ_5 PAHs	Σ_7 PCBs
Sediment										
IMAP-IS	652	Greece	IONS	2018				2	2	
IMAP-IS	652	Greece	CENS	2018				1	1	
IMAP-IS	652	Greece	IONS	2019				18	18	
IMAP-IS	652	Greece	IONS	2020	2	0	2			
IMAP-IS	652	Greece	CENS	2020	2	0	2			
IMAP-IS	489	Malta	CENS	2017	12	12	12		15	
IMAP-IS	489	Malta	CENS	2018	10	10	10		10	
Lit[1]		Tunisia	CENS	2019				5		5
M. galloprovincialis										
EMODNet		Italy	CENS	2016		2				
EMODNet		Italy	CENS	2017	4	6	4			
M. barbatus										
IMAP_IS	489	Malta	CENS	2017	3	3	3			
IMAP_IS	489	Malta	CENS	2019	2	2	2			

[1]Jebara et al., 2021

[90] Σ_5 PAHs is the sum of the concentrations of Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene and Benzo(ghi)perylene. Σ_5 PAHs is a non-mandatory parameters for CI 17, whereby Σ_{16} PAHs, is a mandatory parameter.

[91] PCBs congeners 28,52,101,118,132,153,180

471. Data were compiled from the IMAP-IS, as of 31st October 2022. Additional data from the scientific literature (Jebara et al, 2021) and from EMODNet were also used.

472. Based on the available data, the assessment was performed for TM and Σ_{16} PAHs in sediment. In addition, the CEN was assessed based on Σ_5 PAHs in sediments as well. This is not a mandatory parameter, but was included here given significant more data available for Σ_5 PAHs compared to Σ_{16} PAHs (48 vs 28 data points, respectively) encompassing a larger area of the CEN. Therefore, an exception was made to possibly increase confidence of the assessment. A very limited assessment was provided also for the additional parameters: Σ_7 PCBs in sediments, TM in *M. barbatus* and in *M. galloprovincialis* due to the small amount of data available. The 2023 MED QSR needs to be based on data reported as of 2018 onward. However, given limited data availability, an exception was made and data available for 2016 and 2017 were also used in order to increase reliability of the assessment.

<u>Setting the GES/non GES boundary value/threshold for the CHASE+ application in the CEN</u>

473. The thresholds used for the CHASE+ assessment methodology were the updated Mediterranean regional BACs. Table 3.1.4.2.2. summarizes the thresholds values. For most parameters, the sub-regional BACs were not available . Namely, for sediments, only one CEN_BAC is available for TM (Pb), and for Σ_{16} PAHs. Regarding biota matrix, sub-regional CEN_BACs are not available for TM in *M. barbatus*, while for *M. galloprovincialis*, the CEN_BACs are available for Cd and Hg. By having only 4 CEN BACs, it was impossible to ensure homogenous assessment by combing sub-regional and regional BACs, in particular because the sub-regional BACs were calculated with a few data points[92]. For this reason, an exception was made for the CEN assessment and it was decided to use only the Mediterranean regional MED_BACs as thresholds in the assessment. It should also be noted that the four sub-regional CEN_BACs are about one order of magnitude lower than the MED_BACs.

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[92] The CEN sub-region, BACs are multiplications of the BCs :

- It was possible to calculate BC for Pb (in sediments) at the CEN sub-region in 2022, however with only 29 data points. The BC value for Pb in CEN was about one order of magnitude lower than the BCs calculated for the other sub-regions and should be re-examined when additional data will be available (Paragraph 38).
- Σ_{16} PAHs in sediments. The lowest values were calculated for the CEN, however the number of data points was low and not representative (Paragraph 39).
- TM in *M. galloprovincialis* A few data points (4 for Cd and 8 for Hg with 4 Pb, all BDL) were available for the CEN. The calculated BCs were lower than in the other sub-regions, however, the few data is not representative of the CEN (Paragraph 40).
- TM in *M. barbatus*. There were 5 data points available for the CEN, however Cd and Pb were all BDL while the median Hg concentration was 152 µg/kg wet wt, much higher than in the other sub-regions. Given the lack of data for the CEN, it was not possible to propose values for BC in this sub-region, therefore it is suggested to use the regional MED BC values for GES assessment (Paragraph 40).

Table 3.1.4.2.2. Summary of the threshold values (MED_BACs) used in application for GES assessment of the Central Mediterranean Sea sub-division. Available CEN_BAC and MedEAC values are given for comparison.

	CEN_BAC	MED_BAC	MedEAC
Sediments, µg/kg dry wt			
Cd	#	161	1200
Hg	#	75	150
Pb	2708	22500	46700
Σ_{16} PAHs	9.5	41	4022*
Σ_5 PAHs^	#	31.8	
Σ_7 PCBs	#	0.40	68+
***M. barbatus*, µg/kg wet wt**			
Cd	#	7.8	50
Hg	#	81.2	1000
Pb	#	36.6	300
***M. galloprovincialis*, µg/kg dry wt**			
Cd	117&	1065	5000
Hg	18.5&	117	2500
Pb	#	1650	7500

BACs not available for CEN (UNEP/MED WG.533/3). & Based on 4-8 data points, * ERL value derived for the sum of 16 PAHs by Long et al., 1995, do not appear in the Decisions of COP. + Sum of the individual MedEACs values of the 7 PCB compounds as they appear in Decision IG.23/6.^Values do not appear in Decisions of COP. Calculated as a sum from the individual BAC values for each or the 5 PAHs compounds.

Integration of the areas of assessment for the CEN

474. The locations of the sampling stations/ areas are presented in Figures CEN 3.1.4.2.1.C. – CEN 3.1.4.2.3.C.

475. The locations of the sampling stations were sorted by group of contaminants and matrix. As explained above, data were available mainly for the sediment matrix, with a few data points for TM in the fish M. barbatus and the mussel M. galloprovincialis.

476. Further to IMAP implementation, the monitoring stations were considered for grouping in the two main assessment zones i.e., the coastal (within 1 nm from the shore) and offshore zones. All the sediment stations reported by Malta were classified as coastal while the stations where M. barbatus specimens were collected were classified as offshore. The 5 sediment stations from Tunisia were classified as coastal (Jebara et al., 2021). For Greece, 11 sediment stations were classified as coastal and 11 as offshore stations. Six of the offshore stations were located in semi-enclosed areas. M. galloprovincialis in Italy (data from EMODNet) were collected from one coastal location and three offshore locations.

477. Due to the limited number of data points, more so if dividing into coastal and offshore stations, the spatial nesting of stations in spatial assessment units (SAUs) to the level considered meaningful for IMAP CI 17 was not possible in the CEN. Spatial nesting would decrease the reliability and the representativeness of each station for the assessment. Therefore, at this stage, the assessment was based on specific stations irrespective of their positions either in offshore or coastal zones.

Results of the CHASE+ Assessment of CI 17 in the the Central Mediterranean Sub-division.

478. For each measured parameter at each station a contamination ratio (CR) was calculated. Thresholds were the MED_BACs as explained above. CHASE+ assessment methodology in the CEN was provided without spatial integration and aggregation of the areas of assessment and assessment results. Instead, aggregation was possible only for TM in sediments, and only partially. A contamination score (CS) aggregating 2-3 metals was further calculated. Table 3.1.4.2.3 summarizes the results of the CHASE+ application, while detailed calculation of the assessment results is presented in Figures CEN 3.1.4.2.1.C. – CEN 3.1.4.2.3.C.

Table 3.1.4.2.3. Number of data points and their percentage from the total number of data points in each category based on the CHASE+ tool, calculated using the proposed new MED_BACs.

CHASE+		**Blue High**	**Green Good**	**Yellow Moderate**	**Brown Poor**	**Red Bad**
		NPA or GES		**PA or non-GES**		
Sediment	Total number of data points					
		CS=0.0-0.5	**CS =0.5-1.0**	**CS =1.0-2**	**CS =2-5**	**CS >5**
Cd, Hg, Pb	26*	23	0	1	0	2
% from total number of data points		*88*	*0*	*4*	*0*	*8*
		CR=0.0-0.5	**CR=0.5-1.0**	**CR =1.0-2**	**CR =2-5**	**CR>5**
Σ_{16} PAHs	26	12	4	4	5	1
% from total number of data points		*46*	*15*	*15*	*19*	*4*
Σ_5 PAHs	46	25	6	5	6	4
% from total number of data points		*55*	*13*	*11*	*13*	*9*

* 4 stations with Cd and Pb only.

Assessment of Trace metals in sediments of the CEN

479. Data for TM were available for 26 stations: 22 from Malta with all three TM (Cd, Hg and Pb) and 4 from Greece with Cd and Pb only. Most stations (23) were classified in high status (Figure 3.1.4.2.1.C). One station, in the IONS offshore, was classified in moderate status due to the concentration of Cd. Two stations were classified in poor status due to the high concentrations of Hg and Pb. These two stations were located at the Port il- Kbir off Valetta, an area affected by industrial plants and marine traffic.

480. Although most of the stations (88%) were in-GES, it is not possible to classify the Sub-region nor the sub-division as a whole. Twenty-two sampling stations were located along the coast of Malta (CENS), 2 on the offshore area of the IONS and 2 on the offshore of the CENS. Due to the uneven distribution of the stations, it is not possible to assess an environmental status to the whole sub-region regarding TM in sediments.

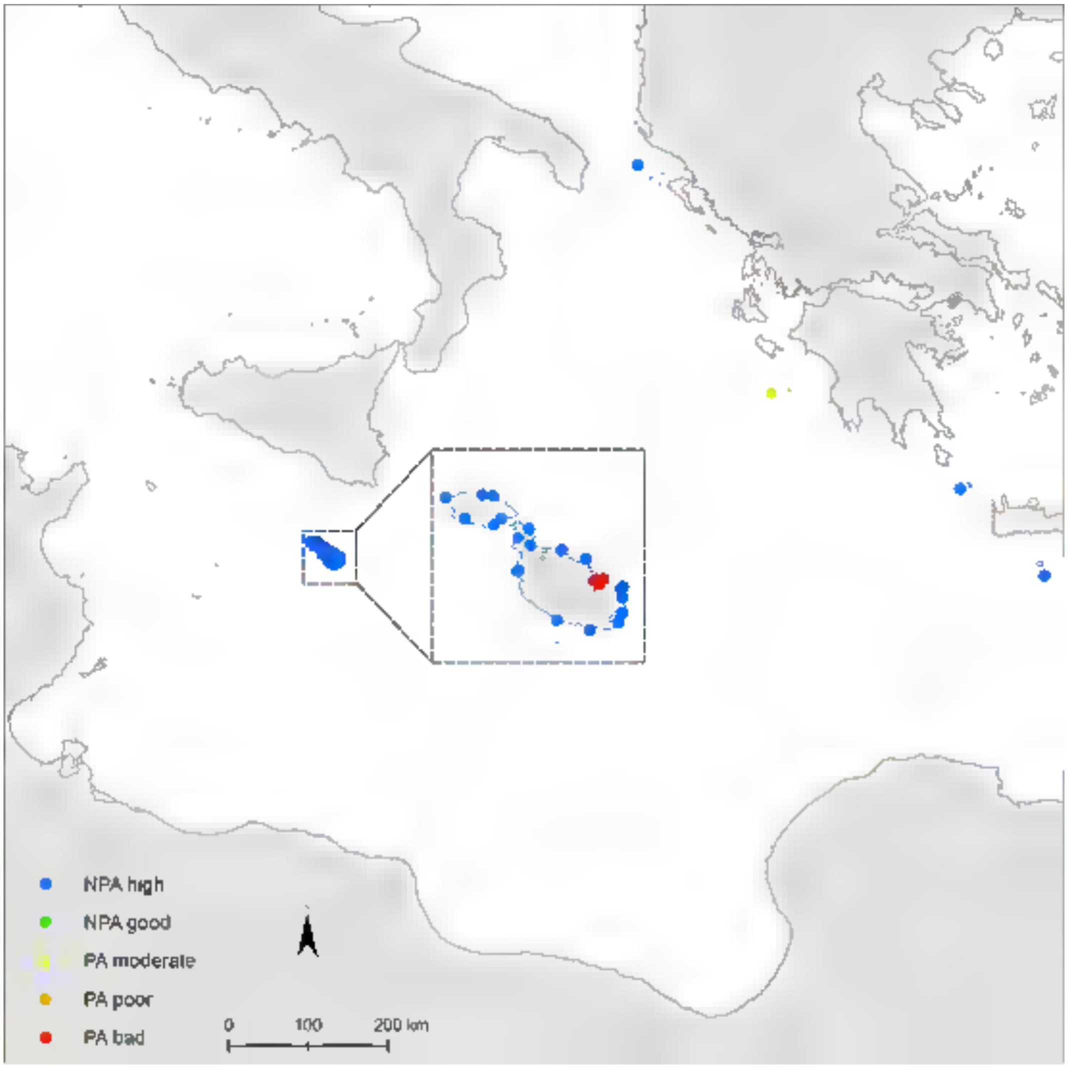


Figure CEN 3.1.4.2.1.C. Results of the CHASE+ approach to assess the environmental status of TM in sediments in the CEN, using MED_BACs as thresholds. Stations in blue - NPAhigh (CS=0.0-0.5); stations in green- NPAgood (CS =0.5-1.0); Stations in yellow- PAmoderate (CS =1.0-2.0); stations in brown - PApoor (CS =2.0-5.0) and stations in red - PAbad (CS > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES. The coastal area of Malta was enlarged to improve visibility and clarity (i.e. area delimited by broken line).

Assessment of Σ_{16} PAHs and of Σ_5 PAHs in sediments of the CEN

481. *Σ_{16} PAHs in sediments* were available only for 21 stations in Greece (20 in the IONS, 1 in CENS) and 5 stations in Tunisia (CENS)[93]. All the stations in Tunisia were classified in-GES and assigned a high environmental status. Out of the 21 stations reported by Greece, 12 stations (52%) of the stations were in-GES and 10 were non-GES (48%), with 4 stations in moderate status, 5 stations in poor status

[93] Jebara et al., 2021

and 1 station in bad status (Figure 3.1.4.2.2.C). The non-GES stations were located along the eastern Ionian coast, in the Gulf of Patras and the Gulf or Corinth, with 4 stations in poor status and one station in bad status in Kerkyraiki.

482. In brief, due to the lack of data it was impossible to classify the environmental status of the CENS sub-divisions nor of the CEN Sub-region for Σ_{16} PAHs in sediments. Non-GES stations were located in the Gulf of Patras, Gulf or Corinth and in Kerkyraiki.

483. *Σ_5 PAHs in sediments* were available only for 21 stations in Greece (20 in the IONS, 1 in CENS) and 25 stations in Malta (CENS). The classification of the stations reported by Greece were better using Σ_5 PAHs compared to Σ_{16} PAHs: 16 stations (76%) of the stations were in-GES and 5 were non-GES (24%), with 3 stations in moderate status, 2 stations in poor status and no station in bad status. Non-GES stations were located in the Gulf of Patras, Gulf or Corinth and in Kerkyraiki. Out of the 25 stations reported by Malta, 15 stations (60%) of the stations were in-GES and 10 were non-GES (24%), with 2 stations in moderate status, 4 stations in poor status and 4 stations in bad status (Figure CEN 3.1.4.2.3.C). The non-GES stations were located at the north-eastern and south-eastern part of Malta, in particular two stations were located at the Port il- Kbir off Valetta, an area affected by industrial plants and marine traffic, and impacted by TM in sediments as well, as explained for Trace metals. Two additional stations in bad status were located at the Operational Wied Ghammieq, affected by industrial plants. However, due to the lack of data and uneven distribution of the stations it was not possible to classify the environmental status to the whole sub-division nor the sub-region with respect to Σ_5 PAHs in sediments. It must also be noted that in the absence of data reported for Σ_{16} PAHs, as mandatory parameter, these initial findings were provided as indicative for Σ_5 PAHs, as non-mandatory parameter reported by the two CPs.

484. In brief, due to the lack of data and uneven distribution of the stations it was impossible to classify the environmental status of the whole sub-division nor the sub-region with respect to Σ_5 PAHs in sediments. Stations with non-GES status were located in Port il- Kbir off Valetta, Operational Wied Ghammieq, in the Gulf of Patras, Gulf or Corinth and in Kerkyraiki.

Assessment of Σ_7 PCBs in sediments of the CEN

485. Σ_7 PCBs in sediments were available only for 5 stations in Tunisia (CENS)[94]. Four of the stations were classified in-GES, in good status while only one, Chebba, was classified as non-GES, in moderate status. Concentrations of all individual PCBs were higher at the location of Chebba than those from other locations, which could be linked to the discharge of wastewater from the neighboring fishing port in this area (Jebara et al., 2021).

486. The meagre data on Σ_7 PCBs in sediments in the CEN does not allow for the regional assessment of the CEN nor of its sub-divisions.

[94] Jebara et al., 2021

Assessment of Organochlorinated contaminants other than Σ_7 PCBs in sediments of the CEN

487. Malta reported the concentration of hexachlorobenzene in sediments, one of the mandatory organochlorine contaminants, for 22 stations. All the concentrations were below the detection limit of 0.05 µg/kg dry wt.

488. Given only Malta reported the concentration of hexachlorobenzene in sediments, one of the mandatory organochlorine contaminants, only this compound could not be used for GES assessment.

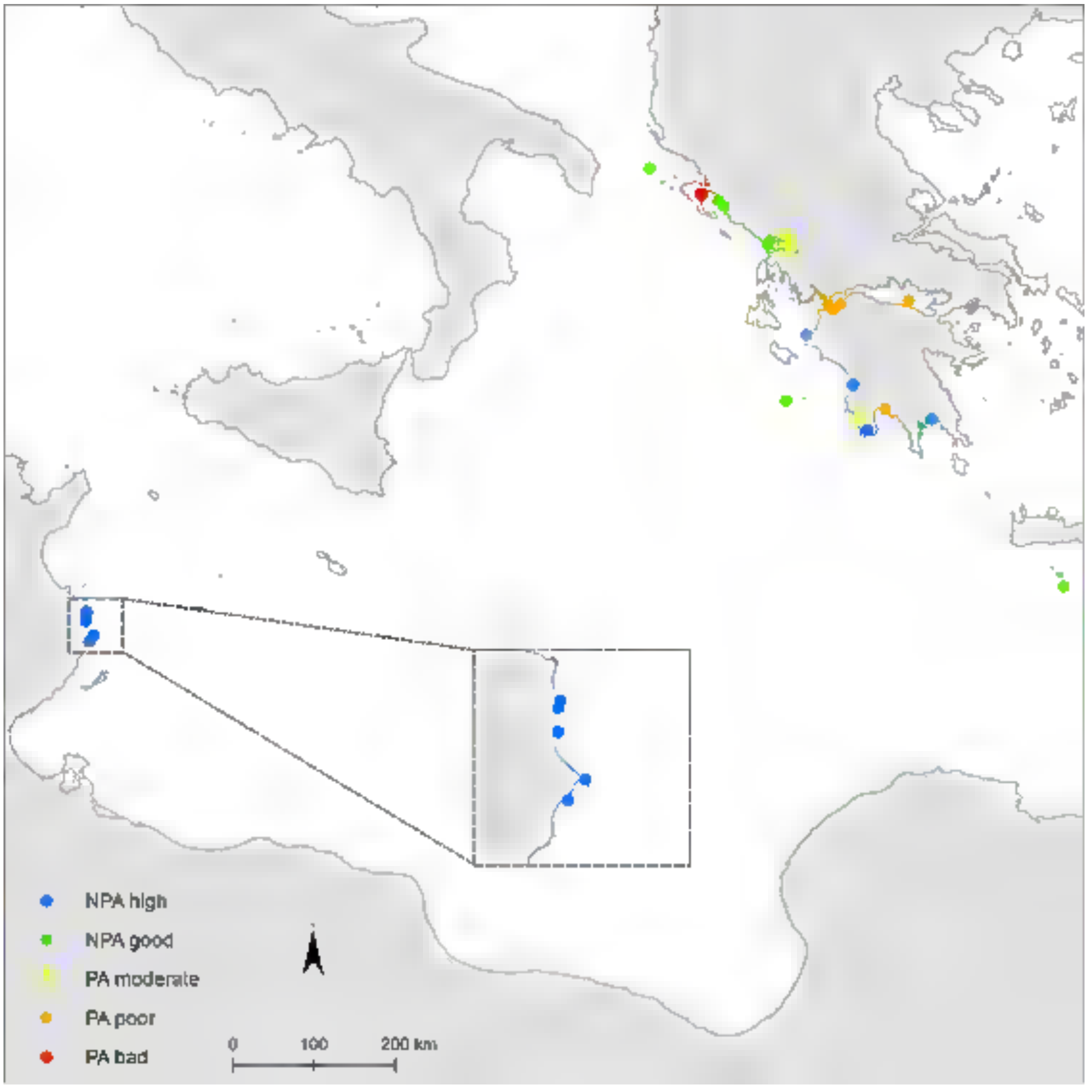


Figure CEN 3.1.4.2.2.C. Results of the CHASE+ approach to assess the environmental status of Σ_{16} PAHs in sediments in the CEN, using MED_BACs as thresholds. Stations in blue - NPAhigh (CR=0.0-0.5); stations in green- NPAgood (CR =0.5-1.0); Stations in yellow- PAmoderate (CR =1.0-2.0); stations in brown - PApoor (CR =2.0-5.0) and stations in red - PAbad (CR > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES. Part of the coastal area of Tunisia was enlarged to improve visibility and clarity (i.e. area delimited by broken line).

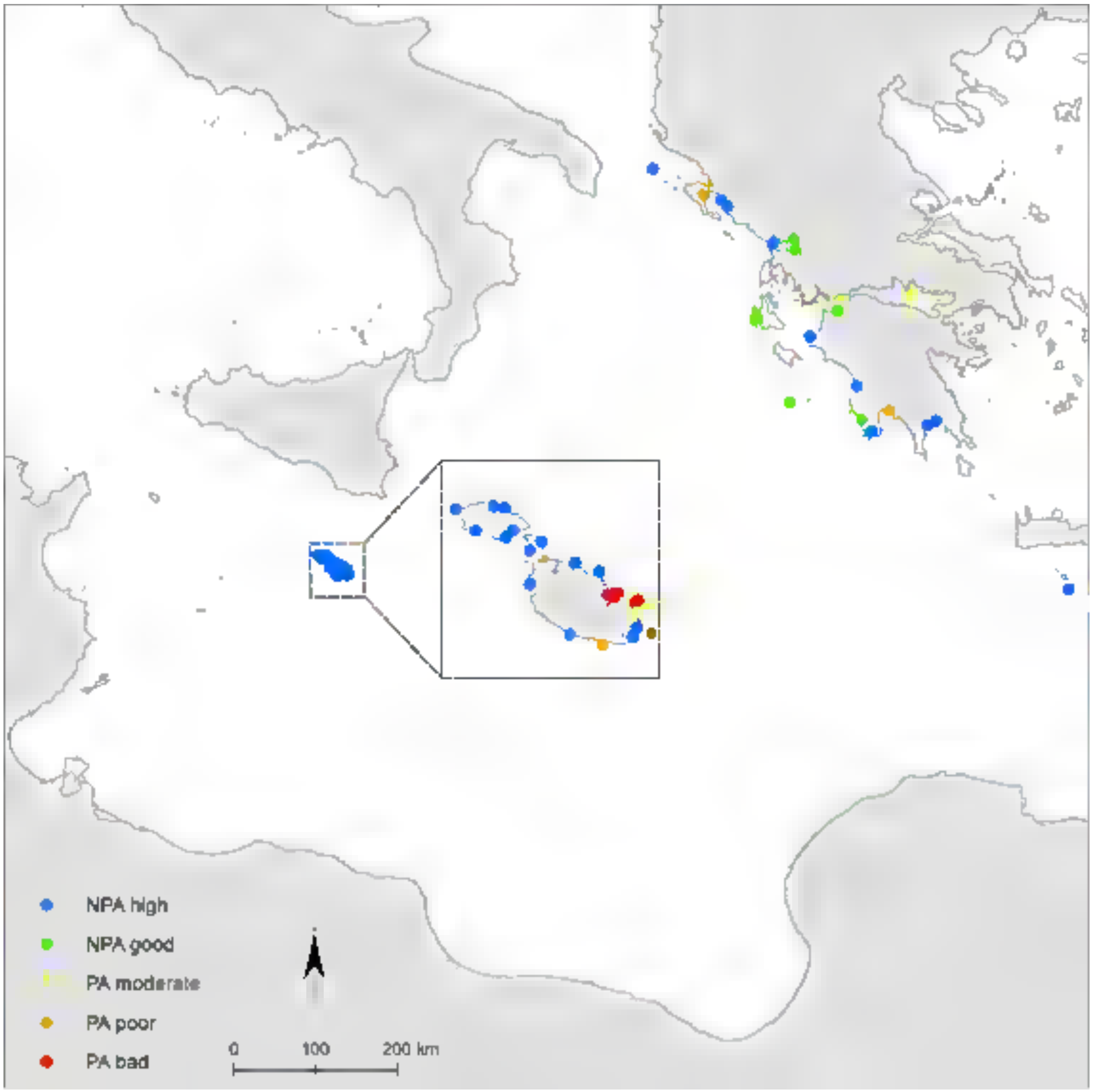


Figure CEN 3.1.4.2.3.C. Results of the CHASE+ approach to assess the environmental status of Σ_5 PAHs in sediments in the CEN, using MED_BACs as thresholds. Criteria for Σ_5 PAHs were not adopted in Decisions IG.22/7 and IG.23/6 (COP 19 and COP 20) and not addressed in UNEP/MED WG. 533/3. Here we used the sum of the individual BAC values as provided for the 5 PAHs compounds in UNEP/MED WG. 533/3 as Σ_5 PAHs_BAC. Stations in blue - NPAhigh (CR=0.0-0.5); stations in green-NPAgood (CR =0.5-1.0); Stations in yellow- PAmoderate (CR =1.0-2.0); stations in brown - PApoor (CR =2.0-5.0) and stations in red - PAbad (CR > 5.0). Blue and green stations are considered in GES; yellow, brown and red stations are considered non-GES. The coastal area of Malta was enlarged to improve visibility and clarity (i.e. area delimited by broken line).

Assessment of Trace metals in biota of the CEN

489. *M. barbatus*: Cd and Pb in all the 5 samples for which Malta reported data were below the detection limit (100 and 250 for Cd and Pb, respectively). The detection limits were much higher than the MED_BACs for these metals in *M. barbatus* (Table 3.1.4.2.2.). Hg in all the 5 samples were non-GES, with 3 samples classified in moderate status, one in poor status and one in bad status.

490. *M. galloprovincialis*. Data were available only for Italy (EMODNet). All the 8 samples were in-GES, 7 classified in high status and one in good status .

491. The meagre data on biota for the CEN does not allow for the regional assessment of the CEN nor of its sub-divisions.

2.1.1.2 The IMAP GES assessment of the Adriatic Sea Sub-region (ADR)

492. The integration and aggregation rules were elaborated in the context of the NEAT tool application for GES assessment of IMAP Common Indicator 17 in the Adriatic Sea Sub-region, including optimal temporal and spatial integration and aggregation of the assessment findings within nested approach agreed for IMAP implementation. The GES was assessed by applying the NEAT tool on the Adriatic nested scheme. The Contaminants' data were aggregated and integrated per habitat (sediments, mussels) while the various levels of spatial integration (nesting) are provided to ensure scaling of the assessment findings i.e., integration of the assessment findings to the level that is considered meaningful for CI 17. The NEAT IMAP GES Assessment methodology was applied on the spatial scope of the finest areas of assessment and the areas of assessment nested to the levels of integration that are considered meaningful.

NEAT is a structured, hierarchical tool for making marine status assessments (Berg et al., 2017; Borja et al., 2016), and freely available at www.devotes-project.eu/neat. The use of NEAT is not limited to the assessment of biodiversity but can be used for assessment of pollution impact. The analysis provides an overall assessment for each case study area and a separate assessment for each of the ecosystem components included in the assessment. The final value has an associated uncertainty value, which is the probability of being determinative in a certain class status (GES - nonGES) (Uusitalo et al., 2016). Essentially, the final assessment value is calculated as a weighted average. The weighting factors are based on the respective surface of the areas and are combined with the respective monitoring data for the indicator/chemical contaminant in question. The total weight of a SAU is not the simple ratio of each SAU area to the total area of the parent SAU. The process of distributing the weight is more complex. SAU weighting by the NEAT tool has two options: i) do not weight by SAU area: weights are calculated based just on the nesting hierarchy of the SAUs; ii) weight by SAU area: weights are calculated based on the nesting hierarchy and the SAU surface area. For the present assessment the option ii) was followed.

The IMAP NEAT GES assessment methodology was tested, and thereafter applied, first to the assessment of contaminants (CI 17), and then to chl*a* (CI 13) and nutrients (CI 14) in the Adriatic Sea Sub-region. The first step in implementing the nested approach was the delimitation of the areas of assessment within the Adriatic Sea Sub-region and later on within the Western Mediterranean Sub-region based on the areas of monitoring defined by concerned Contracting Parties, along with the harmonization of the scales approach between the Contracting Parties (CPs) i.e., scaling up the marine assessment to sub-regional and regional scales within the integration process as required under IMAP. The definition of the areas of assessment is undertaken as indicated in IMAP by applying relevant criteria, e.g. representativeness/importance of the areas of monitoring for establishing areas of assessment; presence of impacts of pressures in monitoring areas; sufficiency of quality assured data for establishing the areas of assessment covering as many as possible IMAP Common Indicators to the extent possible, and ensuring that adequate consideration is given to the risk based principle (both in pristine areas and areas under pressure). The existing monitoring and assessment areas defined by the concerned CPs were used, in case they were compatible with IMAP requirements; in case inconsistency appeared, the necessary adjustments were undertaken.

The IMAP Spatial Assessment Units (SAUs) were defined in the 3 steps approach per each of the Adriatic countries separately; afterward, their nesting within three sub-divisions of the Adriatic Sea sub-region was undertaken i.e., in the North, Central and South Adriatic. Following the methodology applied in the Adriatic Sea Sub-region, the same approach was applied to the Western Mediterranean Sub-region. For the step of nesting, the areas of assessment were first classified under the 3 sub-divisions of the Western Mediterranean Sea (i.e. ALBS, CWMS, TYRS). Relevant geographical information in the form of GIS-based layers were coupled, along with application of the rules of integration and aggregation.

In order to assess the uncertainty in the final assessment value, the standard error/ standard deviation of every observed indicator value is used (Borja et al., 2016). Therefore, the standard deviation values as obtained from the monitoring data play a major role in the uncertainty associated with the final assessment result. This emphasizes the importance of the standard deviation for the accuracy and evaluation of the final assessment result. The NEAT approach ensures that a balance is achieved between a too broad scale, that can mask significant areas of impact in certain parts of a region or subregion, and a very fine scale that could lead to very complicated assessment processes.

Available data

493. Data on contaminants (Cd, Hg, Pb, PAHs and PCBs) have been collected from all Contracting Parties bordering the Adriatic Sea for the years 2015 to 2021, except from Bosnia and Herzegovina[95] that does not monitor contaminants in marine environment. Details on the temporal and spatial availability of data per IMAP SAUs, per environmental matrix (sediments, biota) and per contaminants group (trace metals (TM), PAHs, PCBs) are provided here-below in Table 3.1.4.3.1 .The spatiotemporal coverage varies largely among the various IMAP SAUs. Sediments stations have in general higher spatial coverage. For some IMAP SAUs data are not existent or correspond to only 1 or 2 stations sampled once. Trace metals in sediments are monitored in the highest number of stations (205) and all SAUs have at least one station sampled once, followed by PAHs stations (125) and PCBs (59). The Central Adriatic subdivision is the least monitored for PAHs in sediments while it is not at all monitored for PCBs in sediments. All monitoring stations for biota refer to samplings of the mussel species, *Mytilus galloprovincialis*, therefore no data on organic compounds are available for fish matrix. Regarding the spatial coverage of monitoring stations for biota this is by far lower than that in sediments. Trace metals are monitored in 64 stations, PAHs in 29 and PCBs in 38. Contaminants' data in fish were scarce, reported only for trace metals in 27 stations in Croatian waters and 4 stations in Montenegrin waters. In addition, not always the same fish species was sampled making comparisons and harmonized assessment difficult.

494. A set of criteria was applied to propose the scope of the areas of monitoring. To better understand differences in the spatial coverage of the SAUs the ratio of number of stations to surface of the area (no of stations/km^2) is calculated. This ratio was calculated to support application of the criteria related to representativeness of the areas of monitoring for establishing areas of assessment. It is understood that the highest the ratio, the better the spatial coverage. However, in areas with limited presence of pressures a low ratio may be equally suitable for the purposes of a sound assessment. For this reason, the calculated ratios are only indicative and comparisons among them should be made keeping in mind the specific features of the SAUs. On the Adriatic sub-division level, the North Adriatic Sea is better covered by monitoring stations. Further to this criterion, the spatial distribution of monitoring

[95] Bosnia and Herzegovina has not been included in the present GES assessment due to lack of data on contaminants, however IMAP SAUs were set for this CP

stations and its comparison with the sufficiency of quality-assured data as collated for NEAT application were analyzed, i.e., the spatial coverage of monitoring data collected per each SAU in the Adriatic Sea and per environmental matrix (sediments, biota) and per contaminant group (trace metals (TM), PAHs, PCBs) separately. Table 4.3.2.1. provides the temporal coverage of monitoring data used again per each SAU in the Adriatic Sea and per environmental matrix (sediments, biota) and per contaminant group (trace metals (TM), PAHs, PCBs) separately.

Table 3.1.4.3.1. Data availability per year and country for the assessment of EO 9 – CI 17 (contaminants) in the Adriatic Sea (ADR) Sub-region, as available by up to 31st Oct 2022.

Source	IMAP-File	Country	Year	Cd	Hg	Pb	Σ_{16} PAHs	Σ_5 PAHs	Σ_7 PCBs	Lindane	Dieldrin	Hexachlorobenzene	p.p' DDE
Sediment													
IMAP_IS		Albania	2020	6	6	6		6					
IMAP_IS	520	Croatia	2017	37	37	37							
IMAP_IS	520	Croatia	2019	30	30	30							
IMAP_IS	652	Greece	2018	1		1	1						
IMAP_IS	457	Italy	2016	42	42	42	23	38	38	52		52	
IMAP_IS	457	Italy	2017	40	40	40	14	30	22	41		41	
IMAP_IS	457	Italy	2018	24	24	24	14	17	16	30		30	
IMAP_IS	457	Italy	2019	11		26				26		10	
EMODNet		Italy	2016	90	72	97							
EMODNet		Italy	2017	74	61	80							
MED POL		Montenegro	2016	5	5	5							
MED POL		Montenegro	2017	15	15	15							
MED POL		Montenegro	2018	6	6	6	6						
IMAP_IS		Montenegro	2019	29	29	29	29	29	29	12	29	29	29
IMAP_IS		Montenegro	2020	12	12	12	12	12	12	12	12	12	12
IMAP_IS		Montenegro	2021	19	19	19							
MED POL		Slovenia	2016				7	7					
IMAP_IS	204,657	Slovenia	2019	5	5	5	5	5	5	5	5	5	5
M. galloprovincialis													
IMAP_IS	520	Croatia	2019	19	19	19			19				
IMAP_IS	520	Croatia	2020	18	16	18							
IMAP_IS	460	Italy	2016	8	15	8		4		8		15	
IMAP_IS	460	Italy	2017	10	18	10		11		10		18	
IMAP_IS	460	Italy	2018	8	19	8		8		12		16	
IMAP_IS	460	Italy	2019		7							7	
EMODNet		Italy	2016		15								
EMODNet		Italy	2017		19								
EMODNet		Italy	2018		2								
MED POL		Montenegro	2018	8	8	8	8						
IMAP_IS		Montenegro	2019	10	10	10	11	11	11				
IMAP_IS		Montenegro	2020	10	10	10	10	10	10				
MED POL		Slovenia	2017	3	3	3							
IMAP_IS		Slovenia	2018	3	3	3							
IMAP_IS	204,657	Slovenia	2019	3	3	3	3	3					
IMAP_IS	439,658	Slovenia	2020	3	3	3	3	3					
IMAP_IS	656	Slovenia	2021	3	3	3	3	3					
M. barbatus													

Source	IMAP-File	Country	Year	Cd	Hg	Pb	Σ16 PAHs	Σ5 PAHs	Σ7 PCBs	Lindane	Dieldrin	Hexachlorobenzene	p.p' DDE
IMAP_IS	520	Croatia	2019	1		1							
IMAP_IS	520	Croatia	2020	10	10	10							
MED POL		Montenegro	2018	8	8	8							

495. For the application of the NEAT software, data on contaminants were grouped per parameters, ecosystem components (i.e. for the purpose of present NEAT application these are considered biota and sediment matrixes) and SAUs in all the Adriatic sub-divisions (NAS, CAS, SAS). Average concentrations (arithmetic means) and their respective standard errors were then calculated in the respective groups.

Arithmetic mean concentration: $\bar{C} = \frac{\sum_{i=1}^{n} C_i}{n}$,

Standard Deviation: $SD = \sqrt{\frac{\sum_{i=1}^{n}(C_i - \bar{C})^2}{n-1}}$,

Standard Error : $SE = \frac{SD}{\sqrt{n}}$

where, $\bar{C}$ is the average (arithmetic mean) concentration for each SAU, C_i is the individual contaminant concentration measured in each station/date in the SAU, and n is the total number of concentration records for each SAU; SD is the sample standard deviation for a specific contaminant and SAU and SE is the standard error for a specific contaminant and SAU.

496. Several records on PAHs and PCBs individual compounds were reported as below detection limit values (DL) or were left blank. In a separate technical paper, prepared by MED POL in consultations with OWG EO9, it was recommended to incorporate into the BC and BAC calculations of the BDL values and not to exclude them[96]. For the present application of NEAT these cases were substituted by the BDL/2 value, given a rather small quantum of data available, this does not influence the calculation of the assessment findings. In the Slovenian data, the BDL values were left blank so these were substituted by a value equal to 1µg/kg which corresponds to the average BDL/2 value from the whole data set. Furthermore, due to this fact, but also considering the list of substances the monitoring of which is mandatory according to IMAP[97], the sum of the 16 EPA compounds (Σ_{16}PAHs) and sum of the 7 PCBs compounds (Σ_7PCBs) was taken into account for the present assessment. In this way the assessment results show the cumulative impact by each of these two groups of contaminants. A detailed data matrix was prepared and used for the NEAT software application.

The integration of the areas of assessment and assessment results by applying the 4 levels nesting approach

497. Following the rules of integration of assessments within the nested approach, for the assessment of EO9 Common Indicators, the coastal monitoring zone is equal to the respective assessment zone as

[96] In a separate technical paper, prepared by MEDPOL in consultations with OWG on Contaminants, it was suggested to 'replace BDL values with a fraction of the reported value. The fraction could be 1 (BDL value), 0.5 (BDL/2), 0.7 (BDL/SQRT(2)), other' and not exclude BDL values from BC calculation. The decision to replace BDL with the reported value or a fraction of it should be based on the available data and expert evaluation. Italy, Spain and France supported the use of LOD/2 or LOQ/2 in the BCs calculation. Israel pointed out that the US- EPA suggests this only when less than 15% of data is BDLs. Therefore, the calculation for the assessment criteria was performed with the reported value and not half of it. This is because the wide range of BDL values for a specific contaminant in a specific matrix, depending on the country and it varies even within the country.

[97] According to IMAP i.e. IMAP Guidance Fact Sheet and Data Dictionaries for IMAP CI 17, monitoring of the sum of 7 PCB congeners: 28, 52,101,118,138,153 and 180 and sum of 16 US EPA PAHs is considered mandatory.

defined for the purposes of the present work. For the offshore zone, monitoring areas may be representative of broader assessment areas beyond territorial waters and in these cases the offshore monitoring areas are not necessarily equal to the offshore assessment areas. The stations positioned within the offshore zone are considered representative of a wider offshore area, as officially declared by the countries.

498. In the absence of declared areas of monitoring by all the concerned CPs, following the rationale of the IMAP national monitoring programmes and distribution of the monitoring stations, as well as the NEAT assessment methodology, the two zones of areas of monitoring are defined for the purposes of the present work: i) the coastal zone and ii) the offshore zone.

499. Detailed explanation on data sources used and methodology followed for setting of the two zones (coastal and offshore) is provided for the purpose of the present work. In summary, GIS layers collected from different sources (International Hydrographic Organization - IHO, European Environment Information and Observation Network - EIONET, VLIZ Maritime Boundaries Geodatabase) by the MEDCIS project were used for the present work for Slovenia, Croatia and Italy; for Albania, Montenegro and Greece these data were not accurate or do not include the relevant information and therefore were replaced/corrected in line with relevant national sources i.e. results of GEF Adriatic Project and provisions of relevant national legal acts. The MEDCIS work takes into consideration the existence of bays and inlets which are numerous in particular in the east part of the Adriatic Sea and calculates the baseline using the straight baseline method by joining appropriate points.

500. For IMAP CI 17, integration of assessments up to the subdivision level is considered meaningful. Therefore, the three main subdivisions of the Adriatic Sea, namely, North, Central and South Adriatic (NAS, CAS, SAS) have been chosen following the specific geomorphological features as available in relevant scientific sources (e.g. bottom depths and slope areas, existence of deep depression, salinity and temperature gradient, water mass exchanges) (Cushman-Roisin et al., 2001). The coverage of the 3 sub-divisions is shown in Figure 3.1.4.3.1.

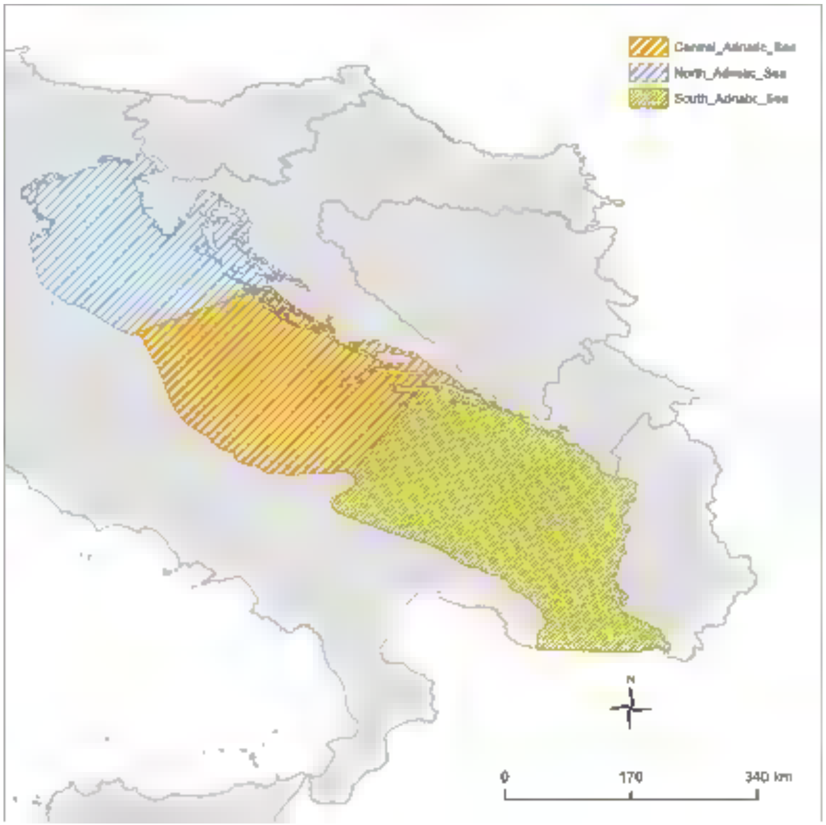


Figure 3.1.4.3.1. The 3 subdivisions of the Adriatic subregion defined based on Cushman-Roisin et al. (2001).

501. The four following steps for integration of the areas of assessment was followed to accomplish the objectives of the NEAT IMAP GES Assessment :

- Step 1 “Defining coastal and offshore waters”;
- Step 2 “Recognizing scope of IMAP areas of monitoring”;
- Step 3 “Setting IMAP area of assessment”:
- Step 4 “Nesting of the areas of assessment within application of NEAT tool” by applying the 4 levels nesting scheme where 1st level is the finest and 4th level is the highest:
  - 1st level provided nesting of all national IMAP SAUs & sub-SAUs within the two key IMAP assessment zones per country, i.e. coastal and offshore zones;
  - 2nd level provided nesting of the assessment areas set in the key IMAP assessment zones i.e. coastal and offshore zones, on the sub-division level i.e. i) NAS coastal, NAS offshore; ii) CAS coastal, CAS offshore; iii) SAS coastal, SAS offshore);
  - 3rd level provided nesting of the areas of assessment within the 3 sub-divisions (NAS, CAS, SAS);
  - 4th level provided nesting of the areas of assessment within the Adriatic Sea Sub-region

502. Similarly, the integration of the assessment results is conducted following the 4 levels nesting approach:

- 1st level: Detailed assessment results provided per sub-SAUs and SAUs;
- 2nd level: Integrated assessment results provided per i) NAS coastal (NAS-1), NAS offshore (NAS-12); ii) CAS coastal (CAS-1), CAS offshore (CAS-12); iii) SAS coastal (SAS-1), SAS offshore (SAS-12);
- 3rd level: Integrated assessment results provided per subdivision NAS, CAS, SAS;
- 4thlevel: Integrated assessment results provided for the Adriatic Sea Sub-region.

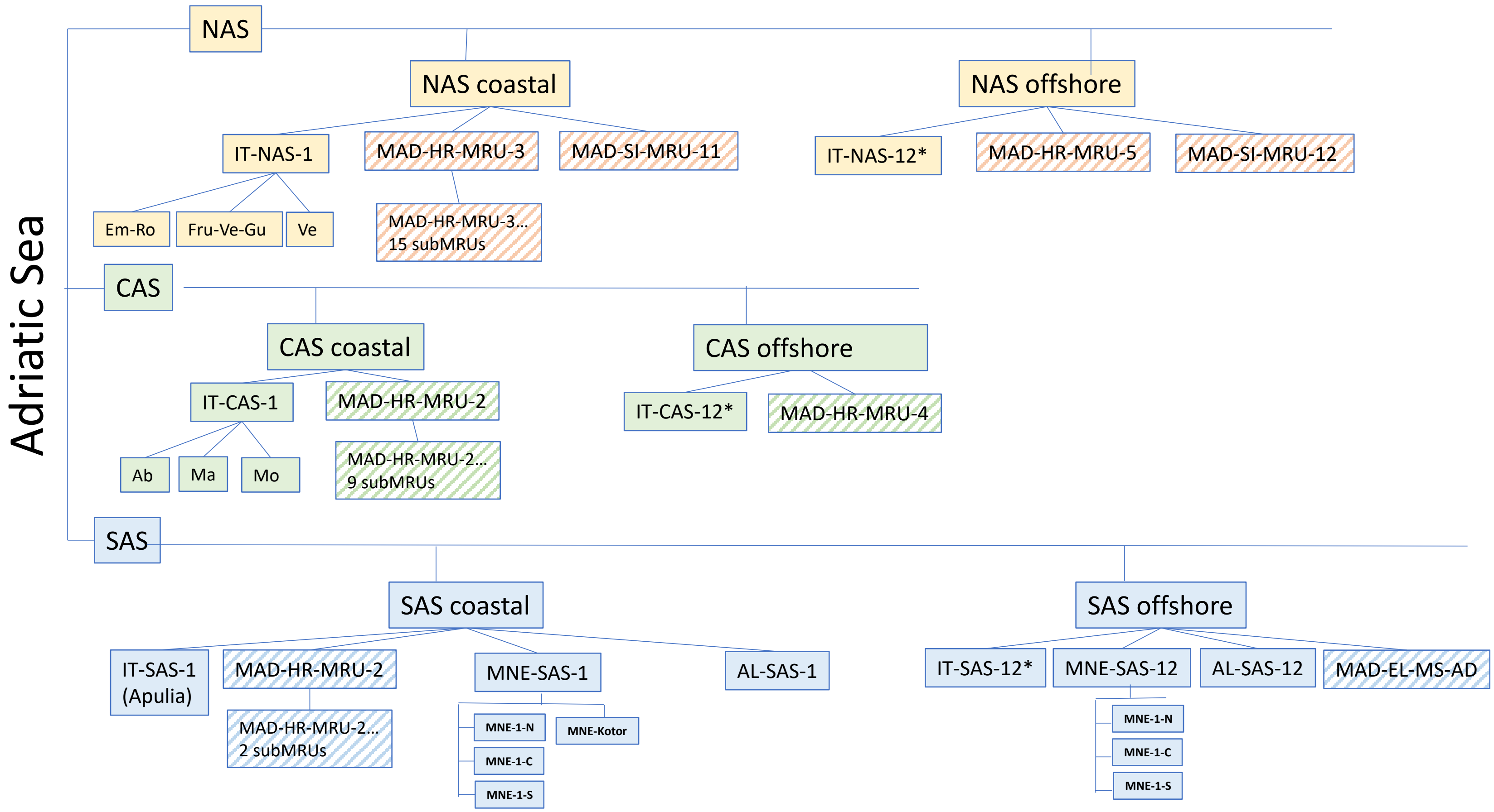
503. The graphical depiction of this nesting scheme is shown in Figure 3.1.4.3.2. .

504. Further to spatial analysis of the monitoring stations distribution, along with recognition of corresponding monitoring and assessment areas, as well as optimal nesting of the finest areas of assessment, , the scope of all Adriatic SAUs and subSAUS were defined. All of them were introduced in the NEAT tool along with their respective codes and surface area (km^2).

505. Within each SAU under ‘habitats’ the sediments and biota are introduced. Under ‘ecosystem component’ the 5 chemical compounds of EO9/CI17 are assigned. For each SAU and ‘Ecological Component’ (EO9 contaminants in our case) and ‘Habitat’ (sediments, biota), average value and standard deviation per chemical compound is inserted.

506. The use of NEAT tool requires two boundary limit values for the best and worse conditions (these are not threshold values but the minimum and maximum values that determine the scale of the assessment) and one threshold value for the GES – non GEs status. For the present analysis, the two boundary limit values are: i) zero contaminant concentration for the best conditions; ii) the maximum concentration of contaminants used for the present analysis for the worse conditions.

507. These boundary limits are mandatory by the tool which then produces five status classes linearly, depending on the distance of the concentrations from the two boundary limit values and the GES-non GES threshold. However, the user may also assign threshold values for all other status classes as appropriate. A 5-class assessment scale ‘High-Good-Moderate-Poor-Bad’ is then produced.



*For Italy the offshore IMAP SAUs areas (IT-NAS-O, IT-CAS-O, IT-SAS-O) is calculated by subtracting the surface of area of the coastal zone from the surface area of the 3 official MRUs (IT-NAS-0001, IT-CAS-0001, IT-SAS-0001).

Figure 3.1.4.3.2.: The nesting scheme of the SAUs defined for the Adriatic Sea based on the available information. Shaded boxes correspond to official MRUs declared by the countries that are EU MSs and that were decided to be used as IMAP SAUs.

Setting the GES/non GES boundary value/threshold

508. Upgrading of the baselines and threshold values for IMAP CI 17 in the Mediterranean Sea is an ongoing process. The present assessment analysis applying the NEAT tool was conducted for each subdivision using the assessment criteria for the GES-non GES threshold, based on BAC values shown in Table 3.1.4.3.2.

Table 3.1.4.3.2: The BAC values calculated for the Adriatic Sea and used for the present assessment

	Adriatic BAC (µg/kg dry wt)	
	Sediments	**Biota (MG)**
Cd	180	944
Hg	75	113
Pb	23550	1500
$^{*}\Sigma_{16}$ PAHs	61.5	9.9
$^{+}\Sigma_{7}$ PCBs	0.21	17.3

509. The final marine environment quality status assessment regarding CI17 in the Mediterranean Sea provides in a consolidated manner the individual assessments for each of the sub-regions and/or sub-divisions. Therefore, all individual assessments were harmonized to the extent possible in order to ensure the compatibility of the assessments.

510. In line with an updated assessment classification for a harmonized application of NEAT and CHASE+ tools in the four Mediterannean Sea sub-regions , the Boundary limits of the 5-class assessment scale and class Threshold values were applied for NEAT GES Assessment of the Adriatic Sea-Sub-region (Table 3.1.4.3.3).

Table 3.1.4.3.3: Boundary limits of the assessment scale and class Threshold values used for the application of the NEAT tool for IMAP.

	Low Boundary limit	**Threshold** High/Good	**Threshold** Good/Moderate	**Threshold** Moderate/poor	**Threshold** Poor/Bad	**Upper Boundary Limit**
Sediments	**(µg/kg)**	**0.5 (xBAC) (µg/kg)**	**xBAC (µg/kg)**	**2(x BAC) (µg/kg)**	**5(xBAC)**	**Max. conc. (µg/kg)**
Cd	0	135	270	540	1350	9000
Hg	0	56.5	113	225	563	14200
Pb	0	17662	35325	70650	176625	356000
$^{*}\Sigma_{16}$ PAHs	0	61.5	123	246	615	26649
$^{+}\Sigma_{7}$ PCBs	0	0.21	0.42	0.8	2.1	434
Biota (*M. galloprovincialis*)						
Cd	0	708	1416	2832	7080	9000
Hg	0	85	170	339	848	10000
Pb	0	1125	2250	4500	11250	167884
$^{+}\Sigma_{7}$ PCBs	0	17.3	34.6	69	173	180

*sum of the individual BACs or xBACs values of the 16 PAH compounds
$^{+}$ sum of the individual BACs or xBACs values of the 7 PCB compounds

511. The two boundary limit values, mandatory by the NEAT tool, were applied: i) zero contaminant concentration for the best conditions; ii) the maximum concentration of contaminants used for the present analysis for the worse conditions.

512. In line with such defined the two boundary limits, a five-class assessment scale ‘High-Good-Moderate-Poor-Bad’ was linearly set, depending on the distance of the concentrations from the two boundary limit values and the GES-nonGES threshold.

513. The data (i.e. average values inserted), as well as boundary limits and threshold values are normalized by NEAT in a scale of 0 to 1 to be comparable among parameters and to facilitate aggregation on the CI or EO level, as follows:

$$0 \leq \text{bad} < 0.2 \leq \text{poor} < 0.4 \leq \text{moderate} < 0.6 \leq \text{good} < 0.8 \leq \text{high} \leq 1$$

514. The decision rule of GES/ non-GES is by comparison to the boundary class defined by the (xBAC) and this is above/ below Good (0.6).

515. NEAT aggregated data by calculating the average of normalized values of contaminants (Cd, Pb, PAHs, etc.) on the SAU level. This can be done either per each contaminant per habitat (i.e., sediments, biota) separately or for all contaminants per habitats (i.e. sediments, biota) within specific SAU. The first option leads to one value for each chemical compound separately for a specific SAU.

516. The process is then repeated for all nested SAUs (in a weighted or non- weighted mode) for all ecosystem components - contaminants separately, or for all ecosystem components by habitat (sediments, biota). In the weighted mode a weighting factor based on the surface area of each SAU is used.

Results of the IMAP NEAT GES Assessment of CIs 17 in the Adriatic Sea Sub-region

517. The results obtained from the NEAT tool are shown below in Tables 3.1.4.3.4.a and 3.1.4.3.4.b. Table 3.1.4.3.4.a provides detailed assessment results on the EO9/CI 17 level per contaminant and also spatially integrated within the nested scheme at i) the IMAP national SAUs & subSAUs, as the finest level; ii) the IMAP coastal and offshore assessment zones of sub-divisions (NAS Coastal, NAS Offshore, CAS Coastal, CAS Offshore, SAS Coastal, SAS Offshore); iii) the sub-division level (NAS, CAS, SAS) and iv) the sub-regional level (Adriatic Sea).

518. At the same time aggregation of all contaminants data is done in order to obtain one chemical status value (NEAT value) for all the levels of the nesting scheme. In other words data matrix in Table 3.1.4.3.4.b. shows the results per contaminant per habitat per SAU in the finest level which are i) integrated along the nesting scheme (in columns A - I bold lines); and ii) are aggregated for all contaminants and habitats per SAU (in rows) leading to one NEAT value per SAU (column EO9). The latter is further integrated along the nesting scheme (column EO9 bold lines).

519. The NEAT tool has the possibility also to provide assessment results by aggregating data per habitat in this case sediments and biota (mussels) and then spatially integrated within the nested scheme.
520. The final integrated result per SAU (NEAT value) is the same for the two ways of assessment (i.e. per contaminants (Table 3.1.4.3.4.a) or per habitats (Table 3.1.4.3.4.b) as expected.

521. The detailed status assessment results per contaminant per SAU at the 1st level of assessment (no aggregation or integration) show that in most cases GES conditions are achieved (High, Good status) i.e., for 80% of SAUs, which are indicated by the blue and green cells in Table 3.1.4.3.4.a; 9% are classified under the moderate status, 6% under the poor and 5% under the bad. For the sediment matrix,

the highest contamination is observed from PCBs, PAHs and Hg resulting in non-GES status for 60%, 57% and 27 % of sub-SAUs respectively. For the mussels matrix, the highest contamination is observed from PCBs which results in 39% of sub-SAUs in non-GES status. In the NAS, 19% of sub-SAUs are classified as non-GES, in the CAS 12% are classified as non-GES, while in the SAS 22 % are classified as non-GEs. The most affected sub-SAUs in the NAS are HRO-0313-BAZ, HRO-0412-PULP and HRO-0423-RILP in Croatia; Emiglia-Romana', 'Fruili-Venezia-Giulia-1' and 'Veneto-1' in Italy. Also, offshore SAUs IT-NAS-O and MAD-Sl-MRU-12. In the CAS, most affected sub-SAUs are HRO-0313-KASP, HRO-0313-KZ, HRO-0423-KOR in Croatia. In the SAS, affected sub-SAUs are HRO-0313-ZUC and HRO-0423-MOP in Croatia; and MNE-1-N, MNE-1-C, MNE-1-S, MNE-Kotor in Montenegro which are found in moderate conditions due to impacts of several contaminants. Regarding the status of subSAU MNE-1-C, the present assessment does not match the good environmental status corresponding to the status of Marine Protected Area Katic located in this assessment unit, due to non-harmonized data reporting among the countries, and consequent non-harmonized use of data from different types of monitoring stations including hot spot stations, along with non-optimally harmonized size of spatial assessment units among the countries which resulted in inaccurately downgraded status of the small MNE-1-C assessment unit from good to moderate class.

522. Overall, it can be seen from Tables 3.1.4.3.4.a and Table 3.1.4.3.4.b. that TM in sediments have the largest spatial coverage with 49 out of 49 SAUs covered. For the other compounds and 'habitats' (sediments, mussels) several SAUs totally lack of data. In these cases, the integrated assessment result on the sub-division level (NAS, CAS, SAS) is based on only a few SAUs and cannot be considered representative. This is true for the assessment of Σ_{16}PAHs in sediments which is based on 14 out 49 SAUs and data delivered by from Italy, Slovenia, Montenegro; Σ_7PCBs in sediments which is based on 10 out of 49 SAUs and data delivered by Italy and Montenegro. In addition, Σ_7PCBs data in sediments for the CAS are non-existent. For the mussels, TM have the largest coverage and are measured in 28 out of the 49 SAUs, based on data delivered by Croatia, Italy, Slovenia and Montenegro (only in the coastal SAUs). Σ_7PCBs in mussels are measured in 22 out of 49 SAUs based on data delivered by Croatia and Montenegro, however most of the SAUs have been sampled only once.

523.

The comparison and harmonization of the assessment methodologies applied for IMAP CI 17:

To avoid possible bias in the Mediterranean regional assessment that may occur as a result of the use of different assessment methodologies in different areas, comparisons were performed i.e., between i) the "traffic light" and the CHASE+ in the LEVS Sub-division; ii) the NEAT and the CHASE+ in the ADR Sub-region and iii) the NEAT and the CHASE+ in the WMS Sub-region. The comparisons were performed to decrease uncertainty and to harmonize among assessments performed in different sub-regions and sub-divisions, with different number of sampling locations and measurements.

It was shown in the assessment of the Levantine Sea basin that the traffic light system is more lenient than CHASE+ and may mask the classification as non-GES of possible problematic areas for certain contaminants. Therefore, the "traffic light" was not further utilized.

Further to setting of the compatible GES/nGES threshold values for all sub-regions/sub-divisions, the approach described here-below is followed to overcome the above-described discrepancies and to ensure compatible assessments for all subregions/sub-divisions of the Mediterranean Sea on the SAU and on station levels for the purposes of the preparation of 2023 MED QSR. The approach is based on the application of a tailor-made assessment based on the general rationale of the CHASE+ tool while ensuring compatibility with the NEAT tool:

i) For sub-regions where the CHASE+ assessment methodology is applicable: Calculation of contamination ratios (CRs) based on the (xBAC) thresholds;

ii) For sub-regions where the CHASE+ assessment methodology is applicable: Calculate the CS for the overall CI17 aggregated assessment per station as a simple average of CRs and not as used by the EEA, where CS is calculated as the sum of CR divided by the square root of the number of CRs in the sum;
iii) For all Sub-regions and for both NEAT and CHASE+ assessment methodologies: The GES/non-GES boundaries are based on the BAC values. The BAC values (xBAC) multiplied by 1.5 for Cd, Hg, Pb and by 2 for PAHs and PCBs were approved This approach was chosen because it is based on the Mediterranean sub-regional background concentrations of contaminants, therefore having the boundary limits based on the values calculated from monitoring data reported by the CPs, and because it is more stringent than the Med_EAC approach. At the same time, it corresponds to the definition of the GES CI 17 target according to which the concentrations of specific contaminants need to be kept below Environmental Assessment Criteria (EACs) or below reference concentrations. In many cases the Med_EAC thresholds are higher than the maximum value recorded for a particular contaminant, resulting in a very lenient classification of the SAUs/stations. In this way biased assessments in different Mediterranean sub-regions are avoided.
iv) For all Sub-regions: Align the moderate/poor and the poor/bad boundary limits/thresholds between the two assessment methodologies. For the moderate/poor the use of 2(xBAC) value is proposed and for the poor/bad the 5(xBAC) value. In this way, a fine classification in line with the precautionary principle is provided. The NEAT tool is flexible and accepts either calculated thresholds values by the tool itself (based on the GES/nGES and the maximum concentration of contaminants), or threshold values predefined by the user. In the present assessment all thresholds are user defined. In the CHASE+ tool the CR or CS ratios for the moderate/poor and poor/bad are set at 2x and 5x times the GES/nGES threshold, instead of 5x and 10x that are suggested by the tool.

A comparison between the NEAT and CHASE+ results for the WMS sub-region was performed by applying above approach. Briefly all thresholds used were identical in the two methodologies, while the CHASE+ methodology was adapted regarding the calculation of the CS score for compatibility reasons. The harmonization of the two tools gives identical results for the classification (in-GES or non-GES) of the individual contaminants assessments per SAU. There are very small differences between the statuses found for the individual contaminants per SAU, regarding delineation between high and good statuses, the in-GES classification, and between moderate and poor, the non-GES classification. When aggregation is conducted for all contaminants on the individual SAU level comparisons differ by 5% and still can be considered acceptable.

The harmonization of the NEAT and CHASE+ assessment methodologies was as good as possible. They are still different methodologies and the results will not be identical, however the harmonization ensured their alignment to the extent which prevents bias assessment of the four Mediterranean sub-regions within the preparation of the 2023 MED QSR. The NEAT is the methodology which properly supports efforts aimed at the GES assessment in line with the Decision IG. 23/6 on the 2017 MED QSR, and therefore its further application across all four Mediterranean sub-regions should be foreseen within preparation of the future QSR. The CHASE+ assessment methodology may continue being used in specific cases, i.e., for the local areas and limited assessments with insufficient data reported for the GES assessment to guide decision making.

Assessment classification boundary limits/thresholds for a harmonized application of IMAP NEAT and CHASE+ assessment methodologies for IMAP CI 17 in the Mediterannean Sea sub-regions.

	GES		non-GEs		
IMAP – traffic light approach	Good	Moderate	Bad		
NEAT tool	High	Good	Moderate	Poor	Bad
	0< meas. conc. ≤ BAC	BAC<meas. conc. ≤GES/nGES threshold	GES/nGES<meas. conc. ≤ moderate/poor threshold	moderate/poor threshold <m conc. ≤ max. conc.	Max. conc.
Boundary limits and NEAT scores	0 1 < score ≤0.8	0.8<score≤ 0.6	0.6<score ≤ 0.4	0.4< score ≤0.2	Score<0.2
Thresholds	BAC	(xBAC)	2 (xBAC)	5 (xBAC)	
CHASE+ tool	High	Good	Moderate	Poor	Bad
Thresholds	1/2(xBAC)	(xBAC)	2(xBAC)	5(xBAC)	
CHASE+ Scores	0 <CR_CS ≤0.5	0.5<CR_CS≤ 1	1<CR_CS ≤ 2	2< CR_CS ≤5	CR_CS> 5

524. The aggregation of the chemical parameters data per SAU leads to the NEAT value per SAU which represents the overall chemical status of the SAUs, as shown in Table 3.1.4.3.4.a (4th column). It is clear that the above described non-GES classifications affect the overall chemical status and 80% of the SAUs are classified as in GES (High or Good), while 20% of the subSAUs are classified under moderate status.

525. The integration of SAUs data per chemical parameter (Table 3.1.4.3.4.a, bold lines), shows that: i) the NAS subdivision suffers from Hg contamination (moderate status) in sediments and mussels and PCBs (poor status) contamination in sediments; ii) the CAS sub-division suffers from Hg (poor status) and PCBs (moderate status) contamination in mussels; iii) finally, the SAS sub-division is affected by Pb (moderate status) and PCBs (moderate status) contamination in mussels.

526. In Table 3.1.4.3.4.b the NEAT assessment results are aggregated per habitat (sediments, mussels). It is apparent that both the sediments and the mussels matrices are equally affected by chemical contaminants with 27% and 24% of Sub-SAUs classified as non-GES respectively. All other cases are classified in GES (High, Good status).

527. With the exception of TM in sediments, based on the availability of data for contaminants as delivered by the CPs in the Adriatic Sea sub-region, the present integrated assessment status results produced by applying the NEAT tool on the sub-division (NAS, CAS, SAS) and/or the Adriatic sub-Region level (shown in Tables 3.1.4.3.4.a and 3.1.4.3.4.b) can only be considered indicative. This is related to the fact that several SAUs either lack of data or the countries eventually decided not to monitor the areas that are found irrelevant for the assessment of contaminants and therefore excluded the areas where problems were not historically observed (blank cells in Tables 3.1.4.3.4.a and 3.1.4.3.4.b).

528. , The final GES assessment findings for all the IMAP SAUs in the Adriatic Sea, as provided in Table 3.1.4.3.4.a, are shown by the respective color in the maps included in the Figures ADR 3.1.4.3.3.C - 3.1.4.3.6.C. The maps depict the integrated NEAT value for each sub-SAU (i.e., aggregated value for all contaminants as provided in the 4th column of Table 3.1.4.3.4.a).

Table 3.1.4.3.4.a. Status assessment results of the NEAT tool applied on the Adriatic nesting scheme for the assessment of EO9/CI17. The various levels of spatial integration (nesting) are marked in bold. Blank cells denote absence of data. * Light green coloured cell corresponds to subSAU MNE-1-C reconsidered as in good status following justification provided by authorities of Montenegro. The status of this unit was adjusted from moderate to good i.e., color was changed from yellow to light green, without changing the NEAT values, further to the justification related to the status of marine protected area Katic as provided by national authorities**.**
The % confidence is based on the sensitivity analysis.

			EO9				**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
SAU	**Area (km^2)**	**SAU weight factor**	**NEAT value**		**Status class**	**% Confidence**	**CI17_Cd seds**	**CI17_Hg seds**	**CI17_Pb seds**	**Σ16 PAHs seds**	**Σ7 PCBs seds**	**CI17_Cd mus**	**CI17_Hg mus**	**CI17_Pb mus**	**Σ7 PCBs mus**
Adriatic Sea	**139783**	**0**	**0.738**		**good**	**88**	**0.841**	**0.807**	**0.878**	**0.786**	**0.346**	**0.821**	**0.421**	**0.748**	**0.631**
Northern Adriatic Sea	**31856**	**0**	**0.592**		**moderate**	**84**	**0.842**	**0.466**	**0.827**	**0.733**	**0.236**	**0.835**	**0.47**	**0.842**	**0.743**
NAS coastal	**9069**	**0**	**0.774**		**good**	**100**	**0.838**	**0.739**	**0.814**	**0.4**	**0.199**	**0.834**	**0.809**	**0.842**	**0.743**
MAD-HR-MRU-3	6422	0	0.829		high	100	0.891	0.887	0.833			0.811	0.813	0.818	0.696
HRO-0313-JVE	73	0.001	0.726		good	100	0.853	0.872	0.711			0.754	0.574	0.709	0.522
HRO-0313-BAZ	4	0	0.51		moderate	100	0.684	0.333	0.513						
HRO-0412-PULP	7	0	0.477		moderate	100	0.803	0.166	0.462						
HRO-0412-ZOI	473	0.003	0.864		high	100	0.894	0.861	0.874			0.89	0.857	0.859	0.803
HRO-0413-LIK	7	0	0.791		good	86	0.886	0.763	0.623			0.846	0.809	0.85	0.792
HRO-0413-PAG	30	0	0.796		good	69	0.832	0.837	0.761			0.84	0.853	0.814	0.618
HRO-0413-RAZ	10	0	0.825		high	100	0.852	0.883	0.741						
HRO-0422-KVV	494	0.004	0.798		good	57	0.867	0.915	0.849			0.806	0.709	0.768	0.598
HRO-0422-SJI	1923	0.014	0.859		high	100	0.916	0.944	0.906			0.825	0.855	0.816	0.688
HRO-0423-KVA	686	0.005	0.849		high	100	0.879	0.893	0.817			0.847	0.85	0.862	0.78
HRO-0423-KVJ	1089	0.008	0.826		high	97	0.888	0.907	0.791			0.752	0.835	0.992	0.734
HRO-0423-KVS	577	0.004	0.797		good	72	0.903	0.853	0.847			0.831	0.789	0.704	0.58
HRO-0423-RILP	6	0	0.538		moderate	100	0.398	0.626	0.589						
HRO-0423-RIZ	475	0.003	0.766		good	89	0.877	0.861	0.728			0.758	0.677	0.669	0.734

			EO9				**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**I**
SAU	**Area (km^2)**	**SAU weight factor**	**NEAT value**		**Status class**	**% Confidence**	**CI17_Cd seds**	**CI17_Hg seds**	**CI17_Pb seds**	**Σ16 PAHs seds**	**Σ7 PCBs seds**	**CI17_Cd mus**	**CI17_Hg mus**	**CI17_Pb mus**	**Σ7 PCBs mus**
HRO-0423-VIK	455	0.003	0.783		good	71	0.869	0.7	0.737			0.785	0.811	0.721	0.873
IT-NAS-C	2592	0	0.638		good	100	0.703	0.284	0.761	0.398	0.199	0.925	0.917	0.938	0.908
IT-Em-Ro-1	371	0.003	0.587		moderate	71	0.801	0.647	0.869	0.416	0.199				
IT-Fr-Ve-Gi-1	575	0.004	0.543		moderate	100	0.843	0.159	0.627						
IT-Ve-1	1646	0.012	0.684		good	100	0.495	0.272	0.87	0.39	0.199	0.925	0.917	0.938	0.908
MAD-SI-MRU-11	55	0	0.752		good	100	0.886	0.351	0.975	0.446		0.87	0.453	0.881	
NAS offshore	**22788**	**0**	**0.52**		**moderate**	**100**	**0.845**	**0.262**	**0.835**	**0.769**	**0.24**	**0.869**	**0.446**	**0.833**	
MAD-HR-MRU-5	5571	0				0									
IT-NAS-O	10540	0.161	0.519		moderate	100	0.844	0.263	0.84	0.775	0.24		0.445		
MAD-SI-MRU-12	129	0.002	0.477		moderate	0	0.889	0.188	0.574	0.375					
Central Adriatic	**63696**	**0**	**0.728**		**good**	**80**	**0.82**	**0.852**	**0.892**	**0.938**		**0.84**	**0.336**	**0.752**	**0.513**
CAS coastal	**9394**	**0**	**0.833**		**high**	**100**	**0.831**	**0.868**	**0.874**	**0.938**		**0.84**	**0.823**	**0.752**	**0.513**
MAD-HR-MRU-2	7302	0	0.83		high	100	0.854	0.894	0.845			0.84	0.823	0.752	0.513
HRO-0313-NEK	253	0.003	0.803		high	67	0.784	0.824	0.689			0.858	0.865	0.883	0.757
HRO-0313-KASP	44	0	0.595		moderate	55	0.724	0.266	0.686			0.875	0.691	0.762	0.2
HRO-0313-KZ	34	0	0.639		good	100	0.816	0.291	0.81						
HRO-0313-MMZ	55	0.001	0.805		high	60	0.837	0.896	0.788			0.828	0.816	0.755	0.676
HRO-0413-PZK	196	0.002	0.733		good	97	0.887	0.737	0.766			0.844	0.842	0.584	0.406
HRO-0413-STLP	1	0	0.644		good	100	0.778	0.335	0.82						
HRO-0423-BSK	613	0.006	0.788		good	76	0.8	0.705	0.792			0.81	0.819	0.804	0.803
HRO-0423-KOR	1564	0.016	0.791		good	85	0.886	0.893	0.888			0.848	0.819	0.731	0.377
HRO-0423-MOP	2480	0.025	0.883		high	100	0.854	0.941	0.852						

			EO9				A	B	C	D	E	F	G	H	I
SAU	**Area (km^2)**	**SAU weight factor**	**NEAT value**		**Status class**	**% Confidence**	**CI17_Cd seds**	**CI17_Hg seds**	**CI17_Pb seds**	**Σ16 PAHs seds**	**Σ7 PCBs seds**	**CI17_Cd mus**	**CI17_Hg mus**	**CI17_Pb mus**	**Σ7 PCBs mus**
IT-CAS-C	2092	0	0.845		high	100	0.779	0.742	0.94	0.938					
IT-Ab-1	282	0.005	0.886		high	100	0.809	0.867	0.932	0.938					
IT-Ma-1	319	0.006	0.836		high	100	0.724		0.947						
IT-Mo-1	229	0.004	0.808		high	61	0.864	0.626	0.934						
CAS offshore	**54303**	**0**	**0.71**		**good**	**80**	**0.817**	**0.85**	**0.896**	**0.925**			**0.32**		
MAD-HR-MRU-4	18963	0.178	0.897		high	100	0.887	0.909	0.894						
IT-CAS-O	22393	0.21	0.551		moderate	69	0.7	0.749	0.899	0.925			0.32		
Southern Adriatic Sea	**44231**	**0**	**0.858**		**high**	**100**	**0.868**	**0.859**	**0.877**	**0.853**	**0.795**	**0.778**	**0.883**	**0.573**	**0.548**
SAS coastal	**7276**	**0**	**0.769**		**good**	**99**	**0.837**	**0.793**	**0.797**	**0.204**	**0.348**	**0.778**	**0.883**	**0.573**	**0.548**
MAD-HR-MRU-2	4252	0	0.73		good	100	0.843	0.877	0.733			0.777	0.745	0.583	0.516
HRO-0313-ZUC	13	0	0.792		good	68	0.843	0.888	0.903			0.769	0.841	0.724	0.487
HRO-0423-MOP	1756	0.031	0.73		good	100		0.877	0.732			0.777	0.744	0.582	0.516
IT-SAS-C (Ap-1)	1810	0.013	0.931		high	100	0.804	0.944	0.943				0.965		
MNE-SAS-C	483	0	0.618		good	99	0.7	0.665	0.667	0.204	0.348	0.791	0.871	0.47	0.884
MNE-1-N	86	0.001	0.7		good	81	0.813	0.928	0.932	0.198	0.629				
MNE-1-C	246	0.002	0.494*		good*	92	0.52	0.525	0.396	0.237	0.2	0.648	0.816	0.15	0.838
MNE-1-S	151	0.001	0.812		high	94	0.852	0.867	0.931	0.182	0.383	0.986	0.973	0.978	0.986
MNE-Kotor	85	0.001	0.546		moderate	99	0.722	0.183	0.446	0.164	0.15	0.858	0.848	0.492	0.838
AL-SAS-C	646	0.005	0.686		good	95	0.917	0.199	0.943						
SAS offshore	**36955**	**0**	**0.875**		**high**	**100**	**0.87**	**0.869**	**0.888**	**0.876**	**0.841**				
IT-SAS-O	22715	0.216	0.876		high	100	0.861	0.877	0.891						
MNE-SAS-O	2076	0	0.882		high	100	0.91	0.924	0.83	0.905	0.841				
MNE-12-N	513	0.005	0.869		high	100	0.927	0.928	0.845	0.863	0.781				
MNE-12-C	713	0.007	0.891		high	100	0.886	0.941	0.809	0.941	0.876				

			EO9				A	B	C	D	E	F	G	H	I
SAU	**Area (km^2)**	**SAU weight factor**	**NEAT value**		**Status class**	**% Confidence**	**CI17_Cd seds**	**CI17_Hg seds**	**CI17_Pb seds**	**Σ16 PAHs seds**	**Σ7 PCBs seds**	**CI17_Cd mus**	**CI17_Hg mus**	**CI17_Pb mus**	**Σ7 PCBs mus**
MNE-12-S	849	0.008	0.883		high	100	0.92	0.907	0.839	0.899	0.848				
AL-SAS-O	716	0.007	0.78		good	61	0.924	0.5	0.915						
MAD-EL-MS-AD	2253	0.021	0.886		high	100	0.914		0.884	0.86					

Table 3.1.4.3.4.b: Status assessment results of the NEAT tool applied on the Adriatic nested scheme for the assessment of EO9/CI 17. Contaminants' data are aggregated and integrated per habitat (sediments, mussels). The various levels of spatial integration (nesting) are marked in bold. Blank cells denote absence of data. * Light green coloured cell corresponds to subSAU MNE-1-C reconsidered as in good status following justification provided by authorities of Montenegro. The status of this unit was adjusted from moderate to good i.e., color was changed from yellow to light green, without changing the NEAT values, further to the justification related to the status of marine protected area Katic as provided by national authorities**.** The % confidence is based on the sensitivity analysis .

SAU	Area (km^2)	Total SAU weight factor	NEAT value	Status Class	% Confidence	sediments	mussels
Adriatic Sea	**139783**	**0**	**0.738**	**good**	**88**	**0.825**	**0.48**
Northern Adriatic Sea	**31856**	**0**	**0.592**	**moderate**	**84**	**0.637**	**0.545**
NAS coastal	**9069**	**0**	**0.774**	**good**	**100**	**0.741**	**0.814**
MAD-HR-MRU-3	6422	0	0.829	high	100	0.87	0.787
HRO-0313-JVE	73	0.001	0.726	good	100	0.812	0.64
HRO-0313-BAZ	4	0	0.51	moderate	100	0.51	
HRO-0412-PULP	7	0	0.477	moderate	100	0.477	
HRO-0412-ZOI	473	0.003	0.864	high	100	0.877	0.852
HRO-0413-LIK	7	0	0.791	good	86	0.757	0.824
HRO-0413-PAG	30	0	0.796	good	69	0.81	0.781
HRO-0413-RAZ	10	0	0.825	high	100	0.825	
HRO-0422-KVV	494	0.004	0.798	good	57	0.877	0.72
HRO-0422-SJI	1923	0.014	0.859	high	100	0.922	0.796
HRO-0423-KVA	686	0.005	0.849	high	100	0.863	0.835
HRO-0423-KVJ	1089	0.008	0.846	high	97	0.862	0.828
HRO-0423-KVS	577	0.004	0.797	good	72	0.868	0.726
HRO-0423-RILP	6	0	0.538	moderate	100	0.538	
HRO-0423-RIZ	475	0.003	0.766	good	89	0.822	0.709
HRO-0423-VIK	455	0.003	0.783	good	71	0.769	0.797
IT-NAS-C	2592	0	0.638	good	100	0.507	0.922
IT-Em-Ro-1	371	0.003	0.587	moderate	71	0.587	
IT-Fr-Ve-Gi-1	575	0.004	0.543	moderate	100	0.543	

SAU	Area (km^2)	Total SAU weight factor	NEAT value	Status Class	% Confidence	sediments	mussels
IT-Ve-1	1646	0.012	0.684	good	100	0.445	0.922
MAD-SI-MRU-11	55	0	0.7	good	100	0.664	0.735
NAS offshore	**22788**	**0**	**0.52**	**moderate**	**100**	**0.591**	**0.449**
MAD-HR-MRU-5	5571	0			0		
IT-NAS-O	10540	0.161	0.519	moderate	100	0.592	0.445
MAD-SI-MRU-12	129	0.002	0.477	moderate	0	0.477	
Central Adriatic	**63696**	**0**	**0.728**	**good**	**80**	**0.855**	**0.367**
CAS coastal	**9394**	**0**	**0.833**	**high**	**100**	**0.859**	**0.732**
MAD-HR-MRU-2	7302	0	0.83	high	100	0.864	0.732
HRO-0313-NEK	253	0.003	0.803	high	67	0.766	0.841
HRO-0313-KASP	44	0	0.595	moderate	55	0.559	0.632
HRO-0313-KZ	34	0	0.639	good	100	0.639	
HRO-0313-MMZ	55	0.001	0.805	high	60	0.84	0.769
HRO-0413-PZK	196	0.002	0.733	good	97	0.797	0.669
HRO-0413-STLP	1	0	0.644	good	100	0.644	
HRO-0423-BSK	613	0.006	0.788	good	76	0.766	0.809
HRO-0423-KOR	1564	0.016	0.791	good	85	0.889	0.694
HRO-0423-MOP	2480	0.025	0.883	high	100	0.883	
IT-CAS-C	2092	0	0.845	high	100	0.845	
IT-Ab-1	282	0.005	0.886	high	100	0.886	
IT-Ma-1	319	0.006	0.836	high	100	0.836	
IT-Mo-1	229	0.004	0.808	high	61	0.808	
CAS offshore	**54303**	**0**	**0.71**	**good**	**80**	**0.854**	**0.32**
MAD-HR-MRU-4	18963	0.178	0.897	high	100	0.897	
IT-CAS-O	22393	0.21	0.551	moderate	69	0.783	0.32
Southern Adriatic Sea	**44231**	**0**	**0.858**	**high**	**100**	**0.866**	**0.748**
SAS coastal	**7276**	**0**	**0.769**	**good**	**99**	**0.787**	**0.748**
MAD-HR-MRU-2	4252	0	0.73	good	100	0.805	0.655
HRO-0313-ZUC	13	0	0.792	good	68	0.878	0.705

SAU	Area (km^2)	Total SAU weight factor	NEAT value	Status Class	% Confidence	sediments	mussels
HRO-0423-MOP	1756	0.031	0.73	good	100	0.805	0.655
IT-SAS-C (Ap-1)	1810	0.013	0.931	high	100	0.897	0.965
MNE-SAS-C	483	0	0.618	good	99	0.517	0.754
MNE-1-N	86	0.001	0.7	good	81	0.7	
MNE-1-C	246	0.002	0.494*	good*	92	0.375	0.613
MNE-1-S	151	0.001	0.812	high	94	0.643	0.981
MNE-Kotor	85	0.001	0.546	moderate	99	0.333	0.759
AL-SAS-C	646	0.005	0.686	good	95	0.686	
SAS offshore	**36955**	**0**	**0.875**	**high**	**100**	**0.875**	
IT-SAS-O	22715	0.216	0.876	high	100	0.876	
MNE-SAS-O	2076	0	0.882	high	100	0.882	
MNE-12-N	513	0.005	0.869	high	100	0.869	
MNE-12-C	713	0.007	0.891	high	100	0.891	
MNE-12-S	849	0.008	0.883	high	100	0.883	
AL-SAS-O	716	0.007	0.78	good	61	0.78	
MAD-EL-MS-AD	2253	0.021	0.886	high	100	0.886	

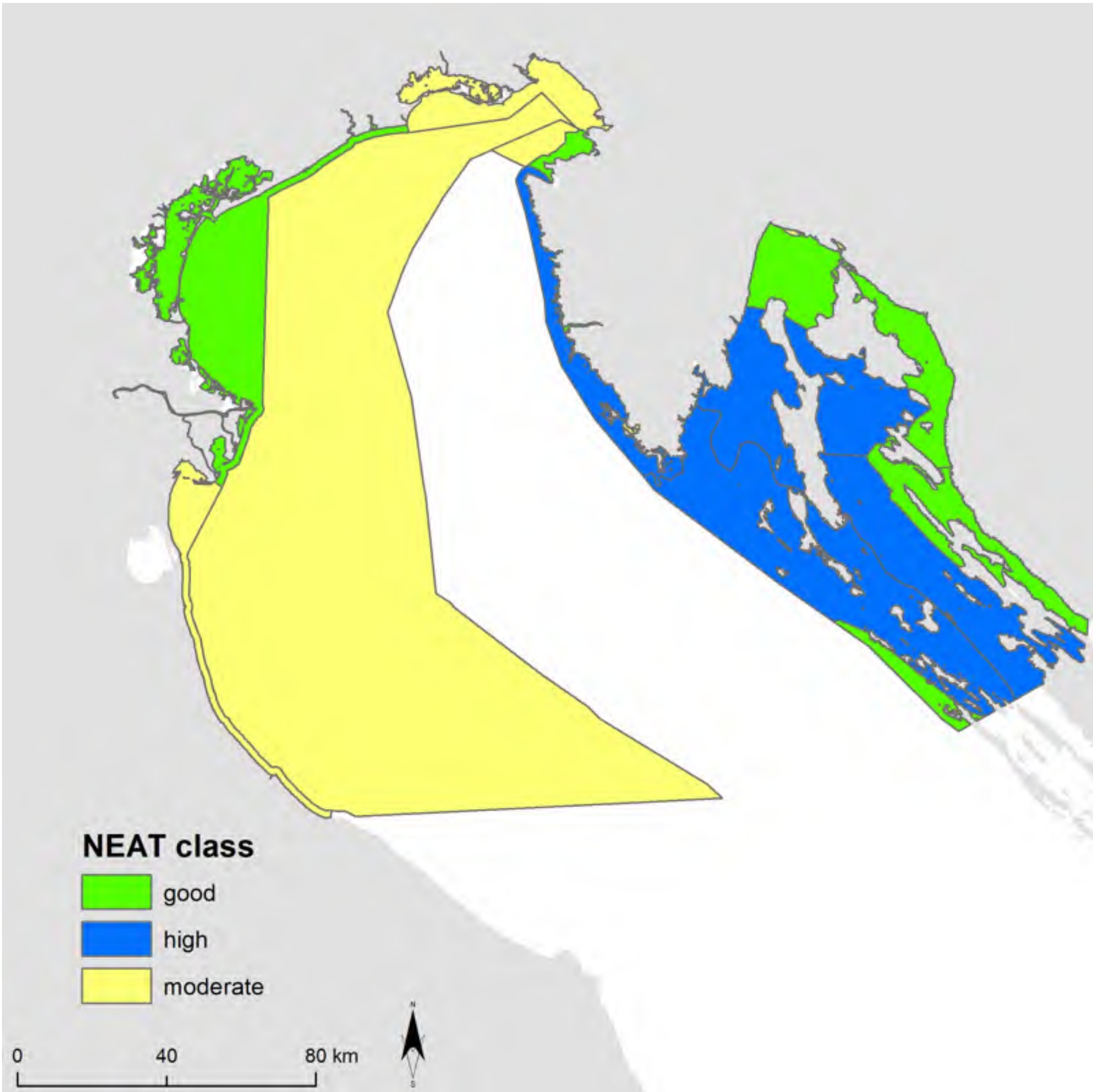


Figure ADR 3.1.4.3.3.C: The NEAT assessment results for IMAP CI17 in the North Adriatic Sea. Aggregation of all contaminants per sub-SAU. Blank area corresponds to no available data/decision or not established monitoring.

529. When all contaminants are aggregated, most sub-SAUs in the NAS Sub-division, are classified under High or Good status and in-GES. Six (6) sub-SAUs are classified under Moderate status, namely the three small coastal sub-SAUs HRO-0313-BAZ, HRO-412-PULP, HRO-0423-RILP in Croatia, two coastal sub-SAUs IT-Em-Ro-1, IT-Fr-Ve-Gi-1 and one offshore SAU IT-NAS-O in Italy.

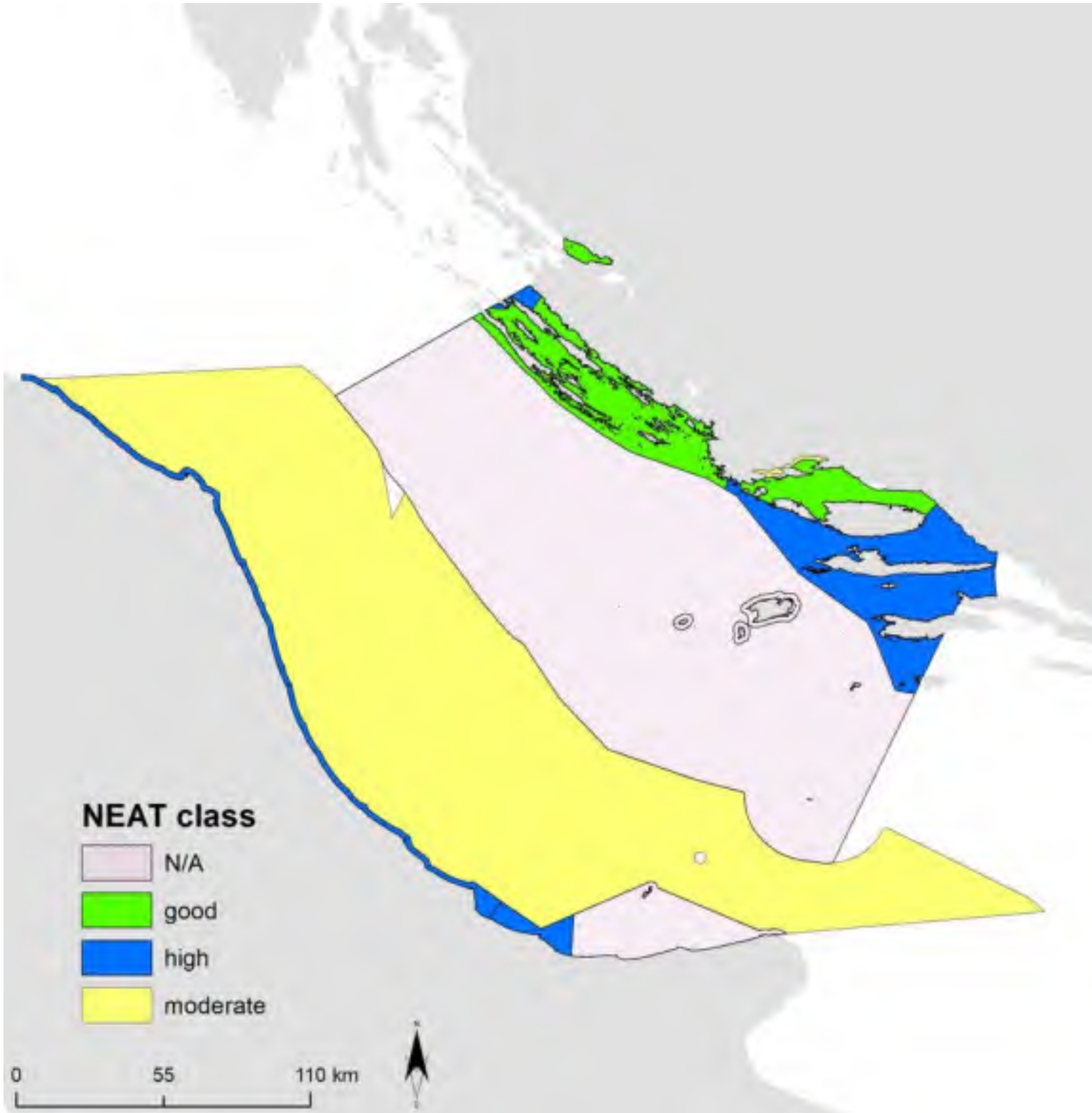


Figure ADR 3.1.4.3.4.C: The NEAT assessment results for IMAP EO9/CI17 in the Central Adriatic Sea. All IMAP SAUs are in GES, characterized by High or Good status.

530. When all contaminants are aggregated, most sub-SAUs in the CAS Sub-division, are classified under High or Good status and in-GES. Only one coastal sub-SAU is classified under Moderate status, namely the coastal sub-SAUs HRO-0313-KASP, HRO-412-PULP, HRO-0423-RILP in Croatia, two coastal sub-SAUs IT-Em-Ro-1, IT-Fr-Ve-Gi-1 and one offshore SAU IT-NAS-O in Italy.

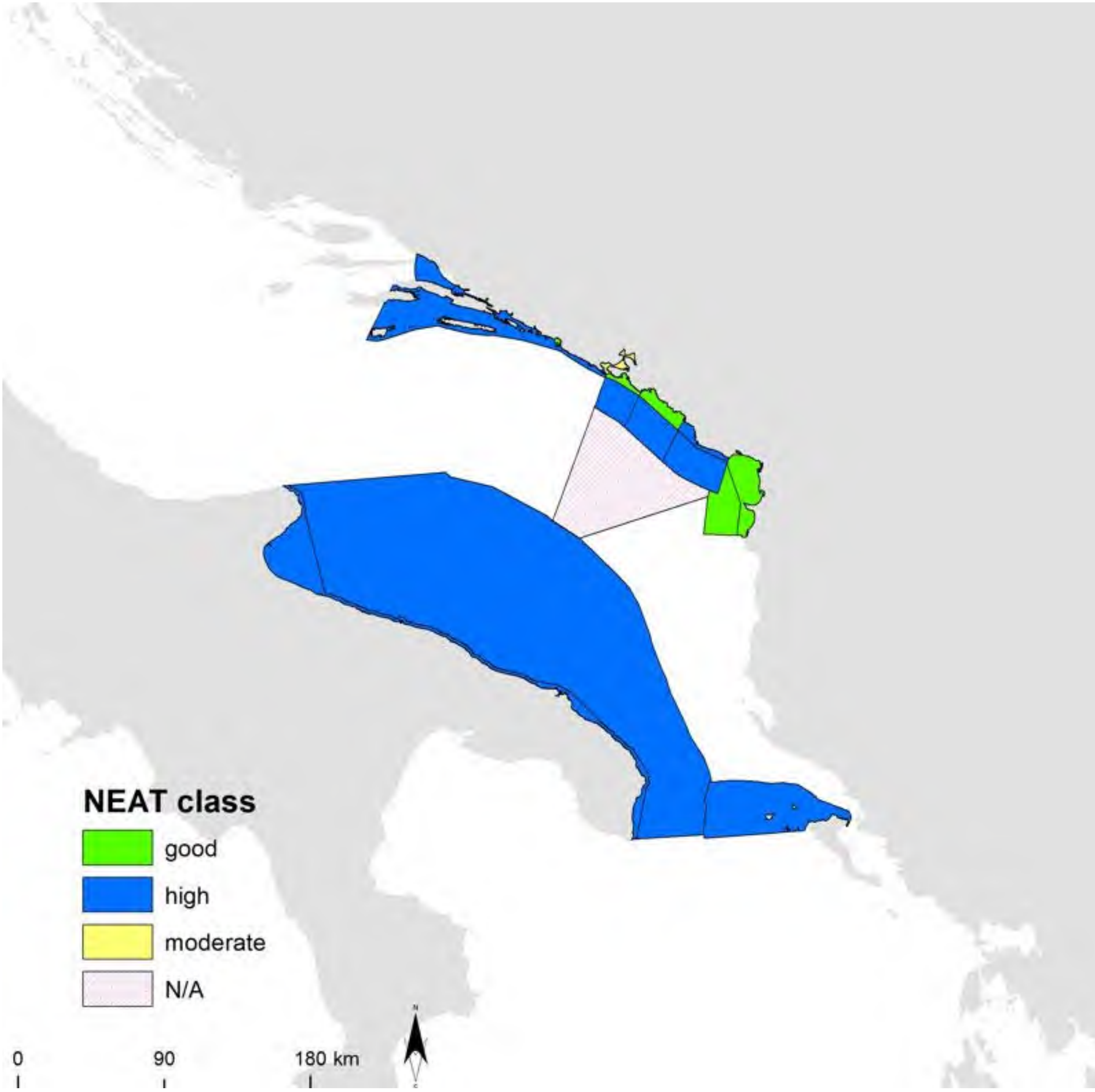


Figure ADR 3.1.4.3.5.C: The NEAT assessment results for IMAP CI17 in the South Adriatic Sea. Aggregation of all contaminants per sub-SAU. Blank area corresponds to no available data/decision or not established monitoring.

531. When all contaminants are aggregated, most sub-SAUs in the SAS Sub-division, are classified under High or Good status and in-GES. Only one coastal sub-SAU is classified under Moderate status, namely the coastal sub-SAU MNE-Kotor in Montenegro.

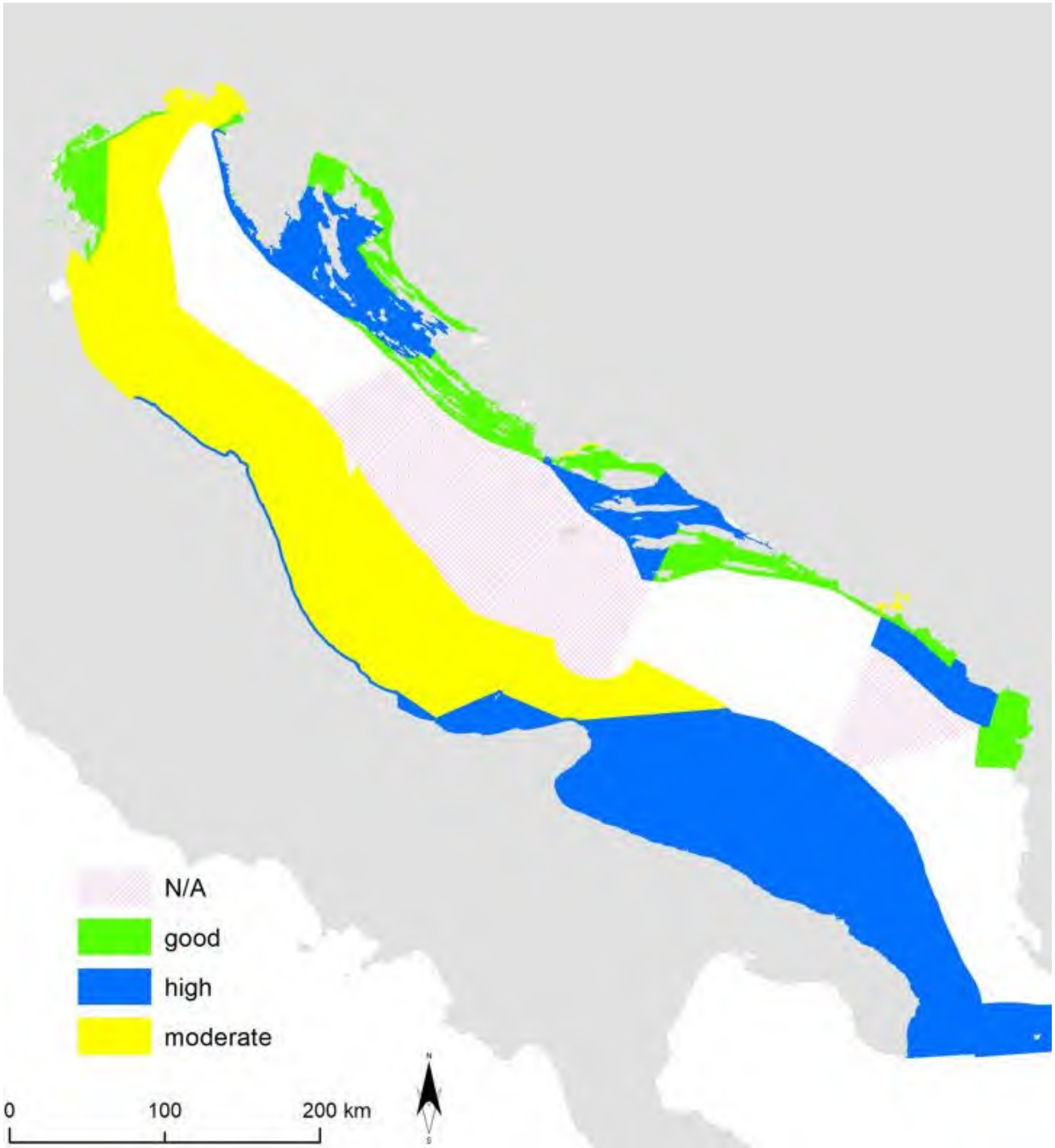


Figure ADR 3.1.4.3.6.C: The NEAT assessment results for IMAP CI17 in the Adriatic Sea sub-region. Aggregation of all contaminants per sub-SAU. Blank area corresponds to no available data/decision or not established monitoring.

The IMAP GES assessment of the Western Mediterranean Sea (WMS) Sub-region

532. The GES for IMAP CI 17 was assessed by applying the NEAT tool on the Western Mediterranean nested scheme in line with the elaboration of the integration and aggregation rules provided for the NEAT tool application in the Adriatic Sea Sub-region, including optimal temporal and spatial integration and aggregation of the assessment findings within nested approach agreed for IMAP implementation. For the purposes of the present work data on contaminants produced within implementation of the national monitoring programmes of the CPs and reported to the IMAP IS or

submitted to UNEP/MAP have been gathered. IMAP SAUs have been defined for the whole WMS, however, based on data availability it was possible to obtain reliable assessment results by using the NEAT tool only for the coastal assessment zones of the Alboran and the Tyrrhenian sub-divisions (ALBS, TYRS), whereby a simplified application of the NEAT tool was chosen only for the IMAP SAUs for which data exist without any spatial integration on the CWMS level.

Available data

533. Data on contaminants (Cd, Hg, Pb, PAHs and PCBs) have been collected from the following Contracting Parties bordering the Western Mediterranean Sea for the years 2017 to 2022: France, Italy, Morocco, Spain. In addition, some data for sediments acquired in 2016 and not used in previous assessment have been included in the present work, in order to increase the amount of data, i.e. reliability of the assessment findings. Details on the temporal and spatial availability of data per IMAP SAUs, per environmental matrix (sediments, biota) and per contaminants group (trace metals (TM), PAHs, PCBs) are provided here-below in Table 3.1.4.4.1. The biota matrix is monitored for mussels *Mytilus galloprovincialis* in all cases. The spatiotemporal coverage varies largely among the various IMAP SAUs. Data for the Alboran Sea were reported for 5 out of 8 coastal SAUs, and no data were reported for any offshore SAUs. Data reported by Morocco refer to Cd, Hg, Pb in sediments and biota, while data reported by Spain refer to Cd, Hg, Pb and PCB on biota only. Algeria has not reported any data for the period 2017-2022. Data for the Central part of the Western Mediterranean Sea (CWMS) have been reported only by France, Spain and Italy. France and Spain reported data mostly for biota and only for stations situated in the coastal zone, i.e. France on Cd, Hg, Pb, PAHs and PCBs, and Spain on Cd, Hg, Pb and PCBs. Data for sediments were reported by France (Cd, Hg, Pb) and Spain (PAHs, PCBs, Cd, Hg, Pb) for 2016 only, mostly in coastal waters. Italy in CWMS reports data for sediments only (Cd, Hg, Pb, PAHs, PCBs). In the Tyrrhenian Sea (TYRS) for 6 out 7 coastal SAUs data were reported on contaminants. These are data reported by Italy for sediments on Cd, Hg, Pb, PAHs and PCBs, and data reported by France for biota on Cd, Hg, Pb, PAHs and PCBs and for sediments on Cd, Hg, Pb. Data for biota reported by Italy are very limited, confined to only 2 coastal SAUs and only for Hg, hexachlorobenzene and fluoranthene, hence they were not included in the assessment. Overall, for all sub-divisions of the WMS no data were reported for offshore IMAP SAUs, with the exception of one station sampled once for metals in biota in ES-CWM-LEV1-O SAU and 9 stations sampled for PAHs, PCBs, Cd, Hg, Pb in ES-CWM-LEV1-O SAU and one station in ES-CWM-LEVOS-O SAU, all during 2016.

534. A set of criteria (e.g. representativeness/importance of the areas of monitoring for establishing areas of assessment; presence of impacts of pressures in monitoring areas; sufficiency of quality assured data for establishing the areas of assessment covering as many as possible IMAP Common Indicators to the extent possible, and ensuring that adequate consideration is given to the risk based principle (both in pristine areas and areas under pressure) was applied to propose the scope of the areas of monitoring. Namely, the first element that was considered for the implementation of the nested approach is the definition of the areas of assessment within the Western Mediterranean Sea based on the areas of monitoring. The existing monitoring and assessment areas defined by the concerned CPs were used, in case they were compatible with IMAP requirements; in case of the Contracting Parties that are EU MSs, if inconsistency appeared between IMAP requirements and MSFD MRUs, the necessary adjustments were undertaken.

535. The percentage (%) of surface area of the IMAP SAUs with monitoring data reported to the total area of the coastal assessment zone was calculated in order to better understand differences in the spatial coverage of the SAUs,. Further to this criterion, the spatial distribution of monitoring stations and its comparison with the sufficiency of quality-assured data as collated for NEAT application were analyzed as provided here-below further to the analysis provided regarding the spatial coverage of monitoring data collected per each SAU in the Western Mediterranean Sea and per environmental matrix

(sediments, biota) and per contaminant group (trace metals (TM), PAHs, PCBs) separately. Table 3.1.4.4.1 provides the temporal coverage of monitoring data used again per each SAU in the Western Mediterranean Sea and per environmental matrix (sediments, biota) and per contaminant group (trace metals (TM), PAHs, PCBs) separately.

536. For the scope of CI17 monitoring in the Western Mediterranean Sea, the CPs have set 91.5% of the monitoring stations in the coastal zone and no data on contaminants were reported for the period 2017-2022 for any of the offshore stations. Only some data on sediments in Spanish offshore waters were reported for 2016 corresponding to 4% of total number of records. Despite that data were reported for 67% of the coastal IMAP SAUs in the CWMS by France, Spain and Italy, whereby there is a lack of data for whole southern coasts of Algeria and Tunisia. Hence the integrated assessment using the NEAT tool for this subdivision would be unreliable. In addition, based on the highest spatiotemporal coverage of data per matrix and per contaminant, reliable assessments using the NEAT tool can be made for the coastal zone of ALBS subdivision for metals in sediments and biota and for the coastal zone of TYRS subdivision for metals, PAHs and PCBs in sediments. The coastal part of the subdivision CWMS corresponding to French, Spanish and Italian monitoring areas was assessed just for the 1st level using the NEAT tool without any further spatial integration.

Table 3.1.4.4.1. Data availability per year and country for the assessment of EO 9 – CI 17 (contaminants) in the Western Mediterranean Sea (WMS) Sub-region, as available by 31st October 2022.

Source	**IMAP-File**	**Country**	**Year**	**Cd**	**Hg**	**Pb**	**Σ_{16} PAHs**	**Σ_5 PAHs**	**Σ_7 PCBs**	**Lindane**	**Dieldrin**	**Hexachlorobenzene**	**p,p' DDE**
Sediment													
IMAP_IS	224	France	2016	23	23	23							
EMODNet		France	2016	27	27	27	29	29					
IMAP_IS	469	Italy	2016	98	56	98		49	7	77		77	
IMAP_IS	469	Italy	2017	55	50	42		14		31		31	
IMAP_IS	469	Italy	2018	98	94	88		56	25	68		68	
IMAP_IS	469	Italy	2019	55	42	53		24		25		15	
IMAP_IS	243	Morocco	2016	11		11							
IMAP_IS	243	Morocco	2017	11	11	11							
IMAP_IS	243	Morocco	2018	11	11	11							
IMAP_IS	593	Spain	2016	54	54	54			54	54	54	54	54
IMAP_IS	623	Spain	2016					54					
M. galloprovincialis													
IMAP-IS	495	France	2018	23	23	23	23	23		23	23	23	
Reported to UNEP/MAP ('Extraction_RNOMV_2018_2022.csv'		France	2018	19	38	19	7		7				
Reported to UNEP/MAP		France	2019	20	40	20	15		15				
Reported to UNEP/MAP		France	2020	30	30	30	13		13				
Reported to UNEP/MAP		France	2021	28	28	28	15		15				
IMAP-IS	494	Italy	2016		12							12	
IMAP-IS	494	Italy	2017		23							23	
IMAP-IS	494	Italy	2018		15							13	

Source	IMAP-File	Country	Year	Cd	Hg	Pb	Σ_{16} PAHs	Σ_5 PAHs	Σ_7 PCBs	Lindane	Dieldrin	Hexachlorobenzene	p,p' DDE
IMAP_IS	494	Italy	2019									2	
IMAP_IS	650	Morocco	2019	4	4	4							
IMAP_IS	650	Morocco	2020	4	4	1							
IMAP_IS	650	Morocco	2021	4	4	4							
IMAP_IS	517	Spain	2017						25	25	25	25	25
IMAP_IS	619	Spain	2017	25	25	25							
IMAP_IS	620	Spain	2019	45	45	45							
M. barbatus													
IMAP_IS	516	Spain	2016						73	73	73	73	73

537. For the application of the NEAT software, data on contaminants were grouped per parameters, ecosystem components (i.e. for the purpose of present NEAT application these are considered biota and sediment matrixes) and SAUs in the Western Mediterranean sub-divisions. Average concentrations (arithmetic means) and their respective standard errors were then calculated in the respective groups as explained above for the Adriatic Sea Sub-region.

538. Several records on PAHs and PCBs individual compounds were reported as below detection limit values (DL) or were left blank. In a separate technical paper, prepared by MED POL in consultations with OWG EO9, it was recommended to incorporate into the BC and BAC calculations of the BDL values and not to exclude them. For the present application of NEAT these cases were substituted by the BDL/2 value, given a rather small quantum of data available, this does not influence the calculation of the assessment findings. In the Slovenian data, the BDL values were left blank so these were substituted by a value equal to 1μg/kg which corresponds to the average BDL/2 value from the whole data set. Furthermore, due to this fact, but also considering the list of substances the monitoring of which is mandatory according to IMAP[98], the sum of the 16 EPA compounds (Σ_{16}PAHs) and sum of the 7 PCBs compounds (Σ_7PCBs) was taken into account for the present assessment. In this way the assessment results show the cumulative impact by each of these two groups of contaminants.

539. Several records on PAHs and PCBs individual compounds were reported as below detection limit values (DL) or equal to the limit of quantification (LOQ). In a separate technical paper, prepared by MED POL in consultations with OWG EO9, it was recommended to incorporate the calculations of the BDL values into the calculation of the BC and BAC and not to exclude them[99]. For the present application of NEAT, BDL were substituted by the BDL/2 value for data reported by Morocco for Hg in sediments. All data reported by Spain are above DL. In data reported by Italy, LOQ values were reported, and these were not uniform for the whole data set. LOQs for the same chemical parameter varied from 0.1 to 10 μg/kg. To compensate the high variability in the LOQs, the LOQ/2 value was used only for those records with reported LOQs equal to 5 and 10 μg/kg. The LOD, LOQ values were analyzed in detail, as reported by the CPs in tdata files. Furthermore, considering the list of substances the monitoring of which is

[98] According to IMAP i.e. IMAP Guidance Fact Sheet and Data Dictionaries for IMAP CI 17, monitoring of the sum of 7 PCB congeners: 28, 52,101,118,138,153 and 180 and sum of 16 US EPA PAHs is considered mandatory.
[99] In a separate technical paper, prepared by MEDPOL in consultations with OWG on Contaminants, it was suggested to 'replace BDL values with a fraction of the reported value. The fraction could be 1 (BDL value), 0.5 (BDL/2), 0.7 (BDL/SQRT(2)), other' and not exclude BDL values from BC calculation. The decision to replace BDL with the reported value or a fraction of it should be based on the available data and expert evaluation. Italy, Spain and France supported the use of LOD/2 or LOQ/2 in the BCs calculation. Israel pointed out that the US- EPA suggests this only when less than 15% of data is BDLs. Therefore, the calculation for the assessment criteria was performed with the reported value and not half of it. This is because the wide range of BDL values for a specific contaminant in a specific matrix, depending on the country and it varies even within the country.

mandatory according to IMAP[100], the sum of the 16 EPA compounds (Σ_{16}PAHs) and sum of the 7 PCBs compounds (Σ_7PCBs) were taken into account for the present assessment. In this way the assessment results show the cumulative impact by each of these two groups of contaminants, similarly to the CI17 assessment made for the Adriatic Sea subregions.

The integration of the areas of assessment and assessment results by applying the 4 levels nesting approach

540. Following the rules of integration of assessments within the nested approach, for the assessment of EO9 Common Indicators, the coastal and the offshore monitoring zones were set as explained above .

541. Detailed explanation on data sources used and methodology followed for setting of the two zones (coastal and offshore) along with SAUs was provided for the purpose of the present work in the Western Mediterranean. In summary, GIS layers collected from different sources (International Hydrographic Organization - IHO, European Environment Information and Observation Network - EIONET, VLIZ Maritime Boundaries Geodatabase; EEA Marine Regions portal) were used for the present work for Italy, France, Spain, Morocco, Algeria, Tunisia.

542. For IMAP CI 17, integration of assessments up to the subdivision level is considered meaningful. Therefore, three main subdivisions of the Western Mediterranean Sea, have been considered: The Alboran Sea (ALBS); The Tyrrhenian Sea (TYRS) and the Central part of the Western Mediterranean Sea (CWMS), following the specific geomorphological features based on the IHO data[101]. The coverage of the 3 sub-divisions is shown in Figure 3.1.4.4.1.

[100] According to IMAP i.e. IMAP Guidance Fact Sheet and Data Dictionaries for IMAP CI 17, monitoring of the sum of 7 PCB congeners: 28, 52,101,118,138,153 and 180 and sum of 16 US EPA PAHs is considered mandatory.

[101] Limits of oceans and seas (1953). 3rd edition. IHO Special Publication, 23. International Hydrographic Organization (IHO): Monaco. 38 pp.

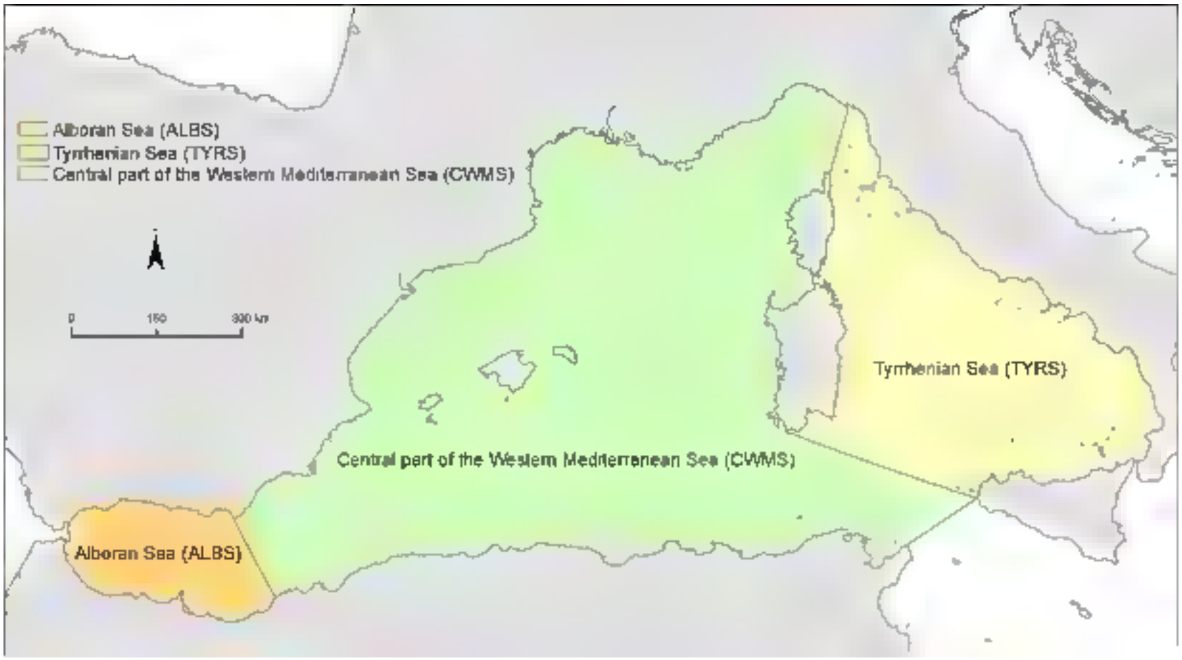


Figure 3.1.4.4.1. The 3 subdivisions of the Western Mediterranean Sub-Region defined, based on IHO data.

543. The four following steps for integration of the areas of assessment was followed to accomplish the objectives of the NEAT IMAP GES Assessment :

- Step 1 "Defining coastal and offshore waters";
- Step 2 "Recognizing scope of IMAP areas of monitoring";
- Step 3 "Setting IMAP area of assessment":
- Step 4 **"**Nesting of the areas of assessment within the application of NEAT tool": For this step of nesting, the areas of assessment were first classified under the 3 subdivisions of the Western Mediterranean Sea (i.e. ALBS, CWMS, TYRS). A 4 levels nesting approach, as applied in the Adriatic Sea Sub-region was also set for the Western Mediterranean Sub-region (Figure 3.1.4.4.2a), where the 1st level is the finest, providing nesting of all the finest areas of assessment i.e. the national IMAP SAUs & subSAUs within the two key IMAP assessment zones per country i.e. coastal and offshore zones and the 4th level is the highest.

544. However, for the scope of CI17 monitoring in the Western Mediterranean Sea, the CPs have set 91,5% of the monitoring stations in the coastal zone and no data on contaminants were reported for the period 2017-2022 for any of the offshore stations. In addition, only 53% of the coastal IMAP SAUs & sub SAUs for the CWMS reported data (by France and Spain) which makes any spatial integrated assessment using the NEAT tool unreliable for this subdivision. For these reasons, it was not considered meaningful to proceed with a 4 levels' nesting scheme in all 3 sub-divisions as shown in Figure 3.1.4.4.2.a.

545. Therefore, only the coastal SAUs were considered and nested under a 2 levels` hierarchical scheme and the integration of the assessment results was conducted for the coastal zone of the Alboran (ALBS) and Tyrrhenian Seas (TYRS) sub-divisions as follows:

- 1st level provided nesting of all national IMAP subSAUs within the coastal IMAP assessment zone per country;
- 2nd level provided nesting of the national coastal IMAP assessment zones on the subdivision level i.e., i) ALBS coastal; ii) TYRS coastal.

546. Similarly, the integration of the assessment was conducted in 2 levels as follows:

- 1st level: Detailed assessment results provided for all national coastal subSAUs and SAUs (ALBS, TYRS, some IMAP subSAUs of CWMS)
- 2nd level: Integrated assessment results provided for the coastal zone: i) ALBS coastal; ii) TYRS coastal.

547. The graphical depiction of this nesting scheme for the ALBs and TYRS is shown in Figure 3.1.4.4.2.b. The description of the IMAP SAUs and details on specificities for each country are also provided..

548. Given the integrated assessment up to the 2nd level using the NEAT tool was unreliable for CWMS, the assessment of this subdivision was undertaken just for the 1st level and only for those IMAP subSAUs for which data exist.

549. Further to spatial analysis of the monitoring stations distribution, along with recognition of corresponding monitoring and assessment areas, as well as optimal nesting of the finest areas of assessment, the scope of all WMS SAUs and subSAUS were defined. All of them were introduced in the NEAT tool along with their respective codes and surface area (km^2).

550. The procedure for use by the NEAT tool of data related to SAUs surface, boundary limits, the class threshold values, the concentrations of the group of contaminants assessed, along with normalization of the values, is explained above for the Adriatic Sea Sub-region.

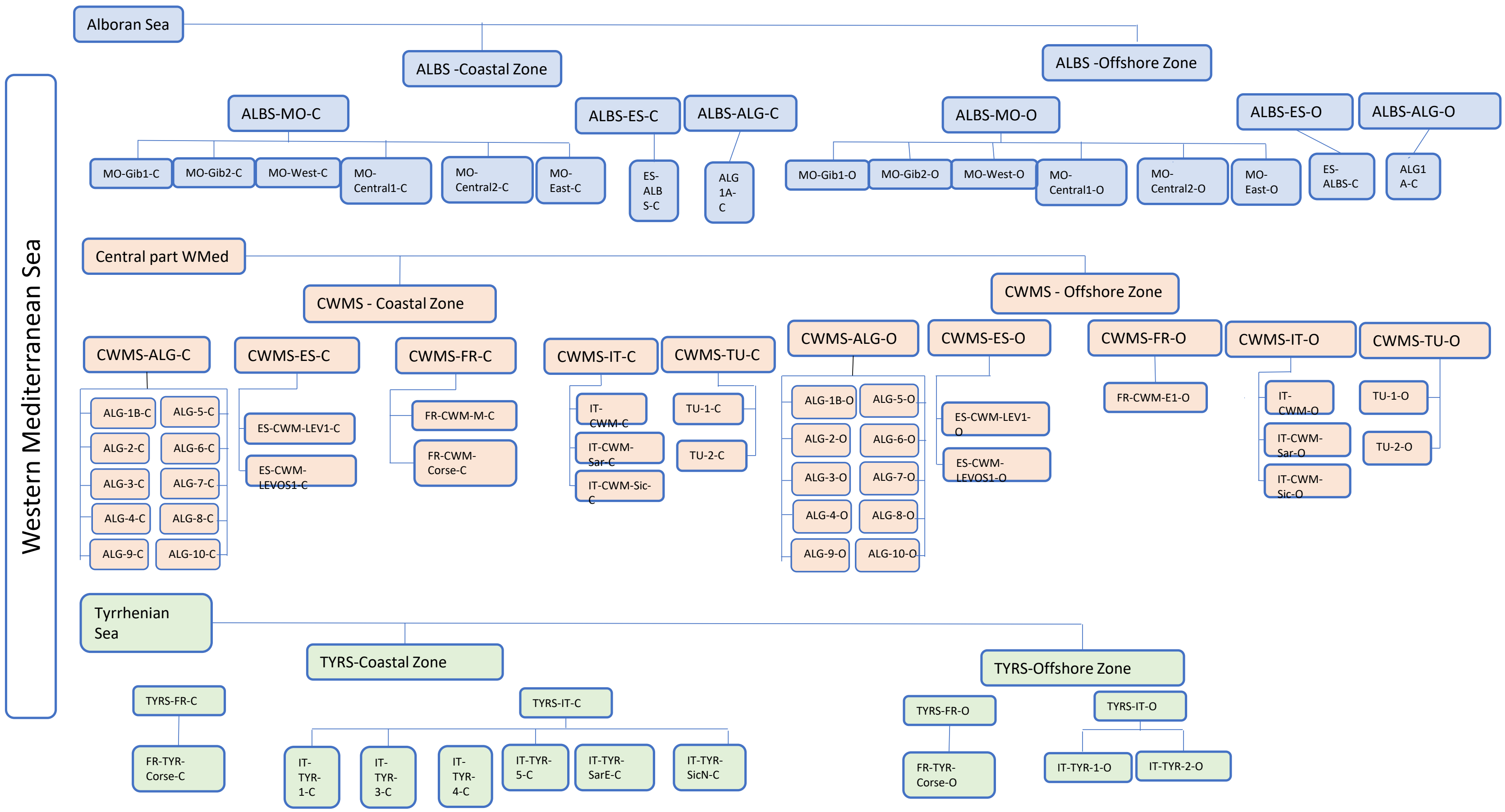


Figure 3.1.4.4.2 (a): The nesting scheme of the SAUs defined for the Western Mediterranean Sea Sub-region based on the available information.

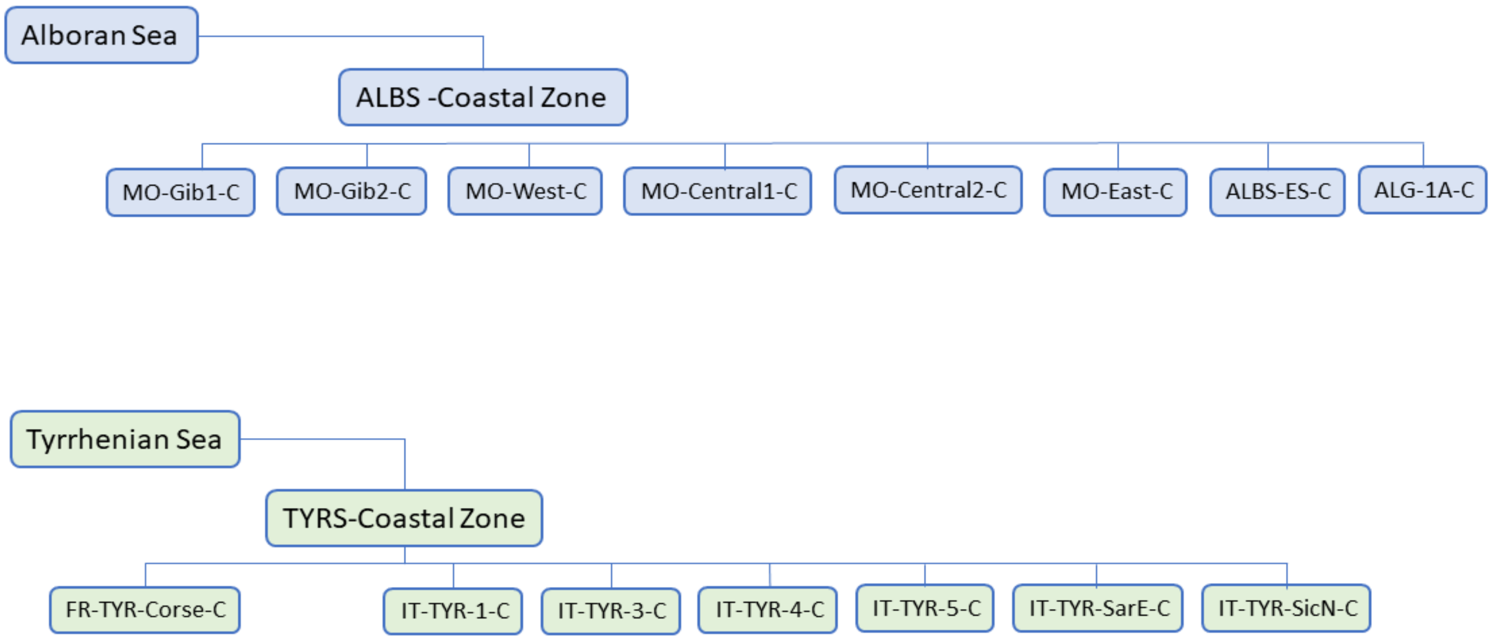


Figure 3.1.4.4.2(b): The 2-level nesting scheme for the Alboran and Tyrrhenian Seas Sub-divisions used for the present assessment of CI17 by applying the NEAT tool.

Setting the GES/non GES boundary value/threshold

551. As explained, the present assessment analysis applying the NEAT tool was conducted for each subdivision using the assessment criteria for the GES-non GES threshold, based on BAC values are shown in Table 3.1.4.4.2.

Table 3.1.4.4.2: The BAC values calculated for the Western Mediterranean Sea and used for the present assessment

	WMED BAC (µg/kg dry wt)	
	Sediments	**Biota (MG)**
Cd	210	1545
Hg	135	120
Pb	24000	1890
$^{*}\Sigma_{16}$ PAHs	240	8.4
$^{+}\Sigma_{7}$ PCBs	1.6	28.6

552. In line with an updated assessment classification for a harmonized application of NEAT and CHASE+ tools in the four Mediterannean Sea sub-regions, the Boundary limits of the 5-class assessment scale and class Threshold values were applied for NEAT GES Assessment of the Western Mediterranean Sea-Sub-region (Table 3.1.4.4.3).

Table 3.1.4.4.3: Boundary limits of the assessment scale and class Threshold values used for the application of the NEAT tool for IMAP. All concentrations are in dry weight.

	Low Boundary limit	**Threshold** High/Good	**Threshold** Good/Moderate	**Threshold** Moderate/Poor	**Threshold** Poor/Bad	**Upper Boundary Limit**
Sediments	**(µg/kg)**	**0.5(xBAC) (µg/kg)**	**xBAC (µg/kg)**	**2(xBAC) (µg/kg)**	**5(xBAC) (µg/kg)**	**Max. conc. (µg/kg)**
Cd	0	157	315	630	1575	1600
Hg	0	101	202	404	1013	1950
Pb	0	18000	36000	72000	180000	190000
$^{*}\Sigma_{16}$ PAHs	0	240	480	960	2400	30690
$^{+}\Sigma_{7}$ PCBs	0	1.6	3.2	6.4	16	120
Biota (*M. galloprovincialis*)						
Cd	0	1159	2318	4635	11588	12000
Hg	0	90	180	*360*	900	1214
Pb	0	1417	2835	*5670*	14175	15000
$^{*}\Sigma_{16}$ PAHs	0	8.4	16.8	33.6	84	286
$^{+}\Sigma_{7}$ PCBs	0	28.5	57	114	285	290

*sum of the individual BACs or xBACs values of the 16 PAH compounds
$^{+}$ sum of the individual BACs or xBACs values of the 7 PCB compounds

553. Data (i.e. average values inserted), as well as boundary limits and threshold values are normalized by NEAT in a scale of 0 to 1 to be comparable among parameters and to facilitate aggregation on the CI or EO level.

Results of the IMAP NEAT GES Assessment of CIs 17 in the Western Mediterranean Sea Sub-region

554. The assessment was conducted in the Alboran Sea subdivision (ALBS) for Cd, Hg, Pb in sediments and biota and in the TYRS for Cd, Hg, Pb, Σ_{16}PAHs and Σ_{7}PCBs in sediments. The simplified application of the NEAT tool (1st level nesting) was applied for the IMAP SAUs of the

CWMS for which data on contaminants exist (Cd, Hg, Pb, Σ_{16}PAHs and Σ_7PCBs in sediments and biota).

555. The results obtained from the NEAT tool using the (xBAC) threshold for the ALBS are shown below in Table 3.1.4.4.4.

556. The detailed status assessment results per contaminant show that most SAUs achieve GES conditions (high, good status) indicated by the blue and green cells. Exceptions to this are moderate classifications for SAUs MO-East-C and ALBS-ES-C for Pb in sediments, MO-Gib2-C for Cd in sediments, and SAU ALBS-ES-C for Hg in mussels.

557. The results obtained from the NEAT tool using the (xBAC) thresholds for the Tyrrhenian Sea subdivision (TYRS) are shown below in Table 3.1.4.4.5.

558. Detailed assessment results for the TYRS subdivision show that SAUs IT-TYR-1-C, IT-TYR-3-C and IT-TYR-4-C fall into moderate status regarding Cd in sediments; regarding Hg in sediments SAUs IT-TYR-1-C and IT-TYR-3-C fall into moderate and poor statuses respectively. Finally, SAU IT-TYR-4-C is classified as moderate regarding Σ_7PCBs.

559. The results obtained from the simplified application of NEAT for the coastal sub-SAUs with data in the CWMS are shown below in Table 3.1.4.4.6, and Figure WMS 3.1.4.4.6.C. Detailed assessments per contaminant per SAU indicate non-GES status for several cases. In sediments, SAU ES-CWM-LEV1-C is classified under moderate status for Pb and SAU FR-CWM_E2-C under poor for Hg. The Italian SAU IT-CWM-C is classified under moderate for Cd and under poor status for Σ_{16}PAHs and Σ_7PCBs. Monitoring data for mussels show that SAU FR-CWM-E2-C is classified under moderate status for Hg and Pb and under poor for Σ_{16}PAHs; SAUs FR-CWM-C-C and FR-CWM-W-C are classified under poor and moderate status respectively regarding Σ_{16}PAHs.

Table 3.1.4.4.4. Status assessment results of the NEAT tool applied on the 2 levels nesting scheme in the Alboran Sea Sub-division, using the xBAC as GES-nGES threshold for the assessment of EO9/CI17. The 2nd level of spatial integration (nesting) on the coastal zone is marked in bold. Blank cells denote absence of data. The % confidence is based on the sensitivity analysis.

SAU	Area (km^2)	Total SAU weight	NEAT value	Status class	% Confidence	CI17_Cd_seds	CI17_Hg_seds	CI17_Pb_seds	CI17_Cd_mus	CI17_Hg_mus	CI17_Pb_mus
ALBS-coastal	**4900**	**0**	**0.757**	**good**	76.5	**0.621**	**0.971**	**0.754**	**0.909**	**0.592**	**0.749**
MO-East-C	700	0.211	0.846	high	100	0.635	0.98	0.572	0.941	0.977	0.972
MO-Central1-C	805	0									
MO-Central2-C	361	0.109	0.824	high	97.5	0.606	0.98	0.924	0.908	0.733	0.79
MO-West-C	286	0.086	0.824	high	94.2	0.628	0.931	0.968	0.894	0.74	0.783
MO-Gib2-C	67	0.02	0.779	good	67.4	0.573	0.98	0.785			
MO-Gib1-C	71	0									
ALBS-ES-C	1908	0.574	0.701	good	79.9				0.905	0.497	0.702
ALBS-ALG-1A-C	702	0									

Table 3.1.4.4.5. Status assessment results of the NEAT tool applied on the 2 levels nesting scheme in the Tyrrhenian Sea Sub-division, using the xBAC as GES-non GES threshold for the assessment of EO9/CI17. The 2nd level of spatial integration (nesting) on the coastal zone is marked in bold. Blank cells denote absence of data. The % confidence is based on the sensitivity analysis.

SAU	Area (km^2)	Total SAU weight	NEAT value	Status class	% Confidence	CI17_Cd_seds	CI17_Hg_seds	CI17_Pb_seds	Σ_{16}PAHs_seds	Σ_7PCBs_seds	CI17_Cd_mus	CI17_Hg_mus	CI17_Pb_mus	Σ_{16}PAHs_mus	Σ_7PCBs_mus
TYRS-C	**27511**	**0**	**0.739**	**good**	99.9	**0.66**	**0.674**	**0.786**	**0.873**	**0.72**	**0.711**	**0.68**	**0.813**	**0.619**	**0.99**
FR-TYR-Corse-C	648	0	0.821	high	92.3	0.949	0.913	0.778			0.711	0.68	0.813	0.619	0.99
IT-TYR-1-C	6363	0.263	0.738	good	99.7	0.552	0.582	0.771	0.969	0.816					
IT-TYR-3-C	4122	0.17	0.712	good	100	0.489	0.398	0.806	0.933	0.934					
IT-TYR-4-C	8072	0.334	0.64	good	89.7	0.578	0.75	0.709	0.725	0.44					
IT-TYR-5-C	2685	0													
IT-TYR-SarE-C	2598	0.107	0.832	high	74.7	0.88	0.81	0.806							
IT-TYR-SicN-C	3023	0.125	0.939	high	100	0.971	0.804	0.967	0.983	0.972					

Table 3.1.4.4.6. Status assessment results of the NEAT tool applied on the 1st level IMAP subSAUs in the Central part of the Western Mediterranean Sea Sub-division, using the xBAC as GES-non GES threshold for the assessment of EO9/CI17. Blank cells denote absence of data. The % confidence is based on the sensitivity analysis.

SAU	NEAT value	Status class	% Confidence	CI17_Cd_seds	CI17_Hg_seds	CI17_Pb_seds	Σ_{16}PAHs_seds	Σ_7PCBs_seds	CI17_Cd_mus	CI17_Hg_mus	CI17_Pb_mus	Σ_{16}PAHs_mus	Σ_7PCBs_mus
ES-CWM-LEV1-C	0.788	good	79.6	0.823	0.804	0.598	0.935	0.875	0.896	0.749	0.639		0.796
FR-CWM-M-C	0.677	good	99.2	0.898	0.475	0.688			0.856	0.624	0.676	0.315	0.867
FR-CWM-Corse-C	0.816	high	81.4	0.924	0.888	0.661			0.729	0.698	0.813	0.81	0.99
IT-CWM-C	0.476	moderate	100	0.484	0.675	0.716	0.2	0.304					

560. The aggregation of the chemical parameters data per SAU leads to the NEAT value per SAU which represents the overall chemical status of the SAUs for the ALBS, as shown in Table 3.1.4.4.4. (4th column). It is clear that all SAUs achieve High or Good status and can be considered in GES regarding trace metals. Similarly, the aggregation-integration within the nested scheme for the coastal zone of the Alboran subdivision (ALBS-C), results in Good GES status regarding trace metals (shown in bold in Table 3.1.4.4.4).

561. The integration of SAUs data per chemical parameter (Table 3.1.4.4.4., 1st line in bold), shows that the coastal zone of the Alboran Sea (ALBS-C) achieves High or Good status regarding trace metals with the exception of Hg in mussels for which it is classified under Moderate status. The aggregation-integration of data for the coastal zone of the Alboran sub-division (ALBS-C) results in Good GES status regarding trace metals.

562. The results of the assessment findings for the Alboran Sea provided per contaminants of EO9/CI 17 without aggregation per habitat, i.e. sediment and biota, as presented in Table 3.1.4.4.4. Also, the final GES assessment findings for the coastal IMAP SAUs in the Alboran Sea, as provided in Table 3.1.4.4.4.are shown by the respective color in the map included in the following Figure WMS 3.1.4.4.3.C. The map depicts the integrated NEAT value for each SAU (i.e. aggregated value for all contaminants assessed as provided in the 4th column of Table 3.1.4.4.4).

563. The overall status for the coastal assessment zone of the Alboran Sea is Good. Assessment is integrated for metals in sediments and biota.

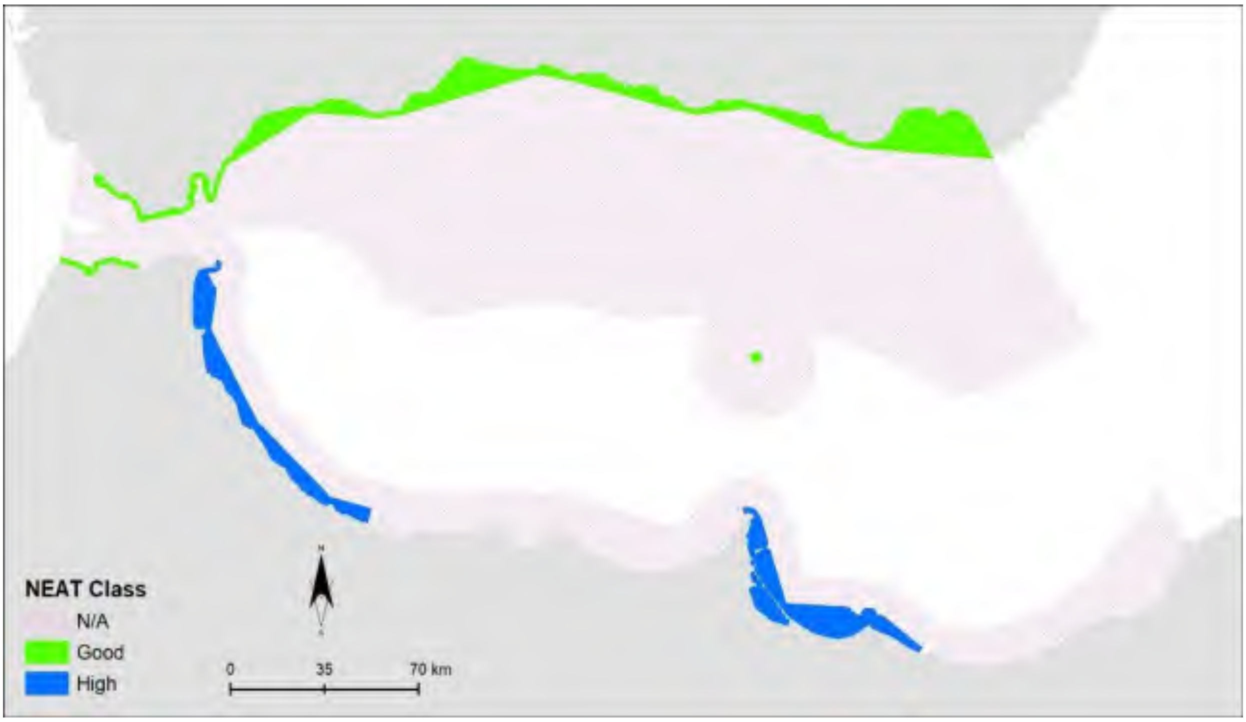


Figure WMS 3.1.4.4.3.C: The NEAT assessment results for trace metals TM in sediments and biota in the coastal assessment zone of the Alboran Sea. Assessment conducted using the xBAC GES-non GES threshold. All IMAP SAUs are in GES characterized by High or Good status. Shaded area corresponds to no available data for the assessment. An absence of some SAUs assessment might also be related to the decision of the countries to monitor areas that are found relevant for the assessment of contaminants and therefore excluding the areas where problems were not historically observed.

564. The aggregation of the chemical parameters data per SAU leads to the NEAT value per SAU which represents the overall chemical status of the SAUs in the TYRS as shown in Table 3.1.4.4.5 (4th column). . All SAUs achieve High or Good status and are in GES regarding contaminants assessed. Similarly, the aggregation-integration within the nested scheme for the coastal zone of the Tyrrhenian

subdivision (TYRS-C) however, results in Good GES status regarding contaminants assessed (shown in bold in Table 3.1.4.4.5.).

565. The integration of SAUs data per chemical parameter (Table 3.1.4.4.5., 1st line in bold), shows that the coastal zone of the Tyrrhenian Sea (TYRS-C) achieves High or Good status regarding chemical contaminants assessed. Similarly, the aggregation-integration within the nested scheme for the coastal zone of the Tyrrhenian subdivision (TYRS-C) as a whole indicates it can be considered in Good GES status regarding chemical contaminants assessed (shown in bold in Table 3.1.4.4.5.).

566. The final GES assessment findings per contaminants for sediments in the coastal IMAP SAUs in the Tyrrhenian Sea, as provided in Table 3.1.4.4.5., are shown by the respective color in the map included in Figure WMS 3.1.4.4.4.C. The map depicts the integrated NEAT value for each SAU (i.e. aggregated value for all contaminants assessed as provided in the 4th column of Table 3.1.4.4.5).

567. The overall status for the coastal assessment zone of the Tyrrhenian Sea is Good regarding contaminants assessed. Assessment is integrated for metals, Σ_{16}PAHs and Σ_7PCBs in sediments.

Figure WMS 3.1.4.4.4.C: The NEAT assessment results for trace metals TM, Σ_{16}PAHs and Σ_7PCBs in sediments in the coastal assessment zone of the Tyrrhenian Sea. Assessment conducted using the xBAC GES-non GES threshold. All IMAP SAUs are in GES characterized by High or Good status. Shaded area corresponds to no available data for the assessment. An absence of some SAUs assessment might also be related to the decision of the countries to monitor areas that are found relevant for the assessment of contaminants and therefore excluding the areas where problems were not historically observed.

568. The aggregation of the chemical parameters data per SAU in the CWMS leads to the NEAT value per SAU which represents the overall chemical status of the SAUs, as shown in Table 3.1.4.4.6. (4th column) and Figure WMS 3.1.4.4.5.C for the CWMS. All SAUs achieve High or Good status and are in GES with the exception of SAU IT-CWM-C where only sediments are monitored, and the overall status for this SAU is moderate regarding contaminants assessed.

Figure WMS 3.1.4.4.5.C. The NEAT assessment results for trace metals TM, Σ_{16}PAHs and Σ_7PCBs in sediments and mussels in the SAUs of France and Spain and in sediments in the SAU of Italy in the CWMS. Assessment conducted using the xBAC GES-nGES threshold. All IMAP SAUs are in GES characterized by High or Good status except sediments assessment in IT-CWM-C which shows moderate status. Shaded area corresponds to no available data for the assessment. An absence of some SAUs assessment might also be related to the decision of the countries to monitor areas that are found relevant for the assessment of contaminants and therefore excluding the areas where problems were not historically observed.

569. Based on the availability of data for contaminants as delivered by the CPs in the Western Mediterranean Sea Sub-region, the present integrated assessment status results produced by applying the NEAT tool on the sub-divisions ALBS and TYRS (shown in Tables 3.1.4.4.4. and 3.1.4.4.5;) can only be considered as an example of how the tool works. This is related to the fact that offshore SAUs lack of data, hence integration is meaningful only up to the 2nd level, i.e. the coastal assessment zone (ALBS-coastal and TYRS-coastal) [102]. Furthermore, several coastal SAUs lack data or the countries eventually decided not to monitor the areas that are found irrelevant for the assessment of contaminants and therefore excluded the areas where problems were not historically observed (blank cells in Tables 3.1.4.4.4., 3.1.4.4.5 and 3.1.4.4.6).

[102] Given lack of data for some SAUs, integration at a higher level that also includes these SAUs makes the uncertainty high.

<u>Assessment of IMAP Common Indicator 18: Level of pollution effects of key contaminants where a cause and effect relationship has been established</u>

Geographical scale of the assessment	The Sub-regions within the Mediterranean region by using scientific literature sources
Contributing countries	Countries in alphabetical order: Algeria, Egypt, Italy, Spain, Tunisia, Türkiye based on scientific literature sources
Mid-Term Strategy (MTS) Core Theme	Enabling Programme 6: Towards Monitoring, Assessment, Knowledge and Vision of the Mediterranean Sea and Coast for Informed Decision-Making
Ecological Objective	EO9. Contaminants cause no significant impact on coastal and marine ecosystems and human health
IMAP Common Indicator	CI18. Level of pollution effects of key contaminants where a cause and effect relationship has been established
GES Definition (UNEP/MED WG473/7) (2019)	Concentrations of contaminants are not giving rise to acute pollution events
GES Targets (UNEP/MED WG473/7) (2019)	• Contaminants effects below threshold • Decreasing trend in the operational releases of oil and other contaminants from coastal, maritime and off-shore activities.
GES Operational Objective (UNEP/MED WG473/7) (2019)	Effects of released contaminants are minimized.

<u>Available data</u>

570. The list of bibliographic studies on biomarkers used for the preparation of the 2023 MED QSR is sorted alphabetically by country as shown in Table 3.1.5.1.

571. Based on the literature search results it can be concluded that a comparison among the studies is hard or mostly impossible. This is due to the use of different biomarkers, with different biota species, using different tissues, and different methodologies. Moreover, as found in the 2017 QSR, there are confounding factors that hinders environmental status assessment such as species, gender, maturation status, season and temperature. In addition, an inherent bias exists in publications towards studies showing an effect. Authors and journals do not usually publish studies showing lack of effect or response. Italy submitted national data for CI 18 following the Meeting of CorMon Pollution that took place in Athens, 1-2 March 2023[103].

[103] Data included biomarkers (Acetylcholinesterase activity, Lysosomal membrane stability on cryostat sections, Micronuclei frequency, Metallothioneins, EROD-microsomal, EROD-S9, Fulton's Condition Factor, Gonadosomatic Index and Hepatosomatic Index) were measured in the fish M. barbatus sampled in 2019 and 2020. Data were not uploaded in the IMAP-Info System because they were found not compliant given the lack of data related to the 'maturation key' and of the 'tissue weight', which are considered mandatory. The national data could not be integrated into the CI 18 assessment as the 2023 MED QSR for CI18 was based on the use of regional scientific literature sources, using the evaluation provided by the authors. The newly submitted data of Italy were all for M. barbatus, for which no criteria were adopted yet, by the CPs. The assessment criteria for the biological effects on *M. barbatus* might be set in the future conditional to optimal data reporting by the CPs. Moreover, no conclusions were also set in the scientific literature.

Table 3.1.5.1: Studies on biomarkers in the Mediterranean Sea since 2016 reviewed in present assessment of CI 18. The list is sorted alphabetically by country.

Reference	Country	Sub-region	Sampling year	Taxa	Species	Organ/tissue	Stressor	Biomarker
Kaddour et al. 2021	Algeria	WMS	2019-2020	Fish	*Mullus barbatus*	blood	non specific	MN, NRRT
Amamra et al. 2019	Algeria	WMS	2016	mollusc	*Donax trunculus*	gonad, mantle, digestive gland	non specific	AChE, GST, MDA
Benaissa et al. 2020	Algeria	WMS	2016	mollusc	*Patella rustica*	Soft tissue	desalination brine	AChE, CAT, SOD, GR, GPx, GST, LPO, Genotox
Laouati et al. 2021	Algeria	WMS	2017	mollusc	*Perna perna*	digestive gland and gills	non specific, TM	AChE, CAT, GSH, GST, MDA
Gabr et al. 2020	Egypt	AEL	2018-2019	mollusc	*Ruditapes decussatus*	soft tissue	TM	AChE, SOD, GPx, MDA
Salvaggio et al. 2019	Italy	FAO Area 37	not reported	Fish	*Lepidopus caudatus*	liver, gonads	Microplastic, TM	VTG, MT
Frapiccini et al. 2021	Italy	ADR	2019	Fish	*Mullus barbatus*	muscle	PAH	CAT,SOD,GST,LPO
Chenet et al. 2021	Italy	CEN	2018	fish	*Trachurus trachurus*	liver	plastic	VTG, MT
Morroni et al. 2020	Italy	WMS	2017	Fish	*Diplodus vulgaris*	various	PAH, TM	AChE, MT, MN, LMS, EROD
Morroni et al. 2020	Italy	WMS	2017	Fish	*Mullus barbatus*	various	PAH, TM	AChE, MT, MN, LMS, EROD
Morroni et al. 2020	Italy	WMS	2017	Fish	*Pagellus erythrinus*	various	PAH, TM	AChE, MT, MN, LMS, EROD
Parrino et al. 2020	Italy	WMS	not reported	Fish	*Parablennius Sanguinolentus*	Brain and blood	pesticides	AChE, BChE
Morroni et al. 2020	Italy	WMS	2017	mollusc	*Mytilus galloprovincialis*	various	PAH, TM	AChE, MT, MN, LMS, EROD
Capo et al. 2022	Spain	WMS	2019	Fish	*Sparus aurata*	blood, plasma, liver	microplastic, plasticizers	CAT,SOD,GRd,GPx, MPO, GST, MDA, EROD, BFCOD, CE
Solomando et al. 2022	Spain	WMS	2020	Fish	*S. dumerili*	liver	microplastic	CAT,SOD,GST, EROD, MDA
Rios-Fuster et al. 2022	Spain	WMS	2019	mollusc	*Mytilus galloprovincialis*	Soft tissue	Anthrop. Particles, bisphenols , phthalate	CAT,SOD,GRd,GPx, GST, TES, GLY, CE, LPO, CARB, GSH
Capo et al 2021	Spain	WMS	not reported	mollusc	*Mytilus galloprovincialis*	gills	microplastic	CAT,SOD,GRd,GPx, GST,MDA, ROS
Rodríguez-Romeu et al., 2022	Spain	WMS	2019	Fish	*Engraulis encrasicolus*	Muscle and liver	Anthopogenic items ingestion	AChE, LDH, CS, CE, CAT, GST, EROD
Mansour et al. 2021	Tunisia	CEN	2016	mollusc	*Ruditapes decussatus*	Soft tissue	hydrocarbons	CAT,SOD,GRd,MDA, AChE

Reference	Country	Sub-region	Sampling year	Taxa	Species	Organ/tissue	Stressor	Biomarker
Zaidi et al. 2022	Tunisia	CEN	2018	mollusc	*Patella caerulea*	soft tissue	TM	CAT,SOD,GPx,GST,MDA
Ghribi et al. 2020	Tunisia	CEN	2017 mesocosm	mollusc	*Mytillus spp*	hemolymph, gills, and digestive gland	non specific PAH, TM	CAT, GPx, GST, AChE
Missawi et al. 2020	Tunisia#	CEN	2018	Seaworm	*Hediste diversicolor*	whole (gut cleaned)	Microplastic	CAT,GST,MDA, AChE
Zitouni et al. 2020	Tunisia*	WMS	2018	Fish	*Serranus scriba*	gastrointestinal tract	Microplastic	CAT,GST,MDA, AChE,MT
Telahigue et al. 2022	Tunisia	WMS	2020-2021	mollusc	*Flexopecten glaber*	gills, digestive gland	TM	CAT,SOD,GPx,GSH, MT, MDA
Bouhedi et al 2021	Tunisia	WMS	not reported	polychaete	*Perinereis cultrifera*	whole body	TM	CAT,GST, AChE, MT, GSH, TBARS
Uluturhan et al. 2019	Türkiye	AEL	2015	mollusc	*Mytilus galloprovincialis*	Hepatopancreas	TM, Pesticides	CAT,SOD,GPx, AChE
Uluturhan et al. 2019	Türkiye	AEL	2015	mollusc	*Tapes decussatus*	Hepatopancreas	TM, Pesticides	CAT,SOD,GPx,AChE
Dogan et al, 2022	Türkiye	AEL	2021	Fish	*Mullus barbatus*	muscle, liver	TM	CAT, MDA
Dogan et al, 2022	Türkiye	AEL	2021	Fish	*Boops boops*	muscle, liver	TM	CAT, MDA
Dogan et al, 2022	Türkiye	AEL	2021	Fish	*Trachurus trachurus*	muscle, liver	TM	CAT, MDA

#data related to the WMS as well; * data related to the CEN as well.
Biomarkers Abbreviations: AChE-Acetylcholinesterase, BChE-Butyrylcholinesterase, BFCOD-7-benzyloxy-4-[trifluoromethyl]-coumarin-O-debenzyloxylase, CAT-Catalase, CE-Carboxylesterase, CS-Citrate synthase,EROD-Ethoxyresorufin-O21 deethylase, ETS-Electron Transport System, GLY-Glycogen, GPx-Glutathione peroxidase, GRd-Glutathione reductase, GSH- Glutathione, GST-Glutathione-S-transferase, LDH-Lactate dehydrogenase, LMS-Lysosomal Membrane Stability, LPO-Lipid peroxidation, MDA-Malondialdehyde, MN-Micronucleus Assay, MT-Metallothionein, NRTT-Neutral red retention time, SOD-Superoxide dismutase, SoS-Stress on Stress,VTG-Vitellogenin

Results of the IMAP Environmental Assessment of CI 18 in the Mediterranean region.

Due to absence of any data reporting by the CPs, data for present assessment were retrieved from the scientific literature. The studies surveyed do not include the parameters assessed in the 2017 MED QSR in mussel. The only exception is Morroni et al., 2020 that measured LMS, AChE and MN in *M. galloprovincialis* but not in the same organs except for MN that was measured in haemocytes with a value of 0.3 permil in reference area and a maximal value of 1.3 permil. The maximal value is slightly higher than 1 permil, the MED BAC adopted in Decision IG.23/6. Ghribi et al., 2020 and Uluturhan et al, 2019 reported AChE in haemolymph and hepatopancreas, respectively and not in gills.

572. Given GES assessment was not possible for CI 18 within the preparation of the 2023 MED QSR, the regional overall assessment findings were provided for the Mediterranean as presented here-below. Instead of providing GES /non-GES classification, the assessment for IMAP CI 18 was based on the determination of biomarkers that were affected by contamination.
573. A summary of reviewed studies is sorted by sub-regions and countries. The biomarkers that were affected by contamination are marked in red, those that were not affected are marked in green, while inconclusive results are marked in blue. Moreover, the biomarkers included in the DDs and DSs are highlighted in yellow, but with no differentiation among species or tissues studied.

a) AEL sub-region (Egypt, Türkiye)

574. Egypt. One study was reviewed. The effect of TM was studied in the mussel *Ruditapes decussatus* collected from Alexandrian Port and Port Said (Gabr et al. 2020). The concentrations of metals were higher in samples from the Alexandrian Port (Site I). Malondialdehyde (MDA) and SOD were higher in samples from Site I while GPx, Total protein and AChE were lower. The reported values in this study are considered as basic data to monitor of the anthropogenic influence on the coastal environment.

575. Türkiye**.** Two studies were reviewed for Türkiye: one from 2015 and one from 2022[104]. The effect of TM and pesticides was studied on the molluscs *Mytilus galloprovincialis* and *T. decussatus* collected from Homa Lagoon (Aegean Sea). The study showed marked differences on the biomarkers (CAT, SOD, GPx, and AChE) but the differences were mainly attributed to seasonal variations and to differences among the two species (Uluturhan et al. 2019). The effect of TM was also studied in the fish *M. barbatus, B. boops and T. trachurus* collected along the coast of Türkiye in the Levantine and the Aegean Seas. Correlations were found between CAT and MDA and some of the trace metals measured in the fish specimens.

b) ADR sub-region (Italy)

576. Italy. One study reported the effect of PAHs in the fish *Mullus barbatus* collected in the northern Adriatic (Frapiccini et al. 2020). The expressions of CAT and GST in *M. barbatus* were dependent on the season, lower in the winter and higher in the summer. SOD expression did not depend on the season. LPO was higher in the winter. CAT showed a significant negative correlation with total

[104] Submitted to Research Square, not peer reviewed by a scientific journal

PAH concentrations, especially total LMW-PAH, in individuals collected during winter. Both GST and SOD did not show any significant correlation with PAH levels.

c) CEN sub-region (Tunisia, Italy)

577. Seven studies were reviewed for Tunisia: 2 from the WMS , 3 from the CEN and 2 with data from both the WMS and the CEN. In the CEN, one mesocosm experiment was performed in *Mytilus spp*. exposed to sediment contaminated by PAH and TM collected from the Zarzis area (Ghribi et al. 2020), while the effects of hydrocarbons were studied in the mollusc *Ruditapes decussatus* collected from the southern Lagoon of Tunis (Mansour et al. 2021). The effect of TM on the mollusc *Patella caerulea* was studied in specimens collected from 4 sites in the CEN (Zaidi et al. 2022).

578. *Mytilus spp* exposed to contaminated sediments in a mesocosm experiment presented the highest values of the tested oxidative stress biomarkers (CAT, GST, GPx) and a significant inhibition of AChE activity in comparison with the unpolluted reference site.

579. Hydrocarbons were found to affect the biomarkers CAT, GR, SOD, MDA and AChE activities in *Ruditapes decussatus.*

580. SOD and GPx activities measured in *P. caerulea* were different among sites (higher in more affected stations), while CAT was similar on all four stations. MDA was inducted but no differences were found among the sites.

581. Italy. In the CEN, the effect of plastic ingestion was studies in the fish *Trachurus trachurus* collected for the Sicily straits (Chenet et al. 2021).

582. Vitellogenin was highly expressed in *T. trachurus* females as expected, there is also a significant expression of the VTG gene in 60% of the males analyzed, from both sampling sites. Moreover, females in Lampedusa island showed a lower expression of vitellogenin than in Mazara del Vallo (with one female sample, TT54, not expressing VTG at all). The endocrine disruption represented by the alteration of VTG expression in specimens observed in this work can be caused by microplastic ingestion, as well as by the interactions between the marine organisms and the wide variety of endocrine-disrupting chemicals possibly present in seawater.

d) WMS sub-region (Algeria, Spain, Tunisia, Italy)

583. Algeria. Four studies reviewed for Algeria studied the effects of non-specific stressor in the mollusc *Donax trunculus* from Annaba Bay (Amamra et al. 2019) , in the fish *Mullus barbatus* along the Algerian west coast (Kristel, Oran, Ghazaouet) (Kaddour et al. 2021), on the mollusc *Perna perna* transplanted to the Gulf of Annaba initianorth-eastern coast) (Laouati et al. 2021) and on the mollusc *Patella rustica* affected by the brine of the Bousfer desalination plant in Oran Bay (Benaissa et al. 2020).

584. *Donax trunculus* specimens showed a significant inhibition of AChE and induction of GST and MDA in individuals of Sidi Salem and Echatt as compared to El Battah with significant effects of both site and season. The effects were more pronounced during summer and spring compared to the other seasons. In addition, the comparison between tissues revealed a more marked response in gonad than mantle and digestive gland.

585. In *M. barbatus*, a significant increase in the frequency of micronuclei (MN) occurrence in the summer period correlated with significantly shorter NRRT. In addition, the erythrocytes of *M. barbatus populations* from polluted areas presented statistically higher MN frequencies and shorter NRRT than those of the reference site.

586. GSH decreased in the gills and digestive glands of *P. perna* specimens transplanted to two of the sites affected by anthropogenic input while GST and CAT activities showed no significant variation. The MDA content in the mussel digestive glands, but not in the gills, increased significantly after the deployment period in the three caging sites, and were significantly different among the 3 sites. AChE activity was significantly inhibited registered in the gills of mussels from the 3 sites and in the digestive glands from one site.

587. A multibiomarker approach (oxidative stress, biotransformation enzyme, lipid peroxidation, neurotoxicity and genotoxicity) were applied in the soft tissue of *P. rustica* . This biomonitoring confirmed the negative impact of brine discharges of the desalination plant, with samples collected close to the outfall more affected. by all the environmental disturbances than ones from the other sites. CAT, TGPx, GR, GST, CSP-3like activities were increased in samples from the outfall. AChE was lower however not significantly different from samples collected from the reference site. Genotoxic effect revealed by ADN and lipid damages.

588. Spain. Five studies were reviewed for Spain: four studies studied the effect of microplastic ingestion and of plasticizers on the biomarker responses, while one studied the effect of anthropogenic items ingestion. Three studies were conducted in the Integrated Multi-Trophic Aquaculture cages in Palma de Majorca, where specimens of the mussel *Mytilus galloprovincialis* and of the fish *Sparus aurata* were transplanted to and analyzed at time 0, after 60 days (T_{60}) and after 120 days (T_{120}) of exposure (Capó et al. 2022, Capo et al. 2021, Rios-Fuster et al. 2022). One study was performed with *S. dumerili* collected around the Balearic Islands (Solomando et al. 2022). Anthropogenic items ingestion was studied in *E. encrasicolus* collected off Catalunia (Rodríguez-Romeu et al. 2022).

589. No effects of time were observed in CAT, SOD, and GRd activities *M. galloprovincialis*, but they were significantly higher in specimens sampled from the cages than in specimens from the controls. GST activity did not change with time, and it increased significantly only in samples for the cages at T_{60}. In T_{120} activity was higher in the cages only if compared to one of the control sites. GPx activity was modulated by both sampling site and time: higher activities in specimens from the cages at T_{120}. MDA was higher in samples from the cages compared to the controls at T60. In a different study with *M. galloprovincialis* higher expressions were observed in the biomarkers CAT, SOD, GPx and LPO in specimens from the aquaculture cages. Those could be triggered by the presence of bisphenol but also by other possible contaminant inputs from the aquaculture.

590. MDA increased throughout the study both in liver and blood cells of *S. aurata* but with a progressive decrease in plasma. EROD, BFCOD and CE, showed a comparable decrease at T_{60} with a slight recovery at T_{120}. In contrast, GST activity was significantly enhanced at T_{60} compared to the other sampling stages.

591. SOD, CAT, and GST activity were significantly higher in *S. dumerili* with higher microplastic (MP) load, while no significant differences were observed for MDA, and EROD enzyme activity.

592. AChE, CAT and GST were lower in *E. encrasicolus* collected off Barcelona, compared to specimens collected Blanes and Tarragona; Terragona LDH, CE and EROD were higher in Terragona

than in the other two locations; Blanes CS was higher than in Tarragona. These differences could not be correlated with any potential stressors nor with fish size Catalunia (Rodríguez-Romeu et al. 2022).

593. Italy. Five studies were reviewed for Italy: 2 from the WMS, 1 from FAO zone 37 (not further specified), 1 from the CEN, 1 from the ADR . In the WMS, the effect of pesticides were studied in the fish *Parablennius sanguinolentus* from the port of Bagnara (western Calabria) (Parrino et al. 2020), and the effect of TM and PAHs on mollusc (*Mytilus galloprovincialis*) and fish (*Mullus barbatus, Pagellus erythrinus* and *Diplodus vulgaris)*from the bay of Pozzuoli (Naples)(Morroni et al. 2020). Microplastics and TM effects were studied on the fish *Lepidopus caudatus* collected from FAO area 37 (area not further specified) (Salvaggio et al. 2019).

594. AChE activity in the brain and BChE activity in blood were significantly inhibited in specimens of *P. sanguinolentus* from the affected port area, by 23.5 and 72.0%, respectively. The esterase inhibition was primarily due to carbamate and organophosphorus insecticides presence.

595. In the Bay of Pozzuoli, the effect of pollution varied by species and biomarkers. In *M. galloprovincialis*, there was a decreased LMS and increased MN at two sites compared to organisms from other areas while no variations were observed for the AChE in haemolymph, nor for MT in digestive gland of mussels from various sites. AChE activity was not affected in *M. barbatus* sampled in the industrial area while a decrease of this biomarker AChE was observed in *P. erythrinus* and *D. vulgaris*. The EROD enzymatic activity was significantly induced in *M. barbatus* and *P. erythrinus* sampled in the industrial area compared to specimens from the reference site, while the cytochrome P450 biotransformation pathway was unaffected in *D. vulgaris*. At the same time, all the fish species exhibited higher levels of aromatic metabolites, particularly B[a]P-like and pyrene-like, in organisms sampled in the industrial compared to reference area. MN increased in gills of *M. barbatus* from the industrial area.

596. Immunohistochemical analysis for anti-metallothionein 1 antibody in *L. caudatus* showed a strong positivity of liver cells, both in females and males, showing a strong stress that activated a cell detoxification system. The immunohistochemical analysis for the anti-vitellogenin antibody showed in females a strong positivity both in the liver cells, and in the gonads, as expected. The analysis of the liver and gonadal preparations of the male specimens was found to be always negative except for one specimen.

597. Tunisia. Seven studies were reviewed for Tunisia: 2 from the WMS, 3 from the CEN and 2 with data from both the WMS and the CEN. In the WMS, the effect of TM was studied in the mollusc *Flexopecten glaber* collected from the Bizerte Lagoon (Telahigue et al. 2022) and on the polychaete *Perinereis cultrifera* collected from the port of Tades and the Punic port of Carthage (Bouhedi et al. 2021). The following 2 studies have data from the two sub-regions: WMS and CEN. The effect of microplastic ingestion was studied in the fish *Serranus scriba* collected from 6 sites along the Tunisian coast (Zitouni et al. 2020) and on the seaworm *Hediste diversicolor* collected from 8 sites along the Tunisian coast (Missawi et al. 2020).

598. The distribution of most analyzed metals in *F. glaber* tissues varied significantly between sites, seasons, and organs. The highest levels were recorded at the polluted site during the warm period. Moreover, the digestive gland was found to accumulate greater concentrations of TM than the gills. The biomarkers (MDA, GSH, GPx, SOD, CAT) in gills were higher in the polluted site while MT was not affected. In the digestive gland, only CAT and MDA showed an increase activity in the polluted site.

599. Higher level of thiobarbituric acid were found in *P. cultrifera specimens* from polluted site. In addition, CAT, GST, SOD, glutathione and MT were enhanced and AChE activities decreased in *specimens from* the contaminated site compared to those from the reference (or less contaminated site).

600. Biomarkers of oxidative stress (MT, CAT, GST, MDA) and neurotoxicity (AChE) responses in *S. scriba* were dependent on site and on the size of the microplastic. High content of microplastic in the gastrointestinal track increased MT levels and GST activity. CAT activity and MDA accumulation were positively related with the medium size class MP A significant negative correlation was found between AChE activity and the small size class of microplastic (MP). The study could not rule out some influence of other pollutants that may be present in some of the sites on biomarker response.

601. In the seaworm *Hediste diversicolor*, responses increased with increased microplastic tissue concentration, in particular CAT but also MDA. A decrease of GST activity was reported in the same sites. AChE was significantly inhibited indicating neurotoxicity.

602. ***Figures 3.1.5.1 and 3.1.5.2*** depict the sampling areas. Figure 3.1.5.1 shows the whole Mediterranean Sea, while Figure 3.1.5.2 shows in detail the study areas off eastern Algeria and Tunisia, where many of the reviewed studies were performed.

Figure 3.1.5.1. Areas of study for biomarkers, reviewed in the recent (since 2016) scientific literature for the Mediterranean Sea. When no coordinates were presented in the papers, the general area was marked in the map.

Figure 3.1.5.2. Detailed map of the study areas for biomarkers reviewed in the recent (since 2016) scientific literature for eastern Algeria and Tunisia coasts. Many stations were occupied in this area of the Mediterranean Sea.

603. Further to the above results based on a review of the studies by sub-regions and countries, it can be concluded that twenty-four studies were retrieved from the scientific literature as follows: 4 studies from Algeria (WMS), 1 from Egypt (AEL), 5 from Italy (2 from WMS, 1 from ADR, 1 from CEN and one from FAO zone 37), 5 from Spain (WMS), 7 from Tunisia (2 from WMS, 2 from CEN and 3 with data from both the WMS and CEN), and 2 from Türkiye (AEL).

604. The sub-region most represented is the WMS, followed by the CEN. In the CEN all studies except one were performed in Tunisia. There was one study from the ADR and three in the AEL.

605. The monitoring species, M. galloprovincialis and M. barbatus, appeared in 5 and 4 studies, respectively. In addition, 10 fish species, 6 mollusc species and 2 polychaeta species were also studied.

606. Of the mandatory biomarkers as defined in in the DDs and DSs for IMAP CI-18, AChE appeared in 13 studies, MT in 5 studies (2 with molluscs, 2 with fish and one with a polychaete species), MN in 2 and LMS-NRTT in 1 study.

607. Data from studies cannot be compared to BAC and EACs values as agreed by Decisions IG.22/7 and IG.23/6 (COP 19 and COP 20) because they were not measured in the specific tissue of M. galloprovincialis.

608. The most common additional biomarkers measured in the reviewed studies were: CAT (15 studies), MDA (12 studies), GST (11 studies), SOD (9 studies), and GPx (8 studies).

609. The anthropogenic stressors identified were: Trace metals (10), Plastic/microplastic (8), non-specific (4), PAHs (3), Pesticides (2), hydrocarbons (1), anthropogenic items, and one study with desalination brine as a source.

610. Drivers and pressures reported in the studies, encompassed the whole range of them: domestic and industrial discharges, agricultural and riverine runoff, fisheries, harbor and marina utilization, maritime activities, tourism. Most of the studies described the environmental conditions at the sampling areas. The exemption was for microplastics, where the source was not determined, and microplastics were considered ubiquitous in the environment.

611. Most biomarkers studied showed a response to anthropogenic stressor. In the case of microplastics, the size of the microplastic also influenced the response.

612. Studies demonstrated that, in addition to anthropogenic stressors, biomarker responses were influenced also by seasonality, tissue analyzed, spawning status, and on species identity.

Assessment of IMAP Common Indicator 19: Occurrence, origin (where possible), extent of acute pollution events (e.g. slicks from oil, oil products and hazardous substances), and their impact on biota affected by this pollution

Geographical scale of the assessment	Sub-regions within the Mediterranean region based on integration of the assessments at Sub-divisions level
Contributing countries	Data from MEDGIS-MAR, Lloyd List Intelligence Seasearcher, CleanSeaNet Service
Mid-Term Strategy (MTS) Core Theme	1-Land and Sea Based Pollution
Ecological Objective	EO9. Contaminants cause no significant impact on coastal and marine ecosystems and human health
IMAP Common Indicator	CI19. Common Indicator 19: Occurrence, origin (where possible), extent of acute pollution events (e.g. slicks from oil, oil products and hazardous substances), and their impact on biota affected by this pollution
GES Definition (REMPEC/WG.51/9/1)	Occurrence of acute pollution events are reduced to the minimum.
GES Targets (REMPEC/WG.51/9/1)	1. Decreasing trend in the occurrence of acute pollution events
GES Operational Objective (REMPEC/WG.51/9/1)	Acute pollution events are prevented, and their impacts are minimized

Available data

613. Three major datasets are available to extract data on oil and HNS spills at the Mediterranean scale: MEDGIS-MAR, Lloyd List Intelligence Seasearcher (hereafter Lloyd), CleanSeaNet Service.

614. The Mediterranean Integrated Geographical Information System on Marine Pollution Risk Assessment and Response (MEDGIS-MAR) is a database managed by REMPEC containing national data about response equipment, accidents, oil and gas installations, and oil handling facilities. Data on

accidents are collected in MEDGIS-MAR since 1977. For this assessment, MEDGIS-MAR data were filtered considering the events causing pollution ("Pollution" = YES) and located into the sea or within a 1 km inland buffer (to include events in any case occurring close to the sea, as for example in port areas).

615. The Lloyd List Intelligence Seasearcher, privately managed, gathers several data on shipping, including ship incidents, recorded since the 70s. The exportable tables do not include information about the spilled substances and volumes. Several incidents registered in the Lloyd database are also included in MEDGIS-MAR. For this assessment, Lloyd data were filtered considering the events causing pollution ("Pollution indicator = YES") and located in the Mediterranean Sea (thus, excluding those in the Black Sea).

616. CleanSeaNet is a European satellite-based service for oil spills and vessel detections managed by the European Maritime Safety Agency (EMSA). The full access to CleanSeaNet database is granted to Member States National Competent Authorities, while the open access website provides access to the so-called yearly "Detection and Feedback data", for the period 2015-2021. These pdf documents have been used for this assessment and include the parameters of interest for the assessment. The available dataset does not include information enabling to distinguish the spilled substance. For the assessment Class A events (high confidence of detection) were considered.

617. The above databases are based on the two different approaches: MEDGIS-MAR and Lloyd are populated with incident reports provided by ships or countries. CleanSeaNet includes satellite observations of possible spills. The number of events reported in each database is therefore very different: MEDGIS-MAR and Lloyd register tens of events per year in the Mediterranean while CleanSeaNet registers hundreds of events per year in the sea basin. CleanSeaNet detections can be caused by mineral oil and other pollutants, but may also indicate naturally occurring features (e.g. algae blooms, areas of upwelling, etc.). CleanSeaNet includes observations spills of different sizes, including also very small ones, not only related to incidents but also to accidental or illicit discharges. In addition to that, it should be observed that spills recorded by CleanSeaNet can derive from offshore (O&G prospections and extractions) or coastal activities, not linked to maritime transport. The datasets extracted from the three databases provide different and complementary information and were therefore assessed separately.

618. With reference to MEDGIS-MAR and Lloyd, the two databases show some overlaps (this means that some incidents are present in both databases). For recent data, integration between the two datasets has been carried out by REMPEC. Despite this, several differences between the two databases still remain and need to be considered by the Contracting Parties and others. A full integration of the two datasets remains outside the scope of this assessment.

619. CleanSeaNet data are considered in the study in order to accomplish for operational pollution events. Such events refer to voluntary or accidental release of oil or other substances. They can result from human decision, error or technical failure. In the Mediterranean any discharge into the sea of oil or oily mixture from the cargo area of an oil tanker is prohibited, according to Annex I of the International Convention for the Prevention of Pollution from Ships (MARPOL). Notwithstanding this, operational pollution and, particularly, illicit discharges, is recognized as a major problem in the region. With the worldwide and regional decrease in the number of big spills caused by important ship accidents, the issue of small but very numerous spills has become an important element to be considered when assessing the state of this indicator in the Mediterranean (REMPEC, 2022).

620. When considering CleanSeaNet dataset, uncertainty related with oil spill detection should be considered. Percentage of correctly detected slicks is known to vary with sensor type, data processing and slick recognition methods, as well as their temporal evolution. Such a percentage is reported to generally rank above 80% (e.g. Carvalho et al., 2021; Shaban et al., 2021; Huang et al., 2022). A fixed correction factor cannot be applied to the entire Mediterranean and to the whole temporal range considered, because this percentage not only depend on above elements but may vary also in relation with several local conditions. Thus, for the purpose of the present study, all reported CleanSeaNet Class A records (observations) have been considered in the assessment. In addition, CleanSeaNet datasets might be biased by increasing monitoring effort from 2015 to the present. Within present assessment of CI 19, it was possible to obtain information on this aspect. Based on these considerations, it is recognised that the adopted methodological approach can lead to an overestimation of the number of oil spills events detected by CleanSeaNet and of their extension. To cope with this possible overestimation, CleanSeaNet data have been used in relative terms (as detailed further below), to identify the areas with the highest spill occurrence and to calculate differences between time periods. In addition to that, in the integrated evaluation of the three datasets and formulation of the final assessment, CleanSeaNet data have been considered with a lower weight than data reported by MEDGIS-MAR and Lloyd. This approach is considered to be in line with the precautionary principle and with the need to account for small spills and illicit discharges.

The integrated assessment of datasets related to CI 19

621. For the purpose of the present assessment of CI 19, the four main sub-regions and related sub-divisions have been established namely: the Western Mediterranean Sea (including the Alboran Sea characterized by the exchange of the Mediterranean waters with the Atlantic Ocean), the Adriatic Sea (which is a double semi-enclosed area by itself and the Mediterranean Sea), the Central Mediterranean (acting as the nexus for the eco-regions and located in the centre of the basin with a low anthropogenic influence), and the Aegean and Levantine Sea in the Eastern Mediterranean part.

622. The application of the environmental assessment methodology for CI 19, is based on the integration of evidences from all the three analyzed datasets.

The assessment for CI 19 in the period 2018-2021 jointly considers: (1) the information on the frequency of spill occurrence i.e., yearly average number of spills/10000 km^2 and yearly average extension of areas interested by pollution/10000 km^2, and (2) the information on the trend of such frequency i.e., increasing, decreasing, stable with no spill, represented by the variation in % in comparison with the previous assessment period (2013-2017). This element (variation of spill density) is based on a CHASE-like approach and capitalizes some elements of the methodology adopted by HELCOM for the assessment of oil spill in the Baltic Sea (HELCOM 2018). The spatial component of the analysis was detailed: the 2023 MED considers the sub-regions and the relative sub-divisions identified in the Mediterranean Sea.

For each of three datasets, the assessment was based on the following steps:

i. Quantification of the average number of oil spills per year in the period 2018-2021 for the entire Mediterranean Sea and its sub-divisions.
ii. The average number of oil spills was standardised on the extension of each sub-division, thus enabling to calculate the average number of spills per 10000 km2 in the assessment period for the entire Mediterranean and its sub-divisions.
iii. The three sub-divisions characterised by higher values of the indicator calculated in step 2 were highlighted in dark red/red/orange to remark the three highest oil spill occurrences.
iv. Percentage of variation (2018-2021 vs. 2013-2017) of average yearly spill occurrence was then calculated for the entire Mediterranean and for each sub-division.
v. Based on the computed percentage variation, the following colour-based classes were defined for variation in percentage: blue = no spills recorded in the sub-division, in the period of assessment (2018-2021) nor in the previous reference period (2013-2017); green = decreased frequency of spill occurrence in the sub-division; yellow = increased frequency of spill occurrence ≤ 100% in the sub-division; red = increased frequency of spill occurrence > 100% in the sub-division.

In the case of CleanSeaNet dataset, the same assessment above described was implemented also for the extension of areas interested by pollution due to oil spills, still comparing 2018-2021 with the previous 2015-2017 period. MEDGIS-MAR enabled to implement the same assessment also on the number of spills of substances other than oil: Hazardous and Noxious Substances (HNS), other substances (non-HNS) and Unknown substances.

This integrated assessment of the evidences from the three data sets was based on the following three criteria:

a) Occurrence of spills reported through MEDGIS-MAR and Lloyds, which are mainly linked to relatively large pollution events and to incidents. Occurrence of reported events is considered as a "negative" factor in the overall assessment of the quality status of a given sub-division, while the absence of reported events is considered as "positive". As additional element to the sub-divisions ranked among the first three for frequency of occurrence of spills, an additional "negative" factor was considered.
b) CleanSeaNet data are used as an indicator of relatively smaller spills, related to minor incidents or illicit discharges. This second criterion has been weighted less than the previous one, to take into consideration the possibility of overestimation of the number and extension of spills reported in this dataset. Thus, a negative contribution to the overall status was considered for the sub-divisions ranking among the first three in terms of average extension of areas affected by oil pollution.
c) The temporal variation of the average number of spills (for all the three datasets) and their extension (for CleanSeaNet) between the assessment period (2018-2021) and the previous reference period (2013-2017 for MEDGIS-MAR and Lloyds; 2015-2017 for CleanSeaNet) was considered. An increasing trend was considered as negative for the overall assessment of the quality status, while a decreasing trend provided a positive indication.

Results of the IMAP Environmental Assessment of CI 19 in the Mediterranean region

623. Table 3.1.6.1. provides an overview of the assessment results based on synthetic data extracted from datasets and used for the assessment. Considering the spills reported by the ships and countries regarding the incidents, MEDGIS-MAR and Lloyd List data indicate for the entire Mediterranean in the assessment period an average occurrence frequency of 0.033 and 0.051 n/y/10000 km2, respectively. The most affected sea is the Aegean Sea, followed by the Ionian Sea, according to MEDGIS-MAR (no incidents reported by Lloyd List, instead) and the Alboran Sea according to Lloyd List (no incidents reported by MEDGIS-MAR, instead). The Northern Adriatic Sea ranks third for occurrence of incidents, according to the Lloyd List (no incidents reported by MEDGIS-MAR, instead). These results are in accordance with the relative intensity of vessel traffic (hours/km), that indicates the Aegean Sea, the Alboran Sean and the Northern Adriatic as the most trafficked areas of the Mediterranean.

624. Focusing on the spills detected by satellite monitoring (CleanSeaNet data), the Adriatic Sea is the area with the highest standardised (per 10000 km2) frequency of spill occurrence and the area where the largest extension of polluted areas is detected. This could be explained by the fact that satellite monitoring enables to detect also small spills, (including small, non-reported incidents, illicit discharges, spills due to other offshore activities. These are particularly numerous in the Adriatic where, beside significant traffic density due to cargos, tankers and passenger vessels, other type of vessels are present in large number,including fishing vessels.

625. The temporal variations in spill occurrence computed from the three different databases are very different. According to MEDGIS-MAR a general improvement of the status can be observed for this indicator, with Alboran Sea, Tyrrhenian Sea and the whole Adriatic Sea reporting no spills both in the considered and in the previous assessment period. Considering Lloyd, a general worsening of the status of the indicator can be observed in the Alboran Sea, Western Mediterranean, the Tyrrhenian Sea, the Northern Adriatic the Aegean Sea showing increased spill occurrence. These findings mostly agree with the ones from CleanSeaNet which additionally highlight an increase of spill occurrence also for the Central Mediterranean, the Middle Adriatic Sea, the Ionian Sea and the Levantine Sea.

626. It is worth noting that CleanSeaNet datasets might be biased by increasing monitoring effort from 2015 to the present. Within present assessment of CI 19, it was possible to obtain information on this aspect.

627. MEDGIS-MAR is the only datasets among the three considered in this assessment allowing to describe the trend in the number of spills of substances other than oil. In MEDGIS-MAR, such substances are categorized as Hazardous and Noxious Substances (HNS), other substances (non-HNS) and Unknown substances. Decrease in number of events with respect to the previous period, or no events recorded, was observed in the last four year in all sub-divisions, with the exception of Ionian Sea and the Aegean Sea. The Levantine sea scores third in number of events, even if with a decreasing trend. iLarge (above 700t) and medium size spills (7-700t) have not been reported since 2018. The last four years are characterised only by small spill events, although several events with unknow size (4 in 2019) have been registered.

Table 3.1.6.1.: CI 19 assessment. (1) average number of oil spills in the assessment period (2018-2021) per 10000 km^2 for the three datasets; (2) average extension of areas interested by oil pollution in the assessment period (2018-2021) per 10000 km^2 (from CleanSeaNet) - the three highest values only are highlighted; (3) average number of other substances spills in the assessment period (2018-2021) per 10000 km^2 (from MEDGIS-MAR); (4) % of variation compared to the previous period of the above indicators for oil spills; (5) % of variation compared to the previous period of the above indicator on other substance spills. Colour code for spill frequency and variation in the extension of the area affected by pollution: dark red = highest value; red = second highest; orange = third highest. Colour code for % variations: blue = no spills recorded, in the assessment period, nor in the previous period; green = decreased frequency of spill occurrence; yellow = increased frequency of spill occurrence <= 100%; red = increased frequency of spill occurrence > 100%. Data sources: MEDGIS-MAR, Lloyd List Intelligence Seasearcher, CleanSeaNet.

Frequency of spills / total polluted area (average values in the period 2018-2021, per 10000 km^2)											
	TOT MED	**ALBS**	**WMS**	**TYRS**	**CEN**	**NADR**	**MADR**	**SADR**	**IONS**	**AEGS**	**LEVS**
Oil											
(1) MEDGIS-MAR	0.033	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.089**	**0.334**	0.000
(1) LLOYD	0.051	**0.178**	0.039	0.012	0.000	**0.075**	0.000	0.000	0.000	**0.371**	0.028
(1) CleanSeaNet (n)	9.3	11.3	9.0	6.8	5.9	**16.5**	**15.4**	**15.6**	9.6	10.9	11.3
(2) CleanSeaNet (km^2)	68.2	57.5	76.6	44.6	62.8	**104.7**	**130.5**	**120.3**	54.4	39.6	75.9
Other substances											
(3) MEDGIS-MAR	0.031	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.104**	**0.284**	**0.004**
Summary of variation %											
	TOT MED	**ALBS**	**WMS**	**TYRS**	**CEN**	**NADR**	**MADR**	**SADR**	**IONS**	**AEGS**	**LEVS**
Oil											
(4) MEDGIS-MAR	-57	-	-100	-	-100	-	-	-	25	-56	-100
(4) LLOYD	12	67	41	25	-100	-	-	-100	-100	34	-27
(4) CleanSeaNet (n)	85	32	62	22	139	207	100	79	137	60	108
(4) CleanSeaNet (km^2)	103	64	106	24	244	197	48	87	141	12	99
Other substances											
(5) MEDGIS-MAR	-14	-100	-100	-	-100	-	-100	-	192	31	-89

628. The combined application of the three assessment criteria defined above (a, b, c) led to the classification of the quality status of CI 19 in the Mediterranean sub-divisions in five classes: bad (red), poor (brown), moderate (yellow), good (green), high (blue). As provided in Table 3.1.6.2, and mapped in Figure 3.1.6.1, according to the adopted methodology, four sub-divisions are classified as bad or poor, five as moderate, one as good and none as high.

629. It is worth noting that the methodology applied is subjected to uncertainty, mostly linked to the heterogeneity of the datasets it is based on. The results from the assessment should be interpreted as best knowledge-based indications on the status of CI 19, aiming at providing a relative indication of priority areas for future monitoring, assessment and, most importantly, pollution prevention measures.

Table 3.1.6.2: Assessment of the marine environment status for CI 19 for sub-divisions of the Mediterranean Sea

Sub-division	Considerations for the assessment	Status of CI 19
ALBS	Spills reported, second highest | Increase (in most of the datasets)	POOR
WMS	Spill reported | Increase (in most of the datasets)	MODERATE
TYRS	Spills reported | Increase (in most of the datasets)	MODERATE
CEN	No spills reported | Increase (only CSN)	GOOD
NADR	Spills reported, third highest | Third ranked for satellite observation (area extension) | Increase (in most of the datasets)	POOR
MADR	No spills reported | First ranked for satellite observation (area extension) | Increase (only CSN)	MODERATE
SADR	No spills reported | Second ranked for satellite observation (area extension) | Increase (only CSN)	MODERATE
IONS	Spills reported, second highest | Increase (for most of the datasets)	POOR
AEGS	Spills reported, first highest in two datasets | Increase (for most of the datasets)	BAD
LEVS	Spills reported | Increase (only CSN)	MODERATE

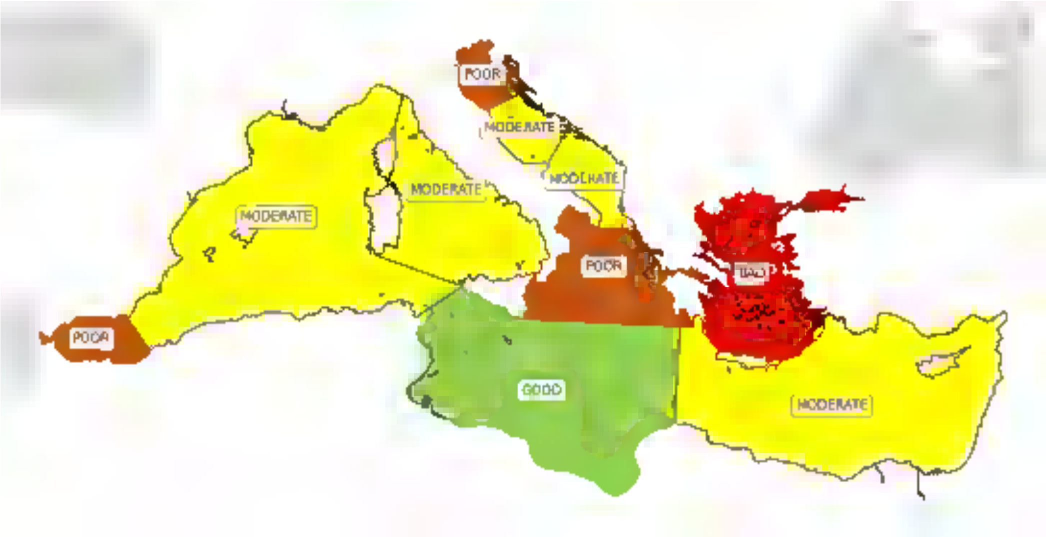


Figure 3.1.6.1. Map of the assessment of the marine environment status for CI 19 for sub-divisions of the Mediterranean Sea

630. The assessments of the ten subdivisions (Table 3.1.6.1) have been aggregated (Figure MED 3.1.6.2.), in order to obtain the assessment for the four Sub-regions of the Mediterranean Sea. This resulted in the following integrated assessment findings:

a) the (Entire) Western Mediterranean Sea (WMS) Sub-region, is assigned to “Moderate”, because this category prevails in its sub-divisions (WMS and TYRS), while the “Poor” status value characterises only the Alboran Sea (ALBS);
b) “Moderate” has been assigned to the Adriatic Sea (ADR) Sub-region, considering the prevalence of this category in its sub-divisions (MADR and SADR).
c) “Moderate” has been assigned to the (Entire) Central Mediterranean Sea (CEN) Sub-region, by qualitative averaging of the poor status of the Ionian Sea (IONS) and the good status of the Central Mediterranean (CEN);
d) In the case of the Aegean and Levantine Seas (AEL) Sub-region, the qualitative average evaluation led to d a” poor” status for this Sub-region.

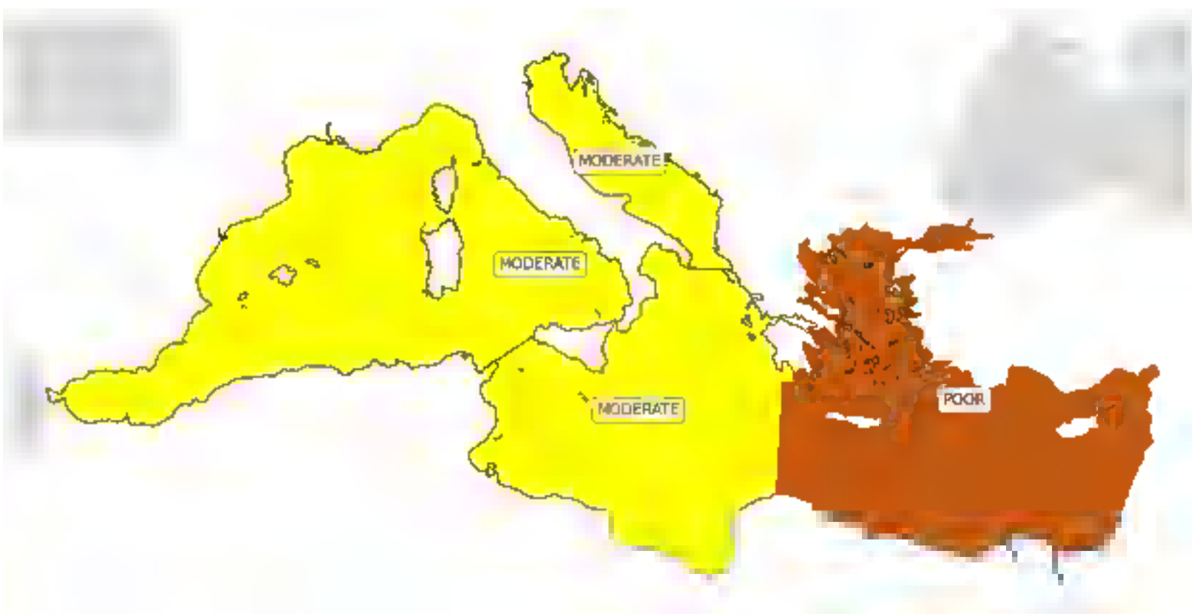


Figure MED 3.1.6.2. Map of the integrated assessment of the marine environment status for CI 19 in the four Sub-regions of the Mediterranean Sea

631. CI 19 assessment: impact on biota. Common Indicator 19 is defined as "Occurrence, origin (where possible), extent of significant acute pollution events (e.g. slicks from oil, oil products and hazardous substances) and their impact on biota affected by this pollution (EO9)". In the Mediterranean the data presently available do not allow to include in the assessment of this indicator the component related to the impacts on biota. In fact, as described above, a few examples are available of monitoring of oil spill impacts in the Mediterranean (e.g. spill in Baniyas, Syria in 2021- REMPEC, 2021; sinking of the Agia Zoni II, Piraeus, Greece in 2017 - REMPEC, 2019; spill from the Jieh power plant in Lebanon in 2006 - Saab et al., 2006). From available guidelines (e.g., the UK PREMIAM initiative: Kirby et al., 2018) and the experience available at European level (e.g. Belgium - Tornero et al. 2022), as well as from the above cases, monitoring of the following elements are recommended: visual survey of macroscopic evidences of pollution both on land and underwater (presence and extension of oil layers, tar-patches, dead or contaminated animals); chemical contamination of waters and sediments (total petroleum

hydrocarbons, IPA, heavy metals); benthic communities (phytobenthos and zoobenthos); fish community; bioaccumulation in bivalves and fish. Based on such guidelines and experiences, REMPEC has recently prepared a revision of the Data Dictionary and Data Standard for CI19, by including also data aimed at assessment of impact on biota. Based on the data that will be collected as indicated in the revised version of the Data Dictionary and Data Standard for CI19, the future QSR assessments is expected to consider the impacts on biota too.

Assessment of IMAP Common Indicator 20. Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood

Geographical scale of the assessment	The Sub-regions within the Mediterranean region
Contributing countries	**Countries reporting IMAP CI-17 data:** Albania, Croatia, Cyprus, France, Israel, Italy, Lebanon, Malta, Montenegro, Morocco, Slovenia, Spain, Türkiye. **Scientific literature**. Algeria, Croatia, Egypt, France, Greece, Italy, Lebanon, Morocco, Spain, Tunisia, Türkiye
Mid-Term Strategy (MTS) Core Theme	Enabling Programme 6: Towards Monitoring, Assessment, Knowledge and Vision of the Mediterranean Sea and Coast for Informed Decision-Making
Ecological Objective	EO9. Contaminants cause no significant impact on coastal and marine ecosystems and human health
IMAP Common Indicator	CI20. Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood
GES Definition (UNEP/MED WG473/7) (2019)	Concentrations of contaminants are within the regulatory limits for consumption by humans
GES Targets (UNEP/MED WG473/7) (2019)	Concentrations of contaminants are within the regulatory limits set by legislation
GES Operational Objective (UNEP/MED WG473/7) (2019)	Levels of known harmful contaminants in major types of seafood do not exceed established standards

Available data.

632. The two groups of data were collected i.e. i) data reported to IMAP - IS for CI-17 contaminants in biota, and ii) data from scientific literature. The relevant data from IMAP-IS consisted of the concentrations of trace metals (Cd, Hg and Pb) in fish and molluscs; PAHs in molluscs and PCBs in fish and molluscs. It should be emphasized that these data were collected within IMAP monitoring programs to assess the status of the marine environment and not to protect human health. Italy submitted CI 20 data after the Meeting of CorMon Pollution (1-2 March 2023, Athens) that included contaminants in different species of fish, molluscs, crustaceans and echinoderm and tunicates sampled in 2020[105].

[105] Data included, among others, concentrations of all the contaminants regulated by the EU, as listed in Annex I of document 556/Inf.12/Rev.1. Those were measured in different species of fish, molluscs, crustaceans and echinoderm and tunicates sampled in 2020. The national data of Italy were not uploaded on the IMAP Info System because they were found not compliant given the

633. CI 17 data available from IMAP-IS for the monitoring species (M. galloprovincialis and M. barbatus) are shown in Table 3.1.7.1.

Table 3.1.7.1. Number of data points extracted from CI-17 database, relevant for CI-20 Assessment. MG – *Mytilus galloprovincialis*; MB- *Mullus barbatus*. Table is sorted by species and alphabetical order of CPs.

CP	**Year**	**Species**	**Cd**	**Hg**	**Pb**	**Σ_4 PAHs**	**Benzo(a) pyrene**	**Σ_6 PCBs**
Albania	2020	MG	2	2	2			2
Croatia	2019-2020	MG	37	35	37			19
France	2015, 2017-2018	MG	50	50	50	25	25	23
Italy	2015-2019	MG	33	170	33		53	
Montenegro	2018-2020	MG	28	28	28	21	21	21
Morocco	2017-2021	MG	27	27	27	6	6	
Slovenia	2016-2021	MG	21	21	15	12	12	
Spain	2015-2017,2019	MG	70	70	70	42	42	40
Croatia	2019-2020	MB	11	10	11			
Cyprus	2020-2021	MB	14	14	14	12	12	12
Israel	2015, 2018-2020	MB	58	60				
Lebanon	2019	MB	14	14	14			
Malta	2017, 2019	MB	5	5	5			
Montenegro	2018	MB	8	8	8			
Türkiye	2015	MB	25	25	25		8	

634. Relevant data for additional species other than the mandatory species reported to IMAP-IS were available as presented here-below under assessment of data reported for the mandatory monitoring species.

635. The literature search on seafood quality in the Mediterranean Sea focused on the studies that reported data from 2016/2017 onward, emphasizing contaminants that are regulated in the EU. Previous studies have been used in the preparation of the 2017 MED QSR.

636. The bibliographic studies reported concentrations of contaminants and compared them to EU regulation while some also addressed national regulation as well as international regulations or advisories (De Witte et al. 2022). Most of the studies provided also risk assessments to human health from

lack of complementary data (D.O., T, S) that are considered mandatory for the system. Out of 3785 relevant entries (including all species and relevant EU contaminants), 11 entries (0.3%) were found to exceed the EU regulations for the protection of human health. The analyzes of additional national data of Italy confirmed the assessment based on CI17 and on the scientific literature, which found in the Mediterranean Sea that most of the measured concentrations were below the concentration limits for the regulated contaminants in the EU.

consumption of the seafood by calculating the estimated daily intake (EDI), target hazard quotient (THQ), total risk (HI), Cancer risk, among others.

637. This emphasizes the fact that the risk to human health (and hence GES- non GES statuses) should not be evaluated based on concentration of a single contaminant but evaluated together with other factors such as synergy with other contaminants, temporal and spatial scales.

638. Another point to make is that recent literature emphasizes the connection between seafood safety and quality and the presence of microplastics in the marine environment (i.e.Wakkaf et al. 2020 among many others). Human health may be impacted either by consuming seafood with microplastic content, or seafood with contaminants that were leached from the microplastic to the organism. This sets an interrelation of CI 20 with CI 23 and should be further pursued.

639. Table 3.1.7.2 provides a summary of the studies published in the peer-reviewed literature. Thirty-six studies from 11 CPs were found relevant for the present work, with 1-4 studies each, except for Italy that had 14 studies. Most (25) reported concentrations of trace metals (TM) and 12 on organic contaminants (PAHs, PCBs, PBDEs, PCDD/Fs). Concentrations in fish were reported in 26 studies and concentrations in molluscs were reported in 17 studies.

Table 3.1.7.2. The number of studies, per country, on seafood quality and safety in the Mediterranean which findings were used to support present assessment.

Country	Total Number of studies	Number of studies reporting on:		Number of studies reporting on:		
		Trace metals	Organic contaminants	Fish	Mollusc	Other (crustaceans, cephalopods)
Algeria	3	3	0	3	0	0
Croatia	2	2	0	2	0	0
Egypt	1	0	1	1*	1	1
France	1	0	1	1	0	0
Greece	2	2	0	2	0	0
Italy	14	9	7	9	9	3
Lebanon	3	3	0	2	2	2
Morocco	3	3	0	1	2	0
Spain	1	1	0	1	0	0
Tunisia	2	0	2	2	1	1
Türkiye	4#	2	1	2	2	1

*fresh water fish; #one study on radioactivity as contaminants in fish.

Results of the IMAP Environmental Assessment of CI 20 in the Mediterranean region

Given the complete lack of data reported for CI 20, the environmental assessment of CI 20 was performed, by using the following two approaches: i) assessment of the status based on data reported to IMAP-IS for CI 17 contaminants in biota up to 31st, October 2022, the cutoff date for data reporting to be used in the 2023 MED QSR, using the EU concentration limits for regulated contaminants, and ii) assessment of present status based on bibliographic studies, following the same approach applied for preparation of the 2017 MED QSR, however by using newer available scientific literature.

a) Assessment of the status based on data reported to IMAP-IS for contaminants in biota (CI 17)

640. Data reported to IMAP-IS for CI-17 was investigated and the relevant data extracted and used for present initial marine environment assessment for IMAP CI 20. The relevant data consisted of the concentrations of trace metals (Cd, Hg and Pb) in fish and molluscs; PAHs in molluscs and PCBs in fish and molluscs. It should be emphasized that these data were collected within IMAP monitoring programs to assess the status of the marine environment and not to protect human health.

a.1. Assessment of data reported for the mandatory monitoring species Mytilus galloprovincialis (MG) and Mullus barbatus (MB)

641. For the assessment of CI 20, based on data reported for CI 17 contaminants in biota, the available data for the mandatory species M. galloprovincialis and M. barbatus are summarized in Table 3.1.7.3., along with the number of data points that exceeded the concentration limits for human consumption.

642. It was found that most of the measured concentrations were below the concentration limits for the regulated contaminants in the EU, with a few exceptions in Cyprus, Montenegro, and Spain. The maximal percentage of values above the EU criteria for one specific contaminant was low (14%). Examination of the national data submitted by Italy confirmed the assessment based on CI 17 and on the scientific literature .

643. Examination of CI 17 data i.e., data for TM and organic contaminants per sub-regions (Table 3.1.7.3.) showed that data for *M. galloprovinciallis* were available only for the WMS and the ADR. Values above the concentration's limits were found for only 14 data points out of 1002 (1.4%).

644. Examination of the CI-17 data i.e. only data related to TM were available, per sub-regions (Table 3.1.7.3.) showed that data for *M. barbatus* were available for the ADR (56 data points), CEN (15 data points) and AEL (213 data points). All concentrations were below the EU concentration limits.

a.2. Assessment of data reported to IMAP-IS for other species

645. The biota files from the IMAP-IS database were screened again for species other than the mandatory monitoring species, M. galloprovincialis and M. barbatus, for CI 17. Additional species were reported as shown here-below.

646. Cyprus (2020-2021). Cd, Hg and Pb were measured in the muscle of the fish Boops boops (n=13), Thynnus alalunga (n=52) and Merluccius merluccius (n=1). All the concentrations were below the concentration limits for the regulated contaminants in the EU, except for Hg in 6 samples of T.

alalunga. Σ4 PAHs and Σ6 PCBs were reported for Boops boops (n=10) and T. alalunga (n=15). All concentrations were below detection limit and for Σ6 PCBs also below the concentration limits in the EU. No criteria were given for PAHs in fish.

647. Croatia (2019). Cd and Pb were measured in the muscle of the fish Merluccius merluccius (n=3), Mullus surmuletus (n=1), Pagellus erythrinus (n=3), Sparus aurata (n=9). All concentrations were below the concentration limits for the regulated contaminants in the EU.

648. France (2017)106. Cd, Hg, Pb (n=6 each) and Σ4 PAHs and Σ6 PCBs (n=4 and n=2, respectively) were measured in the mollusc (bivalve) Crassostrea gigas and Cd, Hg, Pb were measured in 7 samples of the mollusc (bivalve) Venerupis decussata. All concentrations were below the concentration limits for the regulated contaminants in the EU.

649. Israel (2015, 2018, 2020). Cd and Hg were measured in 6 samples of the mollusc (bivalve) Donax trunculus, and Cd and Hg were measured in 26 samples of the mollusc (bivalve) Mactra corallina. All concentrations were below the concentration limits for the regulated contaminants in the EU.

650. Lebanon (2019). Cd, Hg, Pb (n=11 each) and Σ6 PCBs (n=3) were measured in the fish Diplodus sargus and Cd, Hg, Pb (n=15 each) and Σ6 PCBs (n=13) were measured in the fish Euthynnus alletratus. All concentrations were below the concentration limits for the regulated contaminants in the EU.

651. Malta (2017 and 2019). Cd, Hg, Pb (n=4 each), dioxin like PCBs and Total dioxins and furans (n=1 each) were measured in the fish Merluccius merluccius. All concentrations were below the concentration limits for the regulated contaminants in the EU.

652. Morocco (2019-2021). Cd, Hg, Pb (n=30 each) were measured in the mollusks Callista chione (n=30) and petite praire (n=6). All concentrations were below the concentration limits for the regulated contaminants in the EU. Σ4 PAHs were reported for C. chione (n=15) and petite praire (n=3). All concentrations were below the concentration limits for the regulated contaminants in the EU.

b) Assessment of the status based on bibliographic studies

653. In the context of CI 20, to protect human health, trace metals in fish were reported for many species across the Mediterranean countries: Algeria, Croatia, Greece, Italy, Lebanon, Morocco, Spain and Türkiye. Trace metals in molluscs were reported in various species from Italy, Lebanon, Morocco and Türkiye. Organic contaminants in fish were reported for various species from France, Italy and Tunisia, and in molluscs for Egypt, France, Italy, Tunisia and Türkiye. Trace metals and organic contaminants were reported also for some crustaceans and cephalopod species. Information on consumers` health risk was available for Algeria, Croatia, Italy, Tunisia and Türkiye, only. The literature review is summarized here-below and in Table 3.1.7.4 and Figure 3.1.7.1.

654. Algeria (WMS): Cd, Hg, Cu were reported in Sardina pilchardus and in Mullus barbatus collected from the Algerian coast (2017-2018). Concentrations were below the concentration limits for the regulated contaminants in the EU, except concentrations of Cd in some specimens from the bay of

[106] Data from EMODNet.

Algiers that were higher than the EU regulatory threshold. The average Pb concentrations did not exceed the regulatory value, although some specimens had concentrations higher than the threshold. Consumption of S. pilchardus from Algerian coast was not likely to have adverse effect on human health and a few risks were assigned to the consumption of contaminated M. barbatus (Hamida et al. 2018, Aissioui et al. 2021, Aissioui et al. 2022).

655. Croatia (ADR): Cd, Hg and Pb were reported for fish from 11 species107 purchased in 2016 from supermarkets located in different Croatian cities. Hg and Pb concentrations were below the concentration limits for the regulated contaminants in the EU. Mean Cd levels in bluefin tuna exceeded the EU limit. Consumer health risk calculated from the dietary intakes for Cd was low, with exception of bluefin tuna. For Hg, frequent consumption of European sea bass, carp and bluefin tuna over a long period may have toxicological consequences for consumers. In a different study in 2016, the concentration of Hg did not exceed EU regulations in European pilchard and European anchovy (Bilandžić et al. 2018, Sulimanec Grgec et al. 2020).

656. Egypt (AEL): Persistent organic pollutants were reported in the mollusc Donax trunculus at the Rosetta Nile branch estuary. PCBs levels were well below tolerable average residue levels established by FDA and FAO/WHO for human fish consumption (Abbassy 2018).

657. France (WMS): Persistent organic pollutants (POP108s) were evaluated in six fish and two cephalopods species from an impacted area in NW Mediterranean Sea (Rhone river estuary vicinity). For Atlantic bonito (Sarda sarda) and chub mackerel (Scomber colias), the estimated weekly intakes of dioxin-like POPs for humans overpassed the EU tolerable weekly intake. Concentrations of nondioxin-like PCBs in S. sarda were above the EU maximum levels in foodstuffs, pointing to a risk (Castro-Jiménez et al. 2021).

658. Greece (AEL): Cd, Hg and Pb were reported in 4 fish species109. Concentrations in S. aurata and D. labrax were below the concentration limits for the regulated contaminants in the EU. In sardine and anchovy, nutritional benefits seem to outweigh the potential risks arising from fish metal content (Renieri et al. 2019, Sofoulaki et al. 2019).

659. Italy (ADR, CEN, WMS) (TM in fish and mussel): Hg, Cd, Pb were determined in 160 specimens of fish belonging to sixteen species collected in 2018 from commercial centers of South Italy. The concentrations were below the EU regulation, except for Cd in bluefin tuna, which exceeded the tolerable value. The estimated hazard quotient of Hg indicated a high probability of experiencing non-carcinogenic health risks (Storelli et al. 2020). Hg was measured in 42 commercial fish species caught off the Central Adriatic and Tyrrhenian coasts of Italy and in 6 aquaculture species. Hg levels exceeding the EC regulation limits were found in large-size specimens of high trophic-level pelagic and demersal

[107] Hake (Merluccius merluccius, n=7), Atlantic mackerel (Scomber scombrus, n=7), cod (Gadus morhua, n=7), chub mackerel (Scomber japonicas, n=7), fresh and canned sardine (Sardina pilchardus, n=7), European sea bass (Dicentrarchus labrax, n=13), gilthead sea bream
(Sparus aurata, n=11), bluefin tuna (Thunnus thynnus, n=8), salmonbass (Argyrosomus regius, n=8), rainbow trout (Oncorhynchus mykiss, n=7) and carp (Cyprinus carpio, n=7).
[108] Polybrominated diphenyl ethers (PBDEs), polychlorinated dibenzo-p-dioxins and dibenzofurans (PCDD/Fs), polychlorinated biphenyls (PCBs)
[109] Seabream (*Sparus aurata*), sea bass (*Dicentrarchus labrax*) sardine (*Sardina pilchardus*) and anchovy (*Engraulis encrasicolus*)

species. An estimation of the human intake of mercury associated to the consumption of the studied fish and its comparison with the tolerable weekly intake is provided (Di Lena et al. 2017). Hg measured in European hake (Merluccius merluccius) caught in the northern and central Adriatic Sea were lower than the level set by EU regulations (Girolametti et al. 2022). Cd, Pd measured in the swordfish Xiphias gladius muscles were lower than the levels set by EU regulations. Hg in 32% of samples exceeded European maximum limits. Risk assessment indicates hazardous state concerning Hg (Di Bella et al. 2020).

660. Cd, Hg, Pb in Mytilus galloprovincialis did not exceed the maximum limits as established by EU regulation from the Gulf of Naples and Domitio littoral (2016-2019) nor in specimens from the Claich Lagoon (Sardinia, 2017), the Marche (2016-2017) nor in Sicily (2016) (Esposito et al. 2020, 2021; Cammilleri et al. 2020).

661. Italy (ADR, CEN, WMS) (Organic contaminants in fish and mollusc). PAHs were measured Sardina pilchardus and Solea solea caught in the Catania Gulf (Sicily, 2017) (Ferrante et al. 2018). EU criteria for PAH the protection of human health exist only for mollusc and not for fish. Polychlorinated dioxins and furans (PCDD/Fs) and dioxin-like polychlorinated biphenyls (dl-PCBs) measured in fish110 were below the maximum limits set by the EC for human consumption (Barone et al. 2021). Σ6 PCBs and dioxins and dioxin-like PCBs were lower than the values in the EU regulation in specimens of 3 edible fish species111 samples in 2017 in the Northern Tyrrhenian Sea (Bartalini et al. 2020). PCDD/Fs, PCBs, measured in fish112 from Taranto (2016) and PCDD/Fs and dl-PCBs) measured in fish113 from Southern Italy (2019) were below the regulatory limits specified for these contaminants within the EU (Ceci et al. 2022, Barone et al. 2021). Σ6 PCBs in in marine organisms114 collected from the contaminated Augusta Bay (Southern Italy, 2017) showed variable concentrations with a mean value above EU regulation in 2 fish species. Benzo[a] Pyrene (BaP) in mussels exceed threshold limit of the EU regulation. No risk analysis was performed. (Traina et al. 2021).

662. PCBs, dioxins and PAHs in Mytilus galloprovincialis, farmed in the waters of the Gulf of Naples and Domitio littoral (2016 to 2019), did not exceed the maximum limits as established by EU regulation, except for PAHs in a localized area in the winter (Esposito et al. 2020). Concentrations of Benzo(a)pyrene (BaP) and Σ4PAHs115 exceeded the limit reported in EC in the Regulation for the mollusk Donax trunculus, caught in the Catania Gulf (Sicily, 2017). Risk assessment indicated concern for the health of high frequency molluscs consumers (Ferrante et al. 2018). PCDD/Fs and dl-PCBs in seafood116 from Southern Italy (2019) and in mussel from Taranto (2016) were below the maximum limits set by the EC for human consumption except for a single sample taken from a known specific contaminated site in Taranto (Barone et al. 2021; Ceci et al. 2022).

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[110] rosefish, Euro-pean hake, red mullet, common sole, bluefin tuna
[111] Sardine (*Sardina pilchardus*), anchovy (*Engraulis encrasicolus*) and bogue (*Boops boops*).
[112] hake, mullet, sea bream, bogue, red mullet mackerel, sardines and sand steenbras
[113] rosefish, Euro-pean hake, red mullet, common sole, bluefin tuna
[114] In 2017, mussels (*Mytilus galloprovincialis*) obtained from a commercial farm and transplanted to two sites in Augusta Bay and resampled after 5 weeks and 7 months. Fish: 96 specimens of finfish (*Sphyraena sphyraena, Trigla lucerna, Mullus barbatus, Pagellus* spp., *Diplodus* spp.) and shellfish (*Parapaeneus kerathurus* and *Sepia* spp.) were obtained through local fishermen
[115]benzo(a)pyrene (BaP), benz(a)anthracene (BaA), benzo(b)fluoranthene (BbF) and chrysene (CH)
[116] (cephalopods: common octopus, common cuttlefish, European squid), (shellfish: Mediterranean mussel, striped venus clam, common scallop), (crustaceans: red shrimp, spottail mantis shrimp, Norway lobster)

663. Lebanon (AEL): Pb, Cd, and Hg were determined in three fish species (Siganus rivulatus, Lithognathus mormyrus and Etrumeus teres), in shrimp (Marsupenaeus japonicus) and in bivalve (Spondylus spinosus) commonly consumed by the local population. Trace metals concentrations were found to be below the maximum levels set by the EU (Ghosn et al. 2019).

664. Morocco (WMS): Cd and Pb concentrations were measured in soft tissues of M. galloprovincialis. Concentrations did not exceed EU regulations (Azizi et al. 2018; 2021). Cd, Hg and Pb concentrations measured in the fish Liza ramada were also below the values set in the EU regulation (Mahjoub et al. 2021).

665. Spain (WMS): The concentrations of Pb, Cd and Hg measured in the highly migratory Thunnus alalunga and Katsuwonus pelamis were below the tolerable limits considered by EU regulation (Chanto-García et al. 2022).

666. Tunisia (CEN): Organic contaminants (PAHs, PCBs and pesticides) were measured in fish (Sparus aurata and Sarpa salpa) muscle tissue collected from five stations along the Tunisian coast between (2018-2019). Σ6 PCBs for the fish were below the EC regulations. (Jebara et al. 2021). Concentrations of 21 legacy and emerging per- and polyfluorinated alkyl substances (PFAS)117 were measured in in 9 marine species (3 fish, 2 crustaceans and 4 mollusks)118 collected from Bizerte lagoon, Northern Tunisia (2018). Exposure to PFAS through seafood consumption indicates that it should not be of concern to the local consumers (Barhoumi et al. 2022).

667. Türkiye (AEL): Concentrations of Cd, Pb and Hg levels were measured in 9 fish, 1 mollusc and 1 shrimp species119 from the Aegean and Levantine Seas. All the results were found compatible with the Turkish Food Codex and EU Regulation limits except for Cd in two samples from the Mediterranean Sea. As a whole, the seafood was found to be safe for human consumption (Kuplulu et al. 2018). Cd and Pb measured in the fish Trachurus mediterraneus, Sparus aurata and Pegusa lascaris were below the values set in the EU regulation (Karayakar et al. 2022). Mytilus galloprovincialis, were transplanted from a clean site to the 3 sites in Nemrut Bay, known to be impacted by of industrial activities. Benzo(a)pyrene and Σ_4 PAHs levels in the mussels from the clean site were below the EU regulations[120] (Kucuksezgin et al. 2020).

668. Türkiye (AEL): Specific natural radionuclide (^{226}Ra, ^{232}Th and ^{40}K) concentrations were measured in wild and farmed European seabass collected from the Mediterranean coast of Türkiye (AEL) in 2018. From the radiological point of view, the radioactivity doses measured and the consumption of both wild and farmed seabass from the Mediterranean coast of Türkiye do not pose any risk to human health (Ozmen and Yilmaz 2020).

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[117] PFASs are not addressed in the EU regulation
[118] Fish: European eel (*Anguilla anguilla*), common sole (*Solea solea*), sea bass (*Dicentrarchus labrax*); crab (*Carcinus maenas*), shrimp (*Penaeus notialis*), common cuttlefish (*Sepia officinalis*) gastropod mollusc- banded dye-murex (*Hexaplex trunculus*), clam (*Ruditapes decussatus*) and farmed mussel (*Mytilus galloprovincialis*)
[119] Fish: mullet (Mugil cephalus), shad (Alosafallax), hake (Merluccius merluccius), whitting (Merlangius euxmus), seabass (Dicentrarchus labrax), turbot (Scophthalmus maximus), red mullet (Mullus barbatus), blue fish (Pomatomus saltatrix), seabream (Sparus auratus). Mussel: (Mytilus galloprovincialis). Shrimp (Penaeus indicus)
[120] Mussels transplanted from the clean site to the impacted Nemrut bay exhibited in certain occasions PAHs concentrations higher than the concentrations in the EU regulation. Mussels from this area are not used for human consumption.

669. From the above elaboration, it can be concluded that the assessment of CI 20 based on recent peer reviewed literature included 36 relevant studies. Most (25) reported concentrations of trace metals while 12 studies reported on organic contaminants. Concentrations in a wide variety of fish species were reported in 26 studies and concentrations in molluscs in 17 studies. Data on crustaceans and cephalopods were reported in 8 studies.

670. Most of the studies found that the concentrations of the contaminants were below the concentration limits for the regulated contaminants in the EU (24 studies), or if some of the contaminants were higher than regulation, risk analysis showed no risk to human health (7 studies). Only 6 studies reported on possible risk for human health from the consumption of seafood.

671. Examination of the literature data per sub-regions was performed by counting the number of times contaminants (Cd, Hg, Pb, B(a)P) and the number of group of contaminants (Σ4 PAHs, Σ6 PCBs, PCDD/Fs and Σ (PCDD/F and dl PCBs)) (Table 3.1.7.4) were addressed in the literature. There were 37 entries for the WMS, 25 for the ADR, 24 for the CEN and 23 for the AEL sub-region. The percentages of blue status from the total entries were high: 78, 80, 71 and 87% for the WMS, ADR, CEN and AEL, respectively. Red status was assigned to 11, 12, 8 and 11% of the entries for the WMS, ADR, CEN and AEL, respectively (Figure 3.1.7.1).

Table 3.1.7.3. Number of data points extracted from IMAP-IS CI 17 database, of relevance for IMAP CI 20, are shown in black. Assessment findings are shown in red and indicate the number of data points exceeding the criteria i.e. the concentration limits for the regulated contaminants in the EU. Table is sorted by species and alphabetical order of CPs. MG – *Mytilus galloprovincialis*; MB- *Mullus barbatus*. No criteria are specified in the EU regulations for Hg and Σ_6 PCBs in *M. galloprovincialis* nor for PAHs in *M. barbatus*.

CP	Year	Species	Cd	Hg	Pb	Σ_4 PAHs	Benzo(a) pyrene	Σ_6 PCBs
Albania	2020	MG	2	2	2			2
			0		0			
Croatia	2019-2020	MG	37	35	37			19
			0		0			
France	2015, 2017-2018	MG	50	50	50	25	25	23
			0		0	0	0	
Italy	2015-2019	MG	33	170	33		53	
			0		0		0	
Montenegro	2018-2020	MG	28	28	28	21	21	21
			0		4	0	0	
Morocco	2017-2021	MG	27	27	27	6	6	
			0		0	0	0	
Slovenia	2016-2021	MG	21	21	15	12	12	
			0		0	0	0	
Spain	2015-2017,2019	MG	70	70	70	42	42	40
			0		6	6	1	
Croatia	2019-2020	MB	11	10	11			
			0	0	0			
Cyprus	2020-2021	MB	14	14	14	12	12	12
			0	1	0			0

CP	Year	Species	Cd	Hg	Pb	Σ_4 PAHs	Benzo(a) pyrene	Σ_6 PCBs
Israel	2015, 2018-2020	MB	58	60				
			0	0				
Lebanon	2019	MB	14	14	14			
			0	0	0			
Malta	2017, 2019	MB	5	5	5			
			#	0	0			
Montenegro	2018	MB	8	8	8			
			0	0	0			
Türkiye (AEL)	2015	MB	25	25	25		8	
			0	0	0			

#All data were reported to IMAP-IS as below detection limit. Detection limit was higher than the EU maximum regulatory level criteria.

Table 3.1.7.4. Summary of the findings from the scientific literature, used to support present assessment, arranged alphabetically by country. The findings of some of the studies were summarized in more than one row, to allow for the separation of taxa (i.e. fish from mollusc) and contaminants (trace metals from organics). It includes sum of 4 PAHs (benzo(a)pyrene (BaP), benz(a)anthracene (BaA), benzo(b)fluoranthene (BbF) and chrysene (CH) (Σ_4 PAHs); Benzo(a)Pyrene (B(a)P); sum of 6 non dioxin like PCBs (Σ_6 PCBs); sum of polychlorinated dibenzo-para-dioxins and polychlorinated dibenzofurans (PCDD/Fs) and Σ (PCDD/Fs and dioxin like (dl)) PCBs).

Cells in blue: values below EU criteria; cells in green: values above EU criteria but no health risk detected; cells in yellow: values above EU criteria, risk analysis was not reported; cells in red: above EU criteria with risk to human health.

Reference	**Country**	**Sampling Year**	**Species**	**Study area**	**Cd**	**Hg**	**Pb**	**Σ_4 PAHs**	**B(a)P**	**Σ_6 PCBs**	**PCDD/Fs**	**Σ (PCDD/F and dl PCBs)**
Hamida et al. 2018	**Algeria**		sardines	Bay of Boumerdés	□		□					
Aissioui et al. 2022	**Algeria**	2017-2018	*S. pilchardus*	Algiers, Dellys and Bejaia	□□	□	□					
Aissioui et al. 2021	**Algeria**	2017-2018	*M. barbatus*	Algiers, Dellys and Bejaia	□□	□	□□					
Bilandžić et al. 2018	**Croatia**	2016	11 fish species	Purchased from supermarkets (Croatian cities)	□□	□	□					
Sulimanec Grgec et al. 2020	**Croatia**	2016	European pilchard, European anchovy	Eastern ADR	□							
Abbassy, 2018	**Egypt**	2017	*Donax trunculus*	Rosetta, Nile branch estuary						□		
Castro-Jiménez et al. 2021	**France**		Fish and cephalopods	Rhone river estuary vicinity, known as impacted						□□	□□	
Renieri et al. 2019	**Greece**	2017-2018	*Sparus aurata, Dicentrarchus labrax*	Aquaculture sites and fish market, Heraklion	□	□	□					
Sofoulaki et al. 2019	**Greece**		*Sardina pilchardus, Engraulis encrasicolus*	From 6 Greek coastal areas	□	□	□					

Reference	**Country**	**Sampling Year**	**Species**	**Study area**	**Cd**	**Hg**	**Pb**	**Σ_4 PAHs**	**B(a)P**	**Σ_6 PCBs**	**PCDD/Fs**	**Σ (PCDD/F and dl PCBs)**
Storelli et al. 2020	**Italy**	2018	16 fish species	Purchased from commercial centers of South Italy (Apulia)	□□	□□	□					
Di Lena et al. 2017	**Italy**		42 fish species	Central Adriatic and Tyrrhenian coasts of Italy and from aquaculture		□□						
Girolametti et al. 2022	**Italy**	2018-2019	*M. merluccius*	Northern and central ADR		□						
Di Bella et al. 2020	**Italy**	2017	*Xiphias gladius*	Adriatic and Tyrrhenian Seas	□	□□	□					
Esposito et al. 2020	**Italy**	2016-2019	*M. galloprovincialis*	Gulf of Naples and Domitio littoral, known impacted areas	□	□	□					
Esposito et al. 2021	**Italy**	2017	*M. galloprovincialis*	Euthrophic Calich Lagoon, Sardinia	□	□	□					
Tavoloni et al. 2021	**Italy**	2016-2017	*M. galloprovincialis*	Areas along Marche coast	□	□	□					
Cammilleri et al. 2020	**Italy**	2016	*M. galloprovincialis*	10 large urban agglomerations, high industrial activities and national interest sites of Sicily (Barcellona Pozzo di Gotto, Catania, Gela, Licata, Messina, Milazzo, Palermo, Siracusa, Termini Imerese and Trappeto)	□	□	□					
Ferrante et al. 2018	**Italy**	2017	*S. pilchardus, S. solea*	Fish market in Catania Gulf (Sicily				□□				
Barone et al. 2021	**Italy**	2019	5 fish species	Bari, Lecce, Taranto, Foggia, Brindisi and Matera							□	□

Reference	**Country**	**Sampling Year**	**Species**	**Study area**	**Cd**	**Hg**	**Pb**	**Σ_4 PAHs**	**B(a)P**	**Σ_6 PCBs**	**PCDD/Fs**	**Σ (PCDD/F and dl PCBs)**
Bartalini et al. 2020	**Italy**	2017	3 fish species	Northern Thyrrenian Sea						□		□
Ceci et al. 2022	**Italy**	2016	7 fish species	coasts of Abruzzo, Apulia and Sicily						□	□	
Traina et al. 2021	**Italy**	2017	5 fish species	contaminated Augusta Bay (Southern Italy)		□□				□□		
Esposito et al. 2020	**Italy**	2016-2019	*M. galloprovincialis*	Farmed in the Gulf of Naples and Domitio littoral, areas heavily influenced by human activities				□□		□		□
Ferrante et al. 2018	**Italy**	2017	*Donax trunculus*	Fish market in Catania Gulf (Sicily				□□	□□			
Barone et al. 2021	**Italy**	2019	Cephalopods, shellfish and crustaceans	Bari, Lecce, Taranto, Foggia, Brindisi and Matera							□	□
Ceci et al. 2022	**Italy**	2019	*M. galloprovincialis*	□ussel farm, Taranto Area						□	□	
Traina et al. 2021	**Italy**	2017	*M. galloprovincialis*	Augusta Bay (Southern Italy Known as impacted				□	□□	□		
Ghosn et al. 2019	**Lebanon**	2016-2017	3 fish, 1 shrimp, 1 bivalve species	coastline: Tripoli, Beirut and Saida	□	□	□					
Ghosn et al. 2020b	**Lebanon**	2017	1 bivalve, 1 shrimp species	3 sites along the Lebanese coast	□	□	□					
Ghosn et al. 2020a	**Lebanon**	2017	2 fish species	3 sites along the Lebanese coast	□	□	□					
Azizi et al. 2018	**Morocco**	2016	*M. galloprovincialis*	aquaculture farm in Cala Iris sea of Al Hoceima	□		□					
Azizi et al. 2021	**Morocco**	2018	*M. galloprovincialis*	farm installed along the Al Hoceima	□							
Mahjoub et al. 2021	**Morocco**	2018	*L. ramada*	port of Béni Ansar and Ras Kebdana	□	□	□					

Reference	**Country**	**Sampling Year**	**Species**	**Study area**	**Cd**	**Hg**	**Pb**	**Σ_4 PAHs**	**B(a)P**	**Σ_6 PCBs**	**PCDD/Fs**	**Σ (PCDD/F and dl PCBs)**
Chanto-García et al. 2022	**Spain**		*T. alalunga, K. pelamis*	Not mentioned	□	□	□					
Jebara et al. 2021	**Tunisia**	2018-2019	*S. aurata*, S. *salpa*	five stations along the Tunisian coast						□		
Barhoumi et al. 2022	**Tunisia** ^^	2018	3 fish, 2 crustaceans and 4 mollusks species	Bizerte lagoon								
Kuplulu et al. 2018	**Türkiye**	Not reported	9 fish, 1 mollusc and 1 shrimp species	purchased from fishermen of fish markets	□□	□	□					
Kucuksezgin et al. 2020	**Türkiye**	2016-2017	*M. galloprovincialis*	Transplanted into Nemrut bay Known as impacted				□□	□□			
Karayakar et al. 2022	**Türkiye**	2016-2017	3 fish species	bought from local fishermen in the Karatas region (Adana)	□		□					

***** Specific sampling area or organism or size class, no health risk detected; # Cd exceeded EU regulation in bluefin tuna; & Risk for human consumption, specific species and size class; % No EU regulation concerning PAHs in fish, only in mollusc; + Exceeded EU regulation, specific organism or size class, no risk analysis performed; ^^Study measured organics not addressed in EU regulations, no risk to health detected.

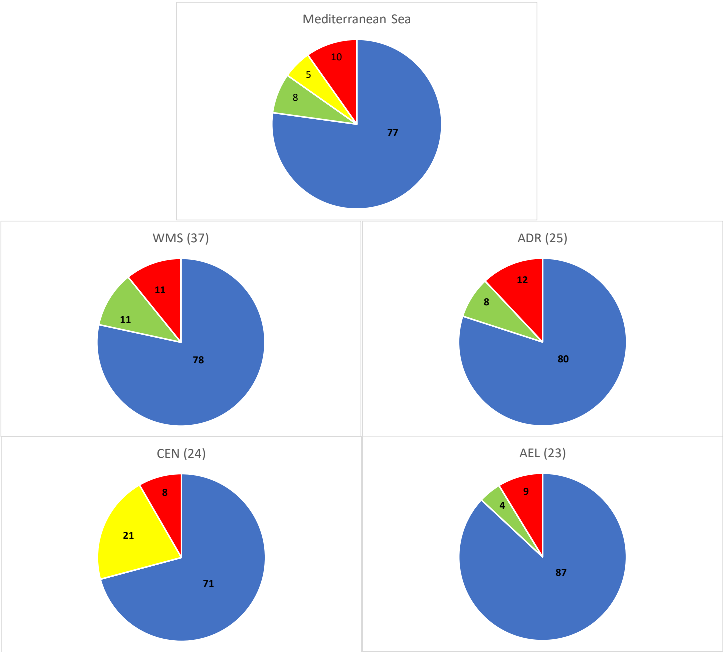

Figure 3.1.7.1. Assessment of CI 20 in the Mediterranean Sea and sub-regions based on recent peer-reviewed literature. Seventeen studies from Italy had results for 2 different sub-regions. Numbers in the chart are the percentage from total entries in each status. Number in parenthesis is the number of studies for each sub-region. Blue: values below EU criteria; green: values above EU criteria but no health risk detected; yellow: values above EU criteria, risk analysis was not reported; red: above EU criteria with risk to human health.

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Assessment of IMAP Common Indicator 21. Percentage of intestinal enterococci concentration measurements within established standards

Geographical scale of the assessment	The Sub-regions within the Mediterranean region by using scientific literature sources
Contributing countries	Countries in EEA 2020 assessment (Albania, Croatia, Cyprus, France, Greece, Italy, Malta, Slovenia, Spain), and, from IMAP-IS, Bosnia and Herzegovina, Israel, Lebanon, Montenegro, Morocco
Mid-Term Strategy (MTS) Core Theme	Enabling Programme 6: Towards Monitoring, Assessment, Knowledge and Vision of the Mediterranean Sea and Coast for Informed Decision-Making
Ecological Objective	EO9. Contaminants cause no significant impact on coastal and marine ecosystems and human health
IMAP Common Indicator	CI21. Percentage of intestinal enterococci concentration measurements within established standards
GES Definition (UNEP/MED WG473/7) (2019)	Concentrations of intestinal enterococci are within established standards
GES Targets (UNEP/MED WG473/7) (2019)	Increasing trend in the percentage of intestinal enterococci concentration measurements within established standards
GES Operational Objective (UNEP/MED WG473/7) (2019)	Water quality in bathing waters and other recreational areas does not undermine human health

Available data

672. In the 2017 MED QSR, it was recommended to prepare the future assessments of IMAP CI 21 based on the statistics from datasets submitted by national authorities or/and the corresponding agencies. However, only a few data sets were reported to the IMAP-IS. Those are presented in Table 3.1.8.1.

Table 3.1.8.1. Available data for IMAP CI 21 in IMAP-IS starting from 2015 and up to October 31st, 2022, the cutoff date for data reporting for the 2023 MED QSR.

Source	IMAP file	Country	Sub-region	Year
IMAP-IS	403	Morocco	WMS	2018
IMAP-IS	404	Morocco	WMS	2019
IMAP-IS	616	Morocco	WMS	2020-2021
IMAP-IS	547-551	Spain	WMS	2017-2021
IMAP-IS	262; 535	Bosnia and Herzegovina	ADR	2015-2021
IMAP-IS	385	Croatia	ADR	2016-2020
IMAP-IS	653	Croatia	ADR	2021
IMAP-IS	655	Croatia	ADR	2022
IMAP-IS	#	Montenegro	ADR	2017-2021
IMAP-IS	146	Slovenia	ADR	2019
IMAP-IS	440	Slovenia	ADR	2020
IMAP-IS	642	Slovenia	ADR	2021
IMAP-IS	490	Malta	CEN	2016-2020
IMAP-IS	147	Lebanon	AEL	2019
IMAP-IS	649	Lebanon	AEL	2017-2021
IMAP-IS	605	Israel	AEL	2021

Reported directly to MED POL, still to be uploaded in the IMAP-IS

673. Given lack of data reported by the CPs prevents implementation of the recommendations of COP 19, the assessment of IMAP CI 21 within the 2023 MED QSR was performed using the approach applied for the 2017 MED QSR. Namely, it combines the assessment results as presented in the assessment report[121] from the European Environment Agency (EEA) on the State of Bathing Water Quality in 2020[122] and the assessment of monitoring data reported for IMAP CI 21 from Bosnia and Herzegovina, Israel, Lebanon, Montenegro and Morocco (Table 3.1.8.1).

674. Recent data of Croatia (2021-2022) and Slovenia (2021) were reported into IMAP-IS. However, for consistency, the status of Croatia and Slovenia were not re-assessed by applying the approach used for the dataset reported by Montenegro, Morocco and Lebanon and the assessment was based on the EEA 2020 assessment of the state of bathing water quality. Data were analyzed only to check for possible problem areas.

Table 3.1.8.2. Details of data on CI 21 available from IMAP_IS.

Source	IMAP file	Country	Sub-region	Year	Number stations	Number of data points per station
IMAP-IS	403-404	Morocco	WMS	2018-2019	129	10*
IMAP-IS	616	Morocco	WMS	2020-2021	147	15
IMAP-IS	262	Bosnia and Herzegovina	ADR	2017-2020	3	9,10,13
IMAP-IS	#	Montenegro	ADR	2017-2020	23	30-39
IMAP-IS	605	Israel	AEL	2021	105	20-184
IMAP-IS	649	Lebanon	AEL	2017-2021	38^	12-47

Reported directly to MED POL, still to be uploaded in the IMAP-IS, *9 stations with less than 10 data points. ^ Not all stations available for all years.

[121] https://www.eea.europa.eu/themes/water/europes-seas-and-coasts/assessments/state-of-bathing-water/state-of-bathing-waters-in-2020
[122] The updated IMAP Guidance fact sheet for CI 21 provided in 2019 mentions the EEA as an available data source for some Mediterranean countries European and non-European.

Results of the IMAP Environmental Assessment of CI 21 in the Mediterranean region

The IMAP Guidance fact sheet for CI 21 **provides the methodology for assessment of this indicator**, This methodology is also aligned with Directive 2006/7/EC.

The methodology used in the EEA 2020 assessment of the state of bathing water quality was as defined in the EU 2006/7 Directive and in IMAP decision IG.20/9, i.e. the classification of the bathing waters was provided according to the 90th or 95th percentile of the log10 normal probability density function of microbiological data. The number of data points for each location was at least 16, over 4 bathing seasons[123], at least 4 for each bathing season.

It should be mentioned that the EU 2006/7 Directive defines two indicators: Intestinal enterococci (IE) (cfu/100 ml) and Escherichia coli (E. coli) (cfu/100 ml). Therefore, the classification of the bathing waters is based on the combination of both microbiological parameters, classifying the stations based on the worse status between the two criteria[124]. For example, if status for IE is excellent but for E. coli the status is poor, the station is classified as poor.

The same methodology used in the EEA 2020 of the state of bathing water quality was applied to data set reported by Montenegro, Morocco and Lebanon, using just intestinal enterococci as indicator.

This methodology could not be applied to data from Bosnia and Herzegovina and Israel because 16 data points for 4 consecutive bathing seasons were not available. Therefore, for these 2 CPs, the classification was based on the geometric mean calculated for each location. The geometric mean was chosen because it reduces the effect of outliers on the mean and is not influenced by skewed distribution as the arithmetic mean.

Comparison between the methodology used by the EEA and the methodology used in present document for the assessment of Bathing waters quality (CI 21)

Assessment methodology	**EEA**	**Present assessment of IMAP CI 21***
Assessment Category	Based on Intestinal enterococci and Escherichia coli (cfu/100 mL)	Based on Intestinal enterococci (cfu/100 mL)
Number of data points	At least 16	Less than 16, depending on the CP*
Number of monitoring years	4	Less than 4, depending on the CP*
Classification of station	percentile evaluation of the log10 normal probability density function	Geometric mean

*Bosnia and Herzegovina and Israel. Lebanon, Montenegro and Morocco were classified using the same methodology as the EEA, based on 16 data points over 4 consecutive bathing seasons, but related to Intestinal enterococci values, only and by applying percentile evaluation of the log10 normal probability density function.

675. The results of the assessment of the state of bathing water quality for Mediterranean countries, EU Member States and Albania are presented in Figure 3.1.8.1. Most (>90%) of the bathing waters in all countries were in the excellent and good GES classifications. A small percentage of bathing waters were classified as poor D category: 0.1% in Spain, 1% in France, 1.7% in Italy and 3.5% in Albania.

676. The analysis of data reported into IMAP-IS by Croatia (2021-2022) and Slovenia (2021) indicated that the classification status of bathing water quality for both countries are the same as the status provided in the EEA 2020 assessment shown below in Figure 3.1.8.1.

[123] Exceptions are outlined in Directive 2006/7/EC and in Decision IG.20/9. Shortly, bathing water quality assessments may be carried out on the basis of three bathing seasons if the bathing water is newly identified or any changes have occurred that are likely to affect the classification of the bathing water. Sets of bathing water data used to carry out bathing water quality assessments shall always comprise at least 16 samples. Only 12 samples may be used to assess bathing water quality in special circumstances when the bathing season does not exceed 8 weeks or location is situated in a region subject to special geographical constraints (Annex IV, paragraph 2).

[124] EEA Guidelines for the assessment under the Bathing Water Directive Prepared by: ETC/ICM (Lidija Globevnik, Luka Snoj, Gašper Šubelj), October 2021

677. The results of the assessment of the status of bathing water quality performed with data available from IMAP-IS for Lebanon, Montenegro and Morocco are presented below in Figure 3.1.8.1, and for Bosnia and Herzegovina and Israel in Figure 3.1.8.3.

678. Lebanon. Data were available for 38 stations for the years 2017-2021, although 7 stations had no data available for all years (Table 3.1.8.2) and therefore were not classified due to insufficient data. Out of the 31 available stations, 6 stations were classified as in excellent category, 13 stations as in good category, 4 as in sufficient category, and 8 in bad category. The percentage of the stations in GES (excellent, good and sufficient category) was 74%. Four out of the 8 stations in bad category were classified as such based on data reported for almost all sampling days during all years. The stations were: Dbayeh Public Beach (DBY-2), Antelias – River Mouth (ANT-2), and Beirut (BEY-4, light house and BEY-6 Ramlet-El-Bayda Public Beach). If the 7 stations with insufficient data were considered, the percentage of the stations in-GES would be 61%.

679. Montenegro: Data were available for 23 stations for the years 2017-2020 (Table 3.1.8.2.). As explained, bathing waters quality in Montenegro was classified using the same methodology as the EEA, at least16 data points over 4 seasons related to Intestinal enterococci values only and by applying percentile evaluation of the log10 normal probability density function. Four stations had data available for only 3 bathing seasons, but they were classified in the same way, based on the exceptions outlined in Directive 2006/7/EC and in Decision IG.20/9. Out of the 23 available stations, 21 were classified in excellent category and 2 in good category.

680. Morocco: Data were available for 129-147 stations for the years 2018-2021 (Table 3.1.8.2). Sixteen stations were not sampled at each year and therefore could not be classified[125]. Out of the 131 available stations, 45 stations were classified in excellent category, 49 stations in good category, 17 in sufficient category and 20 in bad category. The percentage of the stations in GES (excellent, good and sufficient category) was 85%. If the 16 stations with insufficient data were taken into account, the percentage of the stations in-GES would be 76%.

681. Bosnia and Herzegovina: Data were available for 3 stations for the years 2017-2021 (Table 3.1.8.2). All 3 available stations were classified in excellent category.

682. Israel: Data were available for 105 stations for 2021 (Table 3.1.8.2). All the stations were classified in excellent category.

683. In line with the findings on the status of bathing water, as elaborated above, and shown in Figures 3.1.8.1; 3.1.8.2; 3.1.8.3, the Mediterranean bathing waters can be classified in GES (excellent, good and sufficient status), whereby percentage are higher than 85% for the CPs for which the assessment was undertaken. Only for Lebanon the percentage of stations in GES were 74%, however, mainly due to 4 stations. The confidence of this evaluation is high for areas with sufficient data points and bathing seasons, and less so for areas with less data. Some areas of the Mediterranean could not be assessed given no data were reported.

[125] Stations can be classified only if at least 12 sample results, spread over 3-4 bathing seasons, are available. Non-classified stations could be either in-GES or non-GES.

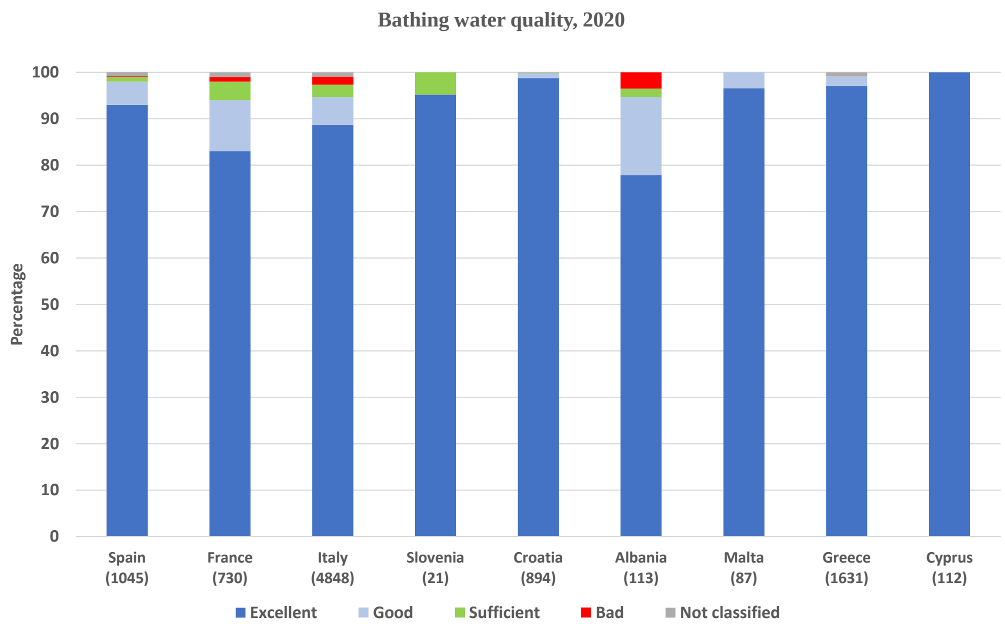

Figure 3.1.8.1: The 2020 bathing water quality assessment related to IMAP CI 21, for a group of the Contracting Parties to the Barcelona Convention. (Source: EEA, 2020). In parenthesis, the number of stations.

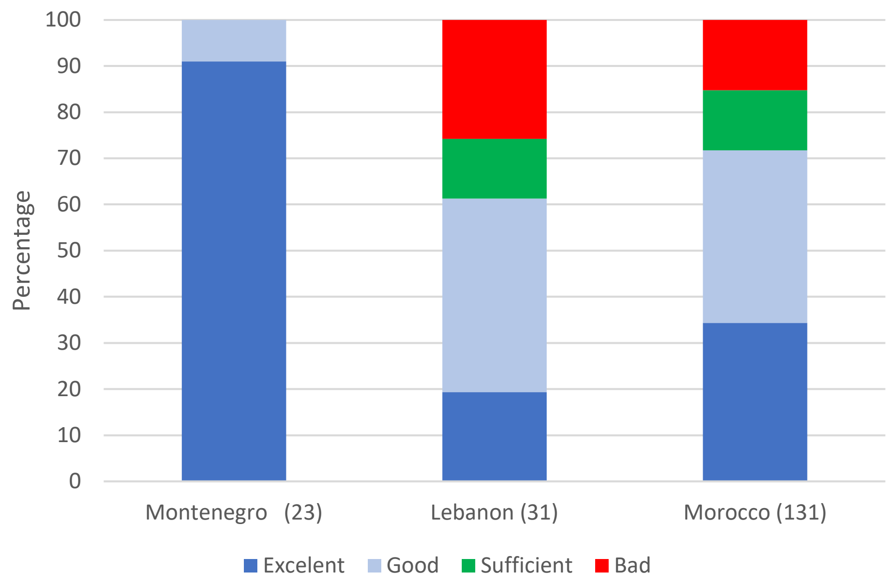

Figure 3.1.8.2: The bathing water quality assessment related to IMAP CI 21,for Lebanon, Montenegro and Morocco (Source IMAP Info System). In parenthesis, the number of stations.

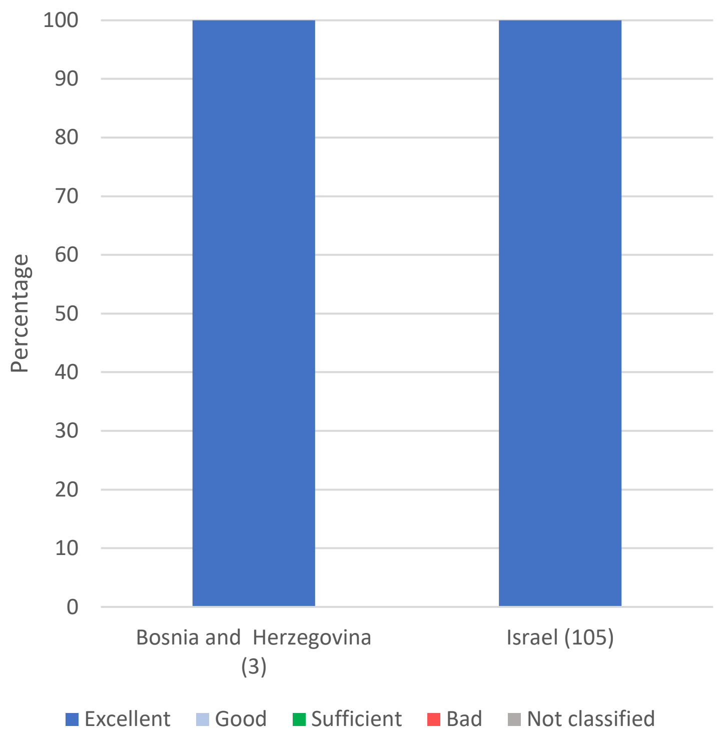

Figure 3.1.8.3: The bathing water quality assessment related to IMAP CI 21 for Bosnia and Herzegovina, and Israel. (Source: IMAP Info System). In parenthesis, the number of stations.

684. The sub-regions with good representation were the Adriatic Sea Sub-region (ADR) with data from all the Adriatic countries (partial data for Bosnia and Herzegovina); and the Western Mediterranean Sea Sub-region (WMS) (with data from Morocco, Spain, France and Italy). The Central Mediterranean Sea Sub-region (CEN) had data from Italy, Malta and Greece, while the Aegean and Levantine Seas (AEL) Sub-region had data from Greece, Cyprus, Lebanon and Israel (partial).

685. Most of data were available through EEA and not through IMAP IS, even up to October 31st, the cut off data for reporting for the 2023 MED QSR. It must be noted that the lack of data reporting for IMAP CI 21 into IMAP IS is a key obstacle to undertake related assessments for the preparation of the 2023 MED QSR. The evaluation of the state of the Mediterranean bathing waters should be improved by reporting additional data from the sub-regions/ sub-divisions with low quantity of data or no data reported. Therefore, the present assessment findings call on CPs to report monitoring data related to IMAP CI 21 so that they can be considered in the future, especially in the case of the countries that have established monitoring programs for CI 21 and regularly implement them.

686. It also must be noted that sufficient data reporting i.e., 16 data points for 4 consecutive bathing seasons would allow the application of uniform assessment methodology across the Mediterranean, therefore increasing the comparability and consistency of the assessment findings.

687. Compared to the 2017 MED QSR, the current assessment includes five CPs instead of one CP with data reported to IMAP IS, along with the CPs assessed within the EEA 2020 assessment of the state of bathing water quality. However, lack of data reporting to IMAP IS implies the use of different assessment approaches that may bring certain discrepancy. Although the present situation is better than in 2017, more data must be reported by the CPs in order to provide comparable and consistent assessment findings.

Assessment of IMAP Candidate Common Indicator 26: Proportion of days and geographical distribution where loud, low, and mid-frequency impulsive sounds exceed levels that are likely to entail significant impact on marine animal

Geographical scale of the assessment	The Sub-regions within the Mediterranean region
Contributing countries	Data for the following countries available either reported to the International Noise Register (INR-MED) of through the Noise Hotspots project led by ACCOBAMS: Algeria, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Lybia, Monaco, Malta, Montenegro, Morocco, Spain, Tunisia, Türkiye,
Mid-Term Strategy (MTS) Core Theme	Enabling Programme 6: Towards Monitoring, Assessment, Knowledge and Vision of the Mediterranean Sea and Coast for Informed Decision-Making
Ecological Objective	EO11. Energy including underwater noise
IMAP Common Indicator	cCI26. Proportion of days and geographical distribution where loud, low, and mid-frequency impulsive sounds exceed levels that are likely to entail significant impact on marine animal
GES Definition (UNEP/MED WG473/7) (2019)	Noise from human activities causes no significant impact on marine and coastal ecosystems
GES Targets (UNEP/MED WG.473/7) (2019)	Number of days with impulsive sounds sources, their distribution within the year and spatially within the assessment area, are below thresholds
GES Operational Objective (UNEP/MED WG.473/7) (2019)	Energy inputs into the marine, environment, especially noise from, human activities, are minimized

Available data

688. Data are initially obtained from the Impulsive Noise Registry (INR-MED) managed by ACCOBAMS. The registry is a tool defined in the Proposal of IMAP Guidance Factsheet for cCI26 . The INR-MED collates data reported by the countries in a standard format that is aligned with the requirements indicated in the Proposal of the IMAP Guidance Factsheet for cCI 26.

689. Data have been provided through the INR-MED by a few countries so far i.e. by France, Greece, Malta, Greece, Lebanon and Montenegro. They are related to three kinds of sound sources: seismic surveys, explosions, sonar or acoustic deterrents. These data cover, with many gaps, the period since 2016 onwards. They concern 247 explosions, 13 seismic surveys and 9 occurrences of sonar or acoustic deterrent use. These are official data which are reported in the correct format and most of them (92%) satisfy the minimum IMAP quality requirements.

690. To complete this process, data from the ACCOBAMS Noise Hotspot assessments i.e. from the 2nd edition which was issued in 2022 and covers the period from 2016 to 2021 (ACCOBAMS-MOP8/2022/Inf.43), are also used. These data were collected directly by a group of experts appointed by the ACCOBAMS Secretariat for the period 2016-2021 and follow theoretically the same standards used for the impulsive noise registry. However, only 170 out of 388 impulsive noise events (43%) collected under the Noise Hotspot initiative were considered good enough to be used for the present initial assessment. These noise events are mainly seismic surveys (N = 53) and port extension works for which pile driving and/or explosions were used (N = 117). They are distributed in the four Mediterranean Sub-regions and concern almost all countries bordering the Mediterranean Sea, thus completing data available from the INR-MED.

691. Globally, 439 impulsive noise events were used for analyses. The annual distribution of noise events is mapped in Figures 4.8.1 to 4.8.6 hereafter using a 20 km x 20 km spatial grid. It should be noted that a 20-km fixed buffer was used from point noise source (e.g. pile driving in ports) in order to account for propagation of noise. The 20-km buffer is selected based on scientific literature (Merchant et al., 2017; Tougaard et al., 2009). Furthermore, for noise sources described with polygons (such as seismic surveys), it was considered that using polygons for describing a moving point source (the seismic vessel using the airguns) is already an overestimation of the area where the noise is produced, and hence no additional buffer was applied. Hence, the below figures show the distribution, over a 20 km x 20 km spatial grid, of buffered point sources for port works and polygons for seismic surveys and sonar and acoustic deterrents.

Figure 3.1.9.1. Impulsive noise events data for 2016. Each purple cell indicates the position of impulsive noise events, meaning that the impulsive noise emissions occurred during at least 1 day in that cell (ACCOBAMS-MOP8/2022/Inf.43).

Figure 3.1.9.2. Impulsive noise events data for 2017. Each purple cell indicates the position of impulsive noise events, meaning that the impulsive noise emissions occurred during at least 1 day in that cell.

Figure 3.1.9.3. Impulsive noise events data for 2018. Each purple cell indicates the position of impulsive noise events, meaning that the impulsive noise emissions occurred during at least 1 day in that cell.

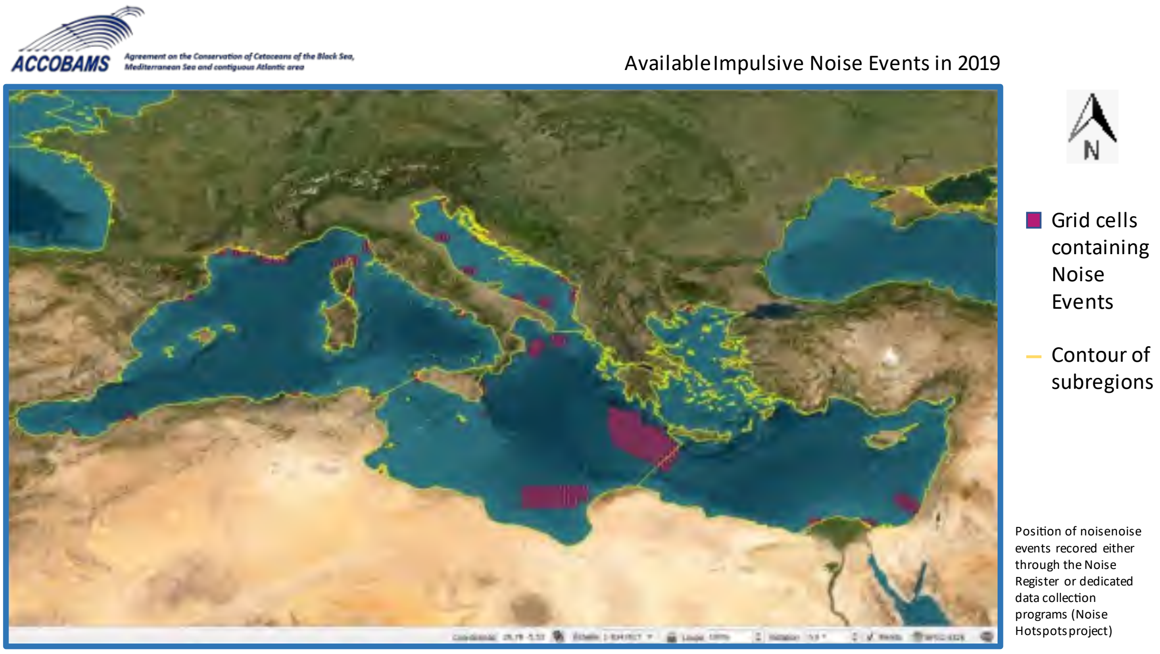

Figure 3.1.9.4. Impulsive noise events data for 2019. Each purple cell indicates the position of impulsive noise events, meaning that the impulsive noise emissions occurred during at least 1 day in that cell.

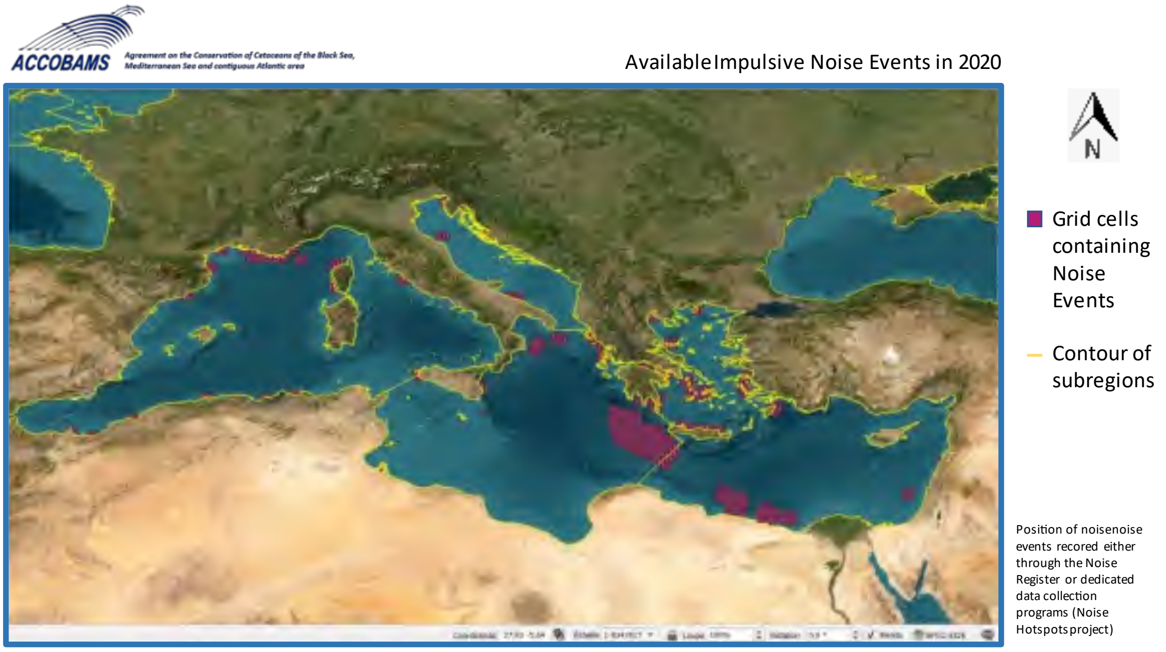

Figure 3.1.9.5. Impulsive noise events data for 2020. Each purple cell indicates the position of impulsive noise events, meaning that the impulsive noise emissions occurred during at least 1 day in that cell.

Figure 3.1.9.6. Impulsive noise events data for 2021. Each purple cell indicates the position of impulsive noise events, meaning that the impulsive noise emissions occurred during at least 1 day in that cell.

Setting the GES/non GES boundary value/threshold for the initial environmental assessment of cCI 26

The assessment for Candidate Indicator 26 is based on data of impulsive noise events reported by the Contracting Parties to the ACCOBAMS through the International Noise Register for the Mediterranean Sea region managed by ACCOBAMS (INR-MED), as well as by using data on further impulsive noise events generated through dedicated activities coordinated by the ACCOBAMS Secretariat which are aimed at enhancing the gathering of impulsive noise event data. For the initial assessment of the noise, the following low and mid-frequency impulsive noise events considered: underwater explosions, geophysical surveys with the use of airguns, sonar or acoustic deterrents, pile driving. The geographical position of such noise sources, the duration of the event (start and end date) and the intensity (in dB re 1µPa or proxy) are the necessary data for the analysis of the geographical and temporal distribution of noise events. This analysis served as an indication of the anthropogenic pressures. Further, by including information about the habitat of noise-sensitive species, it was possible to move towards the assessment of whether the risk of the negative impacts occurring on populations of such species is acceptable. The definition of the GES target proposed by EU TG-Noise was applied for the present initial assessment of cCI 26 within the preparation of the 2023 MED QSR. Considering the available data on impulsive noise events, the statistical calculations related to proportion of days and geographical distribution of low, and mid-frequency impulsive sounds were undertaken as far as possible in line with the Proposal of the IMAP Guidance fact sheet for cCI 26, while for performing the assessment it was necessary to calculate the extent of exposure, an additional indicator, i.e., the extent of habitat of noise-sensitive species which is above the Level of Onset of Biological Effects (LOBE), on average over a year, as outlined in the TG-Noise methodology (2022). For the calculation of the extent of exposure, it is necessary to account for the propagation of noise from the source (either by modelling or other methods such as applying a buffer zone) and to consider the footprint of an impulsive noise event, where the footprint is limited by the isoline at which the LOBE is reached.

692. For the purposes of the 2023 MED QSR a Tolerable Status of the environment is considered when 10% or less of the habitat of noise-sensitive species is impacted by impulsive noise events over a year. For the present initial assessment, this threshold (10%) is used for the four IMAP Sub-regions in the Mediterranean Sea.

693. Based on scientific works which indicate that when the exposure to underwater sound is permanent, the displacement of animals due to acoustic disturbance can be considered as a habitat loss (e.g., Brandt et al., 2018; Graham et al., 2019; Thompson et al., 2013), it was considered that the present initial assessment methodology translates the loss of habitat due to acoustic disturbance into a decline of population following a linear model as suggested by Tougaard et al., 2013.

694. In other words, if the 10% of the habitat of a representative noise-sensitive species is impacted by noise, it is expected that the population will decline by 10% in the long-term. Considering the risk of extinction, 10% is considered sufficiently conservative and precautionary to be selected as the boundary between tolerable and non-tolerable status of a Sub-region i.e., as the boundary value/threshold between the GES and non GES.

Results of the initial IMAP Environmental Assessment of cCI 26 in the Mediterranean region

695. Data collected through the Noise Register lacked geographical representativeness (data from only 5 countries: France, Malta, Greece, Lebanon and Montenegro) and had to be integrated with data collected from dedicated activities led by ACCOBAMS (Noise Hotspot data[126]). Under the 'Noise Hotspot' project, data related to impulsive noise events were found for the period 2016-2021 in waters in front of most Mediterranean countries. However, these data presented uncertainties or gaps in the

[126] ACCOBAMS-MOP8/2022/Inf.43

source level and duration in days of activities that made it impossible either to apply propagation modelling to noise events and compute refined noise footprints, or to compute the number of days with impulsive noise events in the Mediterranean region, as whole, or in its Sub-regions.

696. By pooling together data from the International Noise Register (data from reporting countries) and the Noise Hotspot project (data from scientific study), a database was obtained covering the four Mediterranean Sub-regions, and with sufficient quantity and quality of data to carry out an initial assessment for cCI26.

697. The value of LOBE was not assigned due to heterogeneity of data, preventing the use of refined acoustic propagation modelling to calculate the noise footprint of the impulsive noise events. Instead, as mentioned above, a 20-km fixed buffer was used from point noise source (e.g. pile driving in ports) in order to account for propagation of noise. The 20-km buffer is selected based on scientific literature (Merchant et al., 2017; Tougaard et al., 2009). Furthermore, for noise sources described with polygons (such as seismic surveys), it was considered that using polygons for describing a moving point source (the seismic vessel using the airguns) is already an overestimation of the area where the noise is produced, and hence no additional buffer was applied. Moreover, without consideration of the duration in days for many noise events (the duration in day lacks in 38% of data), it was impossible to calculate the daily cumulated area affected by noise (daily exposure), which is at the basis of the calculation of the average extent of habitat affected by noise over a year i.e. the extent of exposure.

698. Considering these issues, the annual surface of the four Mediterranean Sub-regions with impulsive noise events was computed by summing up the areas of all the noise events described by polygons and buffered point sources, per sub-region. Subsequently, the proportion of potentially usable habitat area (PUHA i.e. Potentially Usable Habitat Area, following habitat models developed by Azzellino et al., 2011), found on areas concerned by noise events, is computed for selected cetacean species, namely the fin whale for the Western Mediterranean sub-region, while the bottlenose dolphin, the sperm whale and the Cuvier’s beaked whale for the four Sub-regions. The result of this calculation is the amount of habitat impacted by noise per Sub-regions and for the whole Mediterranean since 2016 i.e., the extent of exposure, which provides an insight of the risk of decline in population of selected species of cetaceans.

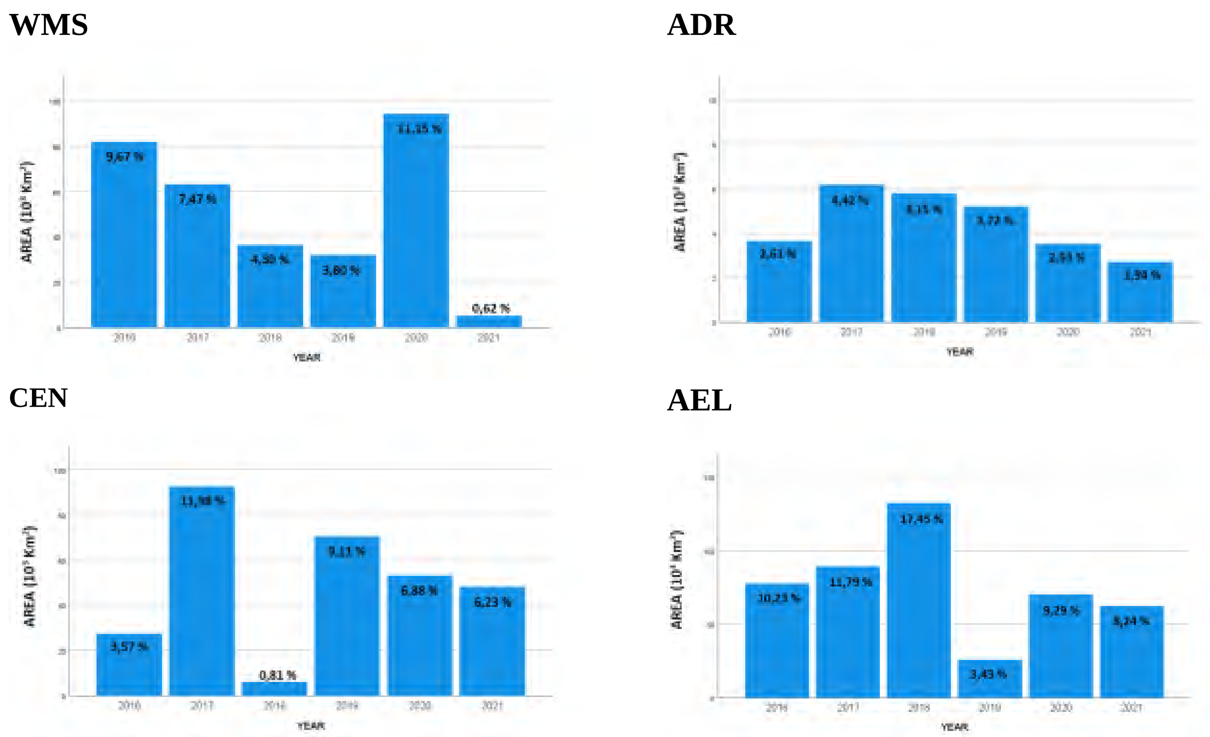

Figure 3.1.9.7. % of sub-regions covered by noise events per year since 2016: **WMS**= Western Mediterranean; **ADR** = Adriatic Sea; **CEN** = Ionian and Central Mediterranean Seas; **AEL**= Aegean and Levantine Seas.

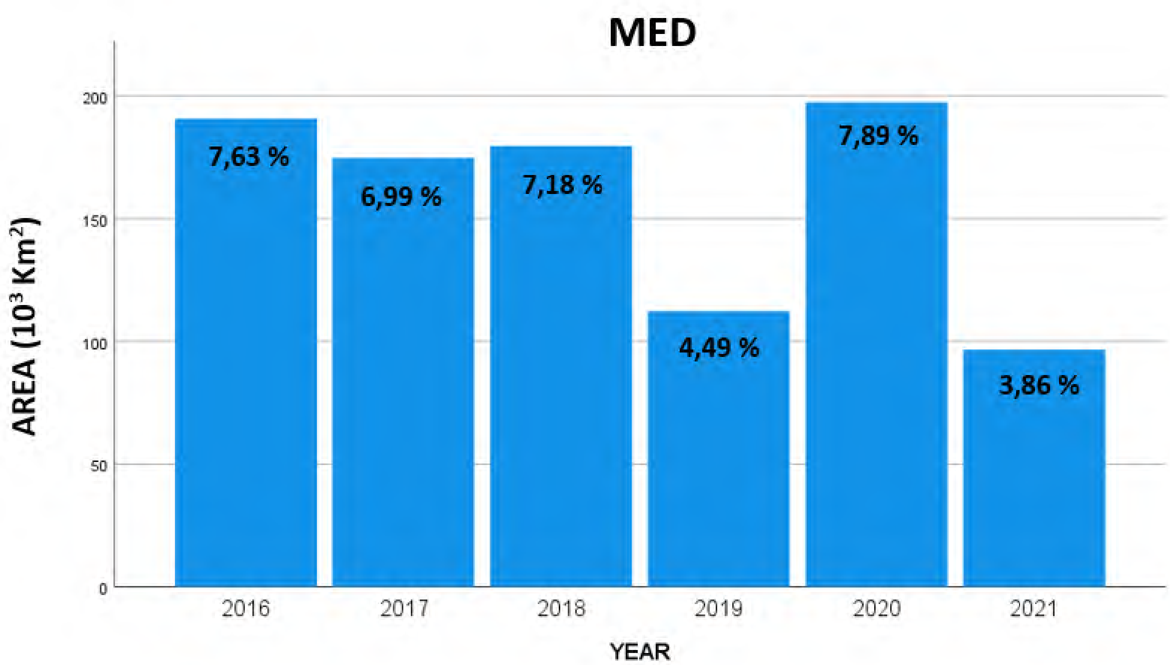

Figure 3.1.9.8. % of the Mediterranean region covered by noise events per year since 2016.

699. To overlap noise event areas to the species habitat an analysis grid is used of about 20 km mesh size (i.e. 10’ x 10’ grid cells) and the concept of PUHA, here applied as habitat proxy. The PUHA is computed from presence/absence habitat models using physiographic predictors as covariates (depth and slope statistics) which estimate the presence probability of the representative cetacean species in the area of interest. Based on the presence probability for a species, called Habitat Suitability (HS), the usable habitat (in km²), is calculated in every cell unit of the analysis grid by multiplying the HS for the area (km²) of the cell unit. The PUHA is then calculated (in km²) for the subregions by summing up the usable habitats from single grid cells in the different subregions.

700. Table 3.1.9.1 shows the percent of habitat (PUHA) of a species which is affected by impulsive noise for every year from 2016 to 2021. Four species are considered: bottlenose dolphin, sperm whale and Cuviers’ beaked whale, and only for the WMS subregion the fin whale.

Table 3.1.9.1: Summary of the percent impacted PUHA for the four selected cetacean species (e.g. bottlenose dolphin, sperm whale and Cuviers’ beaked whale, and fin whale). For the year 2018, the percent of impacted PUHA for sperm whale and Cuvier’s beaked whale is highlighted in red and percent of impacted PUHA of bottlenose dolphin, being close but lower than the 10% GES/non GES boundary limit is highlighted in light blue.

IMAP SUB-REGIONS	**AFFECTED AREA (% POTENTIALLY USABLE HABITAT AREA IMPACTED BY IMPULSIVE NOISE) PER YEAR IN THE PERIOD 2016-2021**						
	Bottlenose dolphin						
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**Median**
ADR	4,81	6,59	6,48	6,27	3,03	2,88	5,54
AEL	4,76	5,21	**8,62**	1,17	4,27	1,39	4,52
CEN	1,28	1,45	0,66	4,02	2,9	2,48	1,97
WMS	1,52	1,34	1,26	1,48	1,63	0,45	1,41
	Fin whale						
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**Median**
WMS	0,99	1,02	0,67	0,74	1	0,23	0,87
	Sperm whale						
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**Median**
ADR	1,48	2	1,97	1,77	0,69	0,64	1,63
AEL	**8,2**	2,59	**11,51**	0,88	3,36	2,12	3,11
CEN	0,63	0,83	0,55	7,39	5,62	5,47	3,15
WMS	0,84	0,94	0,47	0,49	0,78	0,16	0,63
	Cuvier's beaked whale						
	2016	**2017**	**2018**	**2019**	**2020**	**2021**	**Median**
ADR	1,41	2,44	2,37	1,78	0,25	0,28	1,59
AEL	6,18	4,77	**10,15**	0,97	4,75	1,95	4,76
CEN	1,27	1,64	0,83	6,1	4,88	4,41	3,02
WMS	1,22	1,17	0,99	1,19	1,49	0,38	1,18

701. It can be observed that in the 2016-2021 average scenario (median level), the 10% GES/non GES boundary limit was not exceeded, being very far for all the considered species. However, for some year (e.g. in 2018), the 10% GES/non GES boundary limit might have been exceeded in the Aegean-Levantine Sub-region (AEL) concerning the habitat of sperm whale and Cuvier's beaked whale. In such a case, the environmental status may be considered non tolerable for the year 2018 i.e., the non GES can be indicated.

702. For the Western Mediterranean (WMS), the Adriatic Sea (ADR) and the Central Mediterranean Sea (CEN), the environmental status appears as tolerable for all years.

703. For the years 2016, 2017, 2019, 2020, 2021 and for all the 4 cetacean species considered (bottlenose dolphin, fin whale, sperm whale, Cuvier's beaked whale), all subregions are below threshold, i.e., less than 10% of the potentially usable habitat area is affected by noise events as calculated following the adapted assessment methodology.

704. For the year 2018 and for all the 4 species considered (bottlenose dolphin, fin whale, sperm whale, Cuvier's beaked whale), 3 sub-regions are below threshold of affected habitat (ADR, CEN, WMS).

705. In 2018, the proportion of affected habitat was higher than 10% i.e. the GES/non GES boundary value/threshold in the Aegean and Levantine Sea Sub-region (AEL) considering sperm whale and Cuvier's beaked whale habitats, but was lower than 10% considering the bottlenose dolphin habitat. AEL Sub-region presents the higher likelihood to be in non-tolerable i.e., non-GES based on available data and adapted assessment methodology (Figure 3.1.9.9).

706. , The proportion of affected habitat was higher than 10% i.e. the GES/non GES boundary value/threshold in the Aegean and Levantine Sea Sub-region (AEL) considering sperm whale and Cuvier's beaked whale habitats, but was lower than 10% considering the bottlenose dolphin habitat. AEL Sub-region presents the higher likelihood to be in non-tolerable i.e., non-GES based on available data and adapted assessment methodology (Figure 3.1.9.9).

707. Overall, for the Mediterranean Sea region, the environmental status is probably acceptable based on the present preliminary assessment findings, since the whole Mediterranean seems to comply with the 10% GES/non-GES boundary value of impacted habitat of cetaceans selected for this assessment. This conclusion is also supported by the computation of the simple coverage (i.e., without considering the habitat of cetaceans) of the Mediterranean Sea by impulsive noise events, which is below 10% for all year considered (Figures 3.1.9.7.and Figure 3.1.9.8).

708. Figures 3.1.9.9 and 3.1.9.10. provide a mapping of main assessment findings, especially highlighting potential non-GES situations found for the year 2018. It is noteworthy that the red areas highlighted in those maps do not correspond to non-tolerable, i.e., non-GES, positions, but are simply the position of all noise events for periods and areas considered (2018, all sub-regions). Tolerable or non-tolerable status is derived by dividing the extent of habitat of a species which is covered by impulsive noise events in the sub-region by the overall extent of the habitat area in that subregion. Tolerable or non-tolerable status is therefore indicated by one number (i.e., the proportion of affected habitat, in % which is assigned to a sub-region plotted and is plotted in Figures 3.1.9.9 and 3.1.9.10. Beyond this, highlighting the areas that determine the exceedance of the 10% threshold (non-tolerable, i.e. non-GES areas) during a year will be possible when the ACCOBAMS International Noise Register will be fed with enough data to allow for an optimal assessment. However, from a management perspective the way the red areas are interpreted has little importance as bringing a sub-region below thresholds will imply to take measures to reduce the extent of the red areas, wherever they are found.

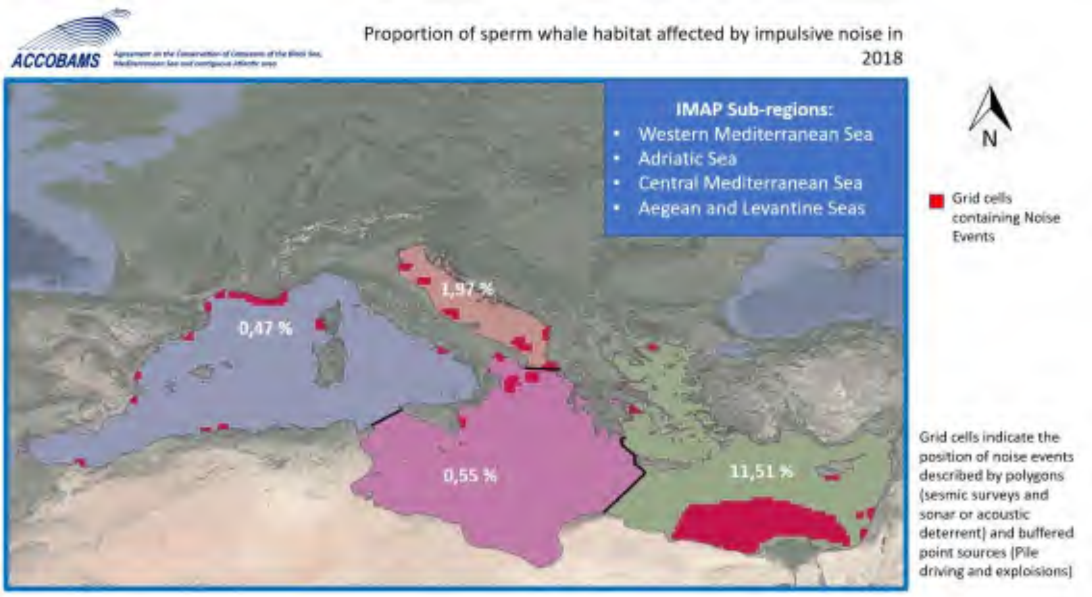

Figure 3.1.9.9. Percentages of habitat (PUHA) exposed to impulsive noise events, in 2018, per four IMAP Sub-regions in the Mediterranean and considering sperm whale as target species. Red grid cells indicate the position of noise events in 2018, irrespective if they are classified as GES or non-GES. The 4 sub-regions are indicated in different colours.

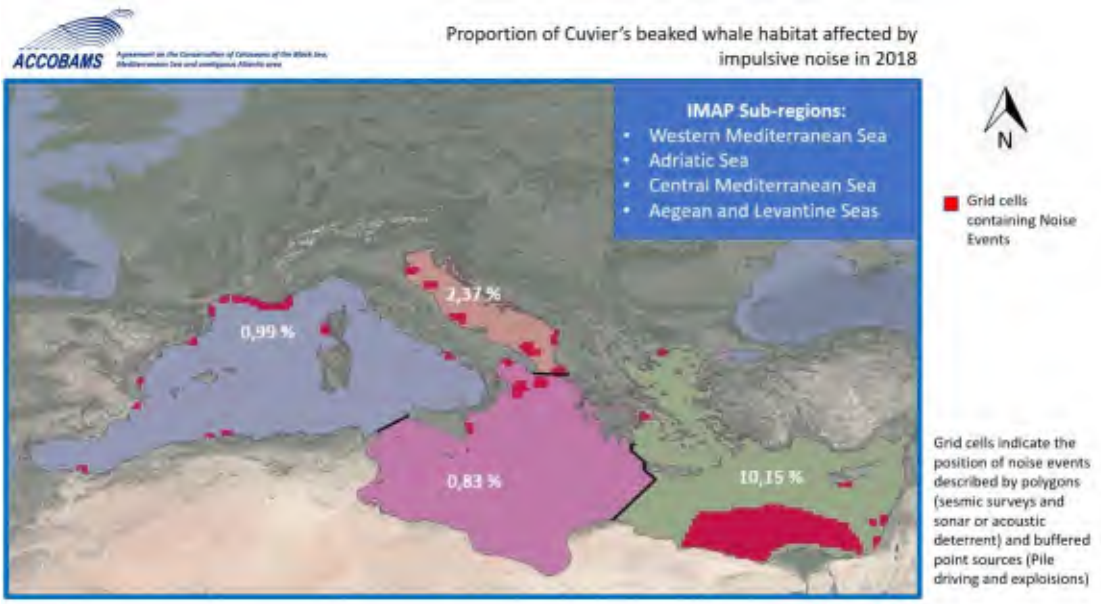

Figure 3.1.9.10. Percentages of habitat exposed to impulsive noise events, in 2018, per four IMAP Sub-regions and considering Cuvier's beaked whale habitat. Red grid cells indicate the position of noise events in 2018. The 4 sub-regions are indicated in different colours.

709. The refinement of the assessment, when the INR-MED will reach a higher level of completeness, should enable simulation of the effect of the concurrent activities of impulsive noise sources through appropriate simulation techniques (including acoustic modelling), and application of the optimal methodological framework .

Assessment of IMAP Candidate Common Indicator 27: Levels of continuous low frequency sounds with the use of models as appropriate

Geographical scale of the assessment	The Sub-regions within the Mediterranean region
Contributing countries	**All ACCOBAMS Contracting Parties** which participate in setting and maintenance of the NETCCOBAMS platform: Albania, Algeria, Bulgaria, Croatia, Cyprus, Egypt, France, Georgia, Greece, Italy, Lebanon, Libya, Malta, Monaco, Montenegro, Morocco, Portugal, Romania, Slovenia, Spain, Syria, Tunisia, Türkiye, Ukraine
Mid-Term Strategy (MTS) Core Theme	Enabling Programme 6: Towards Monitoring, Assessment, Knowledge and Vision of the Mediterranean Sea and Coast for Informed Decision-Making
Ecological Objective	EO11. Energy including underwater noise
IMAP Common Indicator	cCI27. Levels of continuous low frequency sound with the use of models as appropriate
GES Definition (UNEP/MED WG473/7) (2019)	Noise from human activities causes no significant impact on marine and coastal ecosystems
GES Targets (UNEP/MED WG473/7) (2019)	Noise levels at monitoring stations are below thresholds; The extent (% or km²) of the assessment area which is above levels causing disturbance to sensitive marine animal is below limits, or such limits are exceeded for a limited amount of time
GES Operational Objective (UNEP/MED WG473/7) (2019)	Energy inputs into the marine, environment, especially noise from, human activities, are minimized

Available data

710. For cCI27 data are obtained from the NETCCOBAMS Platform, the digital information tool managed by ACCOBAMS that centralizes all relevant data regarding cetaceans and related anthropogenic threats. The platform contains maps of shipping noise distribution over the entire Mediterranean basin in the two out of the five frequency bands of interest (1/3 octave bands centered at 63 Hz and 125 Hz). Shipping noise maps were obtained from modelling techniques which corresponds to requirements indicated in the Proposal of the IMAP Guidance Factsheets for cCI27.

711. Availability of these NETCCOBAMS maps of shipping noise in the two frequencies is also aligned with the ACCOBAMS Monitoring Strategy (2015) on underwater noise monitoring and the EU recommendations contained in the Monitoring Guidance prepared by TG-Noise for the MSFD-D11 (Dekeling et al, 2014).

712. These maps are produced by modelling tools provided by SINAY, a company specialized in underwater acoustics which developed the necessary technologies to set up the NETCCOBAMS platform (ACCOBAMS-SC14/2021/Doc36) which include modeling techniques widely used in environmental studies on noise pollution (e.g., Maglio et al., 2015, 2017; Drira et al, 2018). Such techniques are based on the RAM model (Collins, 1993) and inputs data available from the AIS data for ships parameters and ship traffic (source: Spire Group, a US based company), as well as in EMODnet and COPERNICUS data platforms (EMODNet and Copernicus) providing environmental variables influencing the propagation of noise.

713. An overview of the available data on ship traffic patterns is shown in Figure 3.1.10.1. This map, available in NETCCOBAMS, was produced based on the ship traffic density provided based on AIS data in 2017. Ship traffic patterns appears quite stable year-to-year and the ship density maps that can be obtained from AIS data generally shows the same picture overall, regardless of the period chosen for analysis. Major ship lanes are found indeed between the Gibraltar Strait and the Suez Canal as well as in other lanes connecting the major ports in the Mediterranean Sea area. High traffic areas are especially located in the northern side of the Mediterranean.

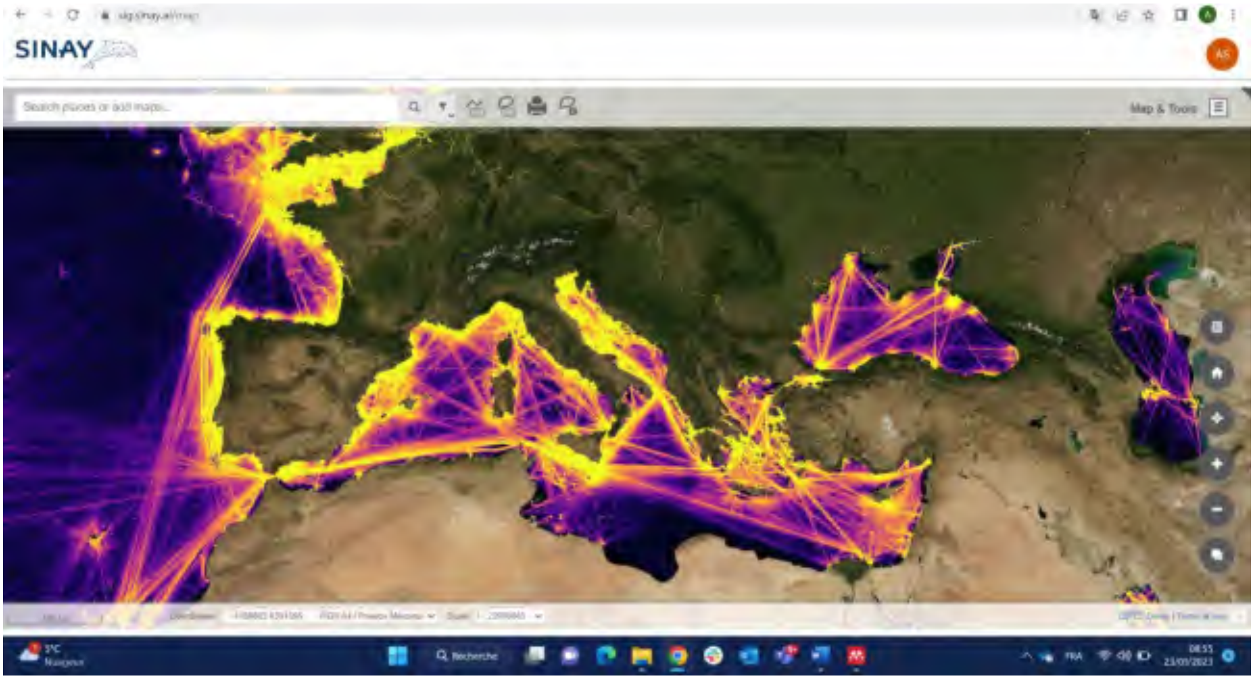

Figure 3.1.10.1: Ship traffic density as total count of AIS messages per grid cell (0.01° in latitude and longitude) for 1 year (2017 in this case). The patterns shown in this map (ship lanes, traffic hotspots, low- and high-density areas) are quite stable year-to-year and can be considered representative of usual ship traffic conditions in the Mediterranean Sea. Source of raw AIS data used in NETCCOBAMS: Spire Group.

714. The noise map used for this assessment referred to the median ambient noise levels for the month of July 2020. The use of median level over 1 month satisfies the minimum requirements for the assessment related to cCI27 according to the 2022 TG-noise guidance. This map is presented below in this document. Given the relative stability of the ship traffic levels and characteristics within a time window of a few years, and that the ship traffic is at the highest levels during summer months, the assessment produced for month of July 2020 can be generalized to other years, and can be seen as the worst case scenario within a year[127].

715. Other relevant sources of data are indirectly explored. These are the ambient noise levels from in-situ measurements in the Balearic Sea collected within the QUIETMED project (quietmed-project.eu) which were used to calibrate the models implemented in NETCCOBAMS. Despite additional in-situ measurements are required to continue improving the model which would estimate situation in the four Mediterranean subregions. The first validation was achieved from field data which do not directly contribute to the assessment, and therefore they are not shown in the 2023 MED QSR.

[127] Furthermore, a new noise map for the month of July 2021 should be available in NETCCOBAMS in the coming months. The noise map for July 2021 will allow to compare the status in July 2020 with the status in July 2021, to test assumptions described in this assessment.

Additional information on data and the calibration process of the acoustic models is found in QUIETMED Deliverable 3.3 (Taroudakis et al., 2018).

716. Finally, data produced under national programs as well as from sub-regional cooperation projects (e.g. the INTERREG-SOUDSCAPE project in the northern Adriatic Sea), were listed and can be used to put into context and compare with assessment findings produced here, thus allowing more robust conclusions. This activity is currently ongoing and will complete the present document at a later stage of the 2023 MED QSR development process.

Setting the GES/non GES boundary value/threshold for the initial environmental assessment of cCI 26

The assessment of IMAP Candidate Indicator 27 was performed by using data obtained from the NETCCOBAMS Platform, a digital information tool managed by ACCOBAMS that centralizes all relevant data regarding cetaceans and related anthropogenic threats. The quality of available data was sufficient and allowed to produce the first assessment findings of cCI 27 in the four Sub-regions of the Mediterranean Sea. For this initial assessment of cCI 27, the methodology served as an indication of the anthropogenic pressures. Further, by including information about the habitat of noise-sensitive species, it was possible to move towards the assessment of whether the risk of that negative impacts occurring on populations of such species is acceptable. Specifically, the methodology for cCI27, which was based on monthly extent of exposure, i.e., the extent of habitat of noise-sensitive species which is above the Level of Onset of Biological Effects (LOBE) on a monthly basis, ensured addressing the risk of extinction of a population due to exposure to underwater noise. This concept is at the basis of the noise assessment methodology developed by the MSFD TG-Noise.

The Proposal of IMAP Guidance Factsheet for cCI 27 indicates the following target: “the extent (% or km²) of the assessment area which is above levels causing disturbance to sensitive marine animals is below limits”. Further to the finalisation of the work from EU TG-Noise in 2022, it is found that this GES target still stands. Therefore, it was applied for the initial cCI 27 assessment within the preparation of the 2023 MED QSR.

717. The overall assessment methodology developed by TG-Noise (2022) could be fully implemented for IMAP cCI27 for the month of July 2020, which is taken as basis for assessing the status i.e., tolerable/non-tolerable that might be considered correspondent to GES/non GES status of marine waters at the sub-regional level.

718. The average noise level for the month of July 2020 is defined as the median ambient noise level. The median is calculated from the statistical distribution of noise values obtained from the acoustic modelling (N = 93 noise maps corresponding to shipping noise levels at 93 instants, 1 every 8 hours for the period of 31 days).

719. The Level of Onset of Biological Effect (LOBE) was set at as a sound pressure level of 125 dB re 1 µPa in the 1/3 octave band centered at 63Hz and each grid cell. The value of 125 dB re 1 µPa was defined based on the models developed by Gomez et al 2016.

720. The frequency band centered at 63 Hz is selected from the list of frequency bands indicated in the Proposal of the IMAP Guidance Factsheets for cCI27 (1/3 octave bands centered at 20, 63, 125, 250, 500, 2 000 Hz) as shipping noise in this frequency bands generally dominates in the underwater ambient noise.

721. With regards to cetacean species selected for the assessment, the fin whale is selected for the Western Mediterranean Sea Sub-region, and the bottlenose dolphin for the other three Mediterranean Sub-regions. The proportion of the potentially usable habitat areas (PUHA, following Azzellino et al, 2011) of these species, found on areas with median shipping noise higher than LOBE (125 dB re 1 µPa), is computed. The result of this calculation is the amount of habitat affected by noise i.e., the extent of exposure, which provides an estimate of the risk of decline of the selected species’ population.

722. A Tolerable Status of the environment is defined when 20% or less of the habitat of noise-sensitive species is impacted by continuous noise on a monthly basis. It is used for all four Mediterranean sub-regions. Based on the scientific works demonstrating that the exposure to underwater continuous noise induce adverse effects (e.g. behavioral disturbance, stress, reduced communication space, and temporary or permanent habitat loss) which in turn could reduce the fitness, and hence the reproductive success of individuals (e.g. CBD, 2012), it was considered that the present initial assessment methodology translates the degradation of portions of habitat due to acoustic disturbance into a decline of population following a linear model as suggested by Tougaard et al (2013). In other words, if the 20% of the habitat of a representative noise-sensitive species is impacted by high levels of continuous noise, it is expected that the population will decline by 20% in the long-term.

723. An acceptable status i.e. the GES relative to continuous noise is achieved if in every month over a year, the area exposed to noise level higher than LOBE is equal to or below 20% of the habitat of a selected species. If one month is above 20%, the environmental status is considered non tolerable. This is found as an optimal boundary value after considering that shipping is nowadays a permanent characteristic of the habitats and it has probably shaped the carrying capacity of habitats and hence the size of populations since decades. This consideration, along with the fact that the scientific literature about the noise effects does not suggest any strong relationship of the shipping-related noise with any dramatic reduction of the population sizes, determines the setting for continuous noise of a less restrictive threshold than for the impulsive noise. This threshold of 20% of habitat of a species exposed to continuous noise in the long term is hence used as a baseline to assess whether at least this initial minimum target is achievable. It should ensure the viability of a population size at 80% of the carrying capacity. This number is therefore subject to further possible adjustments.

Results of the initial IMAP Environmental Assessment of cCI 27 in the Mediterranean region.

724. Figure 3.1.10.2 shows the distribution of median noise levels in the 1/3 octave band centered at 63 Hz for the month of July 2020. Considering that the median divides a distribution of values sorted from lowest to highest in the two parts, each containing 50% of the values, the median noise informs that during 50% of the time the levels are higher than those shown at each point of the area as depicted in Figure 3.1.10.2, and in the other 50% the values are lower. The median value is a good indicator of a ‘typical’ ambient noise value that can be measured in a zone because it is not influenced by small portions of very high or very low values, as it would be the case by applying the arithmetic mean.

725. Beyond indication of the typical values of ambient noise of an area, the median noise can also indicate where the values are high enough to induce the negative effects in individuals of sensitive marine species, they are even higher for the 50% of the time. In such a case, the exposure to the levels inducing negative effects would occur very frequently i.e. during 50% of the time and potentially for a long period of time (e.g. hours to days of continuous habitats` exposure), eventually increasing the risk for populations.

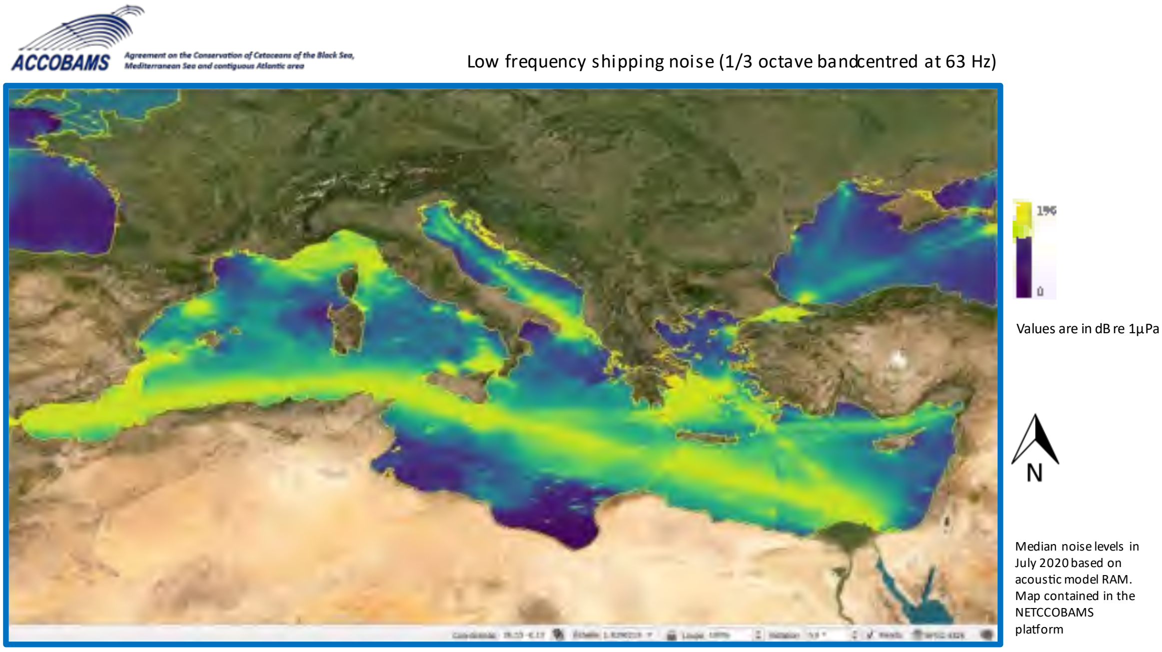

Figure 3.1.10.2: Median shipping noise levels in month of July 2020 based on the acoustic model RAM (Collins, 1996), contained in the NETCCOBAMS platform.

726. By analyzing Figure 3.1.10.2. on the median shipping noise, the main ship lanes can be distinguished (e.g., Gibraltar to Suez) from the areas of diffused noise around port areas, where the median noise levels are estimated at around 140 dB re 1µPa or higher. Also, the areas with lower or very low ship traffic levels (e.g. offshore waters between Sardinia, the Balearic Islands and southern French coast) present median noise levels in the range 100-110 dB re 1µPa. A few areas present the median values below 100 dB re 1µPa, and especially those in Libyan waters due to very low ship traffic and the distance from heavy traffic areas. Also, some high vessel traffic areas do not correspond to high median noise levels (e.g. waters around Cyprus, the Central and the Northern Adriatic Sea).

727. The percentage of habitat of the fin whale and the bottlenose dolphins which is found where the median shipping noise is higher than 125 dB re 1µPa is calculated for the Western Mediterranean Sea Sub-region, and for all four Mediterranean Sub-regions, respectively. The results of the assessment indicating tolerable/ non-tolerable i.e. GES/non GES are summarized here-below in Table 3.1.10.1.

Table 3.1.10.1: Summary of the percent impacted habitat (PUHA) for the two selected cetacean species (i. bottlenose dolphin for all subregions, and ii. fin whale for Western Mediterranean Sea,) for the month of July 2020. The 20% threshold is exceeded in the Western Mediterranean Sea with relationship to both bottlenose dolphin and fin whale habitats, and in the Aegean and Levantine Seas with the relationship of bottlenose dolphin habitat.

BOTTLENOSE DOLPHIN		
IMAP SUB-REGION	**Affected habitat**: % of potential usable habitat area (PUHA) overlapping median shipping noise levels higher than LOBE (125 dB re 1µPa)	**Result of the assessment**
WMS	**35.02%**	Non tolerable
ADR	15.53%	Tolerable
CEN	15.84%	Tolerable
AEL	**27.59%**	Non tolerable

FIN WHALE		
IMAP SUB-REGION	**Affected habitat**: % of potential usable habitat area (PUHA) overlapping median shipping noise levels higher than LOBE (125 dB re 1µPa)	**Result of the assessment**
WMS	**31.53%**	Non tolerable

728. The computation of the extent of exposure results in non-tolerable i.e. in non GES for the Western Mediterranean Sea and the Aegean Levantine Sea Sub-regions i.e., % affected habitat > 20%, while the status is tolerable i.e., GES in the Adriatic Sea and Central Mediterranean Sea Sub-regions.

729. The overlap between continuous noise (median noise in July 2020) and the habitat of cetacean species clearly shows the exceedance of the 20% boundary value/threshold of the habitat area affected by continuous low frequency noise in the Western Mediterranean Sea and the Aegean Levantine Seas Sub-regions. Given that the implementation of the methodology for cCI 27 is overall complete for the month of July 2020, it can be concluded that these two sub-regions were in non-tolerable status i.e., non-GES during that one month. While it cannot be said much regarding the status during other months, one single month exceeding the 20%, is sufficient to induce non tolerable environmental status, i.e. nonGES for continuous noise, for the entire year. Therefore, the assessment finding for 2020 appears to be non-tolerable status, i.e. non-GES, for WMS and AEL sub-regions.

730. Figures 3.1.10.3 and 3.1.10.4 provide such mapped assessment findings. It is worth noting that tolerable/non tolerable, i.e. GES/non-GES status is indicated by the proportion of affected habitat to see whether the value is above the 20%. Red areas determine the non-tolerable status of a sub-region but are not to be considered non-GES areas. However, from a management perspective the way red areas are interpreted has little importance as bringing a sub-region below thresholds will induce taking actions to reduce the extent of the red areas, wherever they are found.

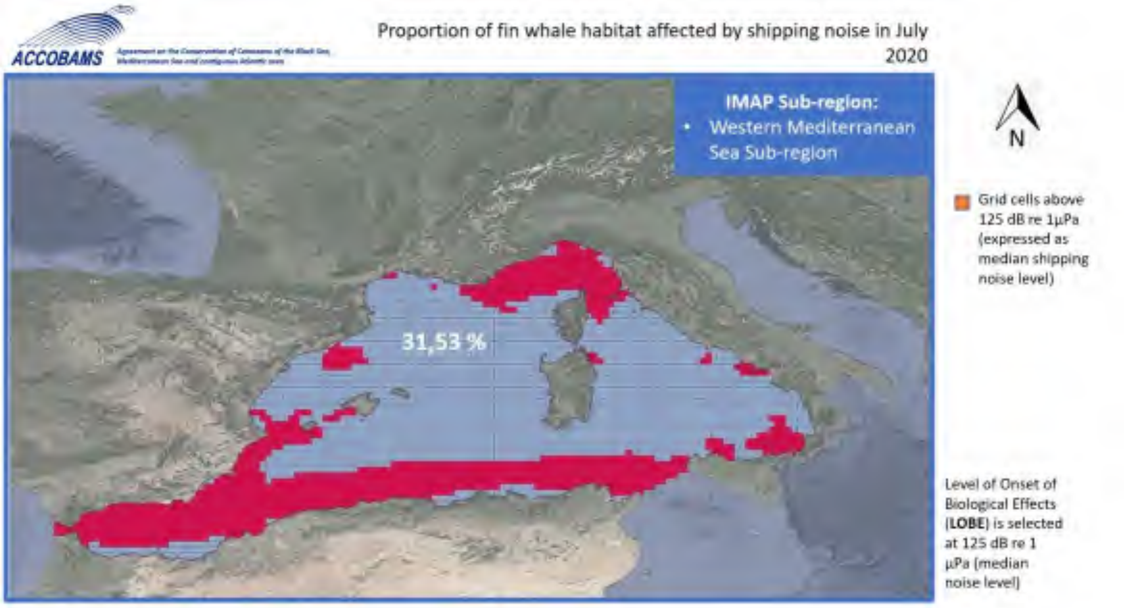

Figure 3.1.10.3. Percent of fin whale habitat (PUHA) exposed to a monthly noise level higher than 125 dB re 1 µPa (LOBE) in the Western Mediterranean Sea Sub-region (WMS). Red cells indicate the area where the Level of Onset of Biological Effects (LOBE, set as median noise level = 125 dB re 1µPa) is exceeded for the month of July 2020.

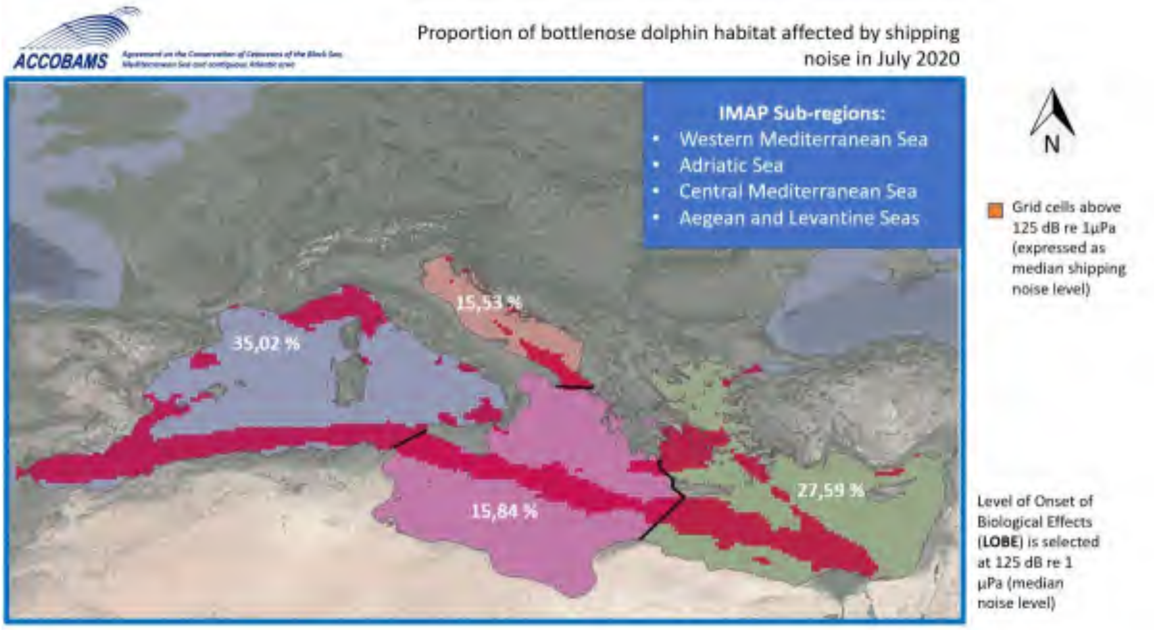

Figure 3.1.10.4. Percent of bottlenose dolphin habitat (PUHA) exposed to a monthly noise level higher than 125 dB re 1 µPa (LOBE) in the Western Mediterranean Sea Sub-region (WMS), Adriatic Sea (ADR), Central Mediterranean (CEN) and Aegean and Levantine Sea (AEL) sub-regions. The picture shows exceedance of thresholds (20% of habitat affected by continuous noise) in the WMS and AEL sub-regions, and compliance in the ADR and CEN sub-regions. Red cells indicate the area where the Level of Onset of Biological Effects (LOBE, set as median noise level = 125 dB re 1µPa) is exceeded for the month of July 2020. Different sub-regions are indicated in different colours.

731. For the Adriatic Sea (ADR) and Central Mediterranean (CEN) sub-regions, the result of the assessment was a tolerable status, i.e. GES for continuous noise, considering that the proportion of habitat of the species considered (bottlenose dolphin) affected by continuous noise was below 20%. As elaborated above, the summer months are those with the highest levels of vessel traffic and hence the analysis done on a month of July 2020 can be seen as the worst-case scenario. Therefore, even

though quantitative data were not produced for other months, it is possible to conclude that if the month representing the worst case scenario results in tolerable status, i.e., GES for continuous noise, this result can be generalized for the entire year, i.e., the ADR and CEN sub-regions were likely in GES in 2020.

732. Finally, based on these preliminary results, the environmental status of the Mediterranean Sea region is not fully in tolerable status i.e., GES status since the Western Mediterranean Sea and the Aegean Levantine Sea Sub-regions do not comply with the 20% threshold of impacted habitat over the monthly scenario.

Measures and actions required to achieve GES

The knowledge gaps common to IMAP Ecological Objectives 5 and 9

Lack of data for nutrients, contaminants and biomarkers, as well as the lack of capacities of National IMAP Pollution competent laboratories:

733. There was a vast improvement in the spatial coverage of data reported for IMAP Pollution Common Indicators into IMAP IS since the last 2017 MED QSR. However, data availability is characterized by significant data inhomogeneity, and uneven data distribution along the Mediterranean region, with areas with satisfactory data availability and with areas for which only a few or no data were reported. The following key observations pertain to specific IMAP Pollution Common Indicators:

- CIs 13&14. The data most lacking are for total phosphorous. Data for all mandatory parameters i.e., the concentration of ammonium, nitrite, nitrate, total nitrogen, orthophosphate, total phosphorus, orthosilicate and chlorophyll a, temperature, salinity, dissolved oxygen and water transparency (Secchi depth), are needed for the Central Mediterranean Sea Sub-region (CEN); the southern part of the Levantine Sea, the sub-division of the Aegean-Levantine Sea Sub-region; and the southern part of the Central part of the Western Mediterranean Sea Sub-region (WMS) which are underrepresented in the IMAP database.
- CI 17. The data most lacking were for organic contaminants in sediments and biota for all four Mediterranean Sub-regions, followed by trace metals in biota *(M. galloprovincialis and M. barbatus)*. As well as for CIs 13&14, data for all the parameters of CI 17 are needed for the CEN Sub-region; the southern part of the LEVS sub-division; and the southern part of the Central part of the Western Mediterranean Sea (CWMS) sub-division.
- CI 18. No data were available in IMAP IS for the preparation of the 2023 MED QSR. Therefore, no improvement in the assessment of CI 18 was achieved since the 2017 MED QSR, and the GES assessment was impossible within the preparation of the 2023 MED QSR. Instead, the assessment was performed based on bibliographic studies, as in the 2017 MED QSR, using newer available scientific literature i.e., the studies on biomarkers in the Mediterranean Sea since 2016. It should also be emphasized that data from studies could not be compared to BACs and EACs values as agreed for CI 18 by Decisions IG.22/7 (COP 19) and IG.23/6 (COP 20) as they were not measured in the specific tissue of *M. galloprovincialis*. Moreover, comparison among the bibliographic studies was mostly impossible. This is due to using different biomarkers, with different biota species, using different tissues, and different methodologies. The confounding factors that hinder environmental status assessment i.e., species, gender, maturation status, season, and temperature were re-confirmed as found in the 2017 MED QSR. In addition, an inherent bias exists in publications toward studies showing an effect. Authors and journals do not usually publish studies showing the lack of effect or response.
- CI 20. No data were available in IMAP IS to undertake GES CI 20 assessment within the preparation of the 2023 MED QSR. Therefore, the environmental assessment could only be performed by combining the two approaches: i) assessment of the status based on data reported to IMAP IS for CI 17 contaminants in biota, and ii) assessment of the present status based on bibliographic studies, following the same approach applied for preparation of the 2017 MED QSR; however, by using newer available scientific literature. It should also be recognized that due to the lack of data, the rule was not set for assigning the GES/non-GES to the areas assessed further to the use of the EU maximum levels for certain contaminants in foodstuffs, approved as the assessment criteria for CI 20.
- CI 21. Very limited data were available in IMAP IS to undertake GES CI 21 assessment within the preparation of the 2023 MED QSR. Most of the data were available through EEA and not through IMAP IS.

734. The lack of data reporting is likely to be related to:

- Lack of expertise and/or instrumentation and/or funding to perform the sampling and analytical determination of the contaminants and nutrients.

- The lack of consistency with monitoring programmes adopted at the national scales as well as with routine measurements undertaken on parameters (e.g. for nutrients).
- The mandatory species for monitoring i.e., the mussel M. galloprovincialis and the fish M. barbatus, may not have a harmonized presence or have low availability in different sub-regions and/or sub-divisions. Therefore, these species could not be sampled and analyzed in all areas, and lack of monitoring data were evident.
- There is an evident lack of accessibility to quality assurance tools, such as interlaboratory comparisons (ILCs), proficiency tests (PTs), or certified reference materials (CRMs), along with a lack of knowledge for use of adequate laboratory equipment.
- Deviations from the IMAP monitoring methodologies, for example, inconsistent biota sampling and discrepancy in the samples preparation negatively affect the performance of IMAP Pollution competent laboratories.

Hindered data use by missing database management tools:

735. IMAP IS platform operates as a repository of data in Excel file format. It is not a quarriable database, with no data export formats or mapping capability. The platform is easy to use for searching and retrieving files, but no QC/QA categories and data flagging are available. All these imposed additional workloads to create the offline databases in order to ensure data control and use for the preparation of the 2023 MED QSR IMAP Pollution and Marine Litter assessments. The files reported by the CPs do not always report all the necessary metadata and data, as specified in the DDs and DSs. At the same time, the CPs reported that the preparation of the files for an upload into the IMAP IS was complicated and time-consuming, lacking an inter-facing modality to ensure data transfer to IMAP IS from national databases.

Absence of optimal integration and aggregation among CIs and EOs:

736. Given the lack of data reporting as required by Decision IG. 23/6 (COP 20), it was impossible to ensure optimal application of the integration and aggregation rules in order to provide the integrated assessments of the EOs and CIs.

The measures to address the common knowledge gaps related to IMAP Ecological Objectives 5 and 9, as well as IMAP Ecological Objectives 10

737. The measures to address common knowledge gaps include the policy and technical measures that are common at the level of IMAP Pollution and Marine Litter Cluster, as provided here below.

The policy measures to address the common knowledge gaps

Increase of data availability and capacity building programmes to address the knowledge and technical gaps of national IMAP Pollution competent laboratories:

738. Submission of good quality data, striving for their uniform distribution across the Mediterranean Sub-regions should be encouraged, and support given to the CPs to enable it. A thorough mapping of the specific needs of each CP should be performed and a tailored capacity building process drawn and executed. The following specific knowledge, technical and financial needs of IMAP Pollution competent laboratories should be addressed:

i) further harmonization of laboratories' performance in line with the IMAP Monitoring Guidelines in order to increase the representativeness and accuracy of the analytical results for generation of quality-assured monitoring data;
ii) improving availability of appropriate analytical equipment to strengthen technical capacities of national IMAP Pollution competent laboratories;
iii) increasing consistency of biota sampling along with the application of Quality Assurance measures;

iv) increasing accessibility to quality assurance tools, such as inter-laboratory comparisons (ILCs), proficiency tests (PTs), or certified reference materials (CRMs).

739. The assessment of the capacities of national IMAP Pollution competent laboratories should continue as a biennial effort aimed at gradual improvement of their performances with a view of reaching optimal compliance of data processing and reporting with the methods provided in Monitoring Guidelines for IMAP Common Indicators 13,14,17, 18, 20 and 21.

740. Further to the results achieved in proficiency testing over a 25-year period, the UNEP/MAP-MED POL in collaboration with the IAEA/MESL continues implementation of the traditional proficient testing (PT) related to the determination of trace metals and organic contaminants in sediment and biota matrixes, along with the organization of the training courses;[128] however, by ensuring their adjustment to the requirements of IMAP CI 17. Along with the continual strengthening of the quality assurance for trace metals and organic contaminants, national capacities need to be further upgraded by undertaking regular inter-laboratory comparisons/proficiency testing for the analysis of nutrients, biomarkers, and contaminants in commonly consumed seafood and intestinal enterococci in bathing waters within ongoing and planned activities of UNEP/MAP - MED POL. The technical missions organized to the IMAP competent laboratories in the greatest need should continue addressing specific technical knowledge gaps.

741. Capacity building needs of the Contracting Parties regarding the use of the IMAP Pollution and Marine Litter assessment methodologies need to be also addressed.[129.] This could be in the form of additional training courses, including the use of environmental assessment tools (NEAT and CHASE+), as well as by supporting the purchase of analytical instrumentation.

Improve DPSIR analysis:

742. DPSIR analysis needs to be improved by supporting the CPs to regularly provide relevant information and share the knowledge which in principle may be ensured by i) reporting information on DPSIR, along with national monitoring data, and compatibly with data reporting for National Action Plans` indicators; ii) ensuring assistance of the local experts, through the CPs, regarding the identification of specific DPs and their impacts; and iii) complementing DPSIR information reporting with data from the scientific literature and national reports.

Monitor the effectiveness of the technical and policy measures:

743. Areas classified as likely non-GES were identified in the 2023 MED QSR Pollution assessments (UNEP/MED WG. 563/Inf.11) for EOs 5 and 9 in the four Sub-regions of the Mediterranean. However, only for a few non-GES areas, DPs were identified. The CPs should identify DPs affecting the environmental classification along the contaminants found responsible for the non-GES classification, therefore, ensuring responses to be derived from integral consideration of GES/environmental assessment findings and DPSIR analysis. Once the DPs are identified, practical measures, both technical and policy oriented should be put in place. For example, if the area will be found in non-GES due to the high concentration of Hg in sediment, the source of Hg should be traced, and pollution abatement measures undertaken. Following the introduction of the measures, tailored to tracing the DP impacts responsible for the non-GES status of the area, their effectiveness should be monitored, to make sure that they improve the environmental status of the non-GES areas. This needs to be provided through environmental monitoring, and reassessment of the environmental status of the non-GES areas.

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[128] UNEP/MED WG. WG.492/10
[129] UNEP/MED WG.556/4/L.2.

Optimally address the impacts of DPs and tailor the responses within the regional plans and national action plans to the needs of continual improvement of the marine environment status:

744. Within the IMAP Pollution Cluster assessments, the most important DPs which negatively impacted the status of the Mediterranean marine environment were related to: agriculture, industry, aquaculture, tourism including sporting and recreational activities, utilization of specific natural resources, infrastructure, energy facilities, ports and maritime works and structures, and maritime activities. Multiple DPs may be present in a specific area, while measures and responses may be common to various DPs. Although the evaluation of the responses i.e. the measures was hindered by the lack of specific local information, the overall responses and measures to abate and prevent pollution, and improve environmental status were already mapped in the UNEP/MAP documents. The regional policies are in place and present a framework for the responses in line with the Barcelona Convention and its Protocols[130]. The present proposals of the Regional Plan for Agriculture Management, the Regional Plan for Aquaculture Management and the Regional Plan for Stormwater Management, along with the adopted Regional Plan for Urban Wastewater Treatment and the Regional Plan for Sewage Sludge Management, as well as the updated Regional Plan for Marine Litter Management in the Mediterranean and the National Action Plans to implement the LBS Protocol and Regional Plans provide the measures of relevance for addressing impacts of drivers and pressures which badly affect the status of marine environment.

745. Further elaboration of the below proposed overall and specific measures should primarily target the likely non-GES areas found within the assessment of IMAP Pollution Cluster (UNEP/MED WG. 563/Inf.11).

a) *The general measures to prevent and abate pollution towards the good environmental status of the Mediterranean*
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746. Pollution prevention needs to be encouraged instead of environmental remediation. This could be achieved by reducing and eliminating the use and discharge of known harmful substances, regulating the emergence of new substances with mandatory environmental and social impact assessments, recycling and using biodegradable green compounds, along with planning emergency responses in case of accidental pollution events.

747. Identification of legacy pollutants[131] in the environment is needed, whereby it should be ensured that they are not currently being introduced into the environment. While the mitigation of current pollutants entails measures at the source of pollution, the mitigation of legacy pollutants takes place *in situ*. The latter includes the study of transport and distribution of pollutants in the environment, the use of technologies for pollutants removal from the environment, and bioremediation.

748. Strengthened use of the Best available technology (BAT) is needed to prevent and control pollution, along with the Best environmental Practice (BEP) to support the most appropriate combination of environmental control measures and strategies to prevent and control pollution.

749. Transition to the blue economy needs to support the sustainable use of ocean resources for economic growth, improved livelihoods, and jobs while preserving the health of the ocean ecosystem.

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[130] The Land-Based Sources Protocol, Dumping Protocol, Hazardous Wastes Protocol, Offshore Protocol, Prevention and Emergency Protocol and Integrated Coastal Zone Management Protocol.
[131] Legacy pollutants are substances that remain in the environment long after they were introduced and after pollution abatement measures were applied or their use was banned.

750. Move towards the circular economy and sustainability needs to support the achievement of zero pollution through recycling. It entails markets that give incentives to reusing products, rather than disposing and then extracting new resources. Major changes in production and consumption patterns are needed, with a focus on climate change concerns, biodiversity protection and ecosystem restoration.

751. Regional policy integration is of utmost importance since marine pollution has no borders, and therefore strengthening regional cooperation is necessary, advocating common environmental policies.

b) *The specific measures to prevent and abate pollution towards the good environmental status of the Mediterranean:*

752. Aquaculture. There are several strategies and guidelines developed by FAO to assist a sustainable growth for aquaculture sector, including the Ecosystem-based Approach to Fisheries and Aquaculture aiming to assist and set limits for aquaculture production given the environmental limits and social acceptability of sector. In this context it is recommended to apply the following key three principles of the FAO/GFCM strategy:

- Aquaculture development and management should take account the full range of ecosystem functions and services and should not threaten the sustained delivery of these to society;
- Aquaculture should improve human well-being and equity for all relevant stakeholders; and
- Aquaculture should be developed in the context of other sectors, policies and goals. In this regard, UNEP/MAP-MED POL is preparing a Regional Plan for Aquaculture Management for adoption by COP 23 advocating the below measures.

753. Nutrient reduction, of relevance to addressing several DPs, should follow a more cyclic approach to produce, use and treat nutrients in treatment plants, where recycling and reuse are enhanced instead of environmental discharge. This is true for nitrogen and in particular for phosphorus, which has finite reserves in the environment. Policy and regulatory instruments could include more strict regulation of nutrient removal from wastewater, mandatory nutrient management plans in agriculture, and enhanced regulation of manure.

754. Tourism and Coastal urbanization. Measures should focus on the improvement of waste treatment, sustainable management of coastal areas to reduce disruption of coastal ecosystems, investment in habitat conservation and restoration to provide ecosystem services, along with implementation of the ICZM tools. Sustainable tourism and urbanization require monitoring and decision-making feedback, improvement of communal infrastructure, environmental coastal spatial and marine spatial planning, as well as the optimal environmental impact assessments, carrying capacity, adaptation to impacts of climate changes, etc.

755. Industry. Measures should focus on the improvement of waste treatment and on upgrade of the industry to the use of BAT and BEP. In addition, resources should be used in the context of a circular economy, with the reduction, reuse and recycling of waste, and shifting towards the production and use of greener substances.

756. Agriculture. Responses to the impacts of agriculture are difficult to manage because of the diffusive i.e. non-point sources introduction of nutrients and agrochemicals into the marine environment. Responses should include the management of river runoffs, the reduction of the use of toxic and bio accumulative agrochemicals, the transition to greener fertilizers and biodegradable pesticides and organic farming.

757. Marine traffic and marine and port operations. The responses should focus on improving the technology of ships and ports operations and of ports infrastructure. Use of BAT and BEP to ensure effective onboard and port pollution control facilities, to prevent accidental discharges and spillages. Specifically, for marine traffic, the designation of restricted areas for anchorage and protection of

sensitive areas are encouraged. Implementation of the measures related to the designation of the Mediterranean Sea as a Sulphur emission control area (SECA) is expected to generate significant benefits in both pollution reduction and ecosystem protection. However, the introduction of exhaust gas cleaning systems EGCS – scrubbers on ships in the Mediterranean, as alternative abatement technology for air emission of Sulphur region, may generate a new stream of shipping liquid wastes, in which metals and PAH discharges dominate from ships, that is the chemical pollution transferred from air to marine waters.

Strengthen the science policy interface:

758. In order to improve the delivery of IMAP the following measures should guide addressing the gaps identified during the preparation of the 2023 MED QSR:

a) Strengthen the use of unprecedented achievements in science and technology in order to ensure that the growing development demands and a healthy ocean co-exist in harmony by identifying the most relevant innovative knowledge and technologies that are of utmost importance for reliable and cost-effective monitoring and assessment of the state of Mediterranean Sea with a focus on:
   i) Promotion of inter-disciplinary research aimed at understanding and prediction in the Mediterranean Sea;
   ii) Mapping of all components of the Mediterranean marine environment, along with the anthropologic pressures across time scales;
   iii) Application of observing and remote techniques to strengthen the IMAP-based monitoring practices and improve forecasts of the state of the marine environment;
   iv) Application of holistic view within the "source-to-sea" framework to structure the assessment of the land-based pressures in conjunction with their impacts on the oceans.
b) Enhance partnerships and support the transfer of ocean knowledge for science-based management, with a focus on strengthening:
   i) The national capacities related to monitoring and data analysis;
   ii) The use of the scientific networks to support the objectives of partnerships for the science-policy interface;
   iii) The synergies for marine science in the Mediterranean.
   iv)

Update the IMAP Pollution and Marine Litter Cluster:

759. The IMAP Pollution and Marine Litter Cluster needs to be updated to include the following:

i) The achievements within the implementation of the IMAP initial phase, both regarding the monitoring and assessment practices and methodologies.
ii) The revision of the list of common indicators and addressing the knowledge gaps as identified within the preparation of the assessments for the 2023 MED QSR.
iii) The transition from the present five-year assessment cycle to the eight-year assessment cycle; such revised frequency of Mediterranean marine assessment should be guided by the current practice of most CPs which set their national programmes based on a 3 years cycle of data collection and reporting which is not in line with the present phase of IMAP implementation.
iv) A multi-fold increase of the resources of the Secretariat, as well as the support to CPs' capacity building within the implementation of the IMAP Pollution and Marine Litter.

The technical measures to address the common knowledge gaps

Increase the efficiency of IMAP implementation regarding Pollution and Marine Litter Cluster:

760. To increase the efficiency of the monitoring and assessment of the Mediterranean marine environment, the following specific actions need to be enforced:

- Advance integrated implementation of the National IMAPs pertaining to Pollution, Biodiversity and Coast and Hydrography Clusters, as well as the GES assessments at the regional/sub-regional level by applying the rules for integration of monitoring efforts within relevant monitoring units. For example, integration can be explored between EO9 and EO1. If based on monitoring of EO1, CI 2 – Condition of the habitat's typical species and communities, an effect on the benthic community is found, EO9, CI 17 can be useful to complement the findings, in terms of the identification of pressures. Conversely, if contamination is identified based on CI 17 monitoring, it could guide the selection of monitoring areas for the species and communities within EO1. Moreover, any impact on the infaunal community structure can be considered a biological effect and be integrated with EO9, CI18. The importance of the interrelation between seafood safety and quality i.e., EO9, CI 20 and the presence of microplastics in the marine environment i.e., EO10, CI 23 should be further pursued. In addition, there may be an interrelation between EO9, CI 13 and EO9, CI 21. Namely, the introduction of nutrients into the marine environment can be attributed to the marine discharge of untreated domestic waste, which in turn can introduce intestinal enterococci (IE) to the bathing waters.
- Pilot implementation of the Joint Monitoring Surveys within the specific sub-divisions, as appropriate, to increase equitable access to resources and balance in strengthening of human and technical capacities of the CPs. Pilot implementation of the Joint Monitoring Surveys should be strongly supported by detailed implementation plans.
- Support collaboration among the countries to promote a transfer of knowledge.

Improve IMAP IS database management:

761. IMAP-IS should be significantly improved. It should be restructured from the repository of data reported by the CPs into an advanced information system which supports integrated assessments and ensure the validation of uploaded data, first technically and then scientifically. It needs to provide a quarriable database, with export formats (vertical and horizontal) for scientific evaluation and presentation, therefore allowing IMAP users and data evaluators to sort, retrieve and export data based on any available parameter of the metadata and data. The formats of the extracted data should be compatible, to the extent possible with other standard analysis methodologies and presentation/mapping tools.

762. Most importantly, the QA/QC mechanism of the IMAP IS needs to be significantly strengthened including operational and scientific quality control of data. The implementation of QC/QA controls and data flagging is necessary. The online tools supporting assessments should also be integrated into IMAP IS.

763. DDs and DSs should be updated, as appropriate, further to the experience built during the present IMAP cycle of data reporting and the preparation of the 2023 MED QSR Pollution and Marine Litter assessments.

764. It is also necessary to invest significant resources to ensure IMAP IS interoperability with national databases This has to be followed by significant improvement of data quality control and quality assurance at the national level.

Improve the GES assessment:

765. For further improvement of the integrated GES assessment of IMAP Pollution and Marine Litter Cluster, it is necessary to continue streamlining the assessment methodologies applied for the environmental status assessment for the Pollution and Marine Litter Cluster within the 2023 MED QSR. To that effect the following priority needs should be addressed:

- Revise/update the Spatial Assessment Units (SAUs) in close collaboration and in agreement with the CPs.
- Eliminate uneven presentation of the assessment findings in different areas of assessment, associated not only with an inhomogeneity of monitoring data both in terms of quality and quantity, but also with the lack of the present assessment methodologies in particular related to pending agreement on :
  - i) The size of the offshore areas of assessment, by considering for example presently applied guiding principle of demarcating IMAP offshore assessment units by the most distant monitoring station set by the CPs in the offshore (open) wasters;
  - ii) The representativeness of the number of stations in the areas of assessment; for example, in large pristine areas, a low number of stations might be adequate in contrast to small areas with pressures where a higher number of stations might be needed.
- Expand the monitoring to include the deep-sea environment. Although IMAP already includes offshore areas, defined as areas more than 1 nautical miles (NM) distance from the coastline, monitoring of the offshore is rarely implemented, and when implemented, is of limited areal scope. Monitoring of offshore areas in the deep-sea is especially important when non-GES areas are identified, in order to trace the possible impact of pressures away from the coastline.
- Revise the use of data reported from different types of monitoring stations for assessments. For example, this action should address the use of data reported from a) reference and master monitoring stations located in i) marine and ii) transitional waters; b) (hot spot) monitoring stations located in the modified water bodies (e.g., ports), in order to define the rules for use of data reported from different types of monitoring stations. This needs to be followed by setting the rules for the classification of monitoring stations by considering the guiding principles presently applied within the initial phase of IMAP implementation.
- Apply additional assessment tools. In that context, remote sensing (e.g., for CI 14 and CI 21) and modelling tools should be standardized for future use. Remote sensing can strengthen monitoring practices and data acquisition nationally and sub-regionally. These observations can in turn be integrated into existing assessment methodologies not only to contribute to the assessment of the present status, but also to forecast the trends in the marine environment.
- Modelling tools are often specific to a given ecosystem and are difficult to standardize. Their use should be associated to relevant uncertainties and acknowledged gaps (e.g. for CI 13 and CI 14).

The technical measures specifically related to the knowledge gaps identified for IMAP Common Indicators of Ecological Objectives 5 and 9

766. In addition to the above policy and technical measures that are common at the level of IMAP Pollution and Marine Litter Cluster, the specific knowledge gaps were identified per individual Common Indicators and therefore the specific technical measures are proposed as provided here below.

Common Indicators 13 and 14

Improve the availability of the assessment criteria for CIs 13 and 14:

767. Upon setting the reference conditions and boundary values for DIN and TP in the Adriatic Sea Sub-region, actions need to be undertaken to improve the availability of the assessment criteria for nutrients in the AEL, the CEN and the WMS Sub-regions. To that purpose three continuous years of monitoring need to be provided with a minimum monthly frequency for Water types I and II and bimonthly to seasonal for Type III. It should also be noted that other supporting parameters (i.e., temperature, salinity and dissolved oxygen) need to be available for defining the water typology. Further update of the assessment criteria for CI 14 should be undertaken as appropriate. The specific knowledge needs to be also built regarding the use of statistical tools for data validation and calculation of the assessment criteria.

Improve the GES assessment:

768. Further to the above elaborated common measures, the GES assessment for CIs 13 & 14 needs to be also improved, including the use of the remote sensing and modelling tools to complement in situ monitoring and adding additional sub-indicator i.e., the satellite-derived Chla data for GES assessment.

Upgrade present policy measures:

769. For the development of the adaptive eutrophication management strategies, the following specific actions should also be undertaken:

- Extend the scope of research and monitoring programs to characterize the effects of eutrophication;
- Implement regulations to mitigate inputs of nutrient to the marine environment, such as standards, technology requirements, or pollution caps for various sectors.
- Preserve and restore natural ecosystems that capture and cycle nutrients.

Common Indicator 17

Update of Environmental Assessment Criteria (EACs):

770. In order to update EACs, the methodology, as detailed in the European Commission Guidance Document (2018) and in Long et al. (1995), should be considered. This entails the creation of a database of scientific literature which elaborates where adverse biological effects, or no effect, are presented in conjunction with chemical data, in the environment and biota, at the same site and time. Briefly, those include but are not limited to sediment toxicity tests, aquatic toxicity tests in conjunction with equilibrium partitioning (EqP) and field, and mesocosm studies. The literature would then be analysed by experts and conclusions drawn. Laboratory results on biomarkers (CI18) are also important for the derivation of the EAC values. The emphasis should be given to the Mediterranean Sea biota species.

Undertake regular updates of Sub-regional and regional Background Concentrations (BCs) and Background Assessment Criteria (BACs):

771. As more data will be submitted to IMAP IS, the Sub-regional and regional BCs should be updated. It is proposed to undertake their regular updates at least 2 years prior to the QSRs preparation. This will allow for sufficient time to analyse the data, detect data gaps and ensure the submission of missing data, to perform a more robust update of the criteria for reliable assessments.

772. The methodology for BACs calculation should be revised and updated. BACs are calculated from BCs by applying the multiplication factors. Due to the lack of Mediterranean data, UNEP/MAP adopted the pragmatic methodology used by OSPAR.[132] Therefore, the precision of monitoring per CP should be calculated and used to set the multiplication factors specific for the Mediterranean.

Improve the GES assessment:

773. Revision of IMAP needs to support the improvement of the good environmental status assessment and contribute to a more robust analysis, and facilitate integration and aggregation of CI 17 with other CIs and EOs, by undertaking the following priority actions:

- Update list of priority pollutants. Measurements of known contaminants of concern, such as As and Cu, and emerging contaminants of concern, such as pharmaceuticals and flame retardants should be considered for inclusion in the IMAP Pollution monitoring. This process should follow the initial steps undertaken in 2019.[133] The updated List of Priority Contaminants could provide the basis for a prioritization of substances to be further included in the IMAP Guidance Factsheets related to Ecological Objective 9, and complement presently agreed mandatory or recommended substances for CIs 17 and 20. The decision on which contaminant to add should be based on pilot studies checking the probability of their presence in the Mediterranean Sea sub-regions.
- Extend the list of commonly agreed IMAP Pollution mandatory species. Species, other than species (*M. galloprovincialis* and *M. barbatus*) presently mandatory, should be added to the IMAP list. The species should be chosen based on their presence in the Sub-regions and their relevance as pollution indicators, which in turn will allow for an improved environmental assessment. Harmonization of the use of different species in different Sub-regions needs to be followed by setting the criteria (BCs and BACs) specific to each species.
- Utilize tools to perform Environmental Risk Analysis, to integrate chemical and biological data, as elaborated here-below for CI 18.
- Revise sediments` temporal monitoring requirements. For hot spot stations, the monitoring should remain every year or 2 years, while for other stations, the monitoring once or twice during the 6-year cycle should be considered.
- Harmonize national efforts regarding contaminants monitoring. As a minimum, it is necessary to ensure that every CP reports all mandatory parameters in mandatory matrixes, including the wet weight for mussels, LOD or LOQ values, the grain size of samples for sediments, and spatial and temporal monitoring requirements. The significant differences among the countries in terms of LOD and LOQ values, as well as differences among the areas of monitoring in the

[132]OSPAR calculated the ratio between BAC and BC (the multiplication factor) from known parameters. The pragmatic approach used in order to have 90% probability of concluding that concentration is below provided for BAC, BAC = BC exp (3.18 CV), where CV is the precision of the monitoring program (per determinant and matrix). In the case of OSPAR, temporal monitoring data from the UK National Marine Monitoring Programme was considered.

[133] UNEP/MED WG.463/Inf.4. The List of Priority Contaminants under MAP/Barcelona Convention within the MED POL Monitoring Programme and IMAP have been revised according the latest lists of priority contaminants development in the EU region and internationally and shows no major changes compared to other RSCs.

same CP, need to be analyzed and drivers of the unsatisfactory analytical performance identified.

Common Indicator 18

Ensure the GES assessment for CI 18:

774. Revision of IMAP needs to support the good environmental status assessment for CI 18 and facilitate its integration and aggregation with other CIs and EOs, by undertaking the following priority actions:

- Review and update the list of CI 18 biomarkers, along with the monitoring species;
- Review and update, as appropriate, the assessment criteria as adopted by Decisions IG.22/7 (COP 19) and IG.23/6 (COP 20), as well as the assessment methodologies;
- Further to the initial work undertaken in 2021[134] towards the development of the Biomonitoring related to IMAP CI 18, the following further actions should be tested:
  - i) An application of new biomarkers should be explored to support the strengthening of CI 18 monitoring and assessment.
  - ii) Use of the Environmental Risk Analysis should be provided by combing the chemical and ecotoxicological data, to support the evaluation of the risk related to marine organisms exposed to contaminated waters and sediments. It should result in objective risk values which allow national and regional policymakers and environmental managers to decide on the actions to decrease marine contamination, or to remediate a polluted area.

Common Indicator 19

Improve quantity and quality of data for CI 19

- REMPEC to continue soliciting the submission of the report on incidents and spills from the Countries, underlining the importance to make use of the latest version of the Data Dictionary and Data Standard (DD&DS) prepared by REMPEC jointly with INFORAC and providing to any extent possible all the data required in DD&DS, including estimation of quantity and volume of oil or other substances released.
- The Countries to start collecting data on impacts on biota with reference to the above-mentioned updated version of DD&DS for CI 19.
- The UNEP/MAP – REMPEC to align the definition of the minimum threshold for reporting with the one used under other regional sea conventions and in the framework of MSFD.
- UNEP/MAP - REMPEC to continue to integrate newly available Lloyds data in MEDGIS-MAR database. UNEP/MAP - REMPEC to prepare a comprehensive, integrated database, considering also old data, based on these two databases, cross-checking and resolving data duplication and inconsistencies.
- UNEP/MAP - REMPEC to continue acquiring information and understanding about CleanSeaNet dataset and assessing the feasibility to integrate CleanSeaNet data for the Mediterranean in MEGIS-MAR.

Improve the GES assessment of CI 19

- The definition of "acute pollution events” is highly debated under the Marine Strategy Framework Directive and other Regional Sea Programmes and Agreements, in particular the Bonn agreement. It remains a complex issue for which consensus has yet to be reached.

[134] UNEP/MED WG.492/6

Additional work should be undertaken by UNEP/MAP - REMPEC and the Contracting Parties to define operational criteria for the identification of acute pollution events. An integrated and escalating approach should be adopted, considering, among others, factors like the spilled volume, the nature of the spilled product(s), the proximity and sensitivity of threatened areas and/or human activities, the environmental conditions (i.e. evidence of an environmental impact), and the need for response operations.

- Based on data collected on impacts on biota, UNEP/MAP - REMPEC and the Contracting Parties should work towards the definition of assessment criteria for CI 19 including biota as component, if possible, in coordination with other regional sea conventions.

Common Indicator 20

Ensure the GES assessment for CI 20:

775. A multidisciplinary approach will be needed to ensure GES assessment for CI 20 by undertaking the following priority actions:

- Agree on the maximal percentage of detected regulated contaminants exceeding regulatory limits in seafood, above which non-GES needs to be assigned to the area assessed;
- Incorporate the risk assessments to human health from consumption of seafood by calculating the estimated daily intake (EDI), the target hazard quotient (THQ), the total health risk (HI), and the cancer risk, among others;
- Incorporate into the overall evaluation the suite of contaminants analyzed, together with other factors such as synergy among contaminants, and temporal and spatial scales.
- Harmonize the choice of species among the CPs, whereby data from national reports on seafood safety and cooperation with national health authorities should be used to complement data reporting to IMAP IS;
- Examine and coordinate monitoring protocols, risk-based approaches, analytical testing, and assessment methodologies between the CPs; the national food safety authorities; research organisations and/or environmental agencies;
- Determine the applicability of CI 20 beyond food consumer protection and public health, although it intuitively reflects the health status of the marine environment in terms of delivery of benefits (e.g., fisheries industry).

Common Indicator 21

Improve the GES assessment for CI 21:

776. An optimal GES assessment for CI 21 needs to be strengthened by optimal data reporting which will ensure the confidence of the assessment. At least, 16 data points for 4 consecutive bathing seasons are needed for the application of the uniform assessment methodology across the Mediterranean; therefore, increasing the comparability and consistency of the assessment findings.

Candidate Common Indicators 26 & 27

<u>Improve underwater noise data quality and availability</u>

777. For the improvement of underwater noise data quality and availability, the following specific actions should be undertaken by the Parties:

778.

- A contribution should be provided to the ACCOBAMS regional register for impulsive noise sources, especially by sharing national data, along with the development of a cooperation mechanism to identify the source of long-distance underwater noise in order to address its long-distance effects;
- Reporting noise generating military activities is needed to provide an actual and precise assessment reflecting the real situation;
- An alternative approach needs to be tested by applying specific assessments for species and their habitats. For such an exercise, Important Marine Mammal Areas (IMMA) could be used as defined habitats.

2.1.2 Marine Litter

779. Given the seriousness of the marine litter issue, most of the important relevant global and regional processes including the 2030 Agenda for sustainable Development and SDGs called for its assessments and urgent action to address it. In the Mediterranean, marine litter has been an issue of concern since 1970s and the importance of dealing with it was explicitly recognized by the Contracting Parties to the Barcelona Convention when adopting in 1980 the Protocol for the Protection of the Mediterranean Sea against Pollution from Land-Based Sources. Annex I of the Protocol, as amended in 1996, defined Litter as "any persistent manufactured or processed solid material which is discarded, disposed of, or abandoned in the marine and coastal environment".

780. The Mediterranean Sea is one of the special areas established under MARPOL Annex V (Regulations for the Prevention of Pollution by Garbage from Ships). In April 2008, the Marine Environment Protection Committee (MPEC) of IMO adopted its Resolution MEPC.172(57) by which it decided "that the discharge requirements for Special Areas in regulation 5 of MARPOL Annex V for the Mediterranean Sea area Special Area shall take effect on 1 May 2009, in accordance with the requirements set out in regulation 5(4)(b) of MARPOL Annex V".

781. At their 18th Meeting (Istanbul, Decembre 2013), the Contracting Parties of the Barcelona Convention adopted the Regional Plan on the Management of Marine Litter in the Mediterranean. It provides for programmes of measures and implementation timetables to prevent and reduce the adverse effects of marine litter on the marine and coastal environment.

782. In relation to the IMAP Ecological Objective 10 (Marine and coastal litter do not adversely affect coastal and marine environment), the Contracting Parties to the Barcelona Convention adopted the following Indicators:

- Common Indicator 22: Trends in the amount of litter washed ashore and/or deposited on coastlines (CI22);
- Common Indicator 23: Trends in the amount of litter in the water column including microplastics and on the seafloor (CI23);
- Candidate Indicator 24: Trends in the amount of litter ingested by or entangling marine organisms focusing on selected mammals, marine birds, and marine turtles.

783. Since 2016, the Mediterranean countries with the support of UNEP/MAP and the EU-funded EcAp MED II Project have supported the Mediterranean Countries to establish national IMAP-based monitoring programmes for the 2 IMAP Common Indicators, i.e., Common Indicator 22 (CI22) and Common Indicator 23 (CI23). The focus for CI22 has been given on monitoring beach macro litter, whereas the focus for CI23 has been given on monitoring seafloor macro-litter and floating microplastics. Monitoring for CI22 has been also supplemented by numerous pilots in the Adriatic and South Mediterranean areas, having as a prerequisite the inclusion and integration of the respective IMAP methodology. Moreover, the regional data repository (IMAP InfoSystem) has been developed and is operational, including the development of reporting templates for CI22 (M1 Module) and CI23 (M2 and M3 Modules).

784. Two additional EU-funded projects, i.e., the Marine Litter MED (2016-2019) and Marine Litter MED II (2020-2023) projects have supported IMAP implementation through the development of knowledge for IMAP Candidate Indicator 24, as well as touching upon, new novel aspects of marine litter monitoring (e.g., monitoring riverine inputs of marine litter and monitoring microplastics coming from wastewater treatment plants).

Methodology for GES Assessment for IMAP Ecological Objective 10

Given the assessed data availability for EO10 CI22 and CI23 for the Mediterranean Sea, the following approach is followed for the quality status assessment. For each CI and each measured parameter (Beach litter, Seafloor Litter, Floating Microplastics) temporal data are averaged per monitoring station. The resulting average value is compared against the respective TV and the score ratio is calculated. No further aggregation on the EO 10 level or spatial integration is conducted for the Mediterranean region as a whole. For the Adriatic sub-region, for which spatial assessment units have been defined in 2022 for the Eutrophication-Pollution and Marine litter cluster, the application of the NEAT methodology was made possible for the 2 IMAP Common Indicators on marine litter (CI22 and CI23).

The assessment focuses one 3 main elements: (a) GES – nonGES assessment; (b) quantitative findings and assessment, and (c) qualitative findings and assessment.

Assessment Criteria for IMAP Ecological Objective 10

UNEP/MAP established in 2016 Baseline Values (BV) and environmental targets for IMAP EO10 Common Indicators (COP19, Decision IG.22/10). Further to the advancement of marine litter monitoring within IMAP EO10 and the acquisition of relevant data, UNEP/MAP, in cooperation with the Contracting Parties of the Barcelona Convention, undertook an update for the 2016 BV and established Threshold Values (TV) for the IMAP Common Indicators 22 and 23.

Baseline Values (BV) and Threshold Values (TV) as adopted in 2021 by COP22.

IMAP Indicators	Categories of Marine Litter	BV-2021	TV-2021
CI22	Beach Marine Litter	**369 items/100m**	**130 items/100m**

Baseline Values and Threshold Values for IMAP CI23, seafloor macrolitter and floating microplastic, 2016 (Agreed) and 2023 (Proposed/Updated).

IMAP Indicators	Categories of Marine Litter	BV-2016	Updated BV-2023	Proposed TV-2023
CI23	Seafloor Macro-litter	130-230 items/km^2	135 items/km^2	38 items/km^2
CI23	Floating Microplastics	0.2–0.5 items/m^2	0.044338 items/m^2	0.000845 items/m^2

Monitoring Floating marine litter with aerial observation survey (ACCOBAMS)

The ACCOBAMS Survey Initiative (ASI) project was launched in 2016 and carried out large-scale surveys in summers 2018 and 2019 (ACCOBAMS, 2021). Its primary aim was to establish an integrated, collaborative and coordinated monitoring system for the status of cetaceans and other species of conservation concern at the whole ACCOBAMS area level (sea turtles, seabirds, fishes). The ASI project also aimed at better understanding the presence and distribution of anthropogenic activities (ships), as well as of floating marine litter (FML), known to acutely plague the Mediterranean.

The Mediterranean was divided into large blocks, subsequently divided into sub-blocks within which the observation transects were laid out. The data collection on the target species and floating marine litter was ensured by eight teams of trained observers each of them was associated to a plane, operating in a predefined sector of the survey. To ensure all observers follow the same principles and carry out the protocol similarly, training flights were operated to simulate real field conditions.

Application of the NEAT Assessment Tool for EO10 for the Adriatic Sub-region

The use of the NEAT tool for the Adriatic Sub-region should be considered as an example showing how the tool should be applied for GES assessment further to sufficient data reporting by the Contracting Parties. the nested approach ensures that a balance is achieved between a too broad scale, that can mask significant areas of impact in certain parts of a region or subregion, and a very fine scale that could lead to very complicated assessment processes. The first element that needs to be considered for the implementation of the nested approach is the delimitation of the areas of assessment based on the areas of monitoring.

The used methodologies as well as information about data availability are detailed in the following sections of Document UNEP/MED WG.550/12:

4.2.1 GES Assessment / Alternative Assessment for IMAP EO10 Common Indicator 22
4.2.2.1 GES Assessment for Floating Microplastics (IMAP EO10 CI23
4.2.2.2 The Mediterranean litterscape assessed from the air during the ACCOBAMS survey initiative
4.3.1 Application of the NEAT Assessment Tool for EO10 for the Adriatic Sub-region

Key messages for IMAP EO10 Common Indicator 22:

a) The monitoring efforts in the Mediterranean region and within each sub-regions vary significantly and further alignment and strengthening of IMAP EO CI22 is required from the Mediterranean Countries.
b) Overall, 16% of the monitored beaches achieve GES, 79% do not achieve GES of which 29% fall into the poor status class and 25% in to the bad one.
c) Plastic/polystyrene pieces (2.5 cm – 50 cm) are the most commonly found marine litter items in the Mediterranean, followed by cigarette butts and filters, and plastic caps and lids. These 3 items account for approximately 60% of the recorded marine litter.

Key messages for IMAP EO10 Common Indicator 23:

A. Floating Marine Litter:
    a) Average floating microplastics concentration on the Mediterranean Sea surface is found equal to 0.36 ± 1.9 items/m^2.
    b) Almost all stations (99%) that have been monitored do not achieve GES, and most of them fall into the poor (44 %) and bad (49 %) status classes.
    c) The Mediterranean region and its subregions suffer from elevated microplastics concentrations in surface waters, reaching up to 100 times and 1000 times higher than the IMAP TV.
    d) From the recorded floating microplastics, Sheets (37%), followed by Filaments (30%), Pellets (21%), Fragments (7%), Foam (4%), and Granules (1%).
    e) Some 41,000 floating mega-litter were recorded in total during the ACCOBAMS Aerial Survey Initiative, with an average encounter rate of 0.8 mega-debris per km, ranging between 0 and 111 litter items per km.
    f) The total number of floating mega-litter was estimated at 2.9 million items (80% confidence interval was 2.7 to 3.1 million) and average density 1.5±0.1 items per km2.
    g) More than two thirds of the mega-litter recorded were identified as plastics (68.5%; e.g., plastic bags, bottles, tarpaulins, palettes, inflatable beach toys, etc.), while 1.7% were fishery debris and 1.9% were anthropogenic wood-trash. The remaining quarter (27.9%) was anthropogenic mega-litter of an undetermined nature.

B. Seafloor Marine litter:
   a) The average seafloor litter concentration on the Mediterranean coastline is found equal to 570 ± 2,588 items/km^2.
   b) The majority (88%) of the seafloor stations monitored do not achieve GES, and most of them fall into the poor and bad status classes (23% and 53% respectively).
   c) Fisheries-related items comprise up to 10% of the total recorded marine litter.
   d) 3 items are the most recorded within the fisheries related items: (i) Synthetic ropes/strapping bands (L1i) with 39%; Fishing nets (polymers) (L1f) with 27%; and Fishing lines (polymers) (L1g) with 25%.

GES Assessment / Alternative Assessment for IMAP EO10 Common Indicator 22

Geographical scale of the assessment	Regional and Sub-regional
Contributing countries	Bosnia-Herzegovina, Cyprus, Croatia, France, Greece, Israel, Italy, Lebanon, Montenegro, Morocco, Spain, Slovenia, Türkiye
Mid-Term Strategy (MTS) Core Theme	Enabling Programme 6: Towards Monitoring, Assessment, Knowledge and Vision of the Mediterranean Sea and Coast for Informed Decision-Making
Ecological Objective	EO10: Marine and coastal litter do not adversely affect coastal and marine environment
IMAP Common Indicators	Common Indicator 22 (CI22): Trends in the amount of litter washed ashore and/or deposited on coastlines (including analysis of its composition, spatial distribution and, where possible, source)
GES definition	Number/amount of marine litter items on the coastline do not have negative impact on human health, marine life and ecosystem services
Related Operational Objective	10.1 The impacts related to properties and quantities of marine litter in the marine environment and coastal environment are minimized
GES **Target(s)**	Decreasing trend in the number of/amount of marine litter (items) deposited on the coast
Baseline and Threshold Values	BV: 369 items/100m | TV: 130 items/100m

785. **Beach Litter (CI22)** data are reported in the IMAP InfoSystem from 13 CPs covering all 4 sub-divisions (ADR, CEN, EM, WM). In total 191 beaches are monitored during the period 2017-2021 in the following countries: Bosnia-Herzegovina, Croatia, Cyprus, France, Greece, Italy, Israel, Lebanon, Morocco, Montenegro, Spain, Slovenia, Türkiye. A total of 931 surveys were stored and uploaded to IMAP InfoSystem reflecting the collection and removal of ~300,000 marine litter items from the Mediterranean coastline. In line with the agreement of the Contracting Parties in 2021[135]on a unified list of marine litter items under IMAP, the Secretariat for the purpose of this report discarded those items which could not be categorized in accordance with the IMAP/ MED POL list for beach marine litter items.

[135] Meeting of the Ecosystem Approach Correspondence Group on Marine Litter Monitoring (CORMON Marine Litter), 30 March 2021 (UNEP/MED WG.490/6).

786. Concentrations of Beach Litter (items/100m) are highly variable fluctuating between 8 and 47,361 items /100m. Average beach litter concentration on the Mediterranean coastline is found equal to 961 ± 3664 items/100 m.

787. Following the assessment methodology explained in Chapter 2.2, and using the TV of 130 items/100m, temporal average data from the 191 beaches are compared against the threshold, resulting in their classification under 5 status classes (high, good, moderate, poor, bad) shown in Table 13.

788. . Overall, 79% of the beaches monitored do not achieve GES, and most of them fall into the moderate (24 %) and poor (29 %) and bad (25 %) categories, i.e., beach litter concentrations are up to two to five times higher than the TV. In Table 14 the classification results are given for each sub-Region separately.

Table 13: The GES – nonGES classification of the 192 monitored beaches in the Mediterranean Region.

Mediterranean Region				
Boundary limits	**GES- nonGES classes**	**No of Beaches**	**% of Beaches**	
≤ 0.5xTV	HIGH	10	**5**	**16% GES**
0.5xTV< ≤ 1xTV	GOOD	23	**11**	
1xTV< ≤2xTV	MODERATE	49	**24**	**79 % nonGES**
2xTV< ≤5xTV	POOR	59	**29**	
> 5xTV	BAD	51	**25**	
		192 beaches		

789. On the sub-Region level, the Central Mediterranean appears the least affected by beach litter with 32 % out for the 22 beaches monitored falling into the GES category The Adriatic, Eastern and Western Mediterranean sub-regions show an equal distribution of beaches under GES (14 -16 %) and non-GES (84 -86 %) classes. These results are depicted spatially in the maps of Figure 23 to Figure 26.

Table 14: The GES – nonGES classification of the monitored beaches in the 4 Mediterranean sub-Regions

Boundary limits	GES- nonGES classes	No of Beaches	% of Beaches	
Adriatic sub-Region				
≤ 0.5xTV	HIGH	3	**7**	**16% GES**
0.5xTV< ≤ 1xTV	GOOD	4	**9**	
1xTV< ≤2xTV	MODERATE	11	**24**	**84 % nonGES**
2xTV< ≤5xTV	POOR	17	**38**	
> 5xTV	BAD	10	**22**	
		45 beaches		
Central Mediterranean sub-Region				
≤ 0.5xTV	HIGH	0	0	**32% GES**
0.5xTV< ≤ 1xTV	GOOD	7	32	
1xTV< ≤2xTV	MODERATE	8	36	**68% nonGES**
2xTV< ≤5xTV	POOR	3	14	
> 5xTV	BAD	4	18	
		22 beaches		
Eastern Mediterranean sub-Region				
≤ 0.5xTV	HIGH	3	**5**	**14% GES**
0.5xTV< ≤ 1xTV	GOOD	5	**9**	
1xTV< ≤2xTV	MODERATE	13	**22**	**86% nonGES**
2xTV< ≤5xTV	POOR	16	**28**	
> 5xTV	BAD	21	**36**	
		58 beaches		
Western Mediterranean sub-Region				
≤ 0.5xTV	HIGH	4	6	**16% GES**
0.5xTV< ≤ 1xTV	GOOD	7	10	
1xTV< ≤2xTV	MODERATE	17	25	**84% nonGES**
2xTV< ≤5xTV	POOR	23	34	
> 5xTV	BAD	16	24	
		67 beaches		

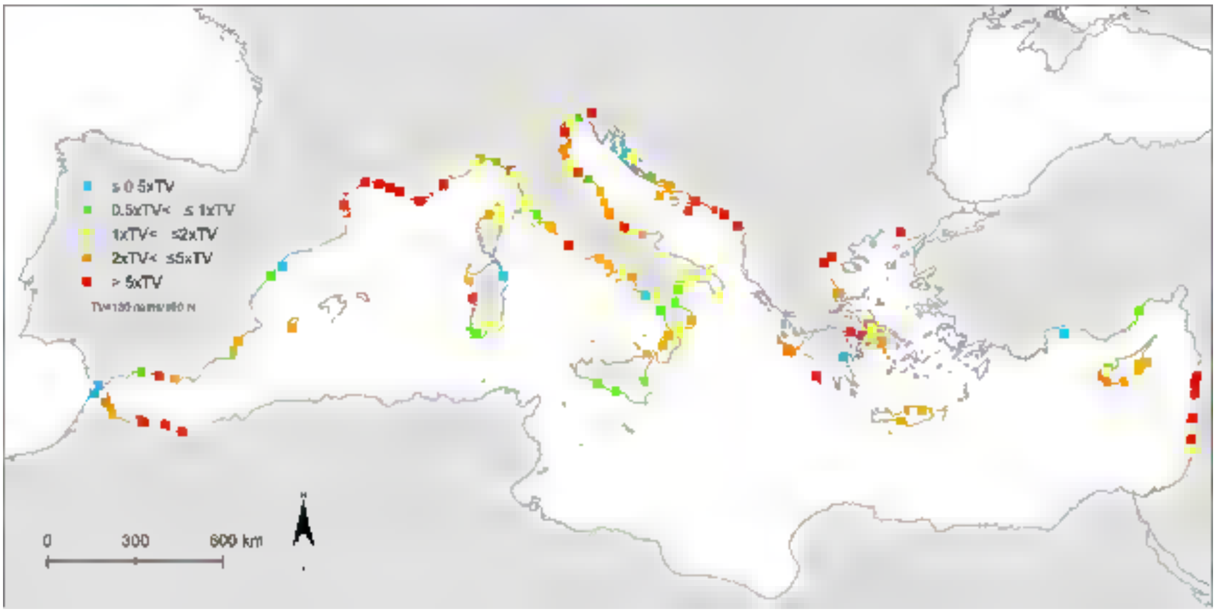


Figure 23**:** GES assessment classification of the beaches monitored for marine litter in the Mediterranean Region.

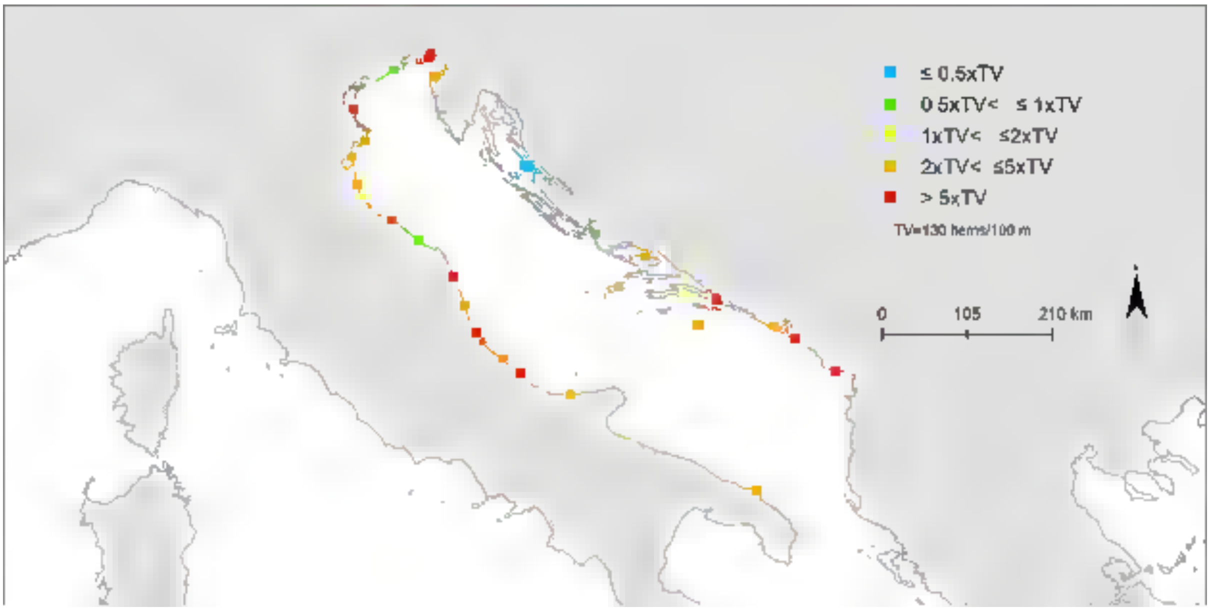


Figure 24**:** GES assessment classification of the beaches monitored for marine litter in the Adriatic and Central Mediterranean sub-regions.

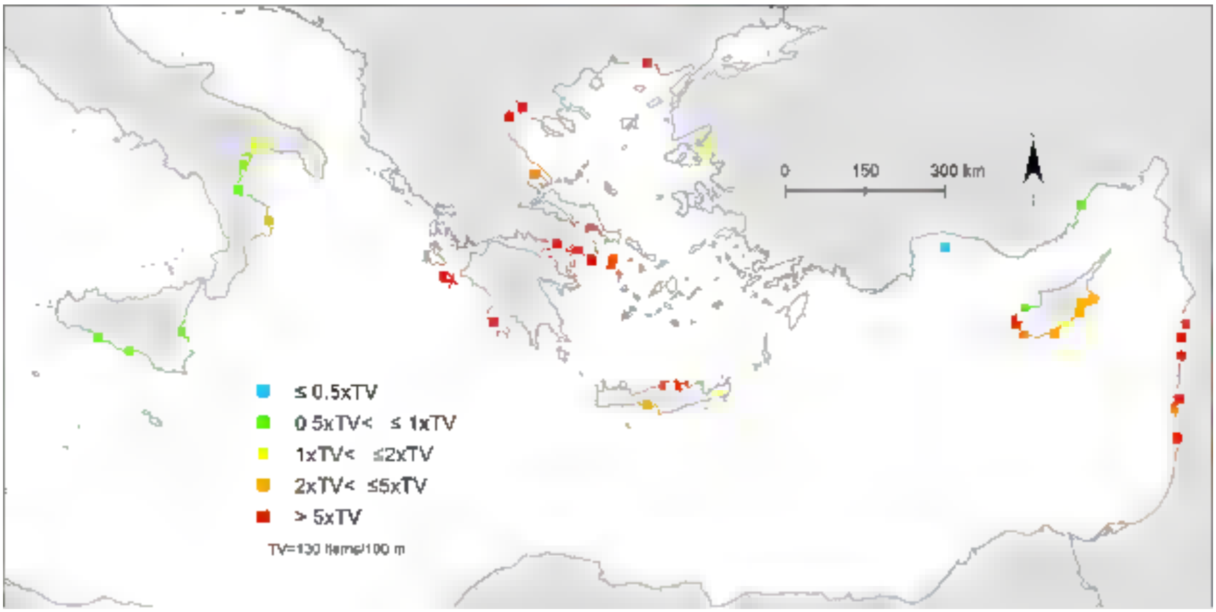


Figure 25**:** GES assessment classification of the beaches monitored for marine litter in the Eastern and Central Mediterranean sub-Regions.

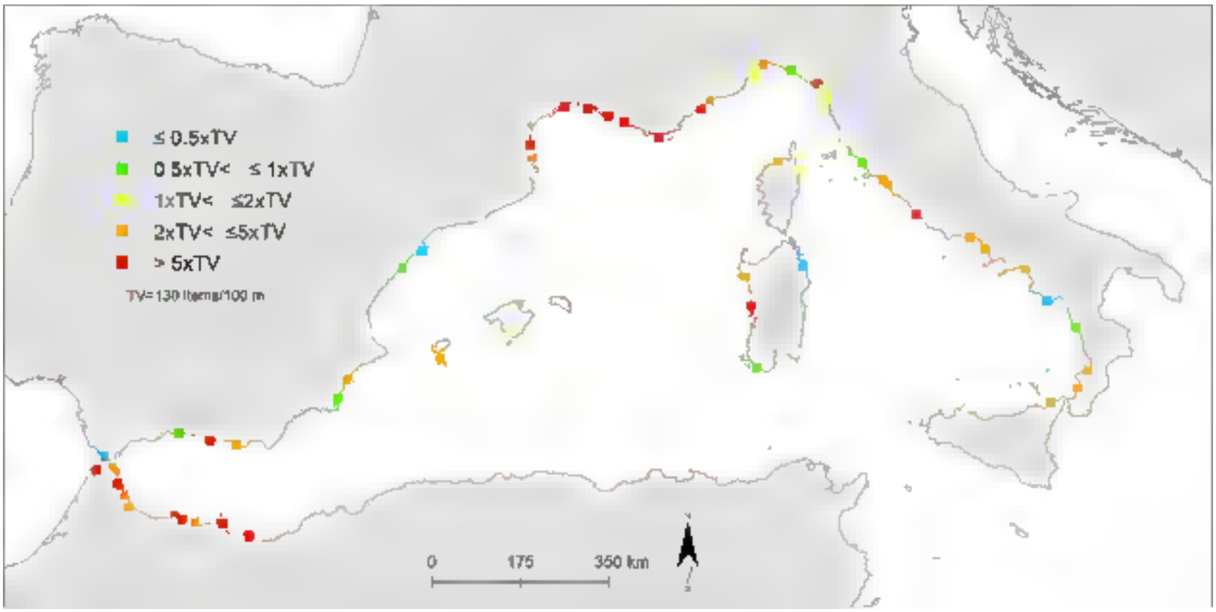


Figure 26**:** GES assessment classification of the beaches monitored for marine litter in the Western Mediterranean sub-Region.

790. The average beach marine litter density from the 10 countries varied between a maximum of 5,716 to 105 items/100m. The average beach marine litter densities are presented hereunder (Table 15).

Table 15: Average beach marine litter densities in the Mediterranean Countries

Country	Average Density (items/100m)
Bosnia & Herzegovina (BA)	1,443 (±1743) items/100m
Croatia (HR)	258 (±1743) items/100m
Cyprus (CY)	396 (±301) items/100m
France (FR)	1,499 (±1,253) items/100m
Greece (GR)	1,232 (±1,203) items/100m
Israel (IL)	483 (±251) items/100m
Italy (IT)	435 (±1352) items/100m
Lebanon (LB)	5,716 (±3252) items/100m
Montenegro (ME)	680 (± 106) items/100m
Morocco (MA)	697 (±343) items/100m
Slovenia (SI)	436 (±240) items/100m
Spain (ES)	265 (±267) items/100m
Türkiye (TR)	105 (±46) items/100m

791. An analysis was undertaken on the Top-10 items that have been recorded in the respective countries. For 11 countries, the top-10 item list represents more than 70% of the collected litter items, and for 2 Countries represents slightly lower share (approximately 68-69%) of the collected litter items. Bosnia and Herzegovina gave an extreme value of 97.4%, followed by Lebanon (86.9%), Slovenia (81.6%), Croatia (81.1%), Italy (79.2%), France (78%), Cyprus (77.1%), Montenegro (73.8), Greece (72.2%), Israel (72.0%), Türkiye (71.5%), Spain (68.9%), and Morocco (67.7%). The analysis and detailed list of the Top-10 item list per country is provided hereunder (
792. Table *16*).

Table 16: Top-10 item list of beach marine litter found in the Mediterranean Countries

Bosnia and Herzegovina			
Top 10	**Beach Litter Item**	**Total Items**	**%**
1	G27	4,864	56.2%
2	G178	1,080	12.5%
3	G76	677	7.8%
4	G21/24	646	7.5%
5	G5	514	5.9%
6	G30/31	231	2.7%
7	G145	151	1.7%
8	G158	104	1.2%
9	G165	96	1.1%
10	G53	68	0.8%

Croatia			
Top 10	**Beach Litter Item**	**Total Items**	**%**
1	G76	3,331	26.6%
2	G27	1,938	15.5%
3	G95	1,719	13.7%
4	G21/24	1,380	11.0%
5	G3	540	4.3%
6	G30/31	318	2.5%
7	G35	313	2.5%
8	G50	235	1.9%
9	G7/G8	201	1.6%
10	G124	193	1.5%

France			
Top 10	**Beach Litter Item**	**Total Items**	**%**
1	G76	74,288	36.03%
2	G21/24	15,046	7.30 %
3	G124	13,198	6.40 %
4	G30/31	12,349	5.99 %
5	G95	11,672	5.66 %
6	G27	10,550	5.12 %
7	G208a	9,818	4.76 %
8	G200	5,608	2.72 %
9	G73	4,351	2.11 %
10	G145	3,680	1.78 %

Greece			
Top 10	**Beach Litter Item**	**Total Items**	**%**
1	G76	5465	25.1%
2	G124	2,661	12.2%
3	G21/24	2,128	9.8%
4	G7/G8	1,643	7.5%
5	G27	1,313	6.0%
6	G45	1,157	5.3%
7	G35	738	3.4%
8	G210a	708	3.2%
9	G50	687	3.2%
10	G171	606	2.8%

Israel			
Top 10	**Beach Litter Item**	**Total Items**	**%**
1	G76	6,202	18.3%
2	G4	3,648	10.7%
3	G21/24	2,867	8.4%
4	G33	2,755	8.1%
5	G37	2,014	5.9%
6	G10	1,590	4.7%
7	G30/31	1,540	4.5%
8	G27	1,535	4.5%
9	G35	1,433	4.2%
10	G50	876	2.6%

Lebanon			
Top 10	**Beach Litter Item**	**Total Items**	**%**
1	G27	5,975	34.8%
2	G76	2,029	11.8%
3	G21/24	1,654	9.6%
4	G208a	1,619	9.4%
5	G124	1,322	7.7%
6	G30/31	1,182	6.9%
7	G35	451	2.6%
8	G--	387	2.3%
9	G7/G8	382	2.2%
10	G3	368	2.1%

Morocco			
Top 10	**Beach Litter Item**	**Total Items**	**%**
1	G27	17,539	25.1%
2	G30/31	9,619	13.8%
3	G21/24	8,189	11.7%
4	G7/G8	3,526	5.0%
5	G124	2,875	4.1%
6	G5	1,929	2.8%
7	G76	1,525	2.2%
8	G33	1,512	2.2%
9	G4	1,442	2.1%
10	G19	1,198	1.7%

Slovenia			
Top 10	**Beach Litter Item**	**Total Items**	**%**
1	G27	1,334	25.5%
2	G76	886	16.9%
3	G4	377	7.2%
4	G21/24	354	6.8%
5	G45	324	6.2%
6	G30/31	270	5.2%
7	G95	258	4.9%
8	G10	176	3.4%
9	G124	161	3.1%
10	G50	133	2.5%

Spain			
Top 10	**Beach Litter Item**	**Total Items**	**%**
1	G27	12,116	15.8%
2	G76	9,235	12.0%
3	G50	7,868	10.3%
4	G21/24	6,876	9.0%
5	G95	4,701	6.1%
6	G124	4,260	5.6%
7	G30/31	3,092	4.0%
8	G73	2,112	2.8%
9	G3	1,506	2.0%
10	G204	1,148	1.5%

Türkiye			
Top 10	**Beach Litter Item**	**Total Items**	**%**
1	G21/24	123	26.3%
2	G7/G8	60	12.8%
3	G76	31	6.6%
4	G30/31	20	4.3%
5	G152	19	4.1%
6	G3	18	3.9%
7	G178	18	3.9%
8	G50	17	3.6%
9	G33	15	3.2%
10	G49	13	2.8%

Italy			
Top 10	**Beach Litter Item**	**Total Items**	**%**
1	G76	89,895	51.2%
2	G21/24	9,393	5.4%
3	G27	7,976	4.5%
4	G95	5,884	3.4%
5	G67	5,755	3.3%
6	G73	5,147	2.9%
7	G45	3,999	2.3%
8	G30/31	3,712	2.1%
9	G124	3,638	2.1%
10	G3	3,531	2.0%

Cyprus			
Top 10	**Beach Litter Item**	**Total Items**	**%**
1	G27	9,338	22.5%
2	G21/24	7,610	18.4%
3	G26	3,844	9.3%
4	G4	3,490	8.4%
5	G30/31	1,616	3.9%
6	G35	1,542	3.7%
7	G7/G8	1,273	3.1%
8	G50	1,253	3.0%
9	G3	1,087	2.6%
10	G158	909	2.2%

Montenegro			
Top 10	**Beach Litter Item**	**Total Items**	**%**
1	G27	2043	36.8%
2	G76	511	9.2%
3	G21/24	419	7.5%
4	G30/31	318	5.7%
5	G7/G8	230	4.1%
6	G124	190	3.4%
7	G175	102	1.8%
8	G154	101	1.8%
9	G198	101	1.8%
10	G3	97	1.7%

793. The aforementioned analysis provides very interesting results for the top item list at the level of the Mediterranean. The Top-item lists from the 13 countries, extracts into 39 common items of which:

- 3 items have a share of more than 10%, respectively: *Plastic/polystyrene pieces 2.5 cm > < 50 cm* (G76) with 38.6%, *Cigarette butts and filters* (G27) with 13.4%, and *Plastic caps and lids* (including rings from bottle caps/lids) (G21/24) with 10.7%.
- 2 items have a share between 5-10%, respectively: *Crisps packets/sweets wrappers/Lolly sticks* (G30/31) with 6.2% and *Other plastic/polystyrene items (identifiable) including fragments* (G124) with 5.0%.
  10 items have a share between 5-1%: *Cotton bud sticks* (G95) with 4.8%, *Foam sponge [items (i.e. matrices, sponge, etc.)]* (G73) with 2.4%, *Glass fragments >2.5cm* (G208a) witg 2.4%, *String and cord (diameter less than 1 cm)* (G50) with 2.1%, *Small plastic bags, e.g. freezer bags incl. pieces* (G4) with 1.7%, *Shopping bags incl. pieces* (G3) with 1.5%, *Straws and stirrers* (G35) with 1.2%, Sheets, industrial packaging, plastic sheeting (G67) with 1.2%, *Glass Bottles (including identifiable fragments)* (G200), and *Drink bottles* (G7/G8) with 1.0%.
- 24 items have a share of less than 1%, respectively: G45, G33, G26, G145, G5, G10, G37, G95, G100, G204, G178, G158, G153, G70, G--, G28. G158, G175, G154, G198, G165, G53, G152, G49.

2.1.3 GES Assessment / Alternative Assessment for IMAP EO10 Common Indicator 23

Geographical scale of the assessment	Regional and Sub-regional
Contributing countries	Bosnia-Herzegovina, Croatia, Cyprus, France, Greece, Israel, Israel, Italy, Lebanon, Malta, Slovenia, Spain, Tunisia and Türkiye
Mid-Term Strategy (MTS) Core Theme	Enabling Programme 6: Towards Monitoring, Assessment, Knowledge and Vision of the Mediterranean Sea and Coast for Informed Decision-Making
Ecological Objective	EO10: Marine and coastal litter do not adversely affect coastal and marine environment
IMAP Common Indicators	Common Indicator 23 (CI223): Trends in the amount of litter in the water column including microplastics and on the seafloor
GES definition	Number/amount of marine litter items in the water surface and the seafloor do not have negative impacts on human health, marine life, ecosystem services and do not create risk to navigation
Related Operational Objective	10.1. The impacts related to properties and quantities of marine litter in the marine and coastal environment are minimized
GES **Target(s)**	Decreasing trend in the number/amount of marine litter items in the water surface and the seafloor
Baseline and Threshold Values	BV: 0.044338 items/m^2 | TV: 0.000845 items/m^2

2.1.4 GES Assessment for Floating Microplastics (IMAP EO10 CI23)

794. **Floating microplastics (CI23)** data are reported in the IMAP InfoSystem from 10 CPs covering all sub-divisions of the Mediterranean region (ADR, CEN, EM, WM). In total 679 surface manta net trawls/stations are monitored during the period 2016-2022 in the following countries: Bosnia-Herzegovina, Croatia, France, Greece, Israel, Italy, Lebanon, Türkiye, Slovenia, Spain.

795. Concentrations of Floating Microplastics (items/m^2) are highly variable fluctuating between 0 and 31 items /m^2. Average floating microplastics concentration on the Mediterranean Sea surface is found equal to 0.355 ± 1.99 items/m^2.

796. Following the assessment methodology explained in Chapter 2.2 and using the TV of 0.000845 items/m^2, temporal average data from the 679 stations are compared against the TV, resulting in their classification under 6 status classes (high, good, moderate, poor, bad, very bad) shown in Table 17. Practically all stations monitored (99%) do not achieve GES, and most of them fall into the poor (5244 %) and bad (45 %) classes, i.e., floating microplastics litter concentrations are up to 100 and 1000 times higher than the TV respectively. In Table 15 the classification results are given for each sub-Region separately.

Table 17: The classification of the 679 stations monitored for surface floating microplastics in the Mediterranean Region

Mediterranean Region				
Boundary limits	**GES- nonGES classes**	**No of stations**	**% of stations**	
≤ 0.5xTV	HIGH	4	1	**1 % GES**
0.5xTV< ≤ 1xTV	GOOD	1	0	
1xTV< ≤10xTV	MODERATE	40	6	**99 % non-GES**
10xTV< ≤100xTV	POOR	297	44	
100xTV< ≤1000xTV	BAD	306	45	
>1000x TV	VERY BAD	31	5	

797. It is clear from Table 18 that all Mediterranean subregions suffer from elevated microplastics concentrations in surface waters 100 times and 1000 times higher than the IMAP TV. In particular, in the EM, the 44% of monitored stations exceed the bad class with concentrations more than 1000 times the TV and are classified as ‘very bad’. In the ADR and WM only 1% and 2 % of stations respectively are found above 1000xTV. These results are depicted spatially in the maps of Figure 27 to Figure 30.

Table 18: The classification of the monitored stations for surface floating microplastics in all Mediterranean sub-Regions

Boundary limits	GES- nonGES classes	No of station	% of Beaches	
Adriatic sub-Region				
≤ 0.5xTV	HIGH	2	3	**3 % GES**
0.5xTV< ≤ 1xTV	GOOD	0	0	
1xTV< ≤10xTV	MODERATE	0	0	**97 % non-GES**
10xTV< ≤100xTV	POOR	23	32	
100xTV< ≤1000xTV	BAD	45	63	
>1000x TV	VERY BAD	1	1	
		71 stations		
Central Mediterranean sub-Region				
≤ 0.5xTV	HIGH	0	0	**0 % GES**
0.5xTV< ≤ 1xTV	GOOD	0	0	
1xTV< ≤10xTV	MODERATE	0	0	**100 % non-GES**
10xTV< ≤100xTV	POOR	4	36	
100xTV< ≤1000xTV	BAD	7	64	
>1000x TV	VERY BAD	0	0	
		11 stations		
Eastern Mediterranean sub-Region				
≤ 0.5xTV	HIGH	0	0	**0 % GES**
0.5xTV< ≤ 1xTV	GOOD	0	0	
1xTV< ≤10xTV	MODERATE	0	0	**100 % non-GES**
10xTV< ≤100xTV	POOR	4	11	
100xTV< ≤1000xTV	BAD	16	44	
>1000x TV	VERY BAD	16	44	
		36 stations		
Western Mediterranean sub-Region				
≤ 0.5xTV	HIGH	2	0.4	**0.6 % GES**
0.5xTV< ≤ 1xTV	GOOD	1	0.2	
1xTV< ≤10xTV	MODERATE	40	7	**99.4 % non-GES**
10xTV< ≤100xTV	POOR	266	47	
100xTV< ≤1000xTV	BAD	238	42	
>1000x TV	VERY BAD	14	2	
		561 stations		

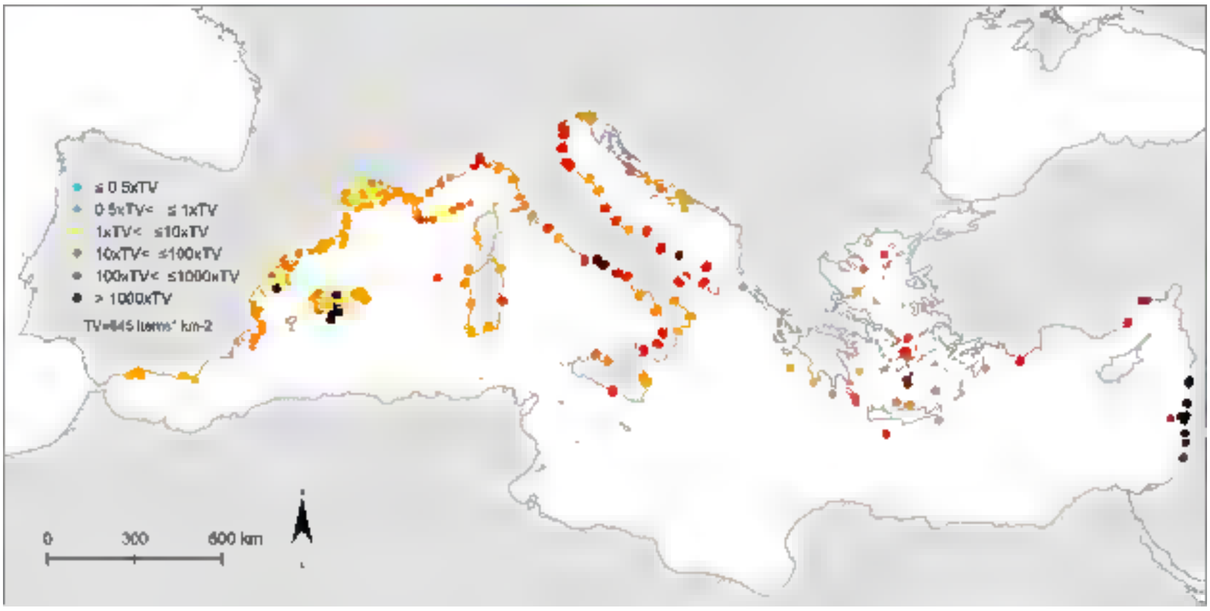


Figure 27**:** GES assessment classification of the monitored stations for sea surface floating microplastics CI23 in the Mediterranean Region.

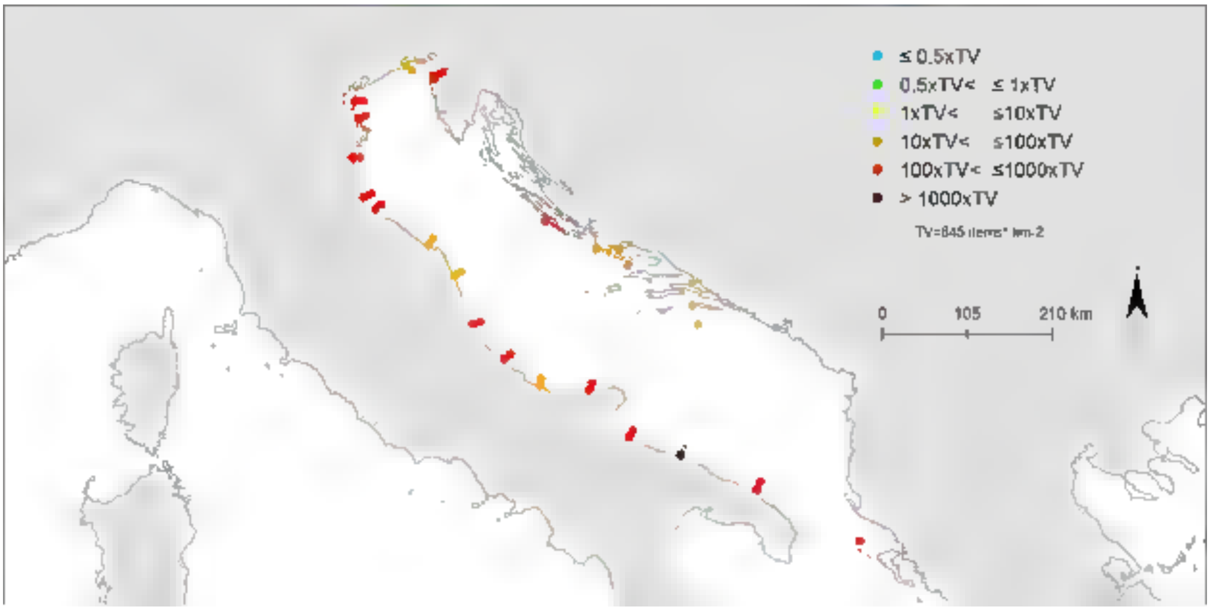


Figure 28**:** GES assessment classification of the monitored stations for sea surface floating microplastics CI23 in the Adriatic Mediterranean sub-region.

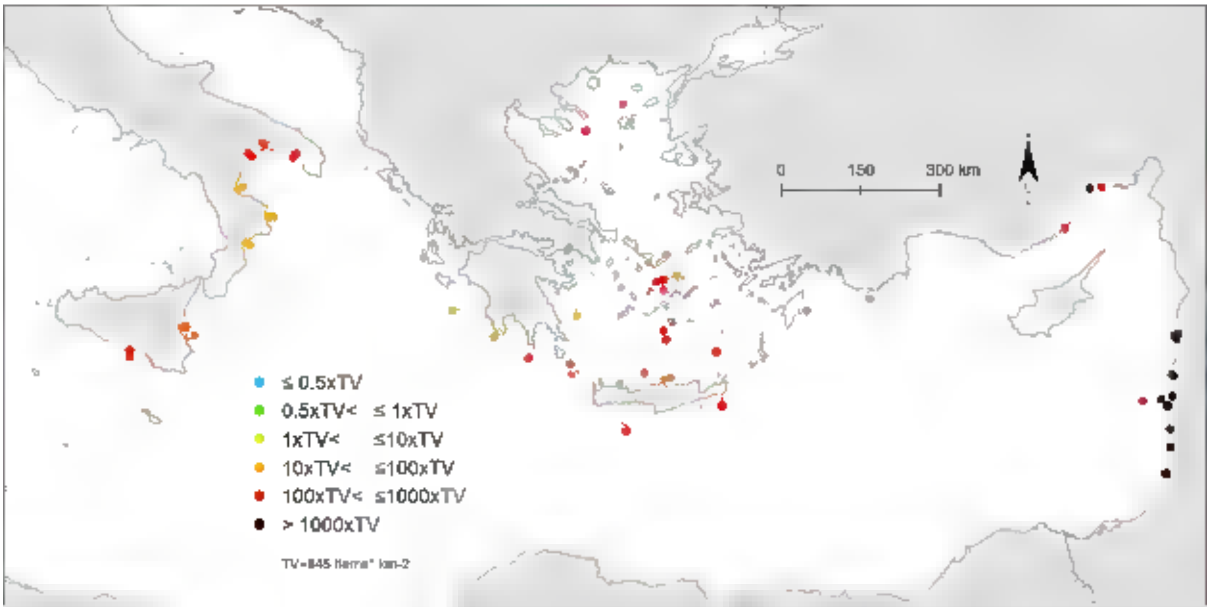


Figure 29: GES assessment classification of the monitored stations for sea surface floating microplastics CI23 in the Eastern and Central Mediterranean sub-regions.

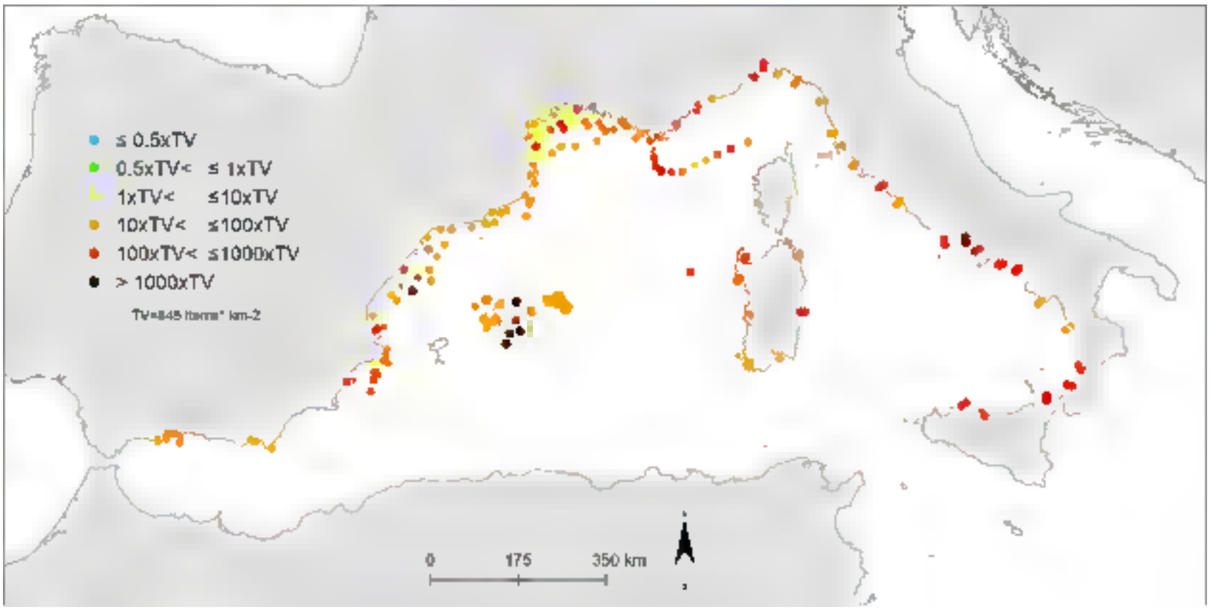
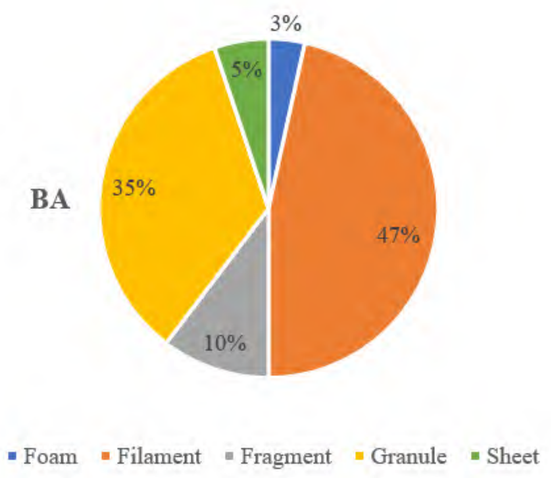
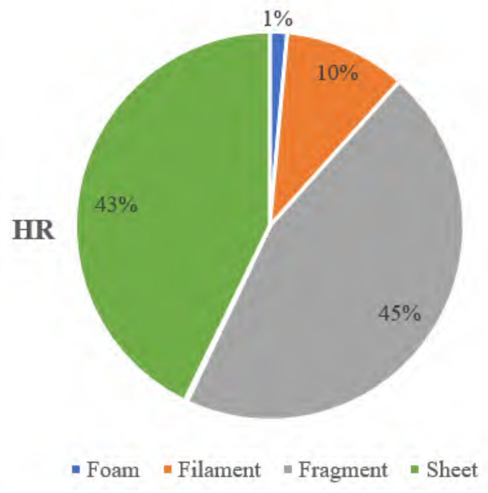


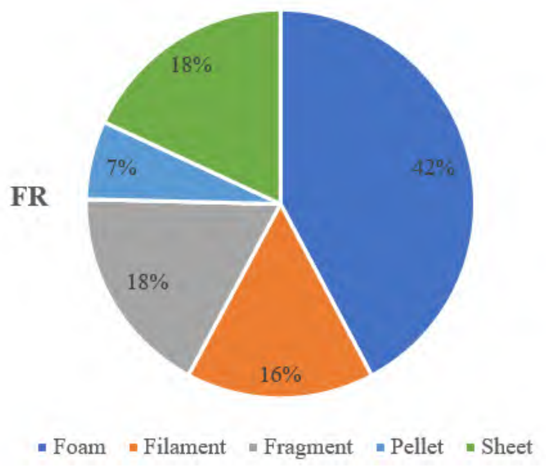
Figure 30: GES assessment classification of the monitored stations for sea surface floating microplastics CI23 in the Western Mediterranean sub-region.

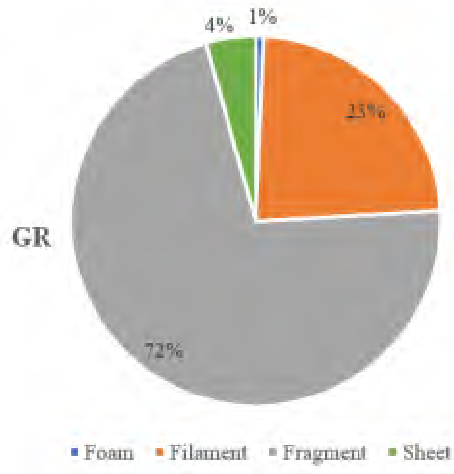
798. The data submitted for floating microplastics from the 10 countries, also provide interesting results regarding the qualitative composition and the different types of microplastics. Predominant in abundance are the Sheets (37%), followed by Filaments (30%), Pellets (21%), Fragments (7%), Foam (4%), and Granules (1%).

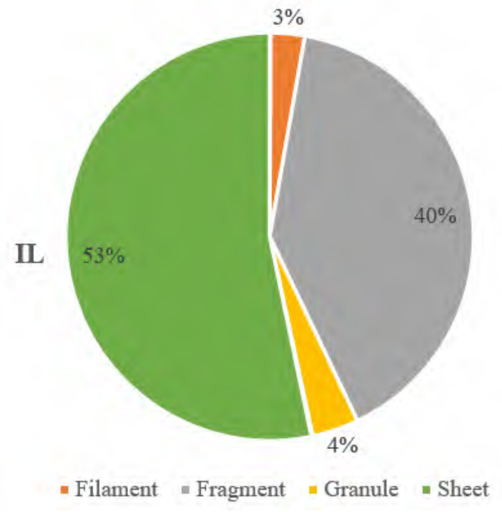
799. The graphs below are representing the qualitative composition (different types of microplastics) per respective country:

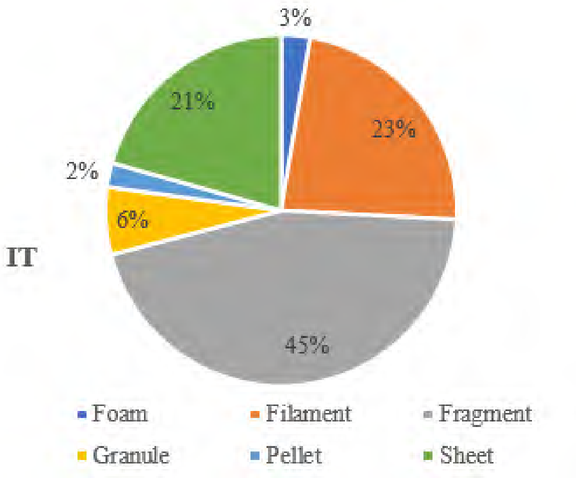

BA
3%
5%
35%
47%
10%
Foam
Filament
Fragment
Granule
Sheet


HR
1%
10%
43%
45%
Foam
Filament
Fragment
Sheet


FR
18%
7%
42%
18%
16%
Foam
Filament
Fragment
Pellet
Sheet


GR
4%
1%
23%
72%
Foam
Filament
Fragment
Sheet


IL
3%
40%
53%
4%
Filament
Fragment
Granule
Sheet


IT
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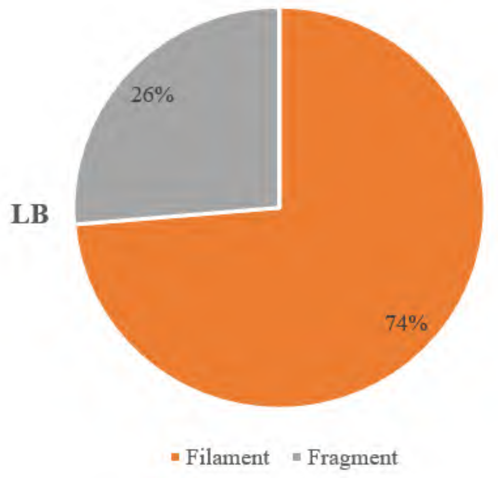
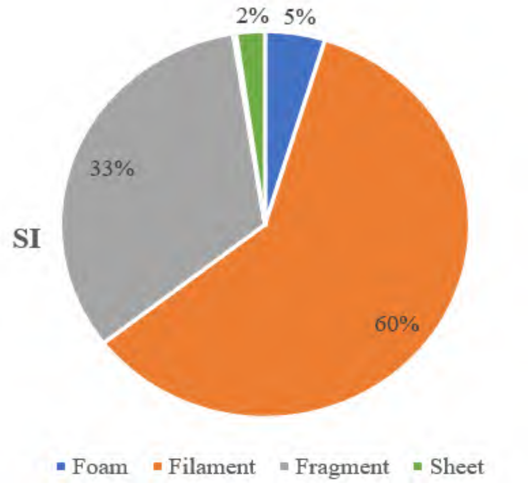
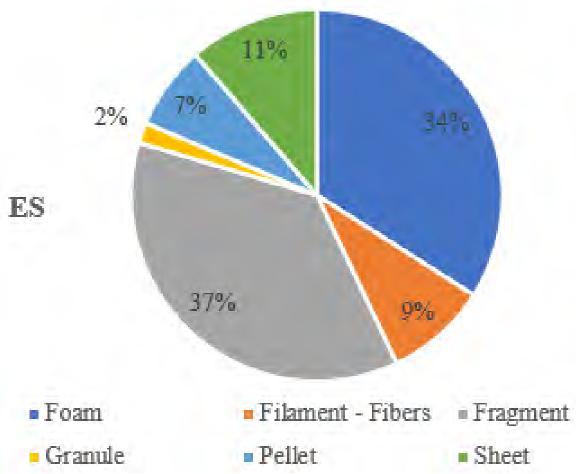
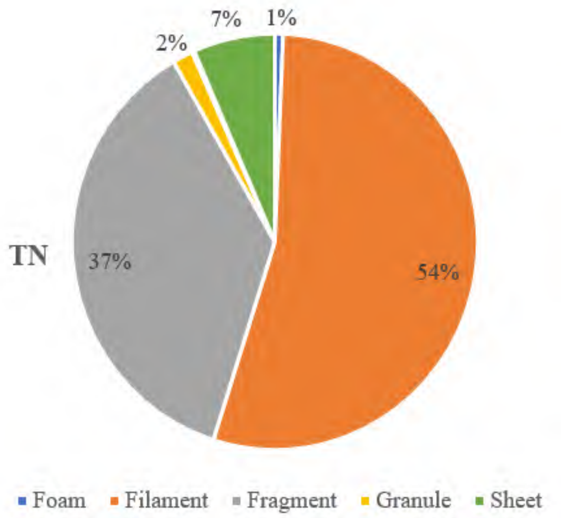
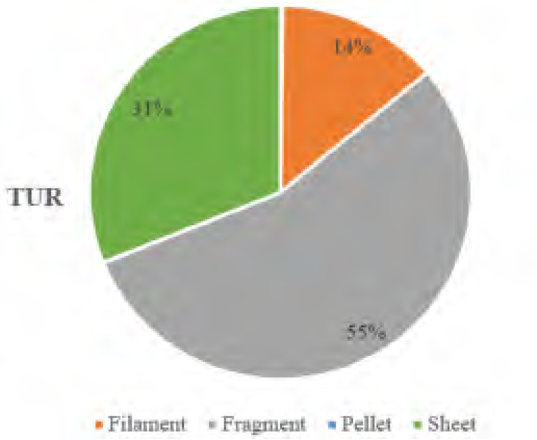
21%
23%
2%
6%
45%
Foam
Filament
Fragment
Granule
Pellet
Sheet


LB
26%
74%
Filament
Fragment


SI
2%
5%
33%
60%
Foam
Filament
Fragment
Sheet


ES
11%
7%
2%
34%
37%
9%
Foam
Filament - Fibers
Fragment
Granule
Pellet
Sheet


TN
7%
1%
2%
37%
54%
Foam
Filament
Fragment
Granule
Sheet


TUR
14%
31%
55%
Filament
Fragment
Pellet
Sheet

<u>The Mediterranean litterscape assessed from the air during the ACCOBAMS survey initiative.</u>

800. Detection and presence probabilities of mega-debris were estimated over the entire Mediterranean Sea and abundance estimate was eventually derived from the presence probability. Some 41,000 floating mega-litter items were recorded in total during the ASI (Figure 32), with an average encounter rate of 0.8 mega-litter per km (standard deviation 3.2), ranging between 0 and 111 debris per km. More than two thirds of the mega-litter recorded were identified as plastics (68.5%; e.g., plastic bags, bottles, tarpaulins, palettes, inflatable beach toys, etc.), while 1.7% were fishery debris and 1.9% were anthropogenic wood-trash. The remaining quarter (27.9%) was anthropogenic mega-debris of an undetermined nature. Plastic litter was largely dominant in all blocks. Beaufort sea state, turbidity and glare extent had a negative effect on detection, whereas subjective conditions had a positive one and detection probability differed among the eight observer teams. Overall, the estimated probability of detecting floating mega- litter during the ASI ranged from 0.1 in the worst conditions to 0.9 in optimal observation conditions: i.e., about 90% of debris actually present are not detected when seas are rough, while near perfect detection is probable when seas are calm, which was the case in 73% of the total survey effort.

801. During the ASI, only 20% of the Mediterranean was free of floating mega-litter. The estimated presence probability was highest in the central and western Mediterranean, in the Tyrrhenian, northern Ionian, and Adriatic Seas and in the Gulf of Gabes (> 80%). The lowest presence probabilities occurred in the Levantine basin, in the southern Ionian Sea and in the Gulf of Lion (< 50%). The total number of floating mega-litter was estimated at 2.9 million items (80% confidence interval was 2.7 to 3.1 million and average density 1.5±0.1 items per km^2), taking into account imperfect detection. Considering that items larger than 30 cm represent only one fourth of the complete load of anthropogenic debris (>2 cm) in the Mediterranean, it scales up the estimate to 11.5 million floating debris.

802. The spatially explicit modelling of mega-litter presence revealed a very heterogeneous distribution of floating mega-debris during summer: highest densities of litter were observed in the central Mediterranean (Tyrrhenian Sea, Adriatic Sea, northern Ionian Sea, off north-eastern Algeria and the Gulf of Gabes; Fig.11), while the lowest densities were found in the eastern basin. Highest densities occurred along the Tyrrhenian coast of Italy and in the Adriatic Sea, with up to 20 items per km^2. This acute marine pollution might disrupt entire ecosystems through its impact on marine fauna (entanglement, ingestion, contamination), eventually impacting associated ecosystem services such as the tourism industry and the well-being of Mediterranean populations. The higher prevalence of litter in the western and central basin compared to the relatively spared eastern basin mimics that of the megafauna, which is both more abundant and more diversified in the western basin. This general overlap suggests that the threat to Mediterranean fauna would be maximum in the western Mediterranean.

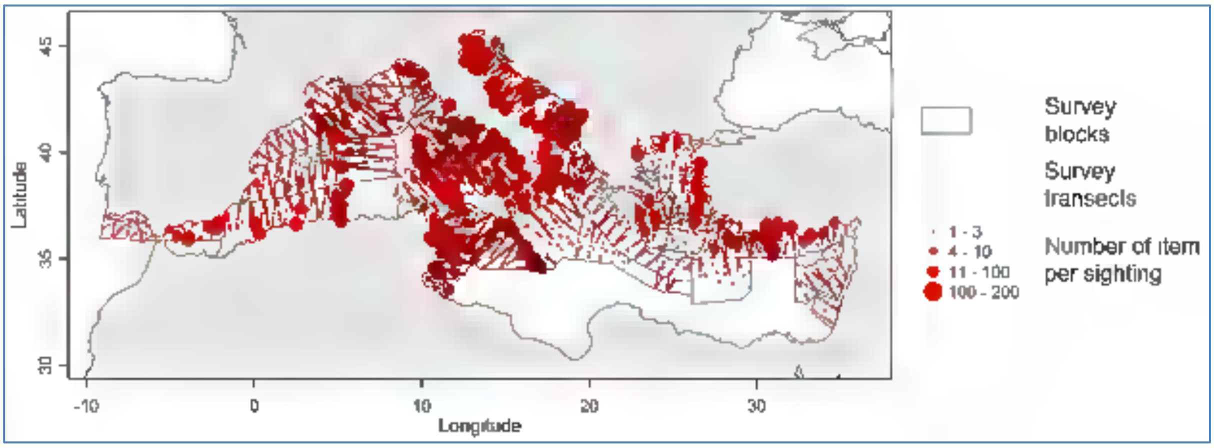


Figure 31**:** ACCOBAMS Survey Initiative (ASI) blocks, sampled transects and distribution of sighted floating mega-litter. Transects were sampled once by 14 different teams operating 8 planes simultaneously in different areas. There was no aerial survey effort off the coasts of Morocco, Libya, Egypt and east of Cyprus where the ASI survey was conducted by boat.

803. Many endangered or vulnerable species, some of them endemic to the area, are at risk of entanglement or of ingesting debris. This work sets a reference situation allowing the efficiency of future plastic pollution remediation strategies to be assessed. It constitutes the first ground-truthing of previous numerical simulations based on surface debris drifting simulations. On a methodological point of view, the present work showed that departing from sea-state 0 to 3 resulted in a drop of c. 31% in the detection probability of mega-debris, violating the assumption, inherent to strip transect approaches, that detection is perfect across the sampled strip.

804. Therefore, accounting for imperfect detection in density estimation procedure based on strip-transect visual surveys is crucial. The line-transect protocol, which is the standard methodology to be used in case of varying detectability of objects with distance from the transect line and observations conditions, cannot readily be implemented in aerial surveys for floating mega-debris, because those are too numerous to allow the necessary distance data to be collected without disrupting the observers' observation capabilities. The use of strip-transect protocol has proven to be operationally effective for collecting debris along with marine fauna and anthropogenic activities, provided that the analytical procedure can take imperfect detection into account.

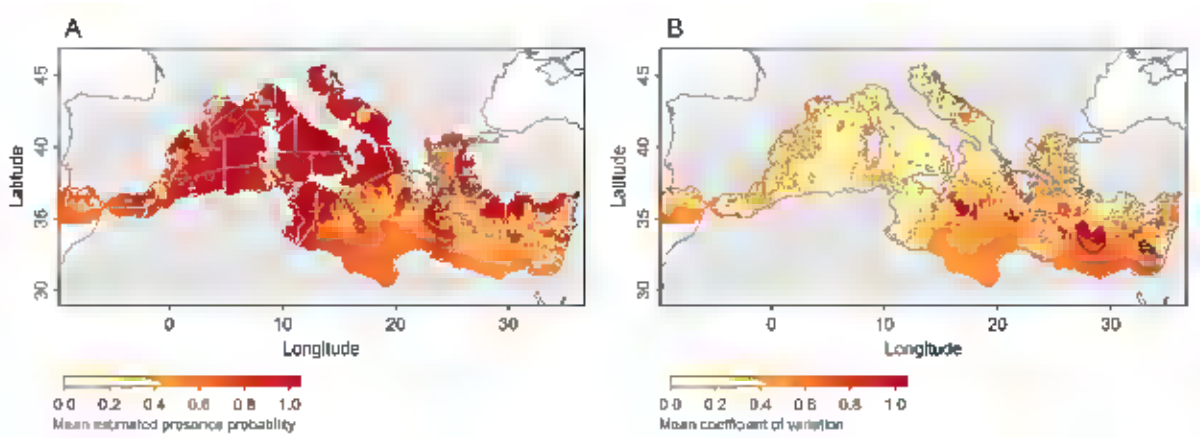


Figure 32**:** (A): Estimated presence probability (posterior mean) of floating mega-debris. (B): Uncertainty in estimated presence probability (coefficient of variation). Isolines corresponding to contours 20% probabilities are shown in dotted black lines and 80% contours in solid black lines. ASI survey blocks are shown in solid white lines.

GES Assessment for Seafloor Macrolitter (IMAP EO10 CI23)

805. **Seafloor marine litter (CI23)** data are reported in the IMAP InfoSystem from 11 CPs covering all sub-divisions of the Mediterranean region (ADR, CEN, EM, WM). In total 367 seafloor trawls/stations are monitored during the period 2017-2021 in the following countries: Croatia, Cyprus, France, Israel, Malta, Montenegro, Morocco, Slovenia, Spain, Tunisia, Türkiye. Most samplings (364) are situated on fishing grounds and were conducted by fishing trawls, thus in most of the cases in soft-bottom grounds, and only 3 samplings in Morocco were conducted by scuba diving in sub-littoral seafloor and correspond to maximum outlier seafloor macro-litter concentrations.

806. Concentrations of seafloor marine litter (items/km^2) excluding the scuba diving outlier data are highly variable fluctuating between 0 and 28,228 items /km^2. Average seafloor litter concentration on the Mediterranean coastline is found equal to 570 ± 2,588 items/km^2. The outlier seafloor concentrations are 662,500 items/km^2, 1,882,500 items/km^2, and 372,500 items/km^2 and are not included in the analysis below because they are based on a different monitoring methodology.

807. Following the assessment methodology and using the TV of 38 items/km^2, temporal average data from the 367 seafloor stations are compared against the threshold, resulting in their classification under 5 status classes (high, good, moderate, poor, bad) shown in

808. Table *19*. Overall, 88% of the seafloor stations monitored do not achieve GES, and most of them fall into the bad (53 %) and moderate (23 %) categories, i.e., seafloor litter concentrations are up to five times higher than the TV. In

809.

811. Table *20* the classification results are given for each sub-Region separately.

Table 19: The classification of the 364 seafloor stations monitored in the Mediterranean Region

Mediterranean Region				
Boundary limits	**GES- nonGES classes**	**No of stations**	**% of stations**	
≤ 0.5xTV	HIGH	23	**6**	**11 % GES**
0.5xTV< ≤ 1xTV	GOOD	19	**5**	
1xTV< ≤2xTV	MODERATE	44	**12**	**88 % nonGES**
2xTV< ≤5xTV	POOR	85	**23**	
> 5xTV	BAD	193	**53**	

812. On the sub-region level the Western Mediterranean appears highly affected by seafloor marine litter since all stations monitored (100%) are classified in the nonGES category. The Central Mediterranean sub-region appears also highly affected with 81% of stations monitored classified under nonGES. The Adriatic and Eastern Mediterranean sub-regions follow with 65 and 68% of the stations monitored falling into the nonGES class respectively. The Eastern Mediterranean is the only area where a considerable percentage (24 %) of trawling stations achieve high status. These results are depicted spatially in the maps of Figure 33 to Figure 37 from where the uneven distribution of stations within each sub-region, attributed to limitations in data submission, can be seen, for example the CEN is covered only by Malta and Tunisia.

Table 20: The classification of the monitored seafloor stations in Mediterranean sub-Regions

Boundary limits	GES- nonGES classes	No of seafloor stations	% of Stations	
Adriatic sub-Region				
≤ 0.5xTV	HIGH	2	**9**	**35% GES**
0.5xTV< ≤ 1xTV	GOOD	6	**26**	
1xTV< ≤2xTV	MODERATE	8	**35**	**65 % non-GES**
2xTV< ≤5xTV	POOR	14	**4**	
> 5xTV	BAD	6	**926**	
23 stations				
Central Mediterranean sub-Region				
≤ 0.5xTV	HIGH	1	**2**	**16% GES**
0.5xTV< ≤ 1xTV	GOOD	7	**17**	
1xTV< ≤2xTV	MODERATE	16	**38**	**81 % non-GES**
2xTV< ≤5xTV	POOR	17	**40**	
> 5xTV	BAD	1	**2**	
42 stations				
Eastern Mediterranean sub-Region				
≤ 0.5xTV	HIGH	20	**24**	**32% GES**
0.5xTV< ≤ 1xTV	GOOD	6	**7**	
1xTV< ≤2xTV	MODERATE	17	**21**	**68% non-GES**
2xTV< ≤5xTV	POOR	16	**20**	
> 5xTV	BAD	23	**28**	
82 stations				
Western Mediterranean sub-Region				
≤ 0.5xTV	HIGH	0	**20**	**0 % GES**
0.5xTV< ≤ 1xTV	GOOD	0	**0**	
1xTV< ≤2xTV	MODERATE	3	**1**	**100 % non-GES**
2xTV< ≤5xTV	POOR	51	**24**	
> 5xTV	BAD	163	**75**	
217 stations				

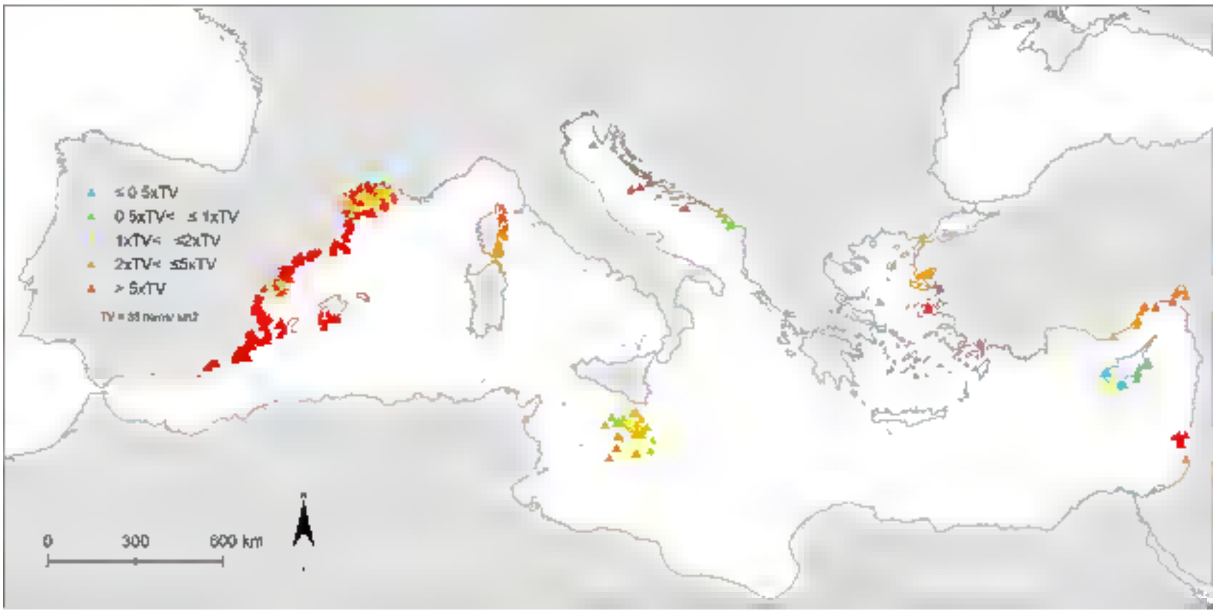


Figure 33: GES assessment classification of the seafloor stations monitored for marine litter in the Mediterranean Region.

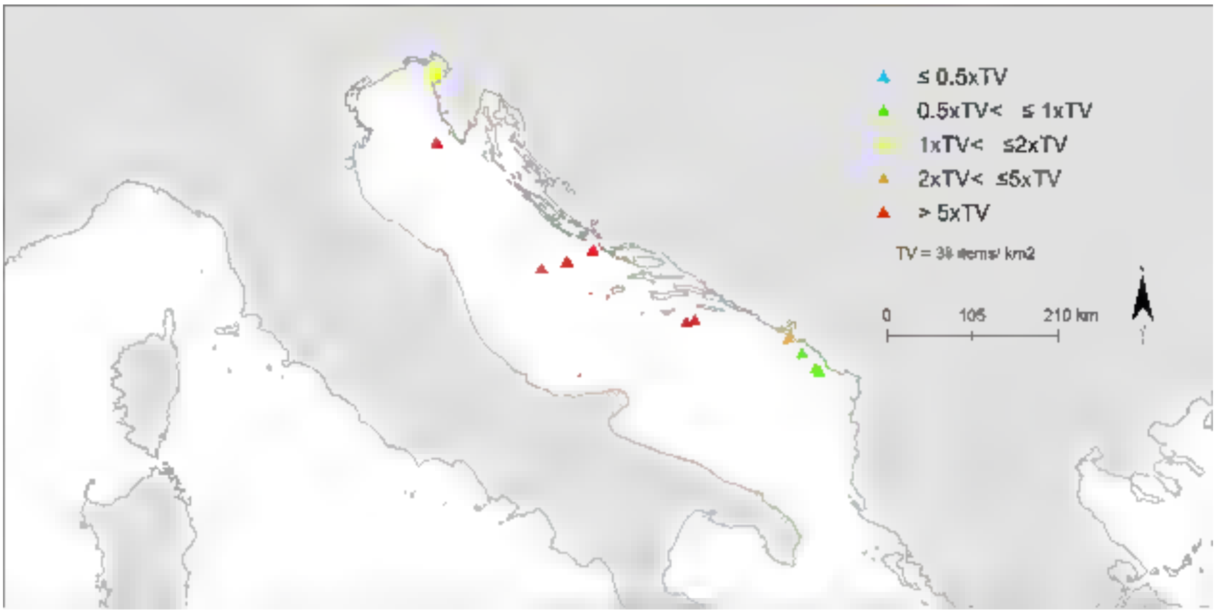


Figure 34: GES assessment classification of the seafloor stations monitored for marine litter in the Adriatic Mediterranean sub-regions.

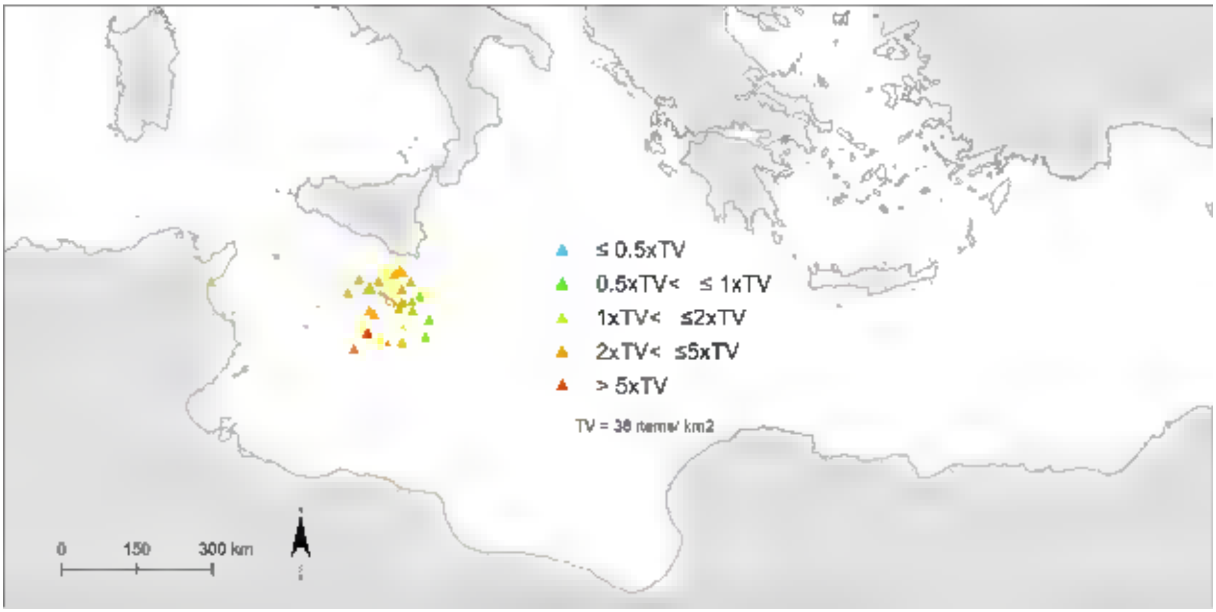


Figure 35**:** GES assessment classification of the seafloor stations monitored for marine litter in the Central Mediterranean sub-region.

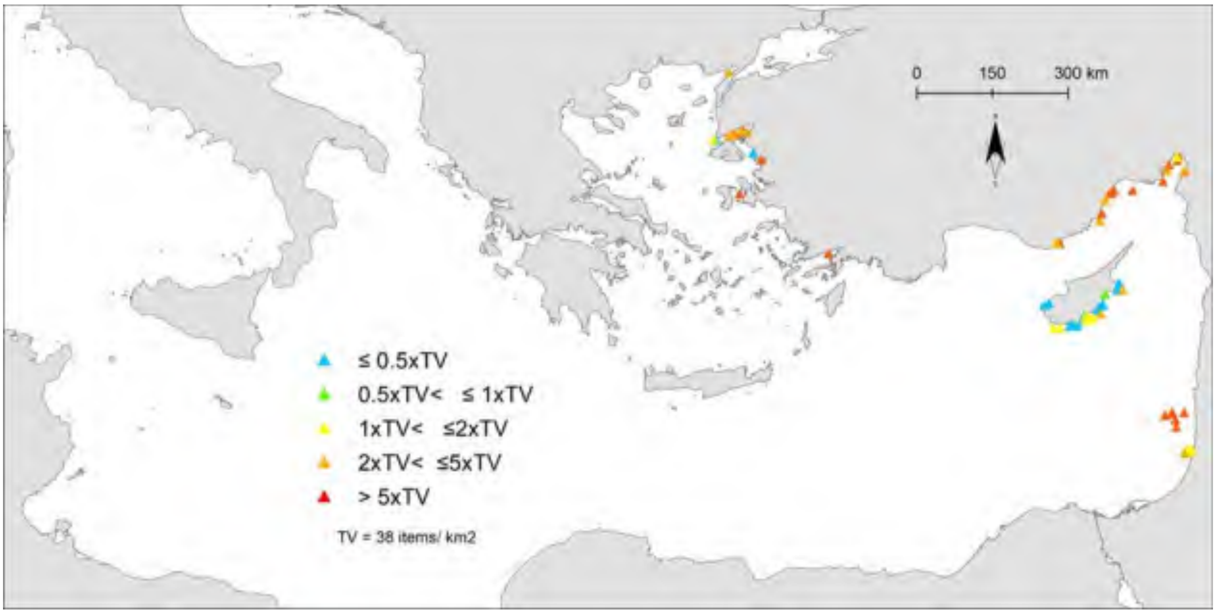


Figure 36**:** GES assessment classification of the seafloor stations monitored for marine litter in the Eastern Mediterranean sub-region.

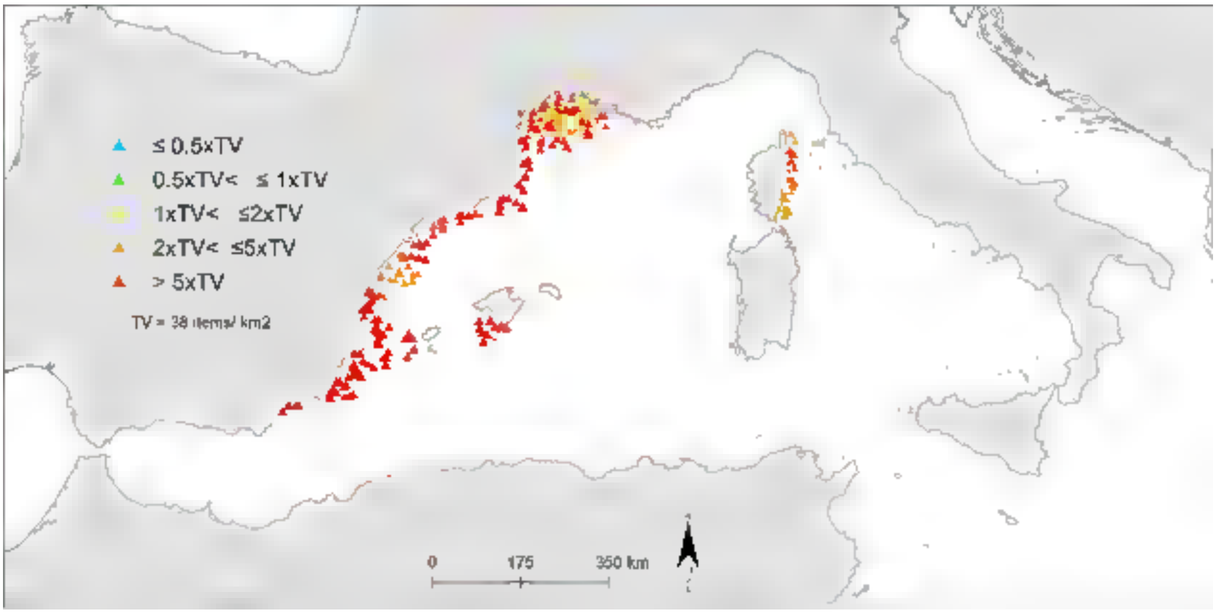


Figure 37**:** GES assessment classification of the seafloor stations monitored for marine litter in the Western Mediterranean sub-region.

813. Further to the submission of data for seafloor macro-litter, an analysis was undertaken with an explicit focus on fisheries-related items. The purpose of this analysis is to identify hotspot areas in the Mediterranean where high abundance rates can be associated with impact on biota (e.g., through ghost fishing, Abandoned Lost or Otherwise Discarded Fishing Gear (ALDFG). Seafloor litter can harm marine organisms of all sizes by various mechanisms, including entanglement, smothering (i.e., in soft bottom environments) and ingestion.

814. A small component (10%) of seafloor macrolitter was represented by fishery-related items. The most common items recorded from the trawl surveys are:

a) “L1i - Synthetic ropes/strapping bands” (39%);
b) “L1f - Fishing nets (polymers)” (27%);
c) “L1g - Fishing lines (polymers)” (25%);
d) “L5c - Natural fishing ropes” (6%);
e) “L1h - Other synthetic fishing related” (2%); and
f) “L3f - Fishing related (hooks, spears, etc.)” (1%).

815. Fishery-related marine litter items varied among countries, from a mean value of approximately 26 items/km^2 in France to approximately 1 item/km^2 in Israel. Intermediate values have been recorded in Türkiye approx. 19 items/km^2, Malta approx. 15 items/km^2, Tunisia approx. 8, and Croatia with approx. 3 items/km^2.

816. In Morocco, fishery-related litter monitored through SCUBA diving represented just the 4% of all the items found. The most common litter item was “L1j - Fishing lines (polymers)” (34%), followed by “L1f - Fishing nets (polymers)” (19%), “L1h – Other synthetic fishing related” (12%), “L3f – Fishing related (hooks, spears, etc.) (12%), “L5c – Natural fishing ropes “ (12%) and “L1i – Synthetic ropes/strapping bands” (9%). The distribution of the fisheries-related items in 3 Mediterranean sub-regions is provided under Figure 38, Figure 39 and Figure 40, below:

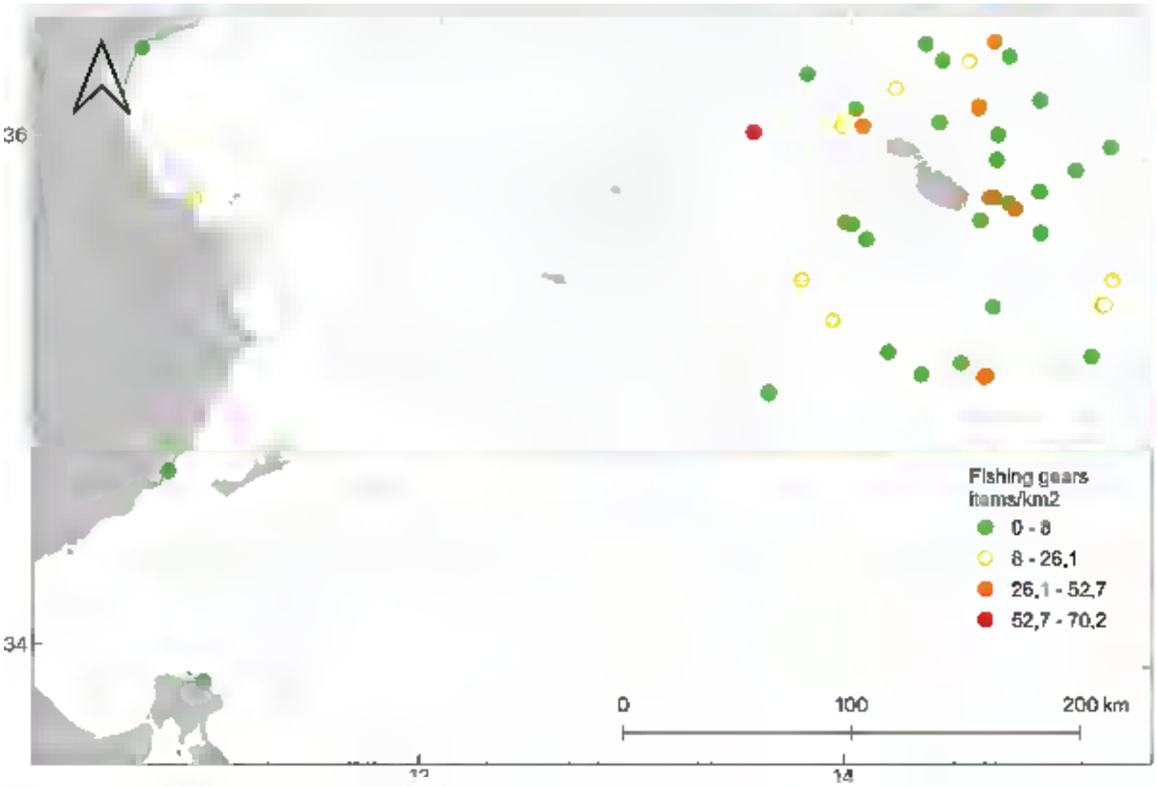


Figure 38: Fishing gear distribution on the seafloor of the Central Mediterranean sub-region.

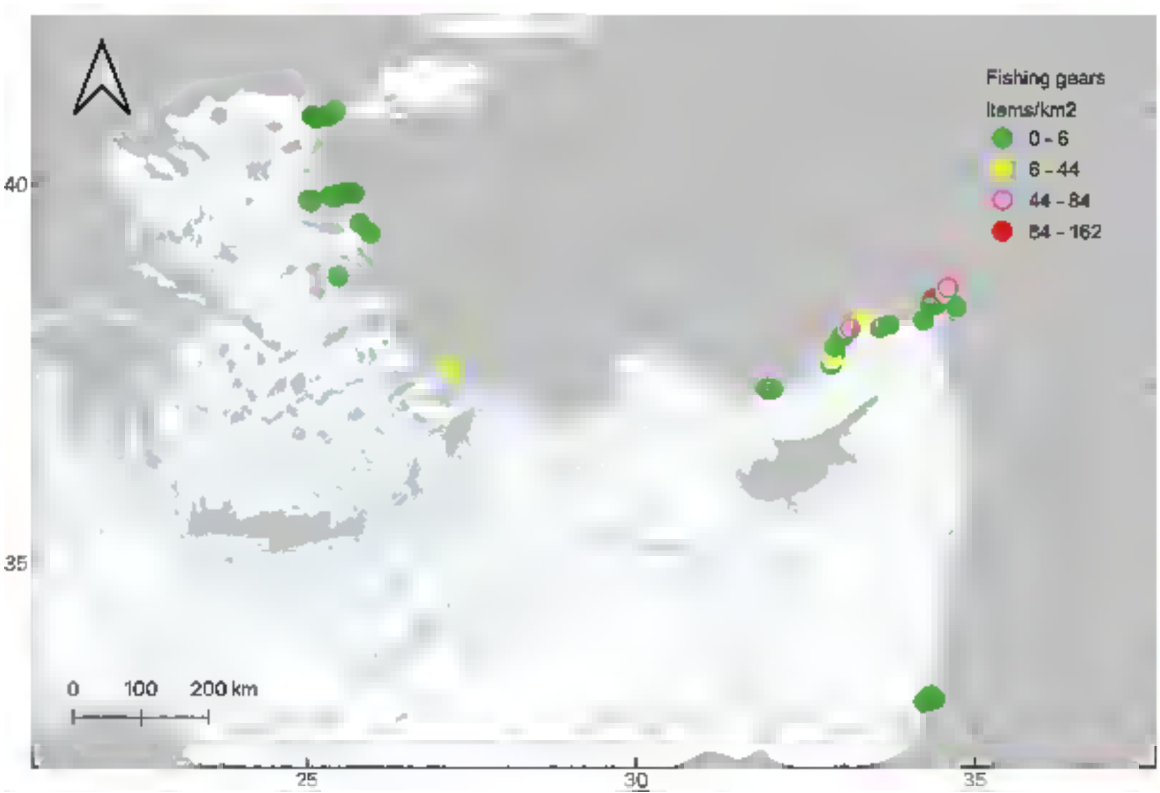


Figure 39: Fishing gear distribution on the seafloor of the Eastern Mediterranean sub-region.

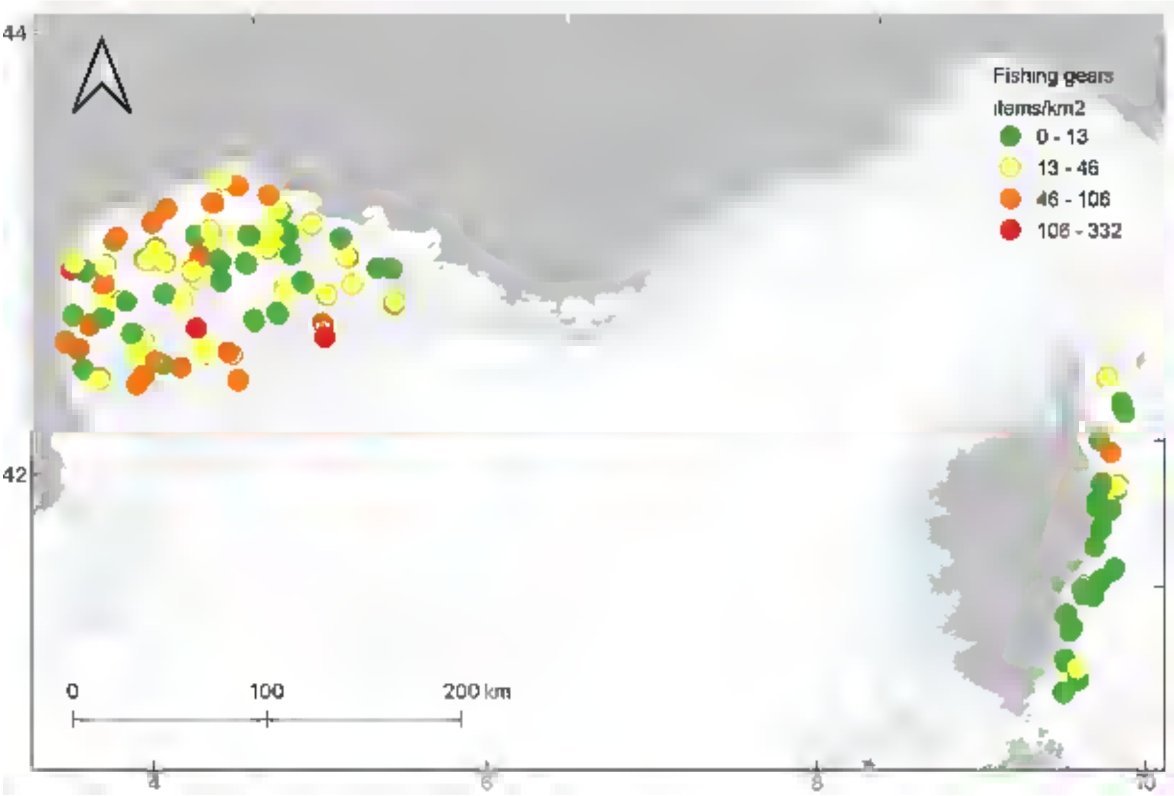


Figure 40**:** Fishing gear distribution on the seafloor of the Western Mediterranean sub-region.

Application of the NEAT Assessment Tool for EO10 for the Adriatic Sub-region

Defining the assessment areas

817. For IMAP EO10/CI 22, integration of assessments up to the subdivision level is considered meaningful. Three main subdivisions of the Adriatic Sea, namely, North, Central and South Adriatic have been chosen following the specific geomorphological features as available in relevant scientific sources (e.g., bottom depths and slope areas, existence of deep depression, salinity and temperature gradient, water mass exchanges).

818. Geographical data for the 3 Adriatic subdivisions have been retrieved from (Cushman-Roisin et al., 2001). The coverage of the 3 sub-divisions is shown in Figure 41. The 3 sub-divisions are nested under the Adriatic Sea, while within each of them are nested the areas of assessment set further to the spatial coverage of the areas of monitoring of each of the CPs. Following the rationale of the IMAP national monitoring programmes as well as the methodology described in UNEP/MAP 2021, two zones for integration of areas of monitoring are defined. These two zones are set based on monitoring stations distribution and anticipation of the relevant IMAP monitoring areas as follows: (i) the coastal zone including monitoring stations within 1nm from the coastal line; and (ii) the offshore zone including monitoring stations beyond 1 nm up to 12nm from the coastal line (i.e., the area 1 nm < <12 nm).

819. For the nesting of the areas, these were first classified under the 3 subdivisions of the Adriatic Sea (North: NAS, Central: CAS, South: SAS), then a nesting scheme was followed. The approach followed for the nesting of the areas is 4 levels nesting scheme (1 - being the finest level, 4 - the highest): 1st: nesting of all national IMAP SAUs & subSAUs under key IMAP assessment zones per country (i.e. coastal and offshore); 2nd: IMAP assessment zones (i.e. coastal, offshore) on the subdivision level (NAS coastal, NAS offshore; CAS coastal, CAS offshore; SAS coastal, SAS offshore); 3rd: under the 3 subdivisions (NAS, CAS, SAS); 4th: under the Adriatic Sea Sub Region. Similarly, the integration of the assessment results is conducted as follows: 1st Detailed assessment results per subSAUs and SAUs; 2nd Integrated assessment results per NAS coastal, NAS offshore;

CAS coastal, CAS offshore; SAS coastal, SAS offshore; 3rd Integrated assessment results per subdivision NAS, CAS, SAS; 4th Integrated assessment results for the Adriatic Sub Region.

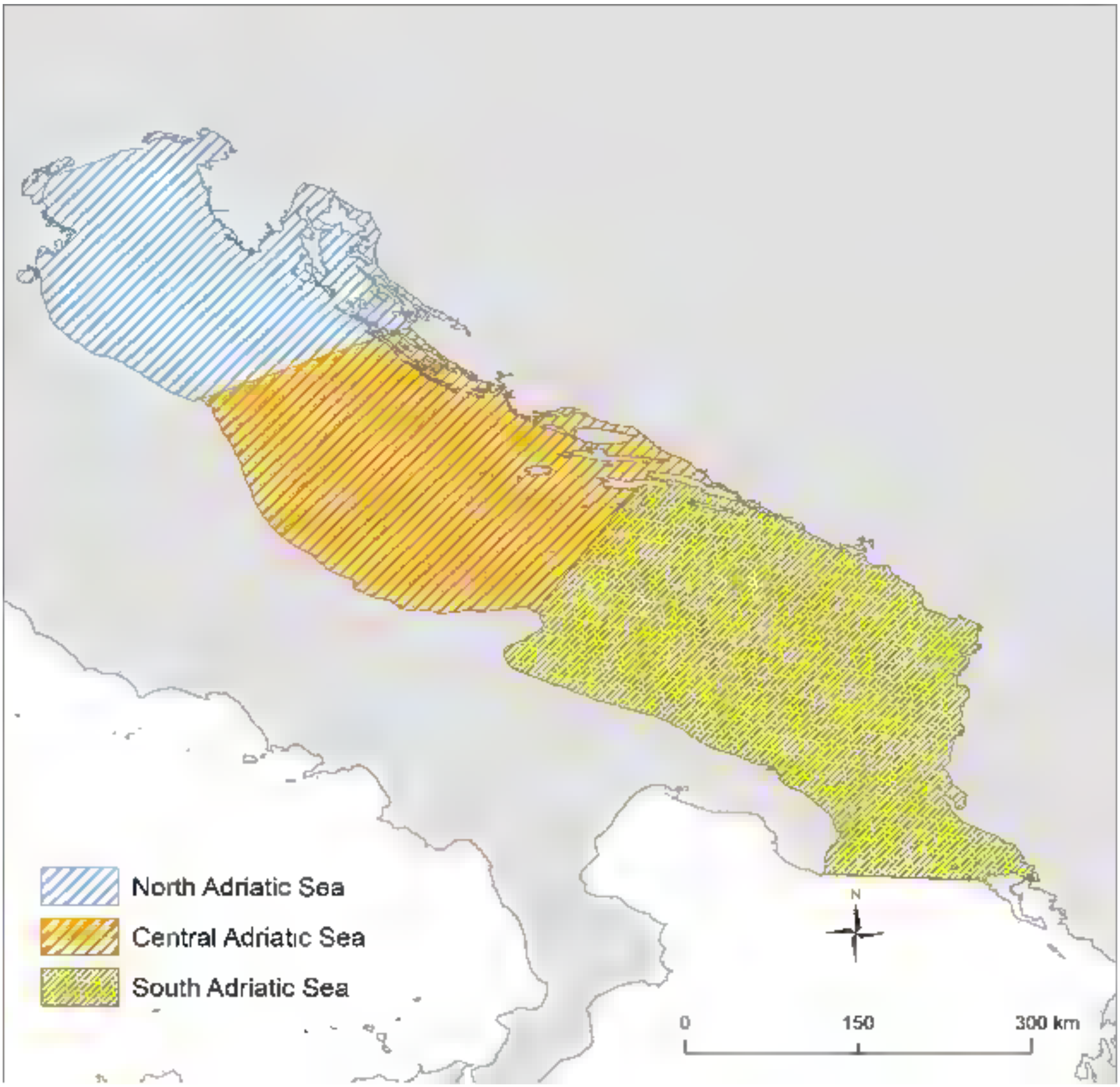
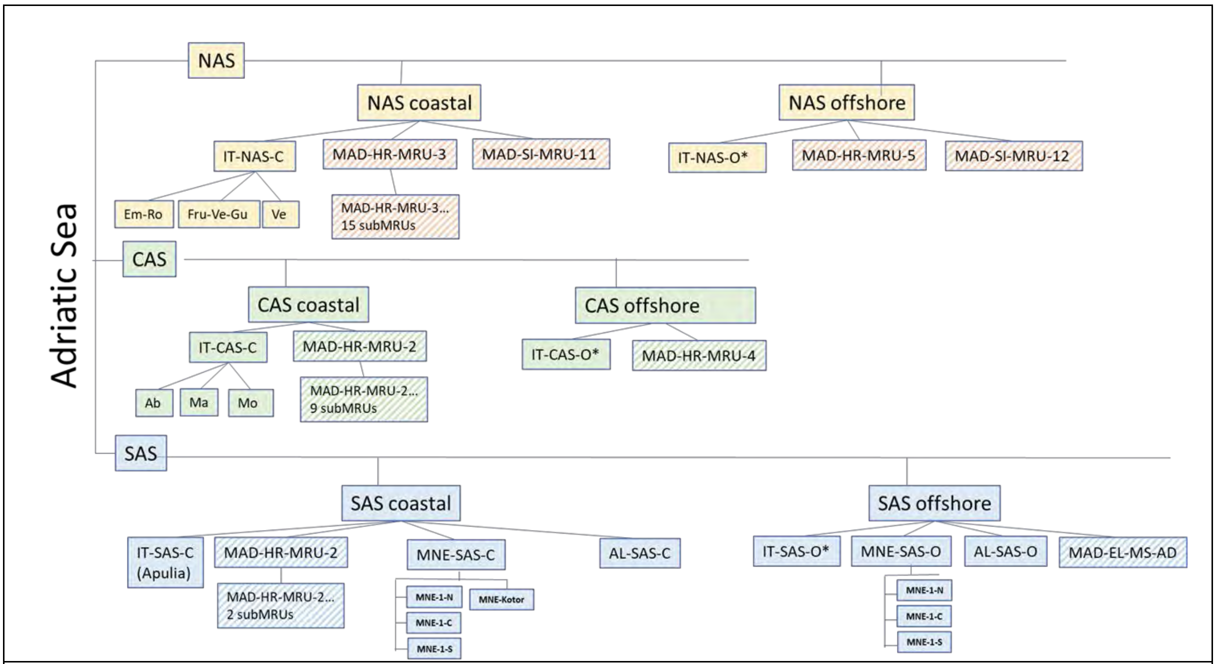


Figure 41: The 3 subdivisions of the Adriatic subregion.

820. The suggested nesting scheme of the IMAP SAUs leads to the aggregation of data on the subdivision level within the coastal and offshore IMAP monitoring/assessment zones and follows the regional/sub-regional approach as required by the IMAP. In line with the integrated assessment approach at the level of Pollution-Marine Litter Cluster, for EO10 CI22/CI23 the assessment is conducted for the same IMAP SAUs and subSAUs (the finest coastal assessment areas on the national level) and the respective nesting scheme, in line with the approach used for IMAP EO9 (Figure 42). The NEAT assessment methodology is applied on the nesting scheme of SAUs and SubSAUs which has the ability to provide aggregated-integrated assessment results.

Data availability

821. Data on IMAP EO10/CI22-Beach Litter have been collected from 6 CPs bordering the Adriatic Sea for the years 2016 to 2021 (i.e. Albania, Bosnia & Herzegovina, Croatia, Italy, Montenegro, Slovenia), except from Greece. Beach Litter data used were either reported by the CP to the IMAP IS or shared with the IMAP Secretariat. Data on IMAP EO10/CI23- Seafloor Litter were reported to the IMAP IS only by Slovenia, Croatia and Montenegro. IMAP EO10/CI23- Sea surface floating microplastics (MPs) data sets were reported by 5 CPs (Bosnia & Herzegovina, Croatia, Greece, Italy, Slovenia).



* For Italy the offshore SAUs areas (IT-NAS-12, IT-CAS-12, IT-SAS-12) is calculated as the difference of the coastal- intercoastal ones from the official MRUs
(IT-NAS-0001, IT-CAS-0001, IT-SAS-0001)

Figure 42**:** The nesting scheme of the SAUs defined for the Adriatic Sea based on the available information. Shaded boxes correspond to official MRUs declared by the countries that are EU MS and that were decided to be used as IMAP SAUs. The finest SAUs nested under national coastal waters are the subSAUs.

Setting the assessment criteria

822. The baseline and threshold values for IMAP CI 22 in the Mediterranean Sea have been endorsed by COP22 (Antalya, Türkiye, 7-10 December 2021) and have been annexed to Decision IG.25/9. The respective values for IMAP CI23 in the Mediterranean were first submitted for review to the CORMON Meeting for Marine Litter Monitoring on 3 March 2023 and an updated version was prepared for the Integrated CORMON Meeting (27-28 June 2023). The threshold value between Good and non-Good Environmental Status used in the NEAT assessment is the TV equal to 130 items/100m for beach litter, the TV equal to 135 items/km^2 for seafloor litter, and the TV equal to 0.000845 items/m2 for floating microplastics.

823. According to the IMAP implementation all stations/beaches having concentrations equal or below the TVs are considered in GES, and those with concentrations higher than the TV value are considered not in GES (nonGES). Apart from the GES-nonGEs threshold/boundary values and their interrelation with the threshold/assessment criteria values, the NEAT tool requires also two more boundary values within the nonGES range of concentrations which defines the ‘worse’ conditions. In this way a 5-status class is produced which further discriminates the above GES threshold

concentration range into two more classes depending on the distances from the GES threshold value. For this boundary (worse conditions) the maximum concentration value of the data set was used.

824. The 5 NEAT status classes for CI22 and CI23_SFL are: the high status with concentrations in the range 0 < ≤0.5xTV; the 'good' status with concentrations in the range 0.5xTV< ≤TV; the moderate status with concentrations in the range TV< ≤2xTV; the poor status with concentrations in the range 2xTV< ≤5xTV. Finally, the 'bad' status is defined by concentrations falling above the 5xTV boundary value. For CI23_ Sea surface MPs the boundary values for the 5 classes are modified as follows: high status with concentrations in the range 0 < ≤0.5xTV; the 'good' status with concentrations in the range 0.5xTV < ≤TV; the moderate status with concentrations in the range TV< ≤10xTV; the poor status with concentrations in the range 10xTV< ≤100xTV. Finally, the 'bad' status is defined by concentrations falling above the 100xTV boundary value.

825. Following the IMAP methodology, NEAT class named 'high' is considered as 'good' *sensu* IMAP i.e., in GES; NEAT classes named 'moderate' and 'poor' *sensu* NEAT are considered as 'Bad' *sensu* IMAP i.e., not in GES. These boundary values and their relation to the IMAP and the NEAT status classes are shown in
826. Table *21* and Table 22.

Table 21: Relation of assessment status classes between the IMAP methodology and NEAT tool and respective colour coding. The position of the 3 required thresholds for the NEAT tool are shown.

	GES		non-GES		
IMAP – traffic light approach	Good	Moderate	Bad		
NEAT tool	High	Good	Moderate	Poor	Bad
Boundary limits and NEAT scores	1<score ≤0.8	0.8<score ≤ 0.6	0.6<score ≤ 0.4	0.4<score ≤0.2	Score<0.2
Thresholds for CI22 Beach and CI23 Seafloor Litter	**1/2(TV)**	**TV**	**2(TV)**	**5(TV)**	
Thresholds for CI23 Sea surface Floating Microplastics	**1/2(TV)**	**TV**	**10(TV)**	**100(TV)**	

Table 22: Boundary/Threshold values introduced in the NEAT tool.

	Low Boundary limit	**Threshold** High/Good	**Threshold** Good/Moderate	**Threshold** Moderate/poor	**Threshold** Poor/Bad	**Upper Boundary Limit**
Beach Litter (items/100m)	0	65	130	260	650	2000
Seafloor Litter (items/km^2)	0	67.5	135	270	675	2000
Floating Microplastics (items/m^2)	0	0.000422	0.000845	0.00845	0.0845	1.076

827. A data matrix to be used for the NEAT software was prepared and given below in
828. Table *23*.

Table 23: Average values and standard error for beach litter (items/100 m) per SAU of the Adriatic subregion. (n: the number of records per SAU, i.e., station number x times visited)

Sub-division	Zone	SAU	Sub-SAU	Beach Litter (items/100m)	Seafloor Litter (items/km^2)	Sea surface Floating Microplastics (items/m^2)
North Adriatic (NAS)						
	NAS coastal					
		MAD-HR-MRU-3				
			HRO-O423-KVJ	99 ± 31 n=7		
		IT-NAS-C				
			Emilia Romagna	233 ± 21 n=40		0.330 ± 0.093 n=4
			Friuli Venezia Giulia	759 ± 167 n=40		0.042 ± 0.006 n=4
			Veneto	363 ± 61 n=38		0.270 ± 0.046 n=6
		MAD-Sl-MRU-11		436 ± 120 n=12	59 ± 3 n=2	0.1250 ± 0.023 n=24
	NAS Offshore					
		MAD-Sl-MRU-12			33 ± 7 n=10	0.123 ± 0.027 n=8
		MAD-HR-MRU-5			491 n=1	
		IT-NAS-O				0.144 ± 0.027 n=7
Central Adriatic (CAS)						
	CAS coastal					
		MAD-HR-MRU-2				
			HRO-0423-BSK	484 n=1		0.083 n=1
			HRO-0423-KOR	93 n=1	1103 n=1	0.085 n=1
		IT-CAS-C				
			Abruzzo	694± 92 n=40		0.122 ± 0.026 n=4
			Marche	1556 ± 908 n=37		0.151 ± 0.009 n=4
			Molise	150 ± 26 n=10		0.025 ± 0.015 n=3

Sub-division	Zone	SAU	Sub-SAU	Beach Litter (items/100m)	Seafloor Litter (items/km^2)	Floating Microplastics (items/m^2)
	CAS offshore					
		MAD-HR-MRU_4			654 ± 178 n=4	0.056 n=1
		IT-CAS-O				0.066 ± 0.014 n=10
South (SAS)	**Adriatic**					
	SAS coastal					
		IT-SAS-C	Puglia	305 ± 31 n=30		0.195 ± 0.026 n = 14
		MAD-HR-MRU-2				
			HRO-O423-MOP	852 ± 599 n=4		0.114 ± 0.047 n=2
			HRO-0313-NEK			0.028 n=1
		MNE-SAS-C				
			MNE-1-N	1129 ± 281 n=5		
			MNE-1-S	802 ± 293 n = 2		
			MNE-Kotor	968 ± 190 n=2		
		AL-SAS-C		757 ± 187 n=4		
		BiH-SAS-C		1240 ± 611 n=2		0.011 n=1
	SAS offshore					
		IT-SAS-O				0.391 ± 0.230 n=4
		MNE-SAS-O				
			MNE-12-N		118 ± 66 n = 2	
			MNE-12-C		22 n = 1	
			MNE-12-S		25 ± 1 n = 2	
		MAD-EL-MS-AD				0.168 n=6

Results of the NEAT tool for the Assessment of the IMAP EO10/CI22/CI23 status in the Adriatic subregion

829. The results obtained from the NEAT tool are shown in Table 24 and in Figure 43 to **Error! Reference source not found.**

830. On the individual parameter level the classification results of subSAUs regarding CI22-Beach Litter show that three subSAUs in Croatia are classified under ‘Good’ status (HRO-0423-KVJ, HRO-0423-KOR) and three under ‘Moderate’ (MAD-HRU-MRU-2, IT-Em-Ro-1, IT-Mo-1). All other subSAUs are classified under ‘Poor’ or ‘Bad’ status. For the case of CI-23 Seafloor Litter the subSAUs monitored in Slovenia and Montenegro (MAD-SI-MRU-12, MNE-12-C, MNE-12-S) are classified under’Good’ status while all other subSAUs are classified under ‘Poor’ or ‘Bad’ status. . Finally, for CI23 Sea surface floating MPs all subSAUs monitored are classified as non-GEs and under ‘Poor’ and ‘Bad’ status classes.

831. Integration of data per each EO10 parameter on higher levels within the nesting scheme (bold lines in Table 7) shows that the NAS subdivision is classified under ‘Good’ status regarding Beach Litter, under ‘Bad’ regarding Seafloor Litter and Floating MPs. The CAS subdivision is classified as ‘Poor’ regarding Beach Litter and Sea surface Floating MPs and under ‘Bad’ regarding Seafloor Litter. Finally, the SAS subdivision is classified under ‘Poor’ status for Beach Litter, ‘Good’ status for Seafloor Litter and ‘Bad’ status for Sea surface Floating MPs.

832. When aggregating all EO10 parameters data per SubSAU, the SubSAUs HRO-0423-KVJ and MNE-12-C, MNE-12-S fall into ‘Good’ status class and the subSAUs IT-Mo-1, MAD-SI-MRU-12 into ‘Moderate’. All other subSAUs are classified under ‘poor’ or ‘bad’ status classes.

833. Based on the data available the assessment results obtained by the NEAT methodology show that most areas of the Adriatic subregion do not achieve GES regarding EO10.

Table 24: Results of the NEAT tool on the assessment of IMAP EO10 in the Adriatic subregion (CI22_BL:Beach Litter; CI23_SFL:Seafloor Litter; CI23_MP:Floating Microplastics). The various levels of spatial integration within the nested scheme are shown in bold. Blank cells denote absence of data.

SAU	Area	Total SAU weight	NEAT value	Status class	Confidence %	CI22_BL	CI23_SFL	CI23_MPs
Adriatic Sea	**139783**	0	0.234	poor	94.7	0.38	0.223	0.2
Northern Adriatic Sea	**31856**	0	**0.292**	**poor**	**100**	**0.632**	**0.173**	**0.189**
NAS-Coastal	**9069**	0	**0.569**	**moderate**	**67.8**	**0.632**	**0.489**	**0.194**
MAD-HR-MRU-3	6422	0	0.695	good	69	0.695		
HRO-0313-JVE	73	0						
HRO-0313-BAZ	4	0						
HRO-0412-PULP	7	0						
HRO-0412-ZOI	473	0						
HRO-0413-LIK	7	0						
HRO-0413-PAG	30	0						
HRO-0413-RAZ	10	0						
HRO-0422-KVV	494	0						
HRO-0422-SJI	1923	0						
HRO-0423-KVA	686	0						
HRO-0423-KVJ	1089	0.046	0.695	good	69	0.695		
HRO-0423-KVS	577	0						
HRO-0423-RILP	6	0						
HRO-0423-RIZ	475	0						
HRO-0423-VIK	455	0						
IT-NAS-C	2592	0	0.259	poor	100	0.324		0.194
IT-Em-Ro-1	371	0.003	0.296	poor	99.9	0.442		0.15
IT-Fr-Ve-Gi-1	575	0.004	0.248	poor	99.9	0.184		0.312
IT-Ve-1	1646	0.012	0.255	poor	100	0.347		0.163
MAD-Sl-MRU-11	55	0	0.336	poor	100	0.327	0.489	0.191
NAS-Offshore	**22788**	0	**0.183**	**bad**	**99.3**		**0.172**	**0.188**
MAD-HR-MRU-5	5571	0.056	0.167	bad	100		0.167	
IT-NAS-O	10540	0.106	0.188	bad	98.9			0.188
MAD-Sl-MRU-12	129	0.001	0.425	moderate	75.3		0.653	0.196
Central Adriatic	**63696**	0	**0.239**	**poor**	**100**	**0.273**	**0.141**	**0.253**
CAS-Coastal	**9394**	0	**0.299**	**poor**	**100**	**0.464**	**0.099**	**0.236**
MAD-HR-MRU-2	7302	0	0.315	poor	100	0.555	0.099	0.236
HRO-0313-NEK	253	0.005	0.349	poor	100			0.349
HRO-0313-KASP	44	0						
HRO-0313-KZ	34	0						
HRO-0313-MMZ	55	0						
HRO-0413-PZK	196	0						
HRO-0413-STLP	1	0						
HRO-0423-BSK	613	0.013	0.245	poor	100	0.285		0.204
HRO-0423-KOR	1564	0.034	0.338	poor	100	0.714	0.099	0.2
HRO-0423-MOP	2480	0						
IT-CAS-C	2092	0	0.242	poor	95.9	0.248		0.235
IT-Ab-1	282	0.005	0.193	bad	71.8	0.193		0.192

SAU	Area	Total SAU weight	NEAT value	Status class	Confidence %	CI22_BL	CI23_SFL	CI23_MPs
IT-Ma-1	319	0.006	0.126	bad	85.1	0.066		0.187
IT-Mo-1	229	0.004	0.463	moderate	93.7	0.569		0.356
CAS-Offshore	**54303**	**0**	**0.229**	**poor**	**96.4**	**0.191**	**0.149**	**0.254**
MAD-HR-MRU-4	18963	0.178	0.205	poor	74.3	0.191	0.149	0.275
IT-CAS-O	22393	0.21	0.249	poor	91.6			0.249
Southern Adriatic Sea	**44231**	**0**	**0.185**	**bad**	**61**	**0.218**	**0.646**	**0.146**
SAS-Coastal	**7276**	**0**	**0.206**	**poor**	**58.1**	**0.218**		**0.189**
MAD-HR-MRU-2	4252	0	0.182	bad	55.3	0.17		0.194
HRO-0313-ZUC	13	0						
HRO-0423-MOP	1756	0.031	0.182	bad	55.3	0.17		0.194
IT-SAS-C (Ap-1)	1810	0.013	0.277	poor	100	0.377		0.178
MNE-SAS-1	483	0	0.181	bad	68.3	0.181		
MNE-1-N	86	0.002	0.129	bad	95.4	0.129		
MNE-1-C	246	0						
MNE-1-S	151	0						
MNE-Kotor	85	0.002	0.234	poor	69	0.234		
AL-SAS-C	646	0.005	0.184	bad	72.7	0.184		
BiH-SAS-C	12.9	0	0.113	bad	84.9	0.113		
SAS-Offshore	**36955**	**0**	**0.181**	**bad**	**69.6**		**0.646**	**0.142**
IT-SAS-O	22715	0.222	0.138	bad	90.2			0.138
MNE-SAS-O	2076	0	0.646	good	94.8		0.646	
MNE-12-N	513	0.005	0.326	poor	62.3		0.326	
MNE-12-C	713	0.007	0.768	good	100		0.768	
MNE-12-S	849	0.008	0.737	good	100		0.737	
AL-SAS-O	716	0						
MAD-EL-MS-AD	2253	0.022	0.183	bad	100			0.183

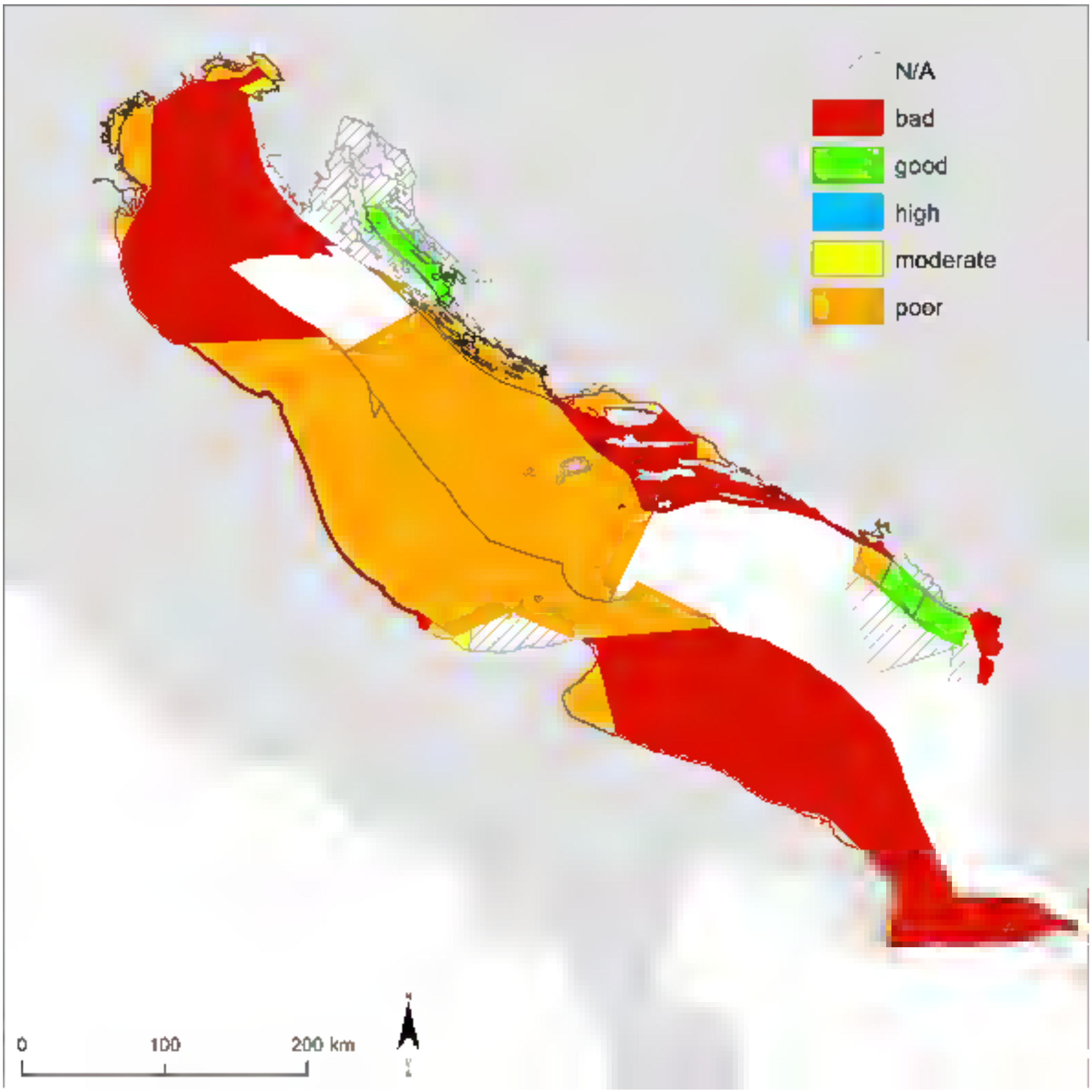


Figure 43: The aggregated-integrated assessment of EO10 in the Adriatic sub-Region following the NEAT assessment methodology.

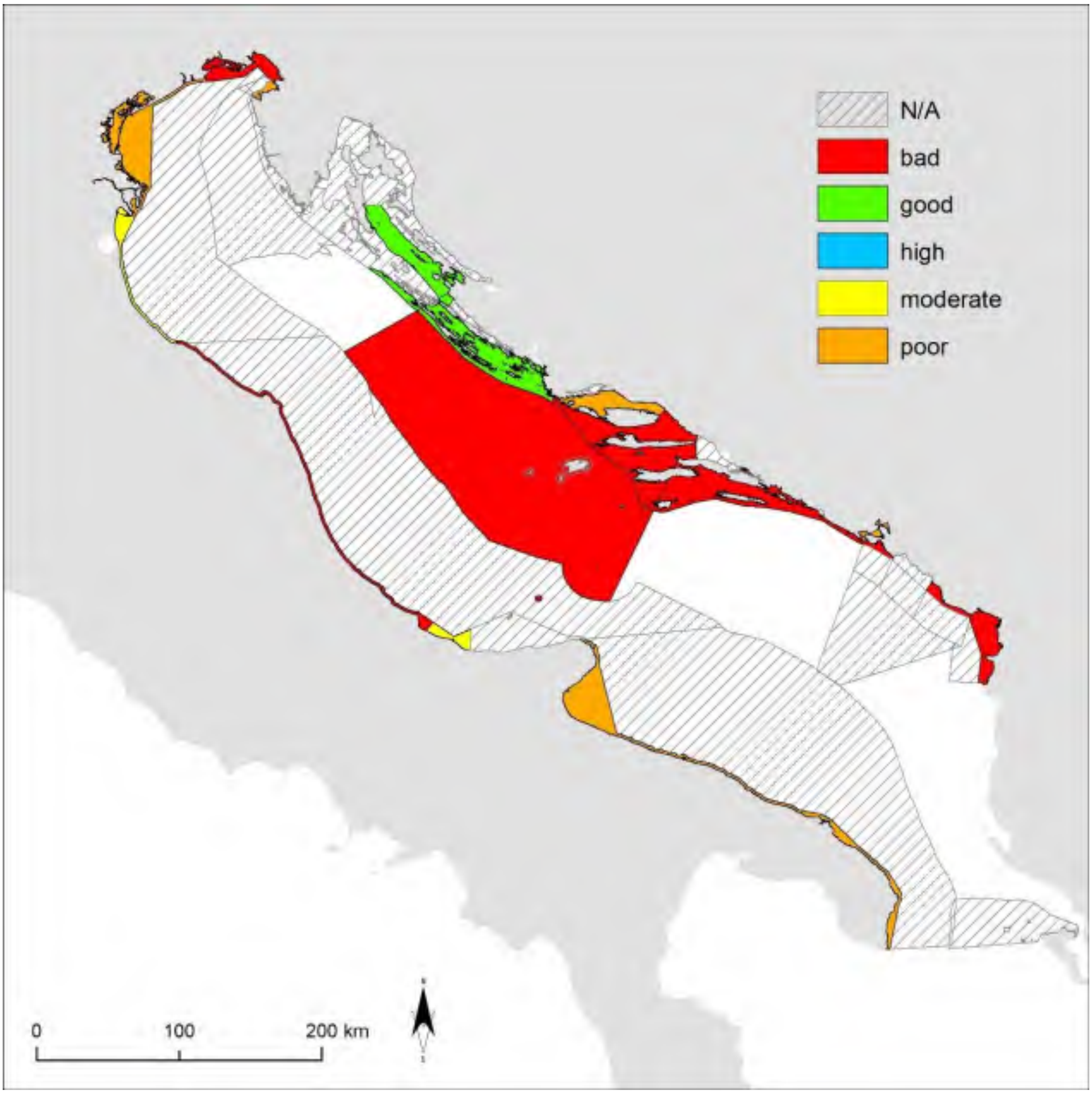


Figure 44: The assessment of CI22-Beach Litter spatial integration in the Adriatic sub-Region following the NEAT assessment methodology.

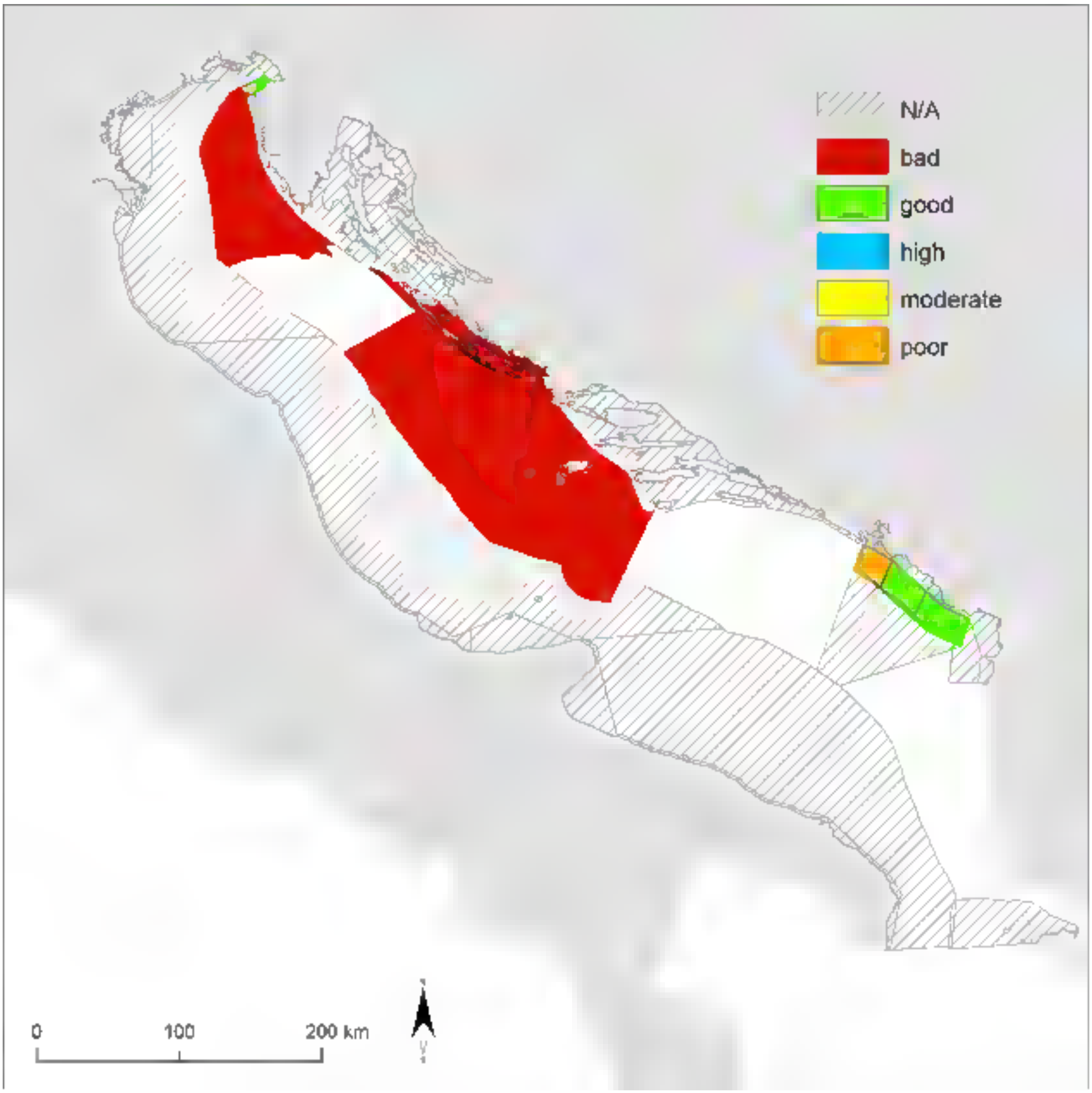


Figure 45: The assessment of CI22-Seafloor Litter spatial integration in the Adriatic sub-Region following the NEAT assessment methodology.

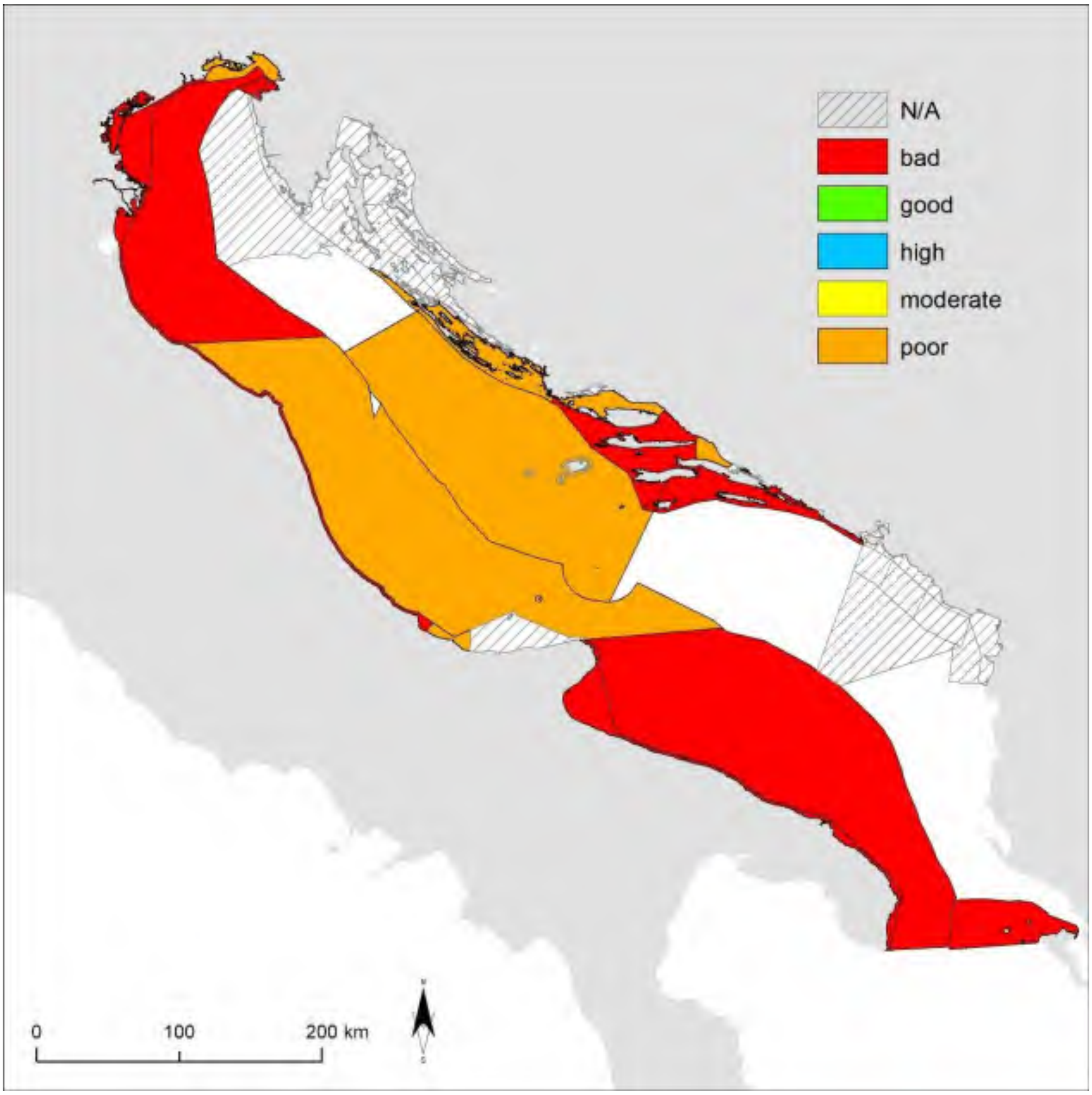


Figure 47: The assessment of CI23-Seasurface Floating MPs spatial integration in the Adriatic sub-Region following the NEAT assessment methodology.

Sensitivity analysis of the assessment results

834. Based on the standard deviation of beach litter per SAU the NEAT tool provides a sensitivity analysis for calculating the uncertainty of the assessment results using a Monte-Carlo simulation model for 1000 iterations. In
835. Table *25* the results of the error analysis are presented.

836. In other words, 1000 assessments are run using different random combinations of the data. Instead of using the average value of the parameters inserted by the user, other random values are used by the tool to run the assessment. The selection of these random values is done based on the standard deviation and it is repeated 1000 times. The resulting assessment value of each of these 1000 assessment runs is recorded and may lead to a different assessment classification. The number of times (out of 1000) of the appearance of these different assessments is given in
837. Table *25*. For example, the overall status for the SAU MAD-HRU-MRU-3 is reported as 'good'. However, from
838. Table *25*, it is understood that out of 1000 iterations, 690 lead to Good status, and 164 to Moderate and 146 to High Status. These results imply a rather high uncertainty (confidence 69%), in contrast to MAD-HRU-MRU-5 where all 1000 iterations led to High status (confidence 100%).

Table 25: Confidence assessment of all SAU/assessment class combinations as absolute counts falling into the specified classes (maximum possible count = 1000).

SAU	bad	poor	moderate	good	high	Confidence %
Adriatic Sea	4	947	49	0	0	94.7
Northern Adriatic Sea	0	1000	0	0	0	100
Southern Adriatic Sea	610	335	5	37	13	61
Central Adriatic	0	1000	0	0	0	100
NAS-C	0	0	678	322	0	67.8
NAS-O	993	7	0	0	0	99.3
SAS-C	325	581	93	1	0	58.1
SAS-O	696	248	6	0	50	69.6
CAS-C	0	1000	0	0	0	100
CAS-O	36	964	0	0	0	96.4
MAD-HR-MRU-3	0	0	164	690	146	69
IT-NAS-C	0	1000	0	0	0	100
MAD-Sl-MRU-11	0	1000	0	0	0	100
MAD-HR-MRU-5	1000	0	0	0	0	100
IT-NAS-O	989	11	0	0	0	98.9
MAD-Sl-MRU-12	0	247	753	0	0	75.3
MAD-HR-MRU-2	553	333	89	23	2	55.3
IT-SAS-1 (Ap-1)	0	1000	0	0	0	100
MNE-SAS-C	683	316	1	0	0	68.3
AL-SAS-C	727	271	2	0	0	72.7
BH-SAS-C	849	104	17	7	23	84.9
IT-SAS-O	902	42	6	0	50	90.2
MNE-SAS-O	0	0	0	948	52	94.8
MAD-EL-MS-AD						
MAD-HR-MRU-2	1000	0	0	0	0	100
IT-CAS-C	0	1000	0	0	0	100
MAD-HR-MRU-4	0	959	41	0	0	95.9
IT-CAS-O	257	743	0	0	0	74.3

SAU	bad	poor	moderate	good	high	Confidence %
HRO-0423-KVJ	84	916	0	0	0	91.6
IT-Em-Ro-1						
IT-Fr-Ve-Gi-1						
IT-Ve-1						
HRO-0423-MOP						
MNE-1-N						
MNE-1-S						
MNE-Kotor						
MNE-12-N						
MNE-12-C						
MNE-12-S						
HRO-0313-NEK	0	0	164	690	146	69
HRO-0423-BSK						
HRO-0423-KOR						
IT-Ab-1						
IT-Ma-1						
IT-Mo-1	0	999	1	0	0	99.9

839. As for any assessment results, the accuracy of the results described above, is dependent also on the amount of data available for each SAU. Many subSAUs totally lack data, so that the integrated results on the SAU level actually reflect the status of one or two subSAUs and cannot be considered indicative of the overall SAU status with confidence.

Comparison of the two assessment methodologies applied for the Adriatic sub-region

840. Given the assessed data availability for EO10 CI22 and CI23 for the Mediterranean Sea as described in Chapters 2.1 and 2.2 the following approach is followed for the quality status assessment. For each CI and each measured parameter (Beach litter, Seafloor Litter, Floating Microplastics) temporal data are averaged per monitoring station. The resulting average value is compared against the respective TV and the score ratio (CR) is calculated. No further aggregation on the EO 10 level or spatial integration is conducted for the Mediterranean region as a whole. For the Adriatic sub-division, for which spatial assessment units have been defined in 2022 for the Eutrophication-Pollution and Marine litter cluster, the application of the NEAT methodology was made possible for the 2 IMAP Common Indicators on marine litter (CI22 and CI23).

841. For the Adriatic sub-region a comparison was made between the two assessment approaches, i.e. the assessment results on the CI level based on the CHASE+ methodology (Chapters 4.2.1; 4.2.2.1; 4.2.2.3) and the results on the EO10 level using the NEAT methodology (Chapter 4.3.1), further to the recommendations for the harmonization of the two assessment.

842. The first assessment approach on the CI level (Chapters 4.2.1; 4.2.2.1; 4.2.2.3) provides assessment per individual stations, while the second one, using NEAT, provides assessments either on the EO10 or CI level spatially integrated (Chapter 4.3.1) along a predefined hierarchical nesting scheme of assessment areas. Therefore, the comparison of the results obtained from the two methods was made possible only on the first level of aggregation i.e. on the subSAUs, for each of the EO10 components separately (CI22-BeachLitter, CI23-Seafloor Litter, CI23-Seasurface MPs). The score ratios (CR) for each of the EO10 components as obtained from the first assessment approach, were grouped for all stations belonging to a specific subSAU and averaged to get one CR per subSAU per

EO10 component. Then the subSAU was classified following the rationale already described in Chapters 4.2.1; 4.2.2.1; 4.2.2.3 and shown here below in
843. Table *26* for both methods. All thresholds used were identical in the two methodologies (
844. Table *26*). The resulting classification is then compared to the respective NEAT value of the subSAU (Table 24). The two alternative assessment results per subSAU and per EO10 component are shown in Table 27.

Table 26: Assessment classification boundary limits/thresholds for a harmonized application of NEAT and simplified CHASE+ tools in the Adriatic Sea sub-region.

	GES		**non-GEs**		
IMAP – traffic light approach	Good	Moderate	Bad		
NEAT tool	High	Good	Moderate	Poor	Bad
	0< meas. conc. ≤ BAC	BAC<meas. conc. ≤GES/nGES threshold	GES/nGES<meas. conc. ≤ moderate/poor threshold	moderate/poor threshold <meas. conc. ≤ max. conc.	
Boundary limits and NEAT scores	1 < score ≤0.8	0.8<score≤ 0.6	0.6<score ≤ 0.4	0.4< score ≤0.2	Score<0.2
Thresholds CI22; CI23_SFL	½	**T**	**2**	**TV 5**	
CI23_MPs	½	**T**	**10**	**TV 100 TV**	
CHASE+ tool	High	Good	Moderate	Poor	Bad
Thresholds CI22; CI23_SFL	½	**T**	**2**	**TV 5**	**TV**
CI23_MPs	½	**T**	**10**	**TV 100**	
CHASE+ Scores	0 <CR ≤0.5	0.5<CR ≤ 1	1<CR ≤ 2	2< CR ≤5	CR > 5

Table 27: Comparison of the two assessment methodologies applied in the Adriatic sub-region for the status assessment of EO10 components. Discrepancies in assessment results marked in bold.

CI22_Beach Litter		
SAU	**Average subSAU score ratio (CR)**	**NEAT Score**
MAD-Sl-MRU-11	3.4	0.31
MAD-HR-MRU-4	**3.7**	**0.191**
HRO-0423-BSK	3.7	0.285
HRO-0423-KOR	0.7	0.714
HRO-0423-KVJ	0.7	0.695
HRO-0423-MOP	**4.2**	**0.17**
IT-Em-Ro-1	1.8	0.442
IT-Fr-Ve-Gi-1	8.5	0.184
IT-Ve-1	2.9	0.347
IT-Ab-1	5.3	0.193
IT-Ma-1	12.3	0.066
IT-Mo-1	1.2	0.569
IT-SAS-1 (Ap-1)	2.3	0.377
BH_SAS_1	9.5	0.113
MNE-1-N	5.7	0.129
MNE-1-S	6.2	0.129
MNE-Kotor	4.6	0.234
AL-SAS-1	5.8	0.184

CI23_Seafloor Litter		
SAU	**Average subSAU score ratio (CR)**	**NEAT Score**
MAD-Sl-MRU-11	1.57	0.489
MAD-Sl-MRU-12	**1.09**	**0.653**
MAD-HR-MRU-4	17.22	0.149
HRO-0423-KOR	8.17	0.099
MAD-HR-MRU-5	**3.64**	**0.167**
MNE-12-N	3.09	0.326
MNE-12-C	0.6	0.768
MNE-12-S	0.66	0.737

CI23_Sea surface MPs		
SAU	**Average subSAU score ratio (CR)**	**NEAT Score**
MAD-Sl-MRU-11	148	0.191
MAD-Sl-MRU-12	134	0.196
MAD-HR-MRU-4	66	0.275
HRO-0423-BSK	98	0.204
HRO-0423-KOR	**101**	**0.2**
HRO-0423-MOP	135	0.194
HRO-0313-NEK	33	0.349
IT-Em-Ro-1	390	0.15
IT-Fr-Ve-Gi-1	49	0.312
IT-Ve-1	319	0.163
IT-Ab-1	144	0.192
IT-Ma-1	**35**	**0.187**
IT-Mo-1	29	0.356
IT-SAS-1 (Ap-1)	231	0.178
IT-NAS-12	170	0.188
IT-CAS-12	78	0.249
IT-SAS-12	463	0.138
BH_SAS_1	13	0.393
MAD-EL-MS-AD	198	0.183

845. The comparison of the two methodologies (Table 27) shows that out of the 45 individual assessments per subSAU per EO10 component only 6 discrepancies were found, most of them between the ‘poor’ and ‘bad’ classes. The two methods agree on 87 % of cases, while the GES/nGES classification, with the exception of one SAU, is identical between methods and thus results can be considered comparable.

Key findings for IMAP EO10 Common Indicator 22:

a) The monitoring efforts around the region and between the sub-regions vary significantly and further alignment and strengthening of IMAP EO CI22 is required from the Mediterranean Countries.
b) Concentrations of beach marine litter are highly variable around the region ranging between 8 and 12,842 items/100m.
c) Overall, 16% of the monitored beaches achieve GES, 79% do not achieve GES of which 29 % fall into the poor status class and 25% in to the bad one. (i.e., beach litter concentrations are up to two to five times higher than the TV).
d) The Central Mediterranean appears the least affected by beach litter with 32% out for the 22 beaches monitored falling into the GES category.
e) The Adriatic, Eastern and Western Mediterranean sub-regions show equal distribution between GES and non-GES classes with only ~14-16 %% of the beaches monitored falling into the GES class, with the highest percentages of beaches (34 - 38%) being classified under the poor or bad classes.
f) For 11 countries, the top-10 item list represents more than 70% of the collected litter items (Bosnia and Herzegovina Lebanon, Slovenia, Croatia, Italy, France, Cyprus, Montenegro, Greece, Israel, and Türkiye), and for 2 Countries represents slightly lower share (approximately 68-69%) (Spain and Morocco).
g) At the level of the Mediterranean Plastic/polystyrene pieces (2.5 cm – 50 cm) are the most commonly found marine litter, followed by cigarette butts and filters , and plastic caps and lids. These 3 items account for more than 60% of the recorded marine litter.
h) The predominant source seems to be human activities on beaches, whereas the "beaching" process seems to play an important role, especially through the fragmentation process.

Key findings for IMAP EO10 Common Indicator 23:

A. Floating Marine Litter:

a) Monitoring efforts are evident in several parts of the Mediterranean, however monitoring efforts for IMAP EO10 CI23 floating microplastics should be further strengthened also in the Southern part of the Mediterranean.
b) Concentrations of Floating Microplastics (items/km^2) are highly variable fluctuating between 0 and 31 items /m^2.
c) Average floating microplastics concentration on the Mediterranean Sea surface is found equal to 0.36 ± 1.9 items/m^2.
d) Almost all stations (99%) that have been monitored do not achieve GES, and most of them fall into the poor (44 %) and bad (49 %) classes (i.e., floating microplastics litter concentrations are up to 100 and 1000 times higher than the TV respectively).
e) The Mediterranean region and its subregions suffer from elevated microplastics concentrations in surface waters, reaching up to 100 times and 1000 times higher than the IMAP TV.
f) In the Eastern Mediterranean 44% of monitored stations exceed the bad class with concentrations more than 1000 times the TV and are classified as 'very bad'.
g) In the Western Mediterranean only 2 % of stations are found above 1000xTV.
h) From the recorded floating microplastics, Sheets (39%) have been found to be predominant, followed by Filaments (29%), Pellets (21%), Fragments (5%), Foam (5%), and Granules (1%).
i) The ACCOBAMS Survey Initiative (ASI), was the first international basin-wide survey of the Mediterranean Sea for floating mega-litter (>30cm) following an opportunistic approach while the main interest was to provide estimations about the mega-fauna.
j) ACCOBAMS (ASI) has developed a well-elaborated monitoring protocol for monitoring mega-litter through aerial surveys.
k) Some 41,000 floating mega-litter items were recorded in total during the ASI, with an average encounter rate of 0.8 mega-litter per km, ranging between 0 and 111 litter per km.

l) The total number of floating mega-litter was estimated at 2.9 million items (80% confidence interval was 2.7 to 3.1 million) and average density 1.5±0.1 items per km^2.
m) More than two thirds of the mega-litter recorded were identified as plastics (68.5%; e.g., plastic bags, bottles, tarpaulins, palettes, inflatable beach toys, etc.), while 1.7% were fishery debris and 1.9% were anthropogenic wood-trash. The remaining quarter (27.9%) was anthropogenic mega-debris of an undetermined nature.
n) During the ASI, only 20% of the Mediterranean was free of floating mega-debris.
o) Many endangered or vulnerable species, some of them endemic to the area, are at risk of entanglement or of ingesting debris.

B. Seafloor Marine litter:

a) Concentrations of seafloor marine litter are highly variable fluctuating between 0 and 28,228 items /km^2.
b) The average seafloor litter concentration collected by seafloor trawling on the Mediterranean is found equal to 570± 2,588items/km^2.
c) The majority (88%) of the seafloor stations monitored do not achieve GES, and most of them fall into the poor and bas categories (23 % and 53 % respectively) (i.e., seafloor litter concentrations are up to five times higher than the TV).
d) The Western Mediterranean highly appears affected by seafloor marine litter since all stations monitored (100%) are classified in the nonGES category.
e) The Central Mediterranean is highly affected by seafloor litter with 81 % of stations monitored classified under nonGES classes.
f) In the Adriatic sub-region 65% of the stations monitored falling into the nonGES class with the highest percentage of seafloor stations to be classified under the moderate (35%) and poor (26 %) classes.
g) The Eastern Mediterranean subregion is also affected by seafloor litter, since 68 % of the monitored stations are classified under nonGES class, with more or less equal share among the 3 nonGES classes.
h) An uneven spatial distribution of stations within each sub-region is evident in the present study, for example the CEN is covered only by Malta and Tunisia.
i) Fisheries-related items comprise up to 10% of the total recorded marine litter.
j) 3 items are the most commonly recorded among fisheries related items : (i) Synthetic ropes/strapping bands (L1i) with 39%; Fishing nets (polymers) (L1f) with 27%; and Fishing lines (polymers) (L1g) with 25%.
k) Another set of 3 items are recorded in minor percentages: (i) Natural fishing ropes (L5c) with 6%; (ii) Other synthetic fishing related” (L1h) with 2%; and (iii) Fishing related (hooks, spears, etc.) (L3f) with 1%.
l) Interesting results have been obtained from limited scuba-dive surveys (972,500 ± 801,311 items/km^2) and IMAP should further provide additional support and guidance to further expand this monitoring component for marine litter (IMAP EO10).

Measures and actions required to achieve GES

846. The legally binding Regional Plan on Marine Litter Management in the Mediterranean was introduced in 2013 (Decision IG.21/7, COP18); entered into force in 2014; and updated in COP 22 (Antalya, Turkey, 7-10 December 2022; Decision IG.25/9) to further reflect global and regional agenda relevant to marine litter management.

847. The Updated Regional Plan on Marine Litter Management includes stronger links to global agenda, i.e. the United Nations Environmental Assembly (UNEA) Resolutions on marine plastic litter, microplastics and single-use plastic products pollution; UNEP marine litter partnerships and initiatives like the Global Partnership on Marine Litter (GPML) and the Clean Seas Campaign; the IMO Action Plan to Address Marine Plastic Litter from Ships; the Basel Convention - Plastic Waste Partnership (PWP); as well as the EU Policies on Marine Litter and Plastic.

848. The Updated Regional Plan on Marine Litter Management:

a. Introduces a number of new, region-wide agreed definitions on marine litter (e.g., ALDFG, BAT-BEP, Circular Economy, EPR, Fishing Gear, Lightweight plastic carrier bags, monitoring, micro-litter/plastics, primary/secondary microplastics, SUPs etc.);
b. Expands the scope of measures in four key areas: (i) economic instruments, (ii) circular economy of plastics, (iii) land-based and (iv) sea-based sources of marine litter;
c. Introduces ambitious, amended targets for plastic waste and microplastics; and
d. Introduces two new appendices with lists on (i) single-use-plastic items, and (ii) chemical additives of concern used in plastic production further to the Stockholm Convention.

849. The Regional Plan also incorporates a number of additional, important principles and measures, including:

- Phasing out single-use plastic items and promote reuse options;
- Setting targets for plastic recycling and other waste items;
- Introducing economic instruments such as environmental taxes, bans and design requirements, and Extended Producer Responsibility (EPR) schemes (land and sea-based sources);
- Promoting new technologies and measures for the removal of marine litter;
- Applying prevention measures to achieve a circular economy for plastics addressing the whole life cycle of plastics;
- Reducing packaging;
- Promoting voluntary agreements with industry;
- Integrating the informal sector into regulated waste collection and recycling schemes;
- Strengthening measures related to Sustainable Consumption and Production (SCP) programmes;
- Phasing-out chemical additives used in plastic products, in particular those under Stockholm Convention;
- Introducing concrete measures on microplastics reduction;
- Implementing measures to prevent and reduce marine litter in Marine Protected Areas (MPAs);
- Minimizing the input of marine litter associated with fisheries and aquaculture;
- Establishing national marine litter monitoring programmes as part of IMAP EO10, including on riverine inputs and wastewater treatment plants (WWTP);
- Enhancing public awareness and education; and
- Introducing measures to Specially Protected Areas of Mediterranean Importance in the (SPAMIs) to combat marine litter.

850. Monitoring and assessment should be further linked and connected with the implementation of measures. Specific and well-elaborated findings can provide the basis for the implementation of targeted measures.

851. The presence of marine litter in the Mediterranean is variable, however tackling few items may yield promising and encouraging results pertinent to the health status of the marine and coastal environment.

852. Based on the assessment findings for both IMAP CI22 and CI23, most of the stations are under nonGES status and urgent action is required.

853. Cigarette butts and filters are predominant in the Mediterranean beaches and primarily require a behavioral change along with the implementation of strong anti-smoking policies and measures, including a strengthen communication campaign linking the damage in human health with the damage in the marine environment. Cigarette filters do not contain only plastic, but also a cocktail of toxic substances (e.g., arsenic, lead, nicotine and pesticides, etc.) for which their effects in the marine biota and the marine environment still are unknown. The engagement of the cigarette companies in this process is of great importance, including their potential inclusion in a "polluters-pay" principle.

854. The vast presence of plastic bottles is documented by the third main item on the Mediterranean beaches, comprising of plastic caps and lids. The introduction of sound alternatives and incentivizing the use of re-use caps could be among the possible options. Strengthening recycling and Extended Producer Responsibility schemes, targeted and tailored to tackle plastic bottles are also part of the solution, including the minimization of the small-sized bottles (<0.5 liters) which are easier to escape in the marine and coastal environment.

855. Microplastics of various types and shapes are escaping into the marine and coastal environment through wastewater treatment plants (WWTP). At the Mediterranean level, the Contracting Parties to the Barcelona Convention in their 22nd COP (Antalya, Turkey, 7-10 December 2021) adopted Decision IG.25/8 related to the Regional Plans on Urban Wastewater Treatment and Sewage Sludge Management in the framework of Article 15 of the Land-based Sources Protocols. Among several measures to ensure their sustainable and safe use and discharge of wastewaters, the regional plan on wastewater treatment addresses for the first time in its scope microplastics. The updated Regional Plan calls for the introduction of emission limit values for emerging pollutants considering the identification of potential microplastic sources and adoption of related policy and methodology further to state of the art on related research on this topic.

856. The Regional Plan on Sewage Sludge Management gives particular attention to the presence and effective management of microplastics on Pharmaceuticals and Personal Care Products (PPCP) (e.g., lotions, soaps, facial and body scrubs and toothpaste) being present in sewage sludge and proposes methods for reduction at the source as provided hereunder:

a) Regulatory approvals for new products potentially harmful to the environment to be introduced for most/all of personal care materials or detergents. However, the said measure may be difficult to be applied for medication products.
b) Education on the correct use of substances containing drugs, and especially the use of the right dose without excess, including ecolabels to raise awareness of ecological impacts of PPCPs.
c) Encouraging the return of unused or expired pharmaceuticals to specific collection points; and
d) Subjecting wastewater originating from pharmaceutical industries, hospitals or healthcare centres to regulations that limit the concentration of organic pollutants in their effluents.

857. Wastewater treatment plants (secondary + tertiary levels of treatment with adequate sludge management) to efficiently remove microplastics from sewage, trapping the particles in the sludge and preventing of entrance into aquatic environments. Treatment plants are essentially taking the microplastics out of the wastewater and concentrating them in the sludge (Corradini et al., 2019).

Therefore, sludge management is of great importance for microplastic removal. Controls should be exercised however on the subsequent use of sludge.

858. Measures that can contribute toward reducing sewage concentrations of microplastics include:

a) Bans on single-use plastics and microplastics in personal care and cosmetic products;
b) Behavior changes and campaigns to reduce the use of such products;
c) Certain textile designs can reduce microfibre generation during washing;
d) Development of household-based systems to prevent microplastics from being released into sewer lines or directly into the environment; and
e) Incineration of sewage sludge to avoid soil and water contamination by microplastics. Care should be exercised however to monitor and regulate pollutants in air emissions with a view to minimise these emissions as much as possible.

859. As rivers in most of the cases is the final repository of litter coming from the various land-based sources the application of measures on land are very relevant for the control and effective management of litter in riverine systems.

860. A Conceptual flow of plastic from production to consumption, waste management and leakage into the environment (i.e., land, rivers and ocean), including possible points of action for policies should be considered. Minimizing leakage on land will subsequently minimize the riverine inputs deriving from wind and rain transportation, as well as from direct dumping and sewerage, and will further reduce the amount of plastics (incl. microplastics) entering the ocean.

861. The updated Regional Plan on Marine Litter Management in the Mediterranean:

a) Takes into consideration the occurrence and extent of marine litter accumulations, and calls for identification and assessment by the year 2025, on the impacts of these accumulations in upstream regions of rivers and their tributaries, and to apply measures to prevent or reduce their leakage into the Mediterranean, particularly during flood seasons and other extreme weather events;
b) Envisages the application of enforcement measures to prevent, reduce and sanction illegal dumping and illegal littering in accordance with national and regional legislation, in particular on coastal zones and rivers, in the areas of application of the Regional Plan; and
c) Couples the aforementioned provisions with aspects related to monitoring of marine litter originating from riverine inputs.

862. Storm water is an important contributor of riverine inputs of marine litter especially for the Mediterranean where seasonal, on several occasions extreme, weather events take place such as flash floods. And with the impacts of climate change, this aspect is becoming more significant as the Mediterranean is experiencing rainfalls, more intense and in shorter periods of time, the impact of which is less infiltration into the ground and more surface run-off.

863. A more systematic approach should be also offered when developing urban storm water management plans. Those plans typically address how urban storm water quantity and quality should be managed to protect ecological, social/cultural, and economic values. Urban storm water management plans are used to assist decision making to ensure that remedial measures (structural and non-structural) in existing developed areas are undertaken in a cost-effective, integrated and coordinated manner, and that decisions in relation to areas of new expansion (including redevelopment) are made with the implications for storm water impacts taken into account in order to achieve the quality goals for water bodies.

864. Urban storm water management (USWM) plans have been developed to a various extent across the Mediterranean. This ranges from major cities having USWM Plans to smaller municipalities where such plans are non-existent, or at best are under preparation. USWM Plans in the Mediterranean mostly include only flooding control segments, i.e., no pollution control, while segments on risk management and information on location of land-based activities are covered only on a basic level. In some cases, some elements of the USWM plans are incorporated into Urban Plans but only to a limited extent, such as collection systems layout, principles and recommended techniques regarding flood and pollution control management, as well as principles on how to achieve environmental water quality goals for water bodies.

865. The Establishment of separate collection systems for surface water run-off should be also promoted. A separate storm water sewer system is a collection of structures, including retention basins, ditches, roadside inlets and underground pipes, designed to gather storm water from built-up areas and discharge it, with or without treatment, into local water bodies, e.g., streams, rivers, coastal waters (National Research Council. 2009). Separate collection prevents the overflow of sewer systems and treatment stations during rainy periods and the mixing of the relatively little polluted surface run-off with chemical and microbial pollutants from municipal wastewater. Separate storm water systems allow for design of sewers and treatment plants that consider the volume of the wastewater only, while surface run-off and rainwater can be reused after a simplified treatment (e.g., for landscaping or agriculture).

866. Measures for combined collection systems are of great importance. Combined collection systems are sewer networks designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. Most of the time, combined sewer systems transport all of their wastewater to a wastewater treatment plant (WWTP) where it is treated and then discharged to a water body (National Research Council, 2009). During periods of heavy rainfall, however, the wastewater volume in a combined collection system can exceed the capacity of the sewer system or the treatment facilities, for which reason the combined collection systems are designed to overflow occasionally and discharge excess wastewater directly into nearby streams, flood drainage canals rivers, lakes or coastal waters.

867. A variety of additional measures could be also proposed with the aim of reducing the occurrence and impacts of storm water overflows and associated floods and pollution (Milieu, 2016), including the following:

a) End-of-pipe solutions such as building water storage capacity to optimising the use of the wastewater treatment plant and sewer system (e.g., using sewer networks for additional storage and optimising pumping operations);
b) Reduction of clean storm water entering a sewer system (e.g., de-connecting impervious areas from combined sewer systems);
c) Alternative green infrastructures as potentially cost-effective measures to reduce storm water (e.g., retention basins, infiltration trenches).

868. In addition, it would be valuable to close the knowledge gaps by gathering comparable information across the Mediterranean on the extent of storm water overflows from combined collection systems, which should include inventory of the locations of overflow structures, inventory of functioning of the overflow structures, inventory of sewage storage capacity structures (e.g. starting with agglomerations of more than 100,000 p.e.), with the aim of acquiring better understanding of the occurrence of storm water overflows and their impacts on the quality of receiving water bodies.

869. Promoting Sustainable Urban Drainage Systems (SUDS) is another measure which aims to minimize the impervious cover by promoting infiltration, ponding, and harvesting of storm water runoff. Furthermore, in this decentralized management approach, storm water runoff and pollution are primarily controlled by measures located near the source to strive towards well-integrated measures that perform multiple functions, including flood protection, pollution removal and groundwater recharge, as well as recreation, biodiversity and urban aesthetics.

870. The Fisheries sector, including both fishing and aquaculture activities have a contribution on marine litter generation.

871. In the past years, considerable attention has been brought to the scale of abandoned, lost and discarded fishing gear (ALDFG), the impacts on the marine environment through ghost fishing, and possible measures for reducing its occurrence like the FAO Voluntary Guidelines on the Marking of Fishing Gear. Given that aquaculture now supplies over half the seafood produced worldwide, it is considered of great importance that this issue is also examined at farm level, especially given the continued expansion of global aquaculture development (Huntington, 2019).

872. Measures targeting specifically on aquaculture farming should focus on overall recommendations and to propose measures scoping to reduce marine litter from aquaculture, block the relevant pathways to the marine environment and reduce the contribution to marine plastic pollution by aquaculture. Moreover, a second level of measures should be introduced touching upon the specific requirements and standards to be applied on a mandatory basis for aquaculture practices.

873. Measures that can contribute to reduced generation of marine litter from aquaculture include the following:

a) Replace to the extent possible plastic infrastructure components with other of physical nature.
b) Use higher density plastics (e.g., Polyethylene terephthalate (PET) or Ultra-high molecular weight polyethylene (UHMWPE)) which are more resistant to fragmentation, UV-irradiation.
c) Reduce single-use plastic with the introduction of relevant alternatives and invest in developing recovery, cleaning and re-distribution schemes.
d) Minimize the use of plastic types with low levels of recyclability.
e) Reduce to the extent possible the use of equipment consisting of different types of plastic (i.e., different lifespan and different approach for collection and recycling).
f) Ensure to the extent possible that all packaging is reusable or recyclable.
g) Reduce to the extent possible packaging and over-packaging to minimize packaging waste.
h) Develop awareness raising trainings for aquaculture staff similar to those offered from the shipping sector (e.g., HELMEPA).
i) Reduce to the extent possible the use of single-use plastics and establish relevant policies;
j) Minimize the use of plastic types with low levels of recyclability;
k) Reduce to the extent possible the use of equipment consisting of different types of plastic (i.e., different lifespan and different approach for collection and recycling).

874. Moreover, aquaculture should ideally apply a circular approach planning considering the whole life cycle of the used equipment. High procurement standards should be introduced, especially when dealing with purchasing of equipment, packaging, polystyrene boxes and other types of consumables and equipment.

875. With regards to plastic pollution, the updated Regional Plan on Marine Litter Management calls for:

a) Innovative business practices to prevent plastic waste generation in line with the Extended Producer Responsibility approach through the establishment of Deposit/Refund System for expandable polystyrene boxes in the commercial and recreational fishing and aquaculture sectors; and
b) Prevention measures aiming to achieve, to the extent possible, a circular economy for plastics (Regulate the use of primary microplastics, Implement Sustainable Procurement Policies, Establish voluntary agreements, Establish procedures and manufacturing methodologies, Identify single-use plastic products, Set targets to phase out production and use, increase the reuse and recycling, Phase-out chemical additives used in plastic products, Promote the use of recycled plastics, substitute plastics, Implement standards for product labelling, Establish

dedicated collection and recycling schemes, minimize the amount of marine litter associated with fishing/aquaculture, Scale-up and replicate sustainable models).

876. During the 21st Meeting of the Contracting Parties to the Barcelona Convention, Decision IG.24/14 was adopted. It provides a clear mandate for the development/update of technical guidelines addressing estimation techniques for pollutant releases from agriculture, catchments runoff and aquaculture in the Mediterranean. The proposed techniques and guidelines constitute effective tools that would enable the generation of compatible data to evaluate the effectiveness of adopted measures in the National Action Plans (NAPs) and in the Regional Plan for Aquaculture Management in the Mediterranean.

877. Shipping is particularly evident in the Mediterranean, thus contribution proportionally to waste and marine litter generation. Although most of the marine litter in the Mediterranean region originates from land-based sources, studies confirmed that ship-originated litter are found at sites under major shipping routes and lost fishing gear are also recognized as an important source of marine litter in the region (UNEP/MAP 2015).

878. While the international maritime organization IMO adopted in 1973 the International Convention for the Prevention of Pollution from Ships (MARPOL) which is the main international convention covering the prevention of pollution of the marine environment by ships from operational and accidental causes. The MARPOL convention under its Annex IV Prevention of pollution by sewage from ships present requirement to control the pollution of sewage into the sea.

879. MARPOL Annex V seeks to eliminate and reduce the amount of garbage being discharged into the sea from ships, which means all ships operating in the marine environment, from merchant ships to fixed or floating platforms to non-commercial ships like pleasure crafts and yachts must follow the same regulation.

880. The IMO's Marine Environment Protection Committee (MEPC) recently adopted its strategy to address marine plastic litter from ships with substantial actions to reduce marine plastic litter from, fishing vessels; shipping, and improve the effectiveness of port reception and facilities and treatment in reducing marine plastic litter. The strategy also aims to achieve further outcomes, including enhanced public awareness, education and seafarer training; improved understanding of the contribution of ships to marine plastic litter; improve the understanding of the regulatory framework associated with marine plastic litter from ships; strengthened international cooperation; targeted technical cooperation and capacity-building.

881. Under the Mediterranean Strategy for the Prevention of, Preparedness, and Response to Marine Pollution from Ships (2022-2031) in its common strategy also addresses the prevention and reduction of litter, in particular plastics entering the marine environment from ships thought the fully implementation of the IMO Action Plan and the UNEP/MAP updated Regional Plan on Marine Litter Management in the Mediterranean.

882. Through the updated Regional Plan on Marine Litter Management in the Mediterranean, the Contracting Parties of the Barcelona Convention have set measures and a timetable to be implemented in relation to sea-based sources of marine litter, especially related to the establishment of best practices to create incentives for fishing vessels to retrieve derelict fishing gear, collect other items of marine litter, and deliver it to port reception facilities. It also presents incentives to the delivering of waste in port reception facilities such as the non-special fee system.

883. Under the Prevention and Emergency Protocol of the Barcelona Convention in its article 14 relevant to the provision of adequate Port Reception Facilities, the Contracting Parties to the Barcelona Convention are invited to explore ways to charge reasonable costs for the use of Port facilities.

884. When facing plastic pollution at large, the following measures or aspects can be also considered:

a) Introducing a number of prevention elements/measures at regional, sub-regional and national levels, having a focus to minimize the production, use and consumption of plastics (especially of single-use plastics), as well as to minimize their leakage into the marine and coastal environment (so, before the introduction of effect/impact);
b) Revising of the current legal framework of the Mediterranean Countries at the National level (e.g., updated/new National Action Plans and/or Programmes of Measures) and development of data base on the production and consumption of plastic products at the national level;
c) Development of compulsory, legally binging EPR systems for priority products (e.g., food and beverage packaging);
d) Progressive minimum recycled content in priority products;
e) Reduction targets in production and consumption of virgin plastic feedstock;
f) Promote behavioral change for achieving sustainable consumption patterns and increase rates of separation, collection, and recycling;
g) Develop mandatory requirements with the industry with a focus on specific, priority single-use plastic items (e.g., information on the composition of plastics on the market and even standards to ease the recycling of certain single-use plastic products);
h) Strengthen the acceptance criteria of the plastics for admission to the organized landfill, facilitating the recycling, reducing plastic disposal at organized landfills, and solicitating and promoting the separation, and recycling at sub-national level (i.e., municipalities, cities, or agglomerations);
i) Minimize the introduction of incentivized interventions, and rather focus on structural changes at governance/national administration, industry, and society levels.

2.2 Biodiversity and Fisheries

2.2.1 EO1 Biodiversity

Common Indicators 1 (Habitat distributional range) & 2 (Condition of the habitat's typical species and communities)

885. The Mediterranean continental shelf possesses rich and important habitats. However, The anthropogenic pressure exerted on the marine and coastal habitats of the Mediterranean region led during the past decades to a substantive decrease in the extent and conditions of most of the key habitats of the region. Pollution, fisheries, urbanisation and invasive alien species (increasing temperature and UV, and acidification) are the most frequently cited pressures in the Red List of European Habitats (Gubbay et. al., 2016) affecting the distribution range and the conditions of habitats. Climate change is also affecting some mediolittoral and infralittoral habitats, especially by altering the thermal structure of the water column, with extensive mass mortalities (Rivette et al., 2014). The proliferation of coastal and marine infrastructures, such as breakwaters, ports, seawalls and offshore installations call for special concern, all being associated with loss of natural habitats and alteration of hydrographic conditions (Perkol-Finkel et al., 2012). New strategies aimed at elevating the ecological and biological value of coastal infrastructures are urgent.

886. According to available data, habitat destruction is one of the most pervasive threats to the diversity, structure, and functioning of Mediterranean marine coastal ecosystems and to the goods and services they provide.

887. The Alboran Sea, the Gulf of Lyons, the Sicily Channel and Tunisian Plateau, the Adriatic Sea, off the coasts of Egypt and Israel, along the coasts of Turkey are highly impacted. Low cumulative human impacts were found in offshore areas, and in several small coastal areas of some countries. These areas represent important opportunities for conservation aimed at preventing future degradation.

Assessment methodology for CI-1 (Habitat Distribution)

This assessment builds upon the 2017 MED QSR chapter on benthic habitats, aiming to provide a more data-driven assessment of benthic habitats across the Mediterranean Sea region, based on available datasets.

The assessment addresses both Ecological Objective 1 (benthic habitats) and Ecological Objective 6 (sea-floor integrity), following a similar approach based on Common Indicator 1 (CI-1 habitat distribution) and Common Indicator 2 (CI-2 habitat condition) of the Integrated Monitoring and Assessment Programme (IMAP).

Assessment of CI-1 and CI-2 is presented, to the extent possible, on the basis of the datasets above. For CI-2 the pressure information is used as a proxy assessment for the possible extent of impacts on habitat condition.

Narratives on the status of benthic habitats according to the sections of the QSR template are provided, drawing from recent reports, including ETC/ICM (Korpinen et al., 2019) and UNEP/MAP-SPA/RAC (2022) and from the above analyses.

The assessment of benthic habitats under EO1 and CI-1 and CI-2 is not yet well established. The approach presented here, extending to broad habitat types under EO6, aims to provide a more holistic assessment of the Mediterranean seabed and the pressures upon it, whilst acknowledging that further methodological development is needed in order to provide a full good environmental status (GES) status assessment for seabed habitats.

Key messages (Habitats):

888. The seabed and its benthic habitats are a key component of the Mediterranean's marine ecosystem. It holds a high diversity of marine communities and species and provides a range of essential ecosystem services including provision of seafood, natural coastal protection and carbon sequestration.

889. The seabed is subject to a wide range of anthropogenic pressures, arising from land-based activities which lead to pollution (contaminants, nutrient enrichment, litter) and sea-based activities that cause physical damage and loss of habitat (bottom fishing, mineral extraction, coastal and offshore infrastructure), introduce non-indigenous species, and disrupt the natural carbon cycle.

890. The seabed is under severe pressure in the coastal zone where extensive stretches of coast have lost their natural marine habitat through the building of coastal infrastructure and sea defences. Offshore, down to depths of 1000m, the most wide-spread and extensive damage to seabed habitats comes from bottom fishing using trawls and dredges. Below this depth, these fishing practices are banned, thereby providing protection to sensitive deep-sea habitats throughout the Mediterranean. However, there is increasing evidence of litter from land-based sources accumulating at these depths.

891. Particularly threatened habitats, including coralligenous habitats, maerl/rhodolith habitats and Posidonia oceanica seagrass meadows, and, are now subject to IMAP monitoring programmes under Ecological Objective (EO) 1 (biodiversity). Consideration of the wider sea-floor under EO6 (sea-floor integrity) is less well developed.

892. Given the current level of development of assessment techniques for EO1 and EO6, it is only possible to present a preliminary approach to seabed habitat assessments for the 2023 Med QSR. This is done at a broad scale and with a focus on assessing the extent of pressures, as a proxy for impacts on habitats.

893. A pilot assessment for the Adriatic Sea shows all coastal and offshore habitats are subject to multiple pressures, but habitats in the south which are below 1000m depth are less affected. The most widespread pressure is physical disturbance which, using data at a 10km-by-10km grid resolution, affects 86% of this subregion of which bottom fishing accounts for 83% of the area disturbed.

Good environmental status (GES) assessment for CI-1 (Habitat Distribution)

894. Distribution maps for the three EO1 habitats for which data are being reported under the IMAP monitoring programme are shown with IMAP data reported up to December 2022 (from Israel, Italy, Malta, Slovenia and Spain), as well as data and models from other sources:

a. Coralligenous habitat (Figure 49, Figure 50);
b. Maerl and rhodoliths habitat (Figure 51, Figure 52);
c. Posidonia oceanica meadows (Figure 53, Figure 54).

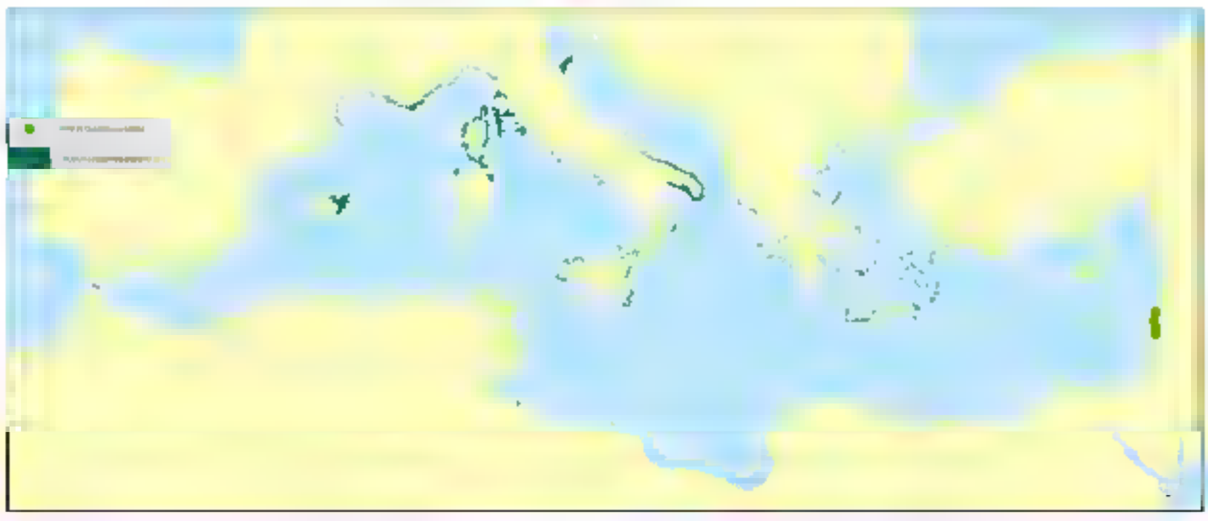


Figure 49: Distribution of Coralligenous habitat in the Mediterranean Sea (from EMODnet (2021) and location of monitoring sites for Coralligenous habitat, based on data reported under IMAP up to December 2022.

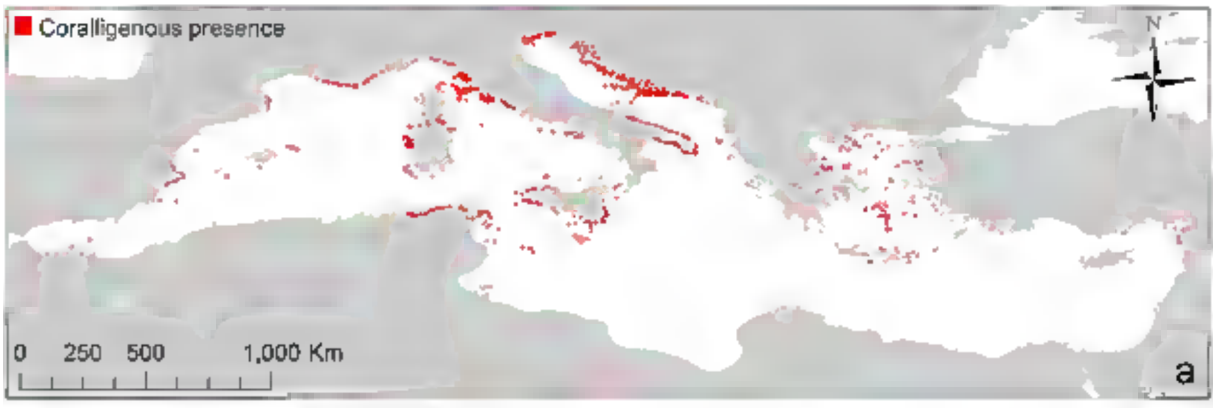


Figure 50: Occurrences of Coralligenous outcrops in the Mediterranean Sea (red areas), based on literature review (from Martin et al., 2014).

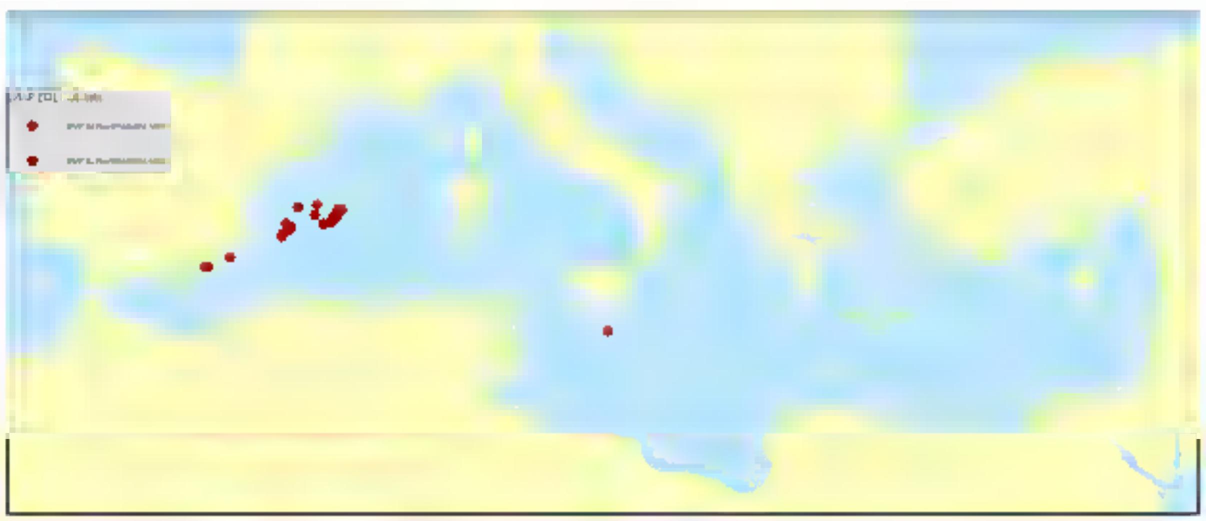


Figure 51: Distribution of maerl and rhodoliths habitat in the Mediterranean Sea, based on data reported under IMAP (up to December 2022).

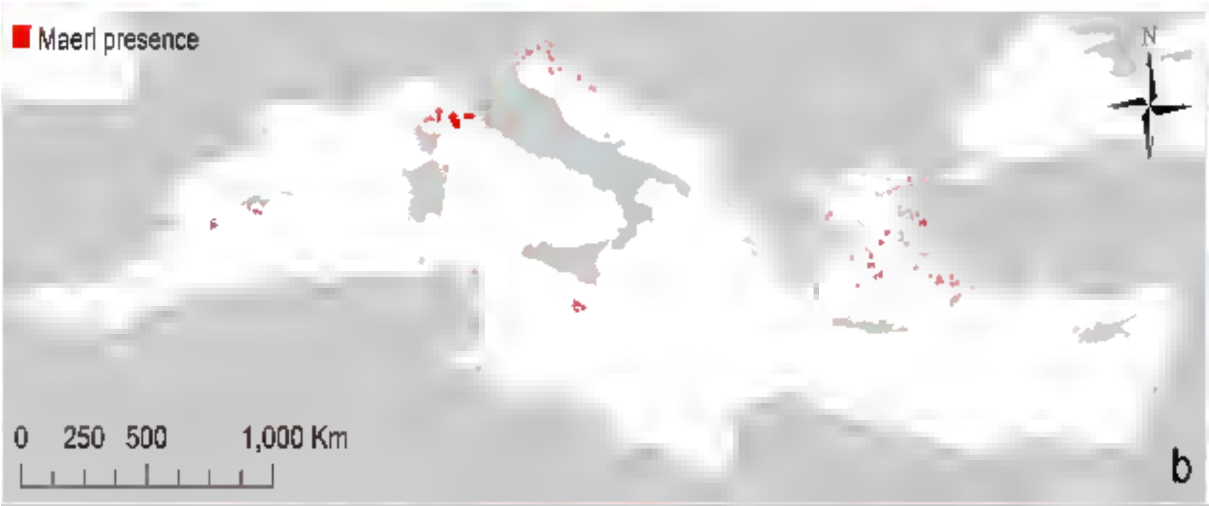


Figure 52: Occurrences of maerl beds in the Mediterranean Sea (red areas), based on a literature review (from Martin et al., 2014).

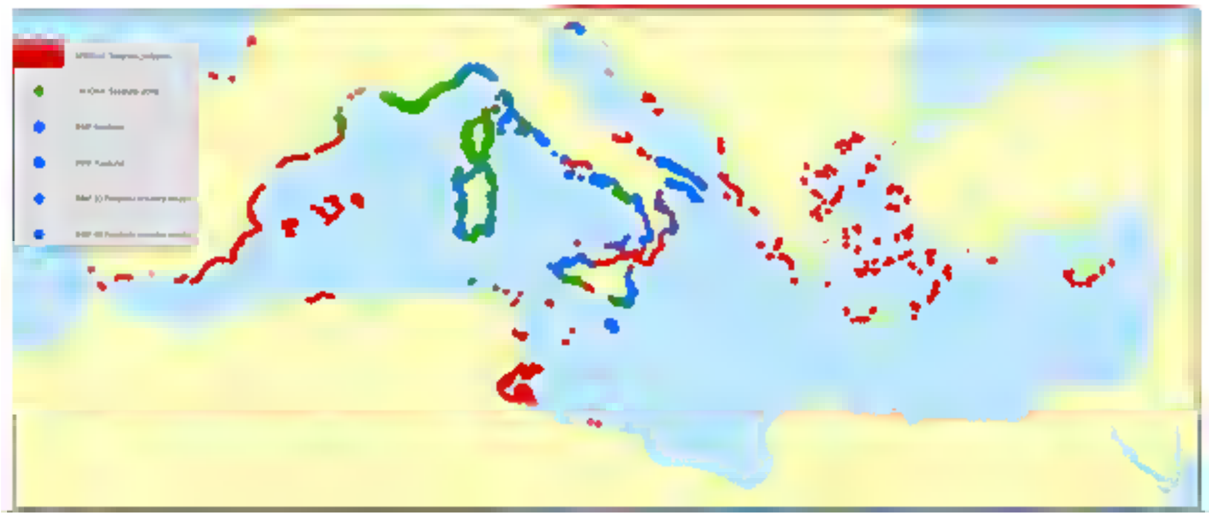


Figure 53: Distribution of *Posidonia oceanica* meadows, based on data reported under IMAP (up to December 2022) and from EMODnet (2021) (data points enlarged to enhance visibility).

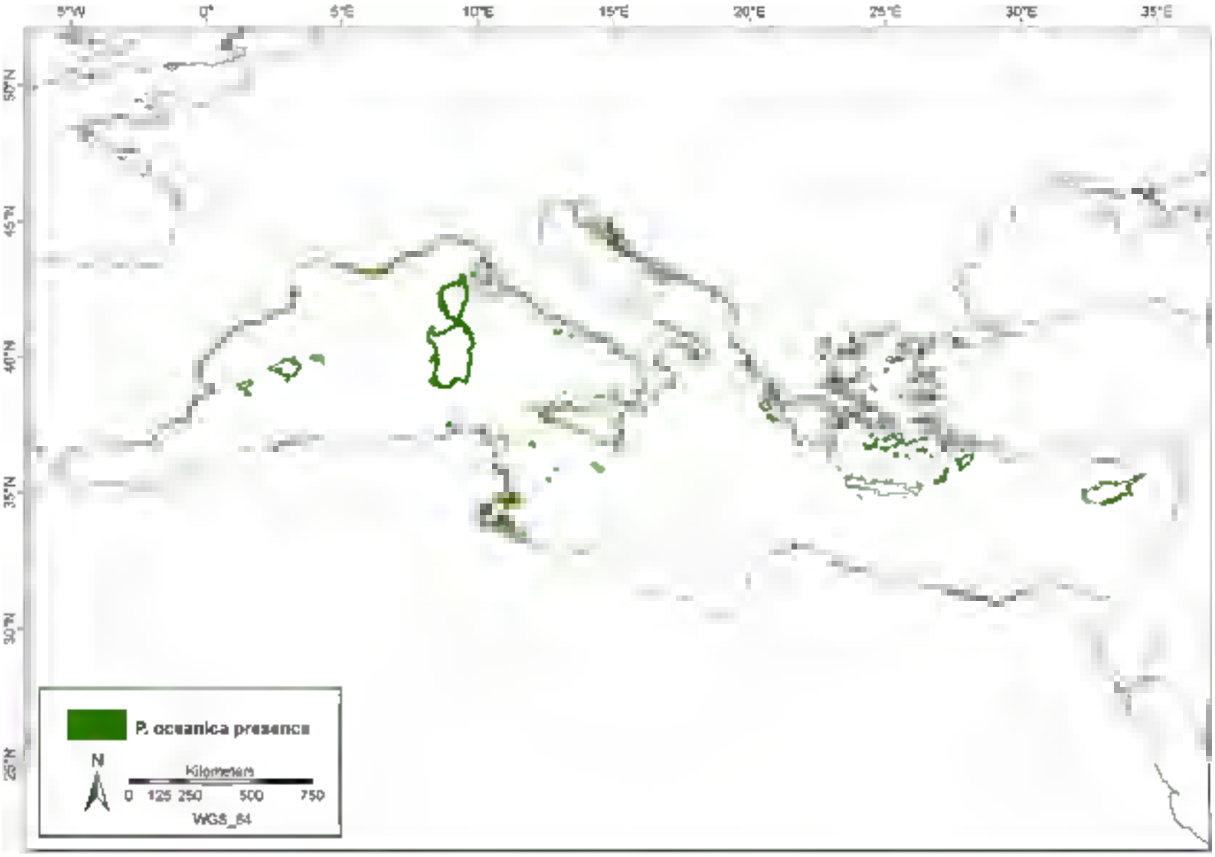


Figure 54: Distribution of Posidonia oceanica meadows in the Mediterranean Sea (green areas) (from Telesca et al., 2015).

Good environmental status (GES) assessment for CI-2 (Habitat Condition)

895. Monitoring methods have been established for three EO1 habitats and Contracting Parties have initiated data flows into the IMAP Info System. The agreed monitoring methods cover a wide range of possible techniques, yielding a variety of data types. The method of assessment of these data, and threshold values, are yet to be agreed under the IMAP. At present, it is therefore not feasible to assess CI-2 for EO1 habitat types. There is, however, a rich scientific literature that describes the state of these habitats and provides evidence of poor state in multiple locations across the region.

Key findings for Common Indicator CI-1 (Habitat Distribution)

896. The distributional range of broad and fine habitat types is considered to generally be in line with prevailing physiographic, geographic and climatic conditions. As the habitats are generally distributed throughout the Mediterranean (north to south, east to west), it is considered unlikely that distributional range will vary at the Mediterranean Sea scale.

897. All habitats may be subject to habitat loss; this is more pronounced in the coastal zone, due to the greater intensity of coastal infrastructures and sea defences; habitat loss is of particular concern for specific habitats under EO1. However, persistent use of bottom-contacting fishing gears can also lead to habitat loss, which may affect extensive areas on the continental shelf and slope.

898. Assessment of CI-1 requires the setting of an ‘extent threshold’ and improvement in the availability of data on habitat extent and loss. A key basis for this is the provision by Contracting Parties of improved habitat maps (both broad- and fine-scale), making these available for compilation at Mediterranean-region scale (broad habitat maps via EMODnet, other habitat types via the IMAP Info System).

Key findings for Common Indicator CI-2 (Habitat Condition)

899. Habitat condition in the Mediterranean Sea region is affected by multiple pressures. There is a greater range of pressures in the narrow coastal zone, whilst the offshore and bathyal zones, down to 1000m depth, are most affected by physical disturbance pressures.

900. Due to narrow nature of the continental shelf across much of the Mediterranean (excepting in the Adriatic Sea and the Strait of Sicily), the bathyal zone, below 1000m depth, and abyssal zone account for a very high proportion of the Mediterranean Sea. In these zones, bottom fishing is banned leading to much lower levels of physical disturbance, although the seabed may be subject to effects of contaminants accumulating in deep-sea sediments and to the accumulation of litter, such as in canyons.

901. Bottom fishing accounts for the vast majority of the physical disturbance, covering up to 90% or more of the seabed (at 10km-by-10km grid cell resolution) in coastal and offshore areas. In some areas this may represent an overestimate of the extent of physical disturbance, due to the grid-cell resolution and use of presence/absence data.

902. Under the IMAP, Contracting Parties have started to submit data on the condition of three specified habitats for EO1; methods for interpreting these data (through specific indicators) and a setting of threshold values are needed. Data across the entire region are needed to enable an assessment of habitat condition against the GES definition for these habitat types in future QSRs.

903. For broad habitat types, improvements in the availability and resolution of pressure data, and in relating these data to the state (condition) of the habitats are needed. This would lead to a more robust assessment than has been presented here in the pilot study.

904. Data on pressures and habitat state are generally more available in northern parts of the Mediterranean, which may incorrectly imply that these areas are in a worse state than southern areas. An effort should therefore be made to ensure an even level of data are available across the region.

Measures and Actions Required to achieve GES (CIs 1 & 2, habitats)

905. Despite many decades of scientific study on particular habitats in specific locations, systematic assessment of seabed habitats, both broad-scale and fine-scale, for the Mediterranean Sea as a whole is generally at an early stage of development. However, the knowledge base and assessment methodologies are under rapid development and offer good prospects for future QSRs.

906. Improvement in the availability of data is needed for:

a. Habitat maps – these provide the fundamental basis for habitat assessments and need to be further improved in quality and accuracy. The EUSeaMap full coverage map of broad habitat types relies on the quality of the underlying input data, especially on seabed substrates, and needs to be improved across much of the region. Countries should be encouraged to contribute mapping data to help improve the region-wide seabed mapping;
b. Activities and pressures – the mapping of pressures, using activities as a basis, provides a good means to assess the wider seabed of the region. These data are generally more easily (and cheaply) collected than direct observational data of the seabed, offering a more cost-effective means to undertake assessments. Further, such data are important for management of pressures (i.e., reducing pressures in areas to help achieved GES) and for marine spatial planning; further data collection is needed, particularly in the south and east, to provide an even coverage across the Mediterranean. The current region-wide datasets of activities and pressures (from the

EEA/ETC-ICM) are at a 10km-by-10km grid resolution – for use in relation to seabed assessments, the data need to be prepared at a finer resolution;

c. Monitoring data on the state of the seabed – the traditional collection of direct observations of the seabed (e.g., through video and sampling) remains an important aspect of data collection programmes, providing a means to validate pressure data to assess seabed habitat condition. Monitoring programmes are costly and need to be focused on the needs of assessment and measures to ensure good value. To facilitate pan-regional assessments, the monitoring data need to be compatible between countries, following specified data standards; further data collection is needed, particularly in the south and east, to provide an even coverage across the Mediterranean;
d. Pressure-state interactions – there is continued need for study of pressure-state interactions, both at research level and through state assessments, to improve confidence in use of pressure data (such as a proxy for broad-scale state assessments);
e. Climate change – the effects of climate change on the seabed and its communities need to be better understood; of particular importance is assessment of the carbon storage capacity of marine habitats and the contribution this makes to mitigation of climate change effects; the importance of shallow vegetated habitats, such as Posidonia oceanica meadows, for blue carbon is often highlighted, but the carbon sequestration capacity of the much more extensive soft sediment habitats of the shelf zone and its disruption by physical disturbance pressures is ultimately a more important knowledge gap;
f. Assessment methods – further work is needed to develop specific indicators (or test existing indicators available in other regions) for use with the monitoring data, and to bring the assessment methods to a fully operational level. Based on these methods, Contracting Parties need to agree threshold values to provide a clear means to assess the extent to which GES has been achieved;
g. Assessment results – the availability of seabed assessment results, including visualisation of the extent of GES in each part of the region, provides an important output that demonstrates the work of the IMAP and Contracting Parties, stimulates improvements and helps direct actions towards achieving GES.

Common Indicators 3, 4 and 5 (Bird species)

907. Seabirds as a group occur in all seas and oceans worldwide. In the Mediterranean, similar to other taxonomic groups, the endemism rate for seabirds is high with various endemic or near-endemic taxa at a species or subspecies level. In addition to their ecological importance, the role of seabirds as potential indicators of marine conditions is widely acknowledged.

908. Nevertheless, despite the importance of seabirds, the most important current challenge is to ensure the survival and improve the status of the many seabird species which are already globally threatened with extinction and to maintain the remainder in favourable conservation status. Indeed, seabirds are among the most threatened bird groups globally. They are all endangered by a number of threats, including contamination by oil pollutants, direct and indirect depletion of food resources, non-sustainable forms of tourism, disturbance, direct persecution including illegal hunting and the use of poison, mortality from bycatch, wind farms, loss of habitats, degradation of habitat, introduction of and predation by alien species as well as climate change.

Assessment methodology for CI3-CI5 of EO1 regarding seabirds

For the current assessment, the reporting and processing is not yet carried out through the IMAP Info System. Thus, for CI3-CI5 of EO1 regarding seabirds, the assessment for the 2023 MED QSR is mainly based on national monitoring datasets, submitted to SPA/RAC by the CPs' focal points. Datasets for at least some of the Common Indicators and some of the 11 indicator species have been received from a list of CPs. Datasets provided by the CPs' focal points were complemented with data from additional sources where available. The following additional data sources were utilised:

- Wetland International - International Winter Census (IWC) data: Datasets of IWC midwinter counts collected during the current assessment cycle were requested from Wetland International for all CPs.
- Birdlife International - Seabird Tracking Database: Datasets of tracked individuals of indicator species in the region were requested from BirdLife International repository.
- Experts on indicator species in the region: Additional information was received from experts of specific indicator
- Published reports on the topic containing relevant information and data concerning the current assessment cycle for specific countries, subregions, or the entire region.

Where available, GES assessments were adopted from national assessments carried out by the CPs. Otherwise, where data quality permitted, evidence-based GES assessments are carried out using quantitative monitoring data collected by each CP during the current assessment cycle. Only if/where it is believed that data collected by the CPs are not sufficient (based on data quality, methodologies used and/or representativeness), quantitative monitoring data collected by other entities were added for the GES assessment. Data is integrated for the GES assessment, creating the basis of the 2023 MED QSR.

For each CI, indicator species, and CP (and stage were relevant, e.g., breeding versus non-breeding), GES is assessed separately, using the methodologies outlined in the document "*Monitoring and Assessment Scales, Assessment Criteria, Thresholds and Baseline Values for the IMAP Common Indicators 3, 4 and 5 related to sea birds*" (UNEP/MED WG.521/Inf.7). GES is presented in a simplified traffic-light system approach (see Tables 13-17). Data from complete assessments or from sub-samples that are deemed representative are evaluated against baselines (in most cases: modern baselines collected in previous assessment cycles) using threshold values.

Key Messages (Bird species)

909. Within the Ecological Objective EO1 seabirds *sensu lato* form a crucial component of the region's marine biodiversity and ecosystem with many of the relevant taxa being endemic or near endemic in the Mediterranean. Mostly situated on top of marine food webs, these highly mobile organisms come to land to breed, thus contributing to nutrient exchange between marine and coastal areas, by linking sea and land.

910. Facing multiple pressures at land and at sea, seabirds from different functional ecological groups in the region act as indicators and serve as sentinels for the health of the Mediterranean Ecosystem.

911. The integrated Good Environmental Status (GES) of EO1 of three Common Indicators related to seabirds (CI3-CI5) reveals that for many populations of various species GES is reached, when taking a modern baseline approach. However, the data quality currently prevents a truly quantitative integrated GES assessment across the entire region. Furthermore, specifically some of the endemic taxa which are of conservation concern, currently appear to fail to reach GES targets, at least in some of the CIs.

912. Closing data gaps, harmonising data collection and monitoring programs and further implementing conservation actions within the Marine Protected Areas (MPA) network that are providing promising results, are important steps for successfully assessing GES and reaching set targets across the region in the near future.

Good environmental status (GES) / alternative assessment (CIs 3, 4 and 5 for Bird species)

913. Based on the monitoring data received at the country level for focal species, GES assessment was carried out for a total of 11 species from six functional groups, for three CIs and four subregions. The detailed results of species, CI and subregion-based analysis are given in the following subsections and a summary of these results are provided in Table 28 to
914. Table *32*.

915. The eleven species considered for the assessment are:

- ✓ Osprey *Pandion haliaetus*
- ✓ Kentish Plover *Charadrius alexandrines*
- ✓ Mediterranean Shag *Gulosus aristotelis desmarestii*
- ✓ Audouin's Gull *Ichthyaetus audouinii*
- ✓ Slender-billed Gull *Chroicocephalus genei*
- ✓ Lesser-crested Tern *Thalasseus bengalensis emigrates*
- ✓ Sandwich Tern *Thalasseus sandvicensis*
- ✓ Mediterranean Storm-petrel *Hydrobates pelagicus melitensis*
- ✓ Scopoli's Shearwater *Calonectris Diomedea*
- ✓ Yelkouan Shearwater *Puffinus yelkouan*
- ✓ Balearic Shearwater *Puffinus mauretanicus*

Table 28: :GES Assessment for CI3. OSPR: Osprey, KEPL: Kentish Plover, MESH: Mediterranean Shag, AUGU: Audouin's Gull, SBGU: Slender-billed Gull, LCTE: Lesser Crested Tern, SATE: Sandwich Tern, MESP: Mediterranean Storm-petrel, SCSH: Scopoli's Shearwater, YESH: Yelkouan Shearwater, BASH: Balearic Shearwater. B: Breeding, OB: Offshore Breeding. LC: Least Concern, VU: Vulnerable, EN: Endangered, CR: Critically Endangered, E: Endemic or near endemic

GES reached (≥90%) *GES partially reached (≥50%)* *GES partially reached (<50%)* *GES not reached (≤10%)* *Data deficiency*

Common Indicator 3: Species Distributional Range – Breeding Sites and Offshore Breeding Distribution																	
		OSPR	KEPL	MESH	AUGU		SBGU	LCTE	SATE	MESP		SCSH		YESH		BASH	
		EN	LC	LC,E	VU,E		LC	LC,E	LC	LC,E		LC,E		VU,E		CR,E	
		B	**B**	**B**	**B**	**OB**	**B**	**B**	**B**	**B**	**OB**	**B**	**OB**	**B**	**OB**	**B**	**OB**
Adriatic	Albania																
	Croatia																
	Italy																
	Montenegro																
	Slovenia																
Aegean and Levantine Sea	Cyprus																
	Egypt																
	Greece																
	Israel																
	Lebanon																
	Syria																
	Türkiye																
Central and Ionian Sea	Albania																
	Greece																
	Italy																
	Libya																
	Malta																
	Tunisia																
Western Mediterranean	Algeria																
	France																
	Italy																
	Spain																
	Tunisia																
	Morocco																

Table 29: :GES Assessment for CI4. OSPR: Osprey, KEPL: Kentish Plover, MESH: Mediterranean Shag, AUGU: Audouin's Gull, SBGU: Slender-billed Gull, LCTE: Lesser Crested Tern, SATE: Sandwich Tern, MESP: Mediterranean Storm-petrel, SCSH: Scopoli's Shearwater, YESH: Yelkouan Shearwater, BASH: Balearic Shearwater. B: Breeding, OB: Offshore Breeding. LC: Least Concern, VU: Vulnerable, CR: Critically Endangered, E: Endemic or near endemic

GES reached (≥90%) *GES partially reached (≥50%)* *GES partially reached (<50%)* *GES not reached (≤10%)* *Data deficiency*

Common Indicator 4: Species Abundance – Breeding Sites and Offshore Breeding Distribution																	
		OSPR	KEPL	MESH	AUGU		SBGU	LCTE	SATE	MESP		SCSH		YESH		BASH	
		EN	LC	LC,E	VU,E		LC	LC,E	LC	LC,E		LC,E		VU,E		CR,E	
		B	**B**	**B**	**B**	**OB**	**B**	**B**	**B**	**B**	**OB**	**B**	**OB**	**B**	**OB**	**B**	**OB**
Adriatic	Albania																
	Croatia																
	Italy																
	Montenegro																
	Slovenia																
Aegean and Levantine Sea	Cyprus																
	Egypt																
	Greece																
	Israel																
	Lebanon																
	Syria																
	Türkiye																
Central and Ionian Sea	Albania																
	Greece																
	Italy																
	Libya																
	Malta																
	Tunisia																
Western Mediterranean	Algeria																
	France																
	Italy																
	Spain																
	Tunisia																
	Morocco																

Table 30: GES Assessment for CI5. OSPR: Osprey, KEPL: Kentish Plover, MESH: Mediterranean Shag, AUGU: Audouin's Gull, SBGU: Slender-billed Gull, LCTE: Lesser Crested Tern, SATE: Sandwich Tern, MESP: Mediterranean Storm-petrel, SCSH: Scopoli's Shearwater, YESH: Yelkouan Shearwater, BASH: Balearic Shearwater. RS: Reproductive Success, SU: Survival Rate. LC: Least Concern, VU: Vulnerable, CR: Critically Endangered, E: Endemic or near endemic

GES reached (≥90%) *GES partially reached (≥50%)* *GES partially reached (<50%)* *GES not reached (≤10%)* *Data deficiency*

Common Indicator 5: Demography– Breeding Stage

		OSPR		KEPL		MESH		AUGU		SBGU		LCTE		SATE		MESP		SCSH		YESH		BASH	
		EN		LC		LC,E		VU,E		LC		LC,E		LC		LC,E		LC,E		VU,E		CR,E	
		RS	SU	RS	SU	RS	SU	RS	SU	RS	SU	RS	SU	RS	SU	RS	SU	RS	SU	RS	SU	RS	SU
Adriatic	Albania																						
	Croatia																						
	Italy																						
	Montenegro																						
	Slovenia																						
Aegean and Levantine Sea	Cyprus																						
	Egypt																						
	Greece																						
	Israel																						
	Lebanon																						
	Syria																						
	Türkiye																						
Central and Ionian Sea	Albania																						
	Greece																						
	Italy																						
	Libya																						
	Malta																						
	Tunisia																						
Western Mediterranean	Algeria																						
	France																						
	Italy																						
	Spain																						
	Tunisia																						
	Morocco																						

Table 31: GES Assessment for CI3 non-breeding state. OSPR: Osprey, KEPL: Kentish Plover, MESH: Mediterranean Shag, AUGU: Audouin's Gull, SBGU: Slender-billed Gull, LCTE: Lesser Crested Tern, SATE: Sandwich Tern, MESP: Mediterranean Storm-petrel, SCSH: Scopoli's Shearwater, YESH: Yelkouan Shearwater, BASH: Balearic Shearwater. LC: Least Concern, VU: Vulnerable, CR: Critically Endangered, E: Endemic or near endemic

	GES reached (≥90%)		*Data deficiency*

Common Indicator 3: Distributional Range – Non-breeding Stage												
		OSPR	KEPL	MESH	AUGU	SBGU	LCTE	SATE	MESP	SCSH	YESH	BASH
		LC/EN	LC	LC,E	VU,E	LC	LC,E	LC	LC,E	LC,E	VU,E	CR,E
Adriatic	Albania											
	Croatia											
	Italy											
	Montenegro											
	Slovenia											
Aegean and Levantine Sea	Cyprus											
	Egypt											
	Greece											
	Israel											
	Lebanon											
	Syria											
	Türkiye											
Central and Ionian Sea	Albania											
	Greece											
	Italy											
	Libya											
	Malta											
	Tunisia											
Western Mediterranean	Algeria											
	France											
	Italy											
	Spain											
	Tunisia											
	Morocco											

Table 32: GES Assessment for CI4, non-breeding stage. OSPR: Osprey, KEPL: Kentish Plover, MESH: Mediterranean Shag, AUGU: Audouin's Gull, SBGU: Slender-billed Gull, LCTE: Lesser Crested Tern, SATE: Sandwich Tern, MESP: Mediterranean Storm-petrel, SCSH: Scopoli's Shearwater, YESH: Yelkouan Shearwater, BASH: Balearic Shearwater. LC: Least Concern, VU: Vulnerable, CR: Critically Endangered, E: Endemic or near endemic

GES reached (≥90%) *GES partially reached (≥50%)* *GES partially reached <50%)* *GES not reached ≤10%)* *Data deficiency*

Common Indicator 4: Abundance – Non-breeding Stage												
		OSPR	KEPL	MESH	AUGU	SBGU	LCTE	SATE	MESP	SCSH	YESH	BASH
		LC/EN	LC	LC,E	VU,E	LC	LC,E	LC	LC,E	LC,E	VU,E	CR,E
Adriatic	Albania											
	Croatia											
	Italy											
	Montenegro											
	Slovenia											
Aegean and Levantine Sea	Cyprus											
	Egypt											
	Greece											
	Israel											
	Lebanon											
	Syria											
	Türkiye											
Central and Ionian Sea	Albania											
	Greece											
	Italy											
	Libya											
	Malta											
	Tunisia											
Western Mediterranean	Algeria											
	France											
	Italy											
	Spain											
	Tunisia											
	Morocco											

<u>Osprey *Pandion haliaetus*</u>

916. With a close to global distribution range, the Osprey is currently listed as Least Concern by the IUCN with an overall increasing population trend (Birdlife International 2023). However, a regional assessment of breeding raptors across the Mediterranean lists the species as Endangered (Westrip et al. 2022). The status of the Mediterranean Breeding population is used as a reference for the current assessment.

917. The main pressures on the species are believed to be disturbance and loss of nesting habitats due to development and direct persecution (illegal killing). Pollutants and electrocution in powerlines are additional pressures.

<u>Common Indicator 3: Species Distribution Range (Osprey *Pandion haliaetus*)</u>

918. The breeding distribution in the region is restricted to the Western Mediterranean subregion, where the species currently breeds in the CPs Algeria, France (Corsica), Italy, Morocco and Spain (Balearic Islands).

919. The distribution range of the breeding population is assessed as stable (well within the 10% threshold). However, for the species to recover from the current status in the region, an increase in range would be required. Therefore GES is currently not reached. There is no indication for a range shift since the last assessment cycle.

<u>Common Indicator 4: Population abundance of selected species (Osprey *Pandion haliaetus*)</u>
<u>Common Indicator 5: Population Demographic Characteristics (Osprey *Pandion haliaetus*)</u>

922. Adult survival and reproductive success rates of the breeding population in the Western Mediterranean Subregion are utilised to assess GES of CI 5. In France, the annual survival rate has been identified to be at 0.52. The annual reproductive success rate is given as 0.62 for Italy and as 0.72 for France with a baseline of 1.17 given for the latter one (1987-1988). Both adult survival and reproductive success rate appear relatively low. Demographic parameters for Ospreys were not available from other CPs, which will ideally be collected during future assessment cycles to identify if CI 5 reaches GES in the Western Mediterranean.

<u>Kentish Plover *Charadrius alexandrines*</u>

923. CPs holding breeding populations in the Mediterranean are Albania, Algeria, Croatia, Cyprus, Egypt, France, Greece, Israel, Italy, Lebanon, Libya, Morocco, Slovenia, Spain, Tunisia and Türkiye. Due to its large distribution range, the species is globally listed as Least Concern by the IUCN (Birdlife International 2023). However, the population trend is believed to be decreasing both globally and in the region.

924. Main pressures acting on the species in the region are the loss and degradation of coastal habitats, estuaries and wetlands due to intensive developments, disturbance from recreational and economic activities during breeding and problematic species such as feral dogs, crows, foxes and large gulls.

<u>Common Indicator 3: Species Distributional Range (</u>Kentish Plover *Charadrius alexandrinus*)

925. The species distributional range during the current assessment cycle is available for the CPs Albania and Croatia (subregion Adriatic). It is assessed against a modern baseline as being stable (Albania) to increasing (Croatia).

Common Indicator 4: Population abundance (Kentish Plover *Charadrius alexandrinus*)

926. Data on breeding pairs have been provided by Albania, Croatia and Spain. The relative breeding bird abundance is assessed as 1.0 for Albania (361-645bps) and as 0.9-1.0 for Croatia (27-32bps), taking a modern baseline approach. These values indicate that GES is reached locally. The relative breeding population abundance for the Spanish part of the Western Mediterranean is assessed as 0.26, therefore not reaching GES locally. For a successful GES assessment of the species regarding CI 4 in the entire region, CPs would need to provide baseline and current values on the number of breeding pairs.

927. Kentish Plovers are reported to winter regularly in all subregions as revealed by IWC midwinter count data. IWC count data during the current assessment cycle amount to approximately 11.000 individuals wintering annually in the region. To confirm that GES regarding the wintering population is reached, CPs would need to provide baseline values for the Kentish plover wintering populations.

Common Indicator 5: Population Demographic Characteristics (Kentish Plover *Charadrius alexandrinus*)

928. No CP provided data on reproductive success and annual survival rates of Kentish Plovers in the region, thus GES regarding CI 5 could not be assessed.

Mediterranean Shag *Gulosus aristotelis desmarestii*

929. The Mediterranean Shag is a subspecies of the European Shag. It is endemic to the Mediterranean and Black Sea. CPs with breeding populations include Albania, Algeria, Croatia, Cyprus, Egypt, France, Greece, Italy, Libya, Morocco, Spain, Tunisia, and Türkiye. The European Shag is listed as Least Concern by the IUCN (Birdlife International 2023), but with decreasing population numbers.

Common Indicator 3: Species Distributional Range (Mediterranean Shag *Gulosus aristotelis desmarestii*)
Common Indicator 4: Population abundance (Mediterranean Shag *Gulosus aristotelis desmarestii*)

931. The assessment and monitoring of this indicator is mainly aiming at the breeding population of the species in the region. Data on the number of breeding pairs against a modern baseline have been provided by Albania and Croatia (Adriatic subregion) and by Cyprus (Aegean-Levantine Sea), all with stable population abundance (relative population abundance ~ 1.0). The at-sea population abundance of the species in Cyprus is assessed as stable.

932. Data from the Western Mediterranean subregion have been provided by France and Spain, both showing a decline in population abundance as compared to the baseline. The relative population abundance of the French population was assessed at 0.8, still above the defined threshold value. However, the relative population abundance of the Spanish population was assessed at 0.31, well below the threshold value (>0.7). Therefore, it appears likely that the GES in the entire Western Mediterranean subregion is currently not reached.

Common Indicator 5: Population Demographic Characteristics (Mediterranean Shag *Gulosus aristotelis desmarestii*)

933. No CP provided data on reproductive success and annual survival rates of Mediterranean Shags in the region. Greece provided baseline levels for hatching and fledgling success. Overall GES regarding CI 5 could not be assessed.

<u>Audouin's Gull *Ichthyaetus audouinii*</u>

934. Part of the functional ecological group Offshore surface-feeders, the Audouin's Gull is near endemic in the region, with approximately 90% of the 33000-46000 mature individuals breeding in the Mediterranean. CPs with breeding populations include Spain, France, Morocco, Algeria, Tunisia, Italy, Croatia, Greece, Cyprus and Türkiye. Due to a recent population decline the species is currently listed as Vulnerable by the IUCN (Birdlife International 2023).

935. It is a widely marine gull species, foraging mainly on fish including fisheries discards. Audouin's Gulls nest in colonies on rocky cliffs, offshore islands and islets, saltmarshes, and sandy peninsulas. Audouin's Gulls lay three to four eggs per season.

<u>Common Indicator 3: Species Distributional Range (Audouin's Gull *Ichthyaetus audouinii*)</u>

936. Assessments of breeding distributional range against a modern baseline were provided by the CPs Albania, Croatia and Italy where the relative area of occupancy was assessed as stable (1.0, Albania, Croatia) or increasing (1.2, Italy). Baseline data for the species distributional range have been provided by Greece.

937. To assess GES of CI 3 of the species for all subregions, other CPs with breeding populations would need to provide current and baseline data of distributional range across the region.

<u>Common Indicator 4: Population abundance of selected species (Audouin's Gull *Ichthyaetus audouinii*)</u>

938. The assessment of CI 4 is based on the breeding and non-breeding population of the species. Current numbers of breeding pairs and baseline levels have been provided by the CPs Croatia, France, Italy and Spain. The breeding population abundance has been assessed as increasing in parts of the relatively small Adriatic population (relative breeding abundance 1.9 – 13). It has also been assessed as increasing for parts of the population of the Central and Ionian Sea (relative breeding abundance: 2.8). In the Western Mediterranean, the breeding population abundance in colonies of birds from Spain, which account for approximately 80% of the global population, has been decreasing (overall relative breeding abundance: 0.54). The smaller populations in the Western Mediterranean subregion in Italy and France have been assessed as stable for Italy (0.9) and increasing for France (1.5). While GES of this CI is assumed to be reached for Audouin's Gulls of the Adriatic and Central and Ionian Sea, no data was available for the Aegean and Levantine Sea. However, baseline data from the Aegean and Levantine Sea have been provided by Greece, where the species has declined during the previous assessment cycle. It is expected that GES is not reached in the Greek part of this subregion. On the basis of data from Spain, it is expected that GES in the Western Mediterranean is currently not reached but data from breeding colonies along the southern coasts of this region were not available.

<u>Common Indicator 5: Population Demographic Characteristics (Audouin's Gull *Ichthyaetus audouinii*)</u>

939. Annual survival rates have been assessed in France, (~1.0, Western Mediterranean). Annual reproductive success rates are reported to be very low in Croatia (0.02, Adriatic Sea) and vary strongly between subregions in Italy (0.83 for the Adriatic, 0.31 for the Central and Ionian Sea, 0.27 for the Western Mediterranean). For France, reproductive success is reported to be 0.99. In the Spanish part of the Western Mediterranean, reproductive success is currently reported to be low (0.35), however it has improved as compared to the previous assessment cycle (0.27). Baseline data for hatching and fledgling success have been provided for the Greek part of the Aegean and Levantine Sea subregion. Overall, the data quality appears too patchy for a GES assessment of CI 5 for Audouin's Gulls in the region, but the data presented here indicates that GES for this vulnerable marine gull species is likely not reached.

Slender-billed Gull *Chroicocephalus genei*

940. The Slender-billed Gull is not strictly a marine species. It forages mainly on fish, crustaceans and insects. The nest in colonies, situated in estuaries, marshes, river valleys and on beaches contains three to four eggs. The species is a partial migrant and can be found in the Mediterranean year-round. Outside the breeding period it can be observed across the region in coastal areas.

941. The global population of this species, which is estimated at 310,000-380,000 individuals (Wetlands International, 2021), is listed as Least Concern, but the population in the European part of the region is known to be decreasing (<25% in three generations (Birdlife International 2023). CPs in the region with breeding populations are France, Greece, Italy, Spain, Tunisia, and Türkiye.

Common Indicator 3: Species Distributional Range (Slender-billed Gull *Chroicocephalus genei*)

942. Breeding distribution baseline data are provided for Italy and can be utilised for future assessment cycles. The species has been confirmed to be absent as a breeding species from Albania during the current assessment cycle. Slender-billed Gulls have been reported wintering commonly in all subregions. To assess whether GES is reached regarding the winter distributional range of the species, CPs would need to provide data on current and baseline winter distribution.

943. Overall, the lack of data especially on breeding distributional range for the current assessment cycle but also for baseline values is preventing a GES assessment of CI 3 for the species.

Common Indicator 4: Population abundance of selected species(Slender-billed Gull *Chroicocephalus genei*)

944. Data on breeding population abundance are available for Spain and France. For the Spanish population the relative breeding population in 2017 is assessed at 0.29-0.31 using a modern baseline approach. The relative population abundance in the French part of the Western Mediterranean is assessed slightly higher at 0.39. If these data are indicative for the subregion in general and for the entire region, GES regarding CI 4 is not reached. However, CPs would need to provide data on breeding population numbers of the current and previous assessment cycle to allow for a region wide GES assessment.

945. Data from IWC mid-winter counts reveal that an average number of close to 33.000 individuals ‘winter across the region, approximately two thirds of them in Tunisia.

Common Indicator 5: Population Demographic Characteristics(Slender-billed Gull *Chroicocephalus genei*)

946. Data on population demographic characteristics of Slender-billed Gulls in the region are available for the Western Mediterranean region from France. There, the annual survival rate is assessed at 0.97 (2016-2021) while the average reproductive success rate is 0.98 (2015-2021). This would mean that GES is tentatively reached there for CI 5. However, demographic parameters would need to be collected across the region to allow modelling population growth rates for the Mediterranean breeding population of the Slender-billed Gull.

Lesser-crested Tern *Thalasseus bengalensis emigrates*

947. The global population of the species, listed as Least Concern by IUCN, is estimated at 225.000 birds. However, the subspecies emigratus, which is endemic to the region numbered some 4000 birds in 1993, or a maximum of less than 2300 pairs in 2009 (Hamza et al., 2011). With Libya (Central Mediterranean Region) being currently the only country with breeding colonies in the region, the Mediterranean population is extremely vulnerable due to small population size and restricted distribution range in very few colonies.

<u>Common Indicator 3: Species Distributional Range (Lesser-crested Tern *Thalasseus bengalensis emigrates*)</u>

948. No data are available regarding the breeding distribution of Lesser-crested Terns during the current assessment cycle. Therefore, GES of the species regarding CI3 cannot be assessed. However, there is no indication of an increase in the breeding distribution range of species. Due to the very restricted range, it is likely that GES in the region is currently not reached.

<u>Common Indicator 4: Population abundance (Lesser-crested Tern *Thalasseus bengalensis emigrates*)</u>

949. There is no data available on breeding population abundance of Lesser-crested Terns during the current assessment cycle. Single-digit figures of the species have been reported during the current assessment cycle along the southern Mediterranean coast, namely from Libya (Central Mediterranean), Algeria and Morocco (Western Mediterranean Region) encountered during IWC midwinter counts. A robust GES assessment based on these few winter records seems currently not possible.

<u>Common Indicator 5: Population Demographic Characteristics (Lesser-crested Tern *Thalasseus bengalensis emigrates*)</u>

950. For the current assessment cycle, no data on population demographic characteristics such as annual survival rates and reproductive success were available to identify the population growth rate. This means that GES of CI 5 for the Lesser-crested Tern population in the region currently cannot be assessed.

<u>**Sandwich Tern *Thalasseus sandvicensis***</u>

951. These birds breed in relatively dense colonies, exclusively in coastal areas with available feeding grounds close by. The population inhabiting the Mediterranean and Black Sea Region is estimated at 20270 – 65670 breeding pairs. The global conservation status is Least Concern and assessed as stable, the population trend in the region is fluctuating.

<u>Common Indicator 3: Species Distributional Range (Sandwich Tern *Thalasseus sandvicensis*)</u>

952. CPs with breeding populations in the region are France, Greece, Italy, Spain and Türkiye, and the species is reported breeding in all subregions.

953. Data on changes in the breeding distribution range for the current assessment cycle as compared to a modern baseline (2010-2016) is available for the Adriatic subregion (Italy). The data reveal a relative breeding distributional range of 0.64. This reduction in distributional range indicates that GES of CI 3 for the Adriatic breeding population of the Sandwich Tern is not reached.

954. The species has been reported wintering in all subregions with data from IWC mid-winter counts provided by the majority of CPs. Relative wintering distributional range is assessed as stable (1.0) for parts of the Adriatic Sea (Albania and Croatia, modern baseline). It can be assumed that GES regarding the wintering range of the species is reached for the entire Adriatic and potentially for the whole region, however CPs would need to provide data on current and baseline range assessments (e.g., occupied versus assessed grid cells) to confirm this.

Common Indicator 4: Population abundance of selected species (Sandwich Tern *Thalasseus sandvicensis*)

955. The relative breeding bird abundance has been provided for the Western Mediterranean (France: 0.32; Spain: 0.91). GES of CI 4 for the Sandwich Terns breeding in this subregion is close to the lower threshold level of 0.7 but not reached (0.68).

956. Breeding pair numbers for the current assessment cycle have been provided for the Adriatic population (Italy), but baseline values would need to be provided to assess GES.

Common Indicator 5: Population Demographic Characteristics (Sandwich Tern *Thalasseus sandvicensis*)

957. Data on demographic parameters is only available from France for the Western Mediterranean subregion for both, annual survival rate (0.97) and reproductive success (0.99), which means that GES regarding CI 5 in part of the subregion is reached.

958. Data on average annual reproductive success during the current assessment cycle has been provided for the Adriatic Sea subregion (0.46; Italy). The value appears low for GES on CI 5 to be reached in the subregion.

Mediterranean Storm-petrel *Hydrobates pelagicus melitensis*

959. The Mediterranean Storm-petrel breeds in colonies among boulders and in sea caves on rocky islands and islets. The females lay a single egg. The birds are highly mobile, but also highly philopatric. At least part of the population leaves the Mediterranean into the Atlantic during the non-breeding season. The population of the Mediterranean subspecies of the European Storm-petrel which is endemic to the region is estimated at around 13000-17000 breeding pairs (Birdlife International 2021). Most known breeding colonies are distributed in the central and western Mediterranean with a large proportion of the population restricted to a few archipelagos and with Malta holding 50% and Italy holding 30% of the population.

Common Indicator 3: Species Distributional Range (Mediterranean Storm-petrel *Hydrobates pelagicus melitensis)*)

960. Breeding distributional ranges assessed against modern baselines are available from parts of the Central Mediterranean and Ionian Sea for Albania: 0.33, Italy: 1.0, and Malta: 2.33. However, it has to be noted that the apparent increase in distribution range in Malta is mainly attributed to an increase in knowledge. Data on relative distributional range are also available from part of the Western Mediterranean subregion, namely Italy: 1.0. As Italy and Malta combined hold approximately 80% of the entire population in the region, GES regarding the species' breeding distribution is reached at least for the Central Mediterranean and Ionian Sea subregion and when taking a modern baseline approach.

961. Additionally, relative breeding distributional range data are available from Greece for the Aegean and Levantine Sea subregions: 1.0. Furthermore, a small colony has been discovered recently in the Southern Adriatic Sea subdivision, leading to a range increase for the CP.

962. At-sea distribution is exemplarily presented as 50%UD core foraging areas and 95%UD home ranges from GPS- and GLS-tracked individuals from some colonies in Italy, Malta and Spain.

<u>Common Indicator 4: Population abundance Mediterranean Storm-petrel *Hydrobates pelagicus melitensis)*</u>

963. For the current assessment cycle, population abundance data are available for parts of the subregions Western Mediterranean (France, Italy, Spain), Central Mediterranean and Ionian Sea (Albania, Italy, Malta), Aegean and Levantine Sea as well as the Adriatic Sea subregion (Greece).

964. For the Western Mediterranean subregion, France reports a current population of 130 bp, leading to a relative population abundance of 9.29 as compared to a modern baseline. Italy reports a current population abundance of 1459-1776 breeding pairs for the Western Mediterranean without providing a baseline, while Spain provides a current population abundance of 528 breeding pairs against a modern baseline of 3347 breeding pairs. However, for many Spanish nesting sites of the species no data are provided for the current assessment period. Therefore, no relative breeding population abundance is calculated for Spain.

965. For the Central Mediterranean and Ionian Sea, Albania provides a relative breeding population abundance of 1.0 (0-50 breeding pairs in both current and modern baseline assessment). Italy provides a current breeding population of seven pairs (without a baseline). Malta provides an average relative breeding population abundance 1.27 (breeding population estimate from 2019 CMR and modelling: 8197-8397 pairs). Due to the apparent slight population increase of the largest Mediterranean Storm-petrel colony in Malta, GES is assessed as being reached for CI 4 at least in the Central Mediterranean and Ionian Sea subregion.

966. Data from Greece indicate a population increase for the Aegean and Levantine Sea subregion as well as for the Southern Adriatic subdivision. However, this apparent population increase is mainly attributed to an improve in knowledge. In order to confirm whether GES regarding CI 4 for this small and elusive seabird species is also reached for the entire region, CPs would need to provide current breeding pair numbers against baseline values across the range.

<u>Common Indicator 5: Population Demographic Characteristics Mediterranean Storm-petrel *Hydrobates pelagicus melitensis)*</u>

967. For the current assessment cycle, no data of reproductive success were provided. The adult annual survival rate is available for Malta’s largest Storm-petrel colony, modelled from CMR data. It is assessed at 0.87 for the period 2013 – 2021. As the colony has experienced a slight population growth over the last two assessment cycles (see CI 4) it can be assumed that GES for CI 5 is reached locally.

<u>Scopoli’s Shearwater *Calonectris Diomedea*</u>

968. The Scopoli’s Shearwaters are nocturnal in the colonies, highly mobile, but also highly philopatric. During foraging trips, they can cover large areas. Almost the entire population spends the non-breeding period (November-March) outside the region, mainly in the Atlantic, which means that some pressures may act on the species outside the region.

969. The species is near-endemic in the region, distributed over a wide range across the Mediterranean, with strong-holds in the Western and Central Mediterranean subregions. CPs with confirmed breeding populations are Algeria, Croatia, France, Greece, Italy, Malta, Spain, and Tunisia. Furthermore, breeding is suspected in Türkiye.

970. The breeding population of this regional near-endemic species is estimated at 285,000-446,000 mature individuals (Birdlife International 2023). The species’ single largest colony on Zembra Island, Tunisia, has been relatively recently reassessed at 141,000 to 223,000 breeding pairs

(Defos du Rau et al 2015). Its conservation status is currently Least Concern with a long-term negative population trend and a reduction in range at least in the European part of the distribution area.

Common Indicator 3: Species Distributional Range (Scopoli’s Shearwater *Calonectris Diomedea*)

971. In the Adriatic Sea subregion, Albania reports for the species a reduction from 5 grid cells (50km x 50km) down to 0, while Croatia and Italy in the same subregion report a relative breeding distribution range of 1.0. (13 occupied grid cells overall, 10km x 10 km). For the Central Mediterranean and Ionian Sea subregion data provided by Greece (one colony) and Italy reveal a relative breeding distribution range assessment of 1.0. In Malta, relative breeding distribution is assessed at 1.19, with improved knowledge of colony sites causing the apparent increase. In the Western Mediterranean subregion, Italian data reveal a relative breeding distribution range of 0.97, within threshold level (10%). The GES for CI 3 is not assessed for any of these subregions due to insufficient data.

972. The at-sea distribution is exemplarily presented as 50%UD core foraging areas and 95%UD home ranges from GPS-tracked individuals from three colonies in Italy (Central and Ionian Sea, Western Mediterranean), one colony in France and three colonies from Spain (Western Mediterranean).

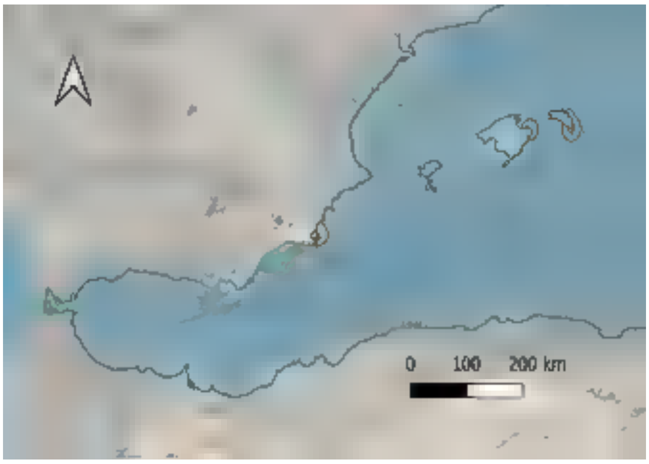
973. Overall, the lack of comparable current assessment and baseline data on breeding and at-sea distribution range, prevent from assessing GES of the species regarding CI 3 across the region.

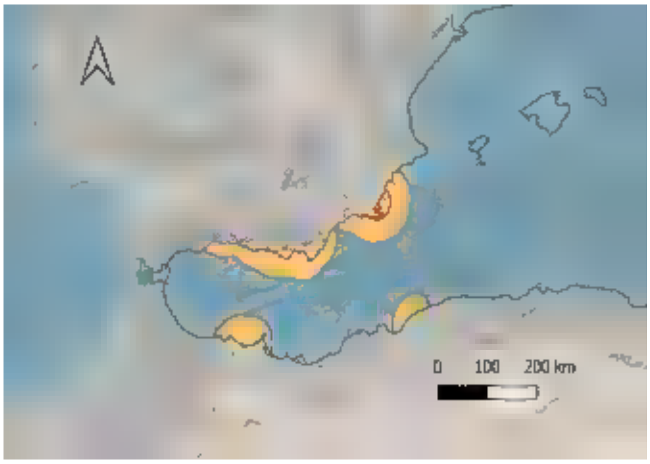
Common Indicator 4: Population abundanceScopoli’s Shearwater *Calonectris Diomedea*)

974. The majority of the population leaves the Mediterranean region to spend the winter period (November to February) in the Atlantic, off the Western African coast. Therefore, population assessments during the non-breeding period appear not representative and thus not meaningful for a GES assessment.

975. Relatively robust baseline breeding population estimates are available for the majority of Scopoli’s Shearwater colonies in the region, with a modern baseline estimate of 140,184 – 215,626 breeding pairs, more than 80% of them on Zembra (Tunisia, Western Mediterranean). Only for some colonies (approximately 17%-22%) of the breeding population there are current population abundance assessments available. For the single largest colony holding the majority of the species’ population, no breeding population estimates have been provided for the current assessment cycle. Available data on relative breeding population abundance draw a heterogenous and non-conclusive picture for CI 4 of the species within subregions and across the region; Adriatic Sea: 0.79-98 (Croatia) to 1.35-1.47 (Italy), Central Mediterranean and Ionian Sea: 1.0 (Greece), 1.13-1.23 (Italy) and 0.56-0.78 (Malta), and Western Mediterranean: 0.92 (France), 0.98-2.53 (Italy) and 1.01 (Spain).

976. Overall, the current data quality and availability does not allow for a conclusive GES assessment of CI 4 in the region.

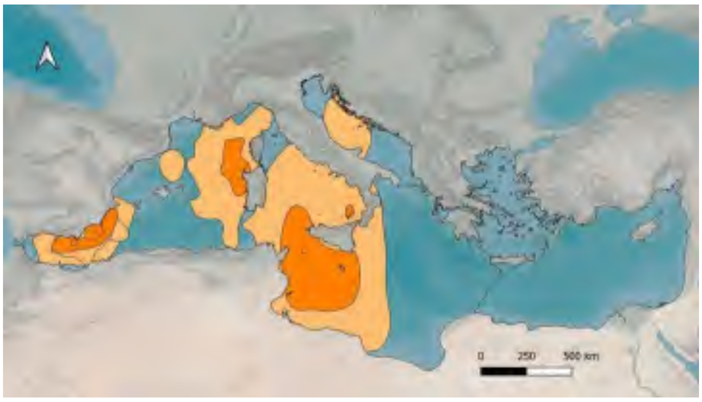


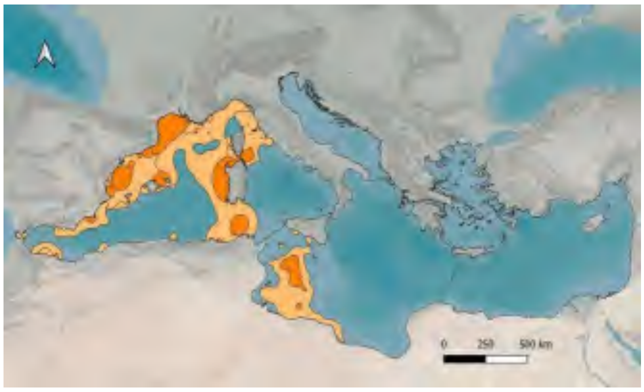


A **B**

Examples of at-sea distribution ranges of in the Western Mediterranean subregion during the breeding season. Home ranges (95% UD, light orange) and core foraging areas (50% UD, dark orange) of GPS tracked adults of:

A- *Gulosus aristotelis desmarestii* B- *Ichthyaetus audouinii (Spanish colony)*



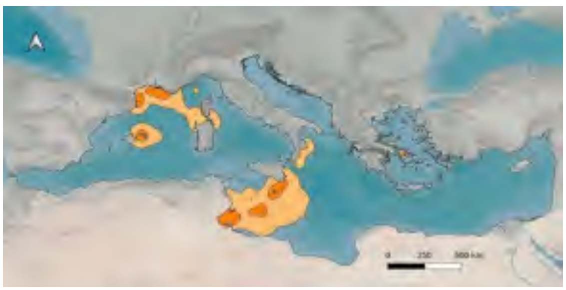


A **B**

Examples of at-sea distribution ranges in the region. Home ranges (95% UD, light orange) and core foraging areas (50% UD, dark orange) of GPS and GLS tracked adults of:

A - *Hydrobates pelagicus melitensis* (from colonies in Italy, Malta and Spain)

B- *Calonectris diomedea* (from one colony in France, three colonies in Italy, and three colonies in Italy, and three colonies in Spain)



Example of at-sea distribution ranges of *Puffinus yelkouan* during the breeding season. Home ranges (95% UD, light orange) and core foraging areas (50% UD, dark orange) of GPS tracked adults from colonies in Greece, Italy, and Malta.

Figure 55: Examples of distribution of bird species

Common Indicator 5: Population Demographic Characteristics Scopoli's Shearwater *Calonectris Diomedea)*

977. Annual survival rates from the current assessment cycle are available for two colonies in the Western Mediterranean (Italy: 0.88 and Spain: 0.83). Reproductive success rates are available for colonies in the following subregions: Adriatic Sea: Croatia: 0.73-0.79; Central and Ionian Sea: Greece: 0.65, Italy: 0.59 and Malta: 0.70-0.72; Western Mediterranean: Italy; 0.69 and Spain: 0.74.

978. No information has been provided regarding demographic parameters of Scopoli's Shearwater colonies in the Aegean and Levantine Sea subregion, nor for the single largest colony in the region (Zembra, Western Mediterranean). Overall, the data quality and availability currently do not allow for an assessment of CI 5 in the region.

Yelkouan Shearwater *Puffinus yelkouan*

979. This region-endemic species is an obligate marine species and strictly nocturnal in the colonies. Females lay one egg per season. Birds can be found in the Mediterranean year-round, but part of the population moves eastwards and spends the non-breeding period (July-November) in the Black Sea, which implies that some pressures on the species may be active outside the region.

980. The population is estimated at 15,337-30,519 pairs, roughly equating to 46,000-92,000 individuals (Derhé, 2012). Strongholds of the population are found in the central and eastern Mediterranean. In the Western Mediterranean subregion (Balearic Islands) it is replaced by the sibling taxon *P. mauretanicus*, with which it may form a stable hybrid population on Menorca. Countries with confirmed current breeding populations are Albania, Algeria, Croatia, France, Greece Italy, Malta, Algeria, and Tunisia. In the past breeding was also confirmed for the Bulgarian Black Sea area and Yelkouan Shearwaters are suspected to breed in Türkiye.

981. The conservation status of the species has been assessed as Vulnerable with a decreasing population trend, the latter being to some extent mitigated by improved knowledge of this elusive breeder, including the discovery of new colonies in recent years leading to an apparent population increase.

Common Indicator 3: Species Distributional Range (Yelkouan Shearwater *Puffinus yelkouan*)

982. Relative breeding distributional range data are available for parts of the Adriatic subregion, namely Albania, Croatia and Italy. Overall, the relative breeding distributional range was assessed at 0.64, indicating a range contraction in the subregion.

983. For parts of the Central Mediterranean and Ionian Sea subregion (Albania, Italy, Malta) the relative breeding distributional range was assessed at 1.39. However, the apparent increase in breeding distributional range can be mainly attributed to the discovery of formerly unknown colonies in Malta due to increased monitoring effort, rather than to a true range expansion. A similar picture is given for the Aegean and Levantine Sea subregion (Greece), where the discovery of colonies in the recent past leads to a relative breeding distributional range of 1.1.

984. For parts of the Western Mediterranean region (Italy) the relative breeding distributional range was assessed at 0.89, indicating a slight range contraction in this subregion, just outside the 10% threshold bracket.

985. Overall, it can be assumed that due to range contractions specifically in the Adriatic and less pronounced in the Western Mediterranean, GES for the vulnerable Yelkouan Shearwater concerning CI3 is currently not reached.

986. The at-sea distribution of Yelkouan Shearwaters in the region is exemplarily presented as 50%UD core foraging areas and 95%UD home ranges from GPS- and GLS-tracked individuals from a colony each in the Western Mediterranean (Italy), Central and Ionian Sea (Malta) and Aegean and Levantine Sea (Greece).

<u>Common Indicator 4: Population abundance (Yelkouan Shearwater *Puffinus yelkouan*)</u>

987. Systematic bi-monthly passage counts at a bottleneck (Bosporus), where a major part of the population is known to migrate through, show the cyclic and consistent nature of passages. This method can be used as a supporting monitoring tool for the species and can reveal relative abundance data here and at other bottlenecks.

988. Relative breeding abundance data are available from parts of the population spread over most subregions. In the Adriatic Sea, the relative breeding population abundance is assessed at 1.83 to 2.0 for Croatia, while it is assessed at 2.87 to 3.9 for Italy. In the Central and Ionian Sea subregion, relative breeding abundance is assessed at 1.0 for Albania, 0.59 to 1.2 for Italy and 1.08 to 1.33 for Malta. In the Western Mediterranean subregion, the relative breeding abundance is assessed at 0.11 for France and Italy 1.06 to 1.35. For the Aegean and Levantine subregion, the relative breeding population abundance is assessed at 1.96 to 2.01 (Greece).

989. The wide ranges between lower and upper values for Yelkouan Shearwater populations in some of the CPs reflect the difficulty to assess CI 4 in this elusive species. The very high relative values of 1,83-3.9 for some CPs, indicating a strong increase of the population, can be mainly explained by an apparent population increase due to improved knowledge, while values between 1 and 1.5 could indicate true population recovery compared to baseline levels due to implemented conservation actions.

990. Overall, the gaps and heterogeneity in available data for this vulnerable species currently don’t give a clear picture of the situation and prevent a truly quantitative assessment of GES regarding CI 4.

<u>Common Indicator 5: Population Demographic Characteristics (Yelkouan Shearwater *Puffinus yelkouan*)</u>

991. For the current assessment cycle, modelled annual survival rates from CMR data in the colonies are available for one CP in the Central Mediterranean (Malta). With just above 0.7 they appear relatively low (baseline assessed at 0.74).

992. Annual reproductive success rates are available for part of the Adriatic Sea subregion (Croatia, 0.63-0.65), the Central Mediterranean and Ionian Sea subregion (Malta, 0.43-0.70) and the Western Mediterranean subregion (Italy, 0.44). Baseline levels of reproductive success rate are available for one large colony in the Aegean and Levantine subregion (Greece), evaluated during the previous assessment cycle. With values between 0.18 – 0.38 they appear very low.

993. Although data quality does not allow for a quantitative GES assessment of CI 5 for the species across the region, it is not likely that a population growth rate of >1 is reached, which would be necessary for a species recovery and thus for reaching GES.

<u>Balearic Shearwater *Puffinus mauretanicus*</u>

994. The Balearic Shearwater is the sibling taxon to the Yelkouan Shearwater, closely related and very similar and thus sharing the same functional ecological group *Offshore surface or pelagic feeder*.

995. In fact, latest research on the genomics of the genus *Puffinus* suggests that the two taxa show low genetic differentiation, not above the level of subspecies (Obiol et al. 2023), with potential consequences for management and conservation decisions.

996. The species is obligate marine and its nest are found in burrows, caves or crevices and females lay one egg per season. They are highly mobile, covering large areas during foraging trips. The birds are nocturnal in the colonies and show philopatry and high site fidelity. After the breeding period, most birds move westwards to spend the non-breeding period (August to December) in the East Atlantic. This means that some pressures on the species are active outside the region.

997. Population estimates for the Balearic Shearwaters are 19,000 - 25,000 mature individuals (Birdlife International 2023), 2,000-2,400 breeding pairs (Oro et al., 2004) or 7,200 breeding pairs (Genovart et al., 2016). The entire known breeding population is restricted to the Balearic Islands, Spain. The species is listed as Critically Endangered with a rapidly declining population trend.

<u>Common Indicator 3: Species Distributional Range (Balearic Shearwater *Puffinus mauretanicus*)</u>

998. No data have been provided in the current assessment cycle by the CP regarding the species' breeding distributional range and the at-sea distribution and the non-breeding distribution.

<u>Common Indicator 4: Population abundance of selected species</u> (Balearic Shearwater *Puffinus mauretanicus*)

999. As a baseline, the average number for the period 1990 to 2016 is provided as 2369 breeding pairs. For the year 2018 in the current assessment cycle, the breeding population is assessed at 351 breeding pairs. However, it appears that only a few colonies were monitored in both assessment cycles, and they do not overlap to an extent where comparison is meaningful. Due to the unfavourable conservation status of the species, GES is currently not reached regarding CI 4.

<u>Common Indicator 5: Population Demographic Characteristics</u> (Balearic Shearwater *Puffinus mauretanicus*)

1000. No data on the adult annual survival rates are available of the species for the current assessment cycle. The reproductive success rate for the current assessment cycle was at 0.7 in 2017 and had been assessed at an average of 0.63 in the period 1986-2016.

1001. For the closely related Yelkouan Shearwater, Oppel et al. (2011) stated that annual survival rates of adults would need to be >0.9 to consider the population to be sustainable. The reproductive success would need to be >0.75 to allow for a recovery or growth of the population (Louzao et al., 2006). Therefore, it is highly likely that GES for CI 5 for this critically endangered species is currently not reached.

<u>Key findings per Common Indicator (CIs 3, 4 and 5 for Bird species)</u>

1002. For CI3, the species' distributional range, the results of the assessment indicate overall compliance with GES targets for seabirds in the Mediterranean. This can be partially explained by taking a modern baseline approach and by apparent range expansion due to increased monitoring and assessment effort for some species. However, it must be noted that the range assessment mainly focused on the breeding distributional range as larger data gaps remain for a more complete assessment of the at-sea- and non-breeding distribution of many indicator species across the region.

1003. For CI4, the current patchiness and heterogeneity of data and the larger gaps in datasets prevent a comprehensive, truly quantitative GES assessment of population abundance of seabirds across the region. However, the available datasets point towards a heterogenous picture, with some species in some countries (or subregions) reaching GES target compliance while others do not. Lack of information on pristine, historical and in some cases even modern conditions impede the abundance assessment for the current cycle. Overall, it appears that assessment results particularly for populations of the species of conservation concern in the region might currently not be compliant with GES targets.

1004. For CI5, the data availability across the indicator species and across the region appears currently insufficient for assessing compliance of this CI with GES targets quantitatively. Demographic parameters such as annual survival rates remain relatively poorly monitored overall. Examples of populations, for which CI5 seems sufficiently monitored suggest that it might be the CI for which GES overall is not reached, especially when assessing species of conservation concern.

1005. The assessment of Mediterranean seabird populations has come a long way since the initial MED QSR (2017). While the 2017 report qualitatively described the status of seabirds in the region without providing GES assessments, there has been significant improvements towards at least a semiquantitative assessment for all CIs, at least for some indicator species and for some populations in the region.

1006. Increased international collaborations, including integrated and representative approaches, knowledge transfer and concerted, comparable efforts are now necessary in order to reduce existing knowledge gaps and allow for a truly quantitative assessment of GES of seabird related indicators in the entire region.

Measures and actions required to achieve GES (CIs 3, 4 and 5 for Bird species)

1007. For the current assessment cycle, the results of the GES assessment regarding seabirds present an improvement in data availability and in applied methodologies when compared to the previous assessment cycle. It is possible to draw some preliminary conclusions using available quantitative monitoring data and assessment methodologies. For some indicator species and CIs sufficient data was available at a national scale, allowing for an assessment that reflects the impact of reduced pressures on local populations. Therefore, it highlights the importance of regular monitoring efforts to inform on the success of implemented conservation actions. However, for the current assessment cycle, the data that was made available remains patchy, heterogenous, and limited for a robust GES assessment of all indicator species for the three CIs across subregions. It is believed that the IMAP Infosystem will facilitate data reporting and improve efficiency and comparability for monitoring and GES assessments of future cycles.

1008. Currently, the lack of representative, comparable subsamples distributed equally across the subregions remains one of the major challenges for an integrated assessment of the status of marine avifauna in the region. To achieve a robust GES assessment, monitoring data between two cycles should be made fully comparable. This requires monitoring a certain number of same or representative populations as prolonged time series at the finest spatial scale practical.

1009. In order to improve the representativeness of monitoring samples, coordinated monitoring within subdivisions or subregions would further improve overall GES assessments. Mid-winter count data made available by IWC for this assessment cycle as well as transboundary counts of Mediterranean Shag roosts in the Adriatic are good examples highlighting useful outcomes of coordinated and synchronised monitoring efforts.

1010. Enabling coordinated efforts and achieving standardised monitoring at the local level also requires regular transfer of know-how and calibration of monitoring methods within subdivisions, subregions or across the region. Finally, harmonisation between different assessment programmes such as MSFD can be further improved for a more efficient assessment of GES in the Mediterranean.

1011. Quantifying GES for seabird populations in the Mediterranean remains challenging. Seabirds are highly mobile organisms and therefore a robust analysis of their state requires transboundary monitoring. Ensuring communication and information exchange between different assessment programmes and sea conventions within the region and for migratory species which leave the Mediterranean also other seas can help overcome this challenge.

1012. The majority of seabird species in the Mediterranean form metapopulations with discrete local breeding colonies. Without better understanding the demographic connectivity between these colonies, deciding on a meaningful spatial scale at which GES should be assessed remains to some extent arbitrary. Therefore, closing such knowledge gaps will be pivotal for the finetuning of monitoring programmes and for successful GES assessments in the future.

1013. Currently, a strong bias remains in the amount of monitoring data available for the different aspects in the life cycle of the majority of Mediterranean seabirds. This bias means that there is insufficient knowledge regarding the non-breeding season and the periods the birds spend out at sea, often far away from the breeding grounds. To reduce this bias, it is recommended that future assessment cycles increase the effort of monitoring the birds away from the colonies, by means of increased colour ringing and ring-reading, tracking programmes and counts at bottlenecks.

Common Indicators 3, 4 and 5 (Monk Seal)

1014. Mediterranean monk seals (*Monachus monachus*) were once widely and continuously distributed in the Mediterranean and Black Seas, and in North Atlantic waters from Morocco to Mauritania, including the Cape Verde and the Canary Islands, Madeira, and the Azores (Johnson et al. 2006). Today fewer than 700 individuals are thought to survive in isolated subpopulations in the eastern Mediterranean, the archipelago of Madeira and the Cabo Blanco area in the north-eastern Atlantic Ocean (Karamanlidis et al. 2015). The largest aggregations of Mediterranean monk seals are found near Cabo Blanco (González and Fernandez de Larrinoa 2012, Martínez-Jauregui et al. 2012). Principal sites in the Mediterranean are located in the Ionian and Aegean seas, including the National Marine Park of Alonissos (Trivourea et al. 2011) and the Gyaros Marine Protected Area (Dendrinos et al. 2008), both in Greece. An increasing presence of monk seals has been also reported in the Levantine Sea (Beton et al., 2021; Kurt and Gücü 2021; Roditi-Elasar et al., 2021; SPA/RAC-UNEP/MAP, 2020). Moreover, within the Mediterranean Basin, there are recent indications that seals might be frequenting areas within their historical range where they had been extirpated in previous decades (Bundone et al., 2019).

1015. Historical evidence suggests that Mediterranean monk seals commonly used to haul out on open beaches (Johnson and Lavigne 1999, González 2015). Still, in more recent times -- probably as an adaptation to increased human disturbance -- they generally seek refuge in remote marine caves. These natural rocky shelters share common morphological characteristics, including one or more entrances above or below water level, an entrance corridor, an internal pool, and a beach that provides a dry haul out area (Dendrinos et al. 2007). While at sea, Mediterranean monk seals have been reported sleeping, either at the surface floating (vertically or horizontally) with eyes closed or resting underwater on the seafloor or over seagrass beds with eyes and nostrils shut (Karamanlidis et al. 2017, Mpougas et al. 2019). On all occasions, seals proved to be easily wakened when approached by humans.

1016. The monk seal populations at Cabo Blanco in the Atlantic, and at Gyaros Island in the eastern Mediterranean, are the only large extant aggregations of the species that still preserve the structure of a colony, while remaining subpopulations in the eastern Mediterranean are usually small, fragmented groups of <20 individuals (Karamanlidis et al. 2015).

Assessment methodology for CI3, CI4 and CI5 of EO1 regarding Monk Seal

1. For the 2023 MED QSR Mediterranean Monk seal assessment to be successful, the main experts working with this endangered species were contacted by SPA/RAC and were kindly asked to provide relevant data on Mediterranean monk seal, covering the three above-listed Common Indicators.
2. To facilitate the data collation process, a questionnaire was produced, as an Excel file (See document provided together with this report with all responses), including four different spreadsheets covering different aspects, namely data supplier information, species distributional range, population abundance, and demographic characteristics.
3. Participants in this survey were requested to also provide any available reports on the three CIs of Mediterranean monk seal and point out any links to additional data, data depositories and contacts of data-holders that might be beneficial to further enhance the assessment. In addition, participants that may consider that they do not have sufficient quantitative data regarding the three CIs, were encouraged to provide or point at any additional information that might allow at least for a qualitative assessment of the Good Environmental Status.
4. The 2023 MED QSR assessment for the Mediterranean monk seal does not only rely on the participation of these experts, in order to count with the most updated and detailed information, but also on the scientific literature available for the species. The above-mentioned questionnaire was shared with 29 experts from 16 countries.

Key messages (Monk Seal)

1017. The present assessment provides insight into both the strengths and limitations of the current status of the Mediterranean monk seal across the Mediterranean basin:

- In the areas where monk seal breeding had been reported (see “Group A” countries in GES section below), the species continues to breed.
- In all areas where no monk seal breeding takes place, but repeated sightings of monk seals were reported (see “Group B” countries in GES section below), the species continues to be present, and the most recent data shared by experts, through the survey conducted to produce this assessment, indicate a moderate expansion of the specie’s range.
- Consequently, if habitat suitable for the species is available (and protected), they offer good potential for new breeding episodes.
- All research and conservation groups (data providers) have agreed in reporting problems related to disturbance and habitat loss, which seem to pose a widespread threat throughout the species' range.
- The reported wider distribution of the species across the basin in recent times has led to an increase in the number of “players” in the Mediterranean monk seal conservation “game”. These research and conservation groups, some of them with a need for capacity building and training initiatives, consider necessary to increase monitoring efforts. In this regard, a significant number of organizations carrying out monitoring activities on Mediterranean monk seals, were not able to respond to the set of questions focussed on demographic parameters, included in the questionnaire (see Methodology section). This lack of response suggests that in many areas an optimal level of (regular) monitoring effort was not achieved in order to obtain these parameters.
- Following up on the above, for instance, groups working in Israel and the Adriatic Sea were not able to respond to these demographic parameters, possibly as a consequence of both a low level of monitoring effort and a very low monk seal presence.
- By improving our capacity to establish the basic demographic parameters for this endangered species, we would be also advancing in our capacity to produce more fine-tuned total population estimates. Recent new approaches to infer population numbers from pup multiplier ratios may largely benefit from it, since there is still a significant knowledge gap on pup survival rates.

- Breeding caves and foraging areas need to be identified and protected. Conservation management action should not be limited to monitor resting and haul-out areas.
- There is a lot of data collected, although not always in a homogeneous format or by applying commonly agreed methodologies and procedures. Therefore, this wealth of data it is often not comparable between different sites and research groups. This important issue could be overcome through the establishment of commonly agreed monitoring protocols and a data sharing platform. New initiatives led by the Monk Seal Alliance seem to provide good *momentum* to address this recurrent request by Mediterranean monk seal researchers and conservation bodies.

Good environmental status (GES) assessment (CIs 3, 4 and 5 for Monk Seal)

1018. The main problem encountered in envisaging a region-wide Strategy derives from the quite diverse conservation status of monk seals in the different portion of the Mediterranean and by consequence the quite different priorities and responsibilities saddled onto the various monk seal Range States.

1019. When developing an updated *regional strategy for the conservation of monk seal in the Mediterranean* (Decision IG.24/7) this challenge was tackled by assigning Mediterranean countries to three groups. Consequently, the following criteria has been also followed for this assessment taking under consideration the information provided by regional experts:

- "Group A" countries, where monk seal breeding has been reported after year 2010.
- "Group B" countries, where no monk seal breeding is reported, but with repeated sightings of monk seals (>3) were reported since 2010.
- "Group C" countries, where no monk seal breeding is reported, and where very rare or no sightings of monk seals (≤3) were reported since 2010.

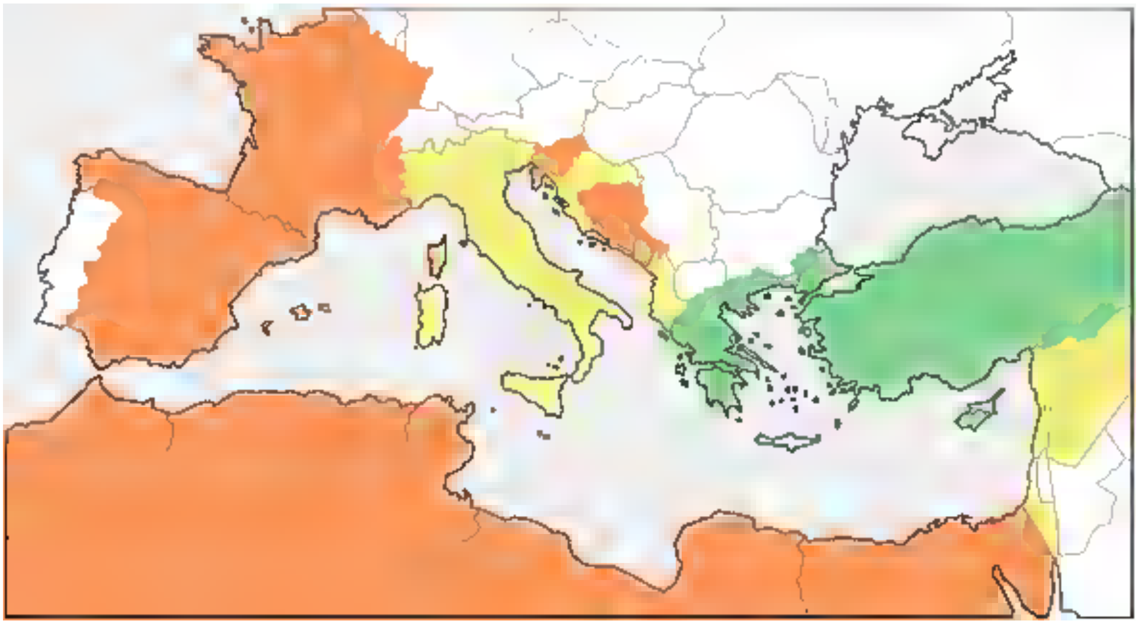


Figure 56: Monk seal conservation status by country, adopted from updated regional strategy for the conservation of monk seal in the Mediterranean (2019). Green: "Group A" countries; yellow: "Group B" countries; tan: "Group C" countries.
Note: Syria has been moved to Group B based on feedback produced by regional experts.

1020. The mid-term implementation of the regional strategy for the conservation of monk seal in the Mediterranean was recently assessed by examining each of its Goal Targets and providing input on the degree of their implementation and achievement (UNEP/MED WG.548/8 Rev.2). This assessment, presented during the Sixteenth Meeting of SPA/BD Focal Points (Malta, 22-24 May 2023) recommended to set up the Monk Seal Advisory Committee no later than December 2023, in order to provide support to SPA/RAC in the development and implementation of specific conservation actions having a regional scope for the remaining of its period as described in the Strategy itself. Terms of Reference for the committee were also produced.

1021. The GES definition for marine mammals (Monk seal) in relation to the CI3, CI4 and CI5 as adopted by Decision IG.22/7 are as follows:

- CI3: Species distributional range: The Monk Seal is present along recorded Mediterranean coasts with suitable habitats for the species;
- CI4: Population abundance of selected species: Number of individuals by colony allows to achieve and maintain a favourable conservation status;
- CI5: Population demographic characteristics: Appropriate measures implemented to mitigate direct killing and incidental catches and to preclude habitat destruction and disturbance.

1022. Considering the GES definition, the current assessment of the status in relation to (CI3, CI4 and CI5), provides insight into both the strengths and limitations of the species across the Mediterranean basin. Most recent data shared by experts, through the survey conducted to produce this assessment, indicate that the species continues to breed in its known breeding zones and there is a moderate expansion of the specie’s range.

1023. The present assessment concluded that for CI3-distribution, GES has not been achieved for all Group B countries (where no monk seal breeding is reported, but repeated sightings were reported), while it has been achieved for most of the Group A countries (countries, where monk seal breeding has been reported after year 2010). However, the lack of a baseline estimates for monk seal population abundance (CI4), makes difficult to validate the (likely) expansion of the species reported in recent years.

1024. Concerning the Monk Seal Population demographic characteristics (CI5), various types of data need to be gathered to enable accurate description of Mediterranean monk seal population demographics. Key demographic data and survivorship are logistically difficult to determine, requiring access to the seals in remote locations and long-term uninterrupted monitoring to build individual historical series

GES assessment for CI3 (Distribution) for Monk Seal

1025. For the **Monk Seal**, one of the flag species of the Mediterranean, the current assessment of the status in relation to **(CI3, CI4 and CI5)**, provides insight into both the strengths and limitations of the species across the Mediterranean basin. Most recent data shared by experts, through the survey conducted to produce this assessment, indicate that the species continues to breed in its known breeding zones and there is a moderate expansion of the specie’s range. The present assessment concluded that for **CI3-distribution**, GES has not been achieved for all Group B countries (where no monk seal breeding is reported, but repeated sightings were reported), while it has been achieved for most of the Group A countries (countries, where monk seal breeding has been reported after year 2010). However, the lack of a baseline estimates for monk seal population abundance (**CI4**), makes difficult to validate the (likely) expansion of the species reported in recent years.

GES assessment for CI5 (Population demographic characteristics) for Monk Seal

1026. Various types of data need to be gathered to enable accurate description of Mediterranean monk seal population demographics. Key demographic data and survivorship are logistically difficult to determine, requiring access to the seals in remote locations and long-term uninterrupted monitoring to build individual historical series. Consequently, these data have not been systematically gathered and reported across the region, which led the authors of the present report to propose it GES unsure for “Group A” countries.

Key findings per Common Indicator (CIs 3, 4 and 5 for Monk Seal)

CI3-distributional range and 2023 data gaps

1027. The Med QSR 2017 targeted marine mammals in general, therefore not focusing specifically on the Mediterranean monk seal. However, most of the key findings and knowledge gaps could be fully attributed to this species. In this sense, the most important knowledge gaps stemmed from the disparity in the global distribution of research effort, with more effort having been made and being made in northern Mediterranean countries, while in some southern Mediterranean countries information on occurrence and distribution came primarily from anecdotal data and very localised research projects. The resulting knowledge gap compromised the identification of protection measures aimed at the conservation of the species on local and regional scales. Accordingly, more sampling and monitoring effort was identified as a basic requirement in the least monitored areas. Since then, a new initiative, the Monk Seal Alliance (MSA), consisting of a consortium of like-minded foundations optimising resources to trigger collaborative conservation and rehabilitation of the Mediterranean monk seal, has committed significant funds to support new research initiatives. Among them, for instance, the Med-Monk seal Project: Enhancing knowledge and awareness on monk seal in the Mediterranean, located in, Algeria, Egypt, Italy, Lebanon, Libya, Morocco, Syria, Tunisia and led by Specially Protected Areas Regional Activity Centre (SPA/RAC), aims at filling the gap of knowledge on the occurrence in these countries categorized as low density countries in relation to the presence of the monk seal and where no breeding episodes have been reported. In this regard, new initiatives, and current monitoring efforts should be yielding valuable information in the early future.

CI4-Abundance and 2023 data gaps

1028. In reference to this CI, the MedQSR2017 focused mainly on knowledge gaps of cetacean species, highlighting the need to provide abundance and density estimates through synoptic levels and to implement the conservation priorities listed by the European directives and the Ecosystem Approach.

1029. For the Mediterranean monk seal there are no density or abundance estimates, and although there is restrictive and specific legislation for the conservation of the species, both in European directives and in regional and national strategies, implementation of these laws is not yet widespread. In this sense, one of the knowledge gaps cited in the MedQSR2017, the lack of baseline critical information is therefore detrimental to conservation and especially in the assessment of trends. Currently it seems that the species is expanding its range with new monitoring initiatives being developed in countries such as Italy, Croatia, Albania, Montenegro and Israel. However, the lack of a baseline estimate makes difficult to validate this (likely) expansion.

CI5-Demographic characteristics and 2023 data gaps

1030. The need for a systematic monitoring programme over time to establish time series is necessary to determine the basic demographic parameters of the species.

1031. Counts of pups seem to have been established as a valid measure of the annual production of the species, on the one hand, and, on the other, by means of different pup multiplier ratios to determine the gross number of adults. However, although pups could be efficiently monitored (and sexed) before their first moult, after this event the monitoring of youngsters results very difficult. This being the case, as indicated in MedQSR 2017, continuous monitoring programmes by means of photo-identification and repeated at regular intervals should be established, since it is the most accurate, and non-invasive way to establish the life story of individual monk seals.

Measures and actions required to achieve GES (CIs 3, 4 and 5 for Monk Seal)

1032. As presented in sections 4 and 5, for CI3-distribution, GES has not been achieved for all Group B countries, while it has been achieved by Group A countries except for Cyprus. Therefore, actions dedicated to facilitating the widespread distribution of the species in all Group B countries and Cyprus should be a priority. Such actions should include not only the set-up of a good monitoring network but also the protection of key habitats for the species and the reduction of any potential threats (e.g.., intentional killings, tourism disturbance).

1033. When looking at Mediterranean monk seal population abundance (CI4), the lack of a baseline estimates makes difficult to validate the (likely) expansion of the species reported in recent years. Based on the reported information by regional experts, it seems that most (rough) population estimates come mainly from the minimum photo-identified individuals. However, a new approach by MOm (Greece) using pup-multipliers method may be taken as a new way forward for reliable abundance estimates. A common strategy for producing population estimates should be agreed on to be able to compare information among researchers.

1034. It must be pointed out that monk seal photo-identification is a widespread practice across the region; therefore, the creation and implementation of a data-sharing platform would offer great potential to establish reliably information on movements and home range establishment. Such initiative is currently in the portfolio of actions to be supported by the Monk Seal Alliance.

1035. Data reported by regional experts manifests the difficulty to study the population demographic characteristics (CI5). Since key demographic data and survivorship are logistically difficult to determine, new actions should focus on providing opportunities for long-term uninterrupted monitoring to allow building individual historical series, key to assess basic demographic trends. New technologies, combined with the long-term regular use of more traditional methods (e.g., individual tags and photo-identification) may shed light on these aspects.

1036. As presented in the newly drafted Mediterranean monk seal DPSIR framework, the following measures and actions should be taken in order to achieve GES for the species:

Research Actions aimed at responding the following questions:

- Distribution
- Abundance
- Pup production
- Movements
- Foraging areas

Conservation Measures:

- Protect critical pupping habitat
- Regulate human activities
- Improvement of surveillance
- Habitat restoration

Management and Law Enforcement measures:

- Regulation of Fishing activities
- Public education and awareness
- Management of tourism
- Reduce anthropogenic mortality

Common Indicators 3, 4 and 5 (Marine Turtles)

1037. The marine reptile theme in the IMAP framework comprises two species of marine turtle that complete their life cycles within the Mediterranean. These are the more widely distributed and abundant loggerhead turtle (*Caretta caretta*) and the less common and more spatially restricted green turtle (*Chelonia mydas*). Both species have established endemic Regional Management Units (RMUs) within the Mediterranean (Wallace et al. 2010; Figure 57). However, especially in the western Mediterranean, juvenile loggerhead turtles of Atlantic origin are also common. This complicates the understanding of the efficacy of conservation measures in that subregion as it is not clear if the impacted turtles are part of Mediterranean or Atlantic RMUs.

1038. A third species of marine turtle, the leatherback (*Dermochelys coriacea*) is also regularly present in the Mediterranean, with individuals originating from the Atlantic, but their numbers in the Mediterranean are low and source populations are large, suggesting that negative impacts on individuals in the region will not adversely affect conservation status of their Atlantic RMU(s).

1039. Good environmental status assessment for marine turtles in the Mediterranean therefore focuses on the two indigenous Mediterranean RMUs of the loggerhead and the green turtle. However, conservation actions to improve the environmental status of these turtles under the biodiversity Ecological Objective (EO1) of the IMAP process of the Barcelona Convention, will also lead to positive impacts on the non-indigenous turtles present in the region.

Key messages (Marine Turtles)

1040. Combining the findings of the three most relevant CIs with literature on research and conservation actions taking place in the Mediterranean, the marine turtle theme can be considered as meeting GES.

1041. Distribution of turtles across the Mediterranean (CI3) is increasing in loggerhead nesting outside their traditional range. Similarly, green turtle distribution at sea is deemed to be expanding.

1042. Nesting levels, a basic proxy for population abundance (CI4) are stable or increasing at all major nesting sites where recent data have been reported and nesting is occurring where there was previously none.

1043. At the breeding areas, available data suggest that hatchling sex ratios (CI5) are in favourable condition. This is the one demographic characteristic that is likely to be impacted by climate change, but it is also one that can be adequately monitored and if required mitigated against.

1044. There are fundamental gaps in monitoring and data reporting for turtles in marine habitats. Monitoring methods and data reporting require standardisation across all CPs. Further research is required for better understanding of turtle populations and improving their conservation status.

Good environmental status (GES) assessment (CIs 3, 4 and 5 for Marine Turtles)

Assessment methodology for CI3, CI4 and CI5 of EO1 regarding Marine Turtles

Data supporting GES assessment of the marine turtle theme in this MED QSR were obtained from multiple sources. The Info System by INFO/RAC did not contain any marine turtle national monitoring data as the system is not ready to ingest such information. Therefore, data were acquired from internet searches that identified primary peer-reviewed scientific literature, reports (grey literature) and in some cases generalist web pages presenting unpublished data records. These were supplemented with additional unpublished reports shared by SPA/RAC and information found on the Mediterranean Biodiversity Platform (http://data.medchm.net/en/home). Lastly the author approached members of his personal network of Mediterranean marine turtle researchers to obtain information and validation of web-derived specific data points.

The gathered data were entered into spreadsheets relating to each relevant CI. Turtle abundance and distribution at sea (CI3, CI4) were kept as separate sheets as they were distinct sets of data sources whereas abundance and distribution of nesting activity were combined into a single sheet as data sources generally contained information covering both CIs. Population demographic characteristics (CI5) were divided into five sheets, grouped around specific diagnostic topics. These data were then investigated to determine if they were sufficient to quantify GES status at region, sub-region, subdivision, and national level (
Figure *58*, Table 34), as set out in the ratified instructional document (UNEP/MED WG.514/Inf.12, 2021).

Integral to the process of determining GES for the different CIs is the requirement to compare current status with either established baseline levels or with threshold values and the outcome of previous GES assessments. For GES to be achieved under CI3 marine turtles need to be present across all their previously established range. As stated in (UNEP/MED WG.514/Inf.12, 2021) presence was assumed unless proven otherwise and available documents and recent distribution maps were examined to identify any such areas where turtles were shown to no longer be present. Similarly for GES to be established under CI4, turtle abundance needs to be at previously established levels across the region. Again, an extensive review of literature was carried out and findings compared with the previous Med QSR. Lastly, the GES assessment for CI5 was attempted through examining available literature for data points mainly focusing on the targets that can be affected/improved by conservation measures, e.g., hatchling emergence success.

Where complete datasets were lacking, the author used their expertise to infer likely GES status and to inform discussion on priority topics in terms of data collection and reporting needs for progress to be made for the subsequent MED QSR in 2029.

1045. Each CI considered in this assessment can be attributed to a colour in a ‘traffic-light’ system, where green equals GES is met, Amber equals uncertain if GES is met, red equals GES is knowingly not met or there are no data on which to make an expert assessment. Ideally this process would be undertaken using prescribed standardised data supplied by all Contracting Parties, which would facilitate the most robust and defensible verdicts, but in lieu of such data being available, information from a variety of sources is compiled to provide a best approximation via expert opinion.

1046. Quantity and quality of data available to carry out this GES assessment varied greatly among countries and was completely lacking for some countries with minor marine areas within the Mediterranean (
1047. Table *35*). Results of the assessment for each of the contributing CIs is presented in turn below.

Table 33: Factors considered in defining GES for marine turtles based on UNEP/MED WG.514/Inf.12 (2021

	CI3 (Species distributional range**)** The species continues to occur in all its natural range in the Mediterranean, including nesting, mating, feeding and wintering and developmental … sites		**CI4 (**Population abundance**)** The population size allows to achieve and maintain a favorable conservation status considering all life stages of the population		**CI5 (**Population demographic characteristic**)** Low mortality induced by incidental catch. Favorable sex ratio and no decline in hatching rates.	
	At sea	Nesting	At sea	Nesting	At sea	Nesting
Spatial scale	Region Sub-region National	Region Sub-region Sub-division National	Region Sub-region National	Region Sub-region Sub-division National	Region Sub-region National	Region Sub-region Sub-division National
National Monitoring requirement	Six-yearly assessments. Nearshore and offshore habitats	Six yearly estimates of nationwide nesting locations.	Annual assessments. Up to 4 nearshore hotspots systematically checked. Ancillary data collected (strandings / fisheries)	Annual assessments based on nesting level category* Six yearly estimates of nationwide nesting levels.	Six-yearly assessment review. Bycatch and mortality rates nearshore and offshore.	Annual assessments. Hatchling Emergence Success, Hatching Sex Ratio
Key target 1	No areas identified as no longer utilised by turtles	Nesting distribution is at least stable: No areas identified as no longer used compared to previous assessment. OR balance between newly exploited and abandoned nesting areas	Turtle presence remains at same level or increasing at index sites.	Nesting levels remain at same level or increasing at index sites.	Assessed mortality rates remain low in nearshore index habitats	Values for Hatchling Emergence Success to exceed the following levels nationally (per species): loggerhead: 65% green: 75%
Key target 2			Ancillary data do not indicate a decline in turtle abundance nationally.	Interpretation of six-yearly data to determine that abundance estimates remain stable or increasing in view of potential changing distribution.	Interpretation of mortality rates from ancillary data to determine national annual survival estimates which should not worsen.	Hatchling Sex Ratio not to exceed 95% ♀ nationally.

*Categories are based on levels of nesting. Category 1 = established, common and dense nesting (•••; 75% nesting or 7 sites), Category 2 = established limited and sparse nesting (••; 50% nesting or 4 sites), Category 3 = new emerging low-level nesting (•; continue existing schemes), and Category 4 = Absent or sporadic nesting (#; continue existing schemes). For country classifications see Table 34.

Table 34: Data availability and GES status for CI3, CI4 and CI5 relating to marine turtles.
Marine turtle species: Cc - *Caretta caretta*, Cm - *Chelonia mydas*
Nesting abundance: # - exceptional occurrences, • - new emerging / low level, •• - established limited/sparse, ••• - established common/dense.
Monitoring reporting fulfilment: M - Missing, P - Partial, C - Complete. *GES met: Y - Yes, N - No, U – Unknown.

		Albania		**Algeria**		**Bosnia and Herzegovina**		**Croatia**		**Cyprus**		**Egypt**		**France**	
		Cc	**Cm**	**Cc**	**Cm**	**Cc**	**Cm**	**Cc**	**Cm**	**Cc**	**Cm**	**Cc**	**Cm**	**Cc**	**Cm**
CI3	At Sea Presence	Y	Y	Y		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Nesting Presence	#		#		Y	Y	Y	Y	Y	Y	Y	Y	#	
CI4	At Sea Abundance	—	↑	—		—	—	—	—	—	—	—	—	—	↑
	Nesting Abundance	#		#		•••	•••	••	••	•••	•••	••	••	#	
	Nesting Trend					↑	↑	—	—	↑	↑	—	—		
CI5	Hatchling Emergence Success*					P-U	P-U	P-U	P-U	P-U	P-U	P-U	P-U		
	Sex Ratio Hatchlings*					C-Y	C-Y	C-Y	M-U	C-Y	C-Y	C-Y	M-U		
	Clutch Size					C	C	C	C	C	C	C	C		
	Clutch Frequency					C	C	M	M	C	C	M	M		
	Internesting Interval					C	C	M	M	C	C	M	M		
	Remigration Interval					C	C	M	M	C	C	M	M		
	(operational) Sex Ratio Adults					N	C	M	M	N	C	M	M		
	Oceanic: Pop structure / sex ratio	M	M	M		N	N	M	M	N	N	M	M	M	
	Neritic: Pop structure / sex ratio	P	P	P		C	C	P	P	C	C	P	P	P	
	Oceanic: threats / survivorship*	M-U	M-U	M-U		M-U	M-U	M-U	M-U	M-U	M-U	M-U	M-U	M-U	
	Neritic: threats / survivorship*	P-U	P-U	P-U		C-U	C-U	P-U	P-U	C-U	C-U	P-U	P-U	M-U	
	Oceanic: Health index	M	M	M		M	M	M	M	M	M	M	M	M	
	Neritic: Health index	M	M	M		M	M	M	M	M	M	M	M	M	
	Growth rates	M	M	M		C	C	M	M	C	C	M	M	M	
	Longevity					C	C			C	C				
	Age / size at Sexual Maturity					M	M			M	M				

Table 34. *(Continued)*

		Greece		Israel		Italy		Lebanon		Libya		Malta		Monaco	
		Cc	***Cm***	***Cc***	***Cm***	***Cc***	***Cm***	***Cc***	***Cm***	***Cc***	***Cm***	***Cc***	***Cm***	***Cc***	***Cm***
CI3	At Sea Presence	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y	
	Nesting Presence	Y	#	Y	Y	Y		Y	Y	Y	#	Y			
CI4	At Sea Abundance	—	—	—	—	—	—	—	—	—	—	—		—	
	Nesting Abundance	•••	#	•••	••	••		••	••	•••	#	•			
	Nesting Trend	↑		↑	↑	↑		—	—	—		↑			
CI5	Hatchling Emergence Success*	P-U		P-U	P-U	P-U		P-U	P-U	P-U		M-U			
	Sex Ratio Hatchlings*	P-U		P-U	P-U	P-U		M-U	M-U	P-U		M-U			
	Clutch Size	C		C	C	C		M	M	C		M			
	Clutch Frequency	C		M	M	M		M	M	M		M			
	Internesting Interval	C		M	M	M		M	M	M		M			
	Remigration Interval	C		M	M	M		M	M	M		M			
	(operational) Sex Ratio Adults	C		M	M	M		M	M	M		M			
	Oceanic: Pop structure / sex ratio	M		M	M	C		M	M	M		P		M	
	Neritic: Pop structure / sex ratio	P	P	M	M	C		M	M	M		P		M	
	Oceanic: threats / survivorship*	M-U	M-U	M-U	M-U	P-U		M-U	M-U	M-U		P-U		M-U	
	Neritic: threats / survivorship*	P-U	P-U	P-U	P-U	P-U		M-U	M-U	P-U		P-U		M-U	
	Oceanic: Health index	M		M	M	P		M	M	M		M		M	
	Neritic: Health index	M	M	M	M	P		M	M	M		M		M	
	Growth rates	P		M	C*	C		M	M	M		M		M	
	Longevity	C		M	M	P									
	Age / size at Sexual Maturity	M		M	C*	C									

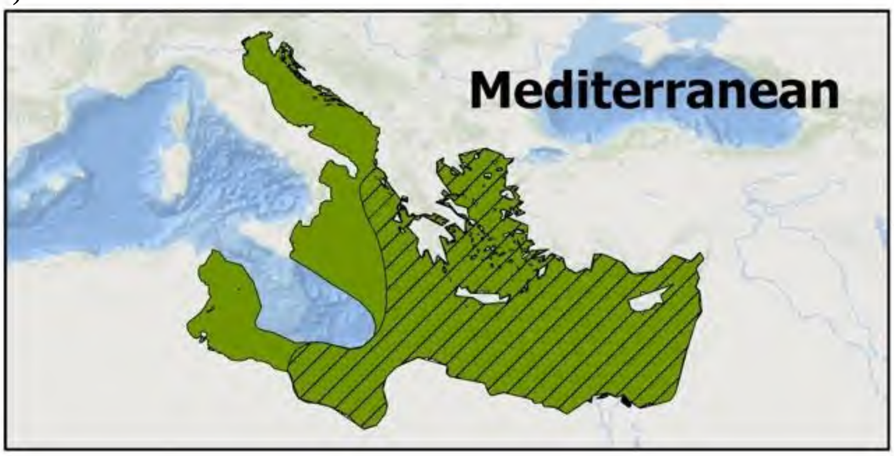
Table 34*(Continued)*

		Montenegro		Morocco		Slovenia		Spain		Syria		Tunisia		Türkiye	
		Cc	***Cm***	***Cc***	***Cm***	***Cc***	***Cm***	***Cc***	***Cm***	***Cc***	***Cm***	***Cc***	***Cm***	***Cc***	***Cm***
CI3	At Sea Presence	Y	Y	Y		Y	Y	Y		Y	Y	Y	Y	Y	Y
	Nesting Presence							Y		Y	Y	Y	#	Y	Y
CI4	At Sea Abundance	—	↑	—		—		—		—	—	—	—	—	—
	Nesting Abundance							•		••	•••	••	#	•••	•••
	Nesting Trend							↑		—	—	—		↑	↑
CI5	Hatchling Emergence Success*							C-N		M-U	P-U	P-U		P-U	C-Y
	Sex Ratio Hatchlings*							P-U		M-U	M-U	P-U		C-Y	C-Y
	Clutch Size							C		M	C	C		C	C
	Clutch Frequency							M		M	M	M		M	M
	Internesting Interval							M		M	M	M		M	M
	Remigration Interval							M		M	M	M		M	M
	(operational) Sex Ratio Adults							M		M	M	M		M	M
	Oceanic: Pop structure / sex ratio	M	M	M				P		M	M	M	M	M	M
	Neritic: Pop structure / sex ratio	P	M	M		P		P		M	P	P	P	P	P
	Oceanic: threats / survivorship*	M-U	M-U	P-U				P-U		M-U	M-U	M-U	M-U	M-U	M-U
	Neritic: threats / survivorship*	P-U	M-U	P-U		P-U		P-U		P-U	P-U	P-U	P-U	P-U	P-U
	Oceanic: Health index	M	M	M				P		M	M	M	M	M	M
	Neritic: Health index	M	M	M		M		M		M	M	M	M	M	M
	Growth rates	M	M	M		M		M		M	M	M	M	M	M
	Longevity										M	M		M	M
	Age / size at Sexual Maturity										M	M		M	M

Common Indicator 3 (Distribution, Marine turtles)

1048. Marine turtle distribution meets GES from national to regional level (
1049. Table *35* & Table 36). As per guidance (UNEP/MED WG.514/Inf.12, 2021), this can be assumed unless there is direct evidence to the contrary provided by national monitoring schemes. Loggerhead turtles remain present or assumed present in all marine locations, as indicated by recent distribution maps produced (Camiñas et al 2020, DiMatteo et al 2022; Figure 3) and are increasing their distribution in terms of nesting (Hochscheid et al. 2022; Figure 4). Green turtle distribution is assessed to be stable or increasing. The most recent spatial designation for this species in the Mediterranean, compiled by the IUCN Marine Turtle Specialist Group (Figure 3; Wallace et al 2023), is expanded westwards compared with the original extent (Wallace et al 2010), with a recent publication contributing new presence records of green turtles in the Adriatic Sea (Jančič et al 2022). In terms of nesting, sporadic green turtle nesting events have started occurring in Greece (Margaritoulis et al 2023), Tunisia (Ben Ismail et al 2022), and Libya (Saied 2023), which are far west of the traditional nesting region (Casale et al 2018; Figure 4), suggesting that green turtles may be starting a breeding range expansion in the same way as loggerheads.

(A)



(B)

Figure 57: Turtle distribution across the Mediterranean as indicated by the revised regional management unit extents for Mediterranean loggerhead (A) and green (B) turtles (taken from Wallace et al 2023).

Table 35: GES status for marine turtle in relation to Common Indicator 3: Distribution. Green = GES met. Orange = Unsure if GES met. Red = GES not met.

Region	Sub-region	Sub-division	Relevant Contracting Parties
Mediterranean	Western Mediterranean	NWMS	Spain - France
		ALBS	Spain - Morocco
		TYRS	France - Italy - Tunisia
		SWMS	Algeria
	Adriatic Sea	ADRS	Italy - Slovenia - Croatia - Bosnia & Herzegovina - Montenegro - Albania
	Central and Ionian Seas	CENT	Libya - Tunisia
		IONS	Italy - Greece - Malta
	Aegean and Levantine Seas	AEGS	Greece - Türkiye
		LEVS	Türkiye - Cyprus - Syria - Lebanon - Israel - Egypt

<u>Common Indicator 4 (Abundance, Marine turtles)</u>

1050. Based on an incomplete non-systematic dataset, marine turtle abundance is interpreted to meet GES from regional to sub-regional level (Tables 3 & 5). Despite the lack of systematic monitoring data for offshore marine habitats, a region-wide turtle abundance at sea has recently been modelled and published (DiMatteo et al. 2022, Figure 59) which can form a baseline for understanding the difficult-to-determine offshore abundance levels. Nearshore data have not been gathered or published in a systematic manner, as proposed (UNEP/MED WG.514/Inf.12, 2021), but there have been no indications of decreased abundance at any monitored site. For green turtles there are indications that numbers are increasing in the Adriatic Sea (Jančič et al. 2022), which has led to the subregion being included in the RMU extent (see CI3 above). Nesting across the region (

1051. Figure *58*) is reported as generally stable or increasing at well-established nesting areas that have received long-term monitoring efforts (Casale et al. 2018), which suggests growing populations. For loggerhead turtles nesting has started to occur more frequently in areas and countries where nesting was not previously reported (Hochscheid et al. 2022), supporting a positive trend and consolidating the positive GES status for this CI.

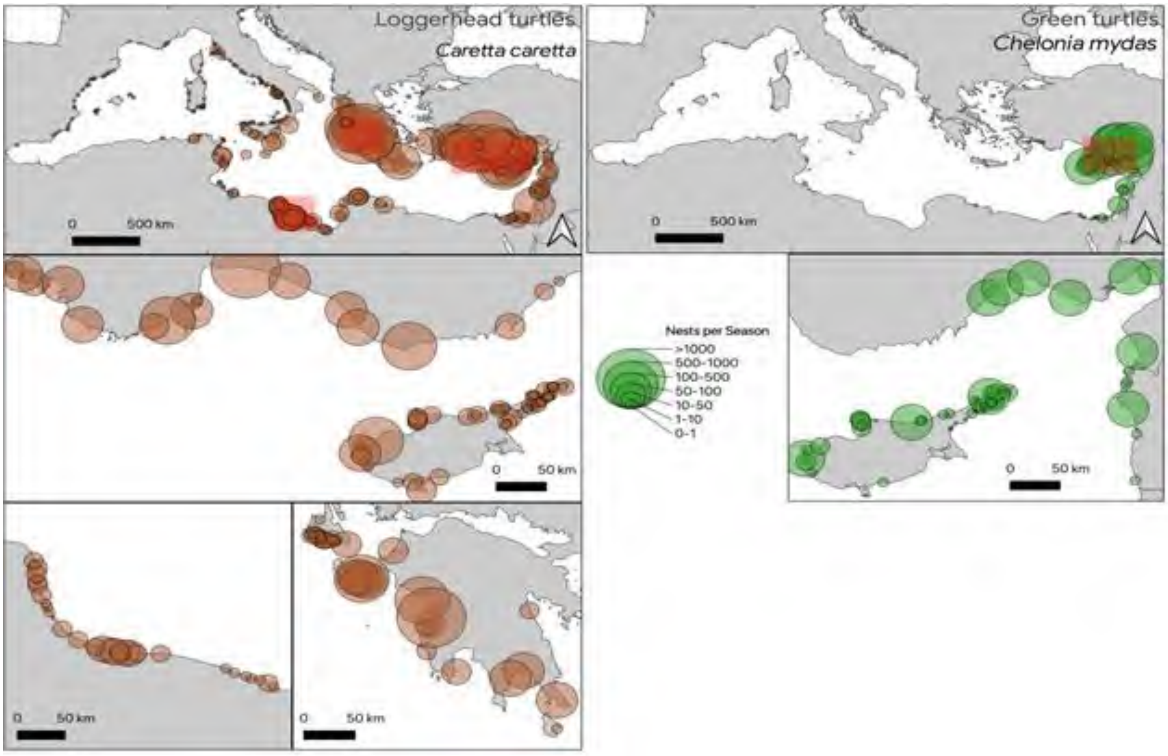


Figure 58: Beach-scale marine turtle nesting levels across the Mediterranean Sea. Green turtle nesting is confined to the eastern Mediterranean, mainly the extreme north-eastern area, and there are no large nesting aggregations for loggerheads in the western Mediterranean, though nesting levels are currently increasing. Marine turtle nesting in Israel and Malta are depicted in generic locations as beach-scale data are not available.

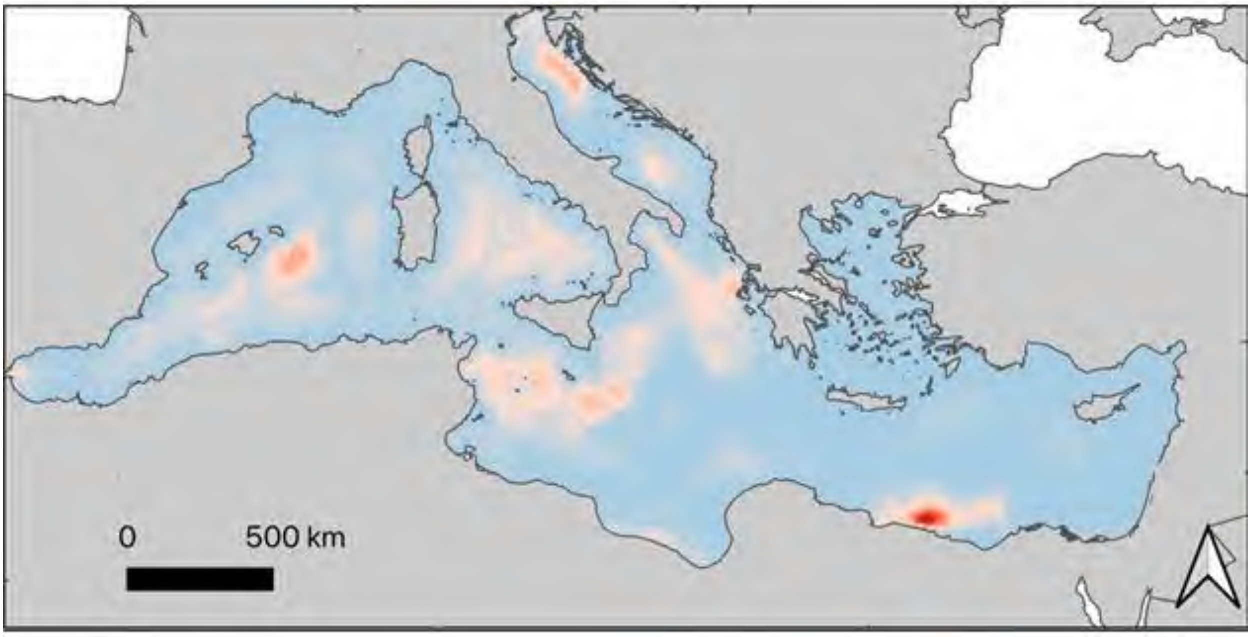


Figure 59: Turtle density across the Mediterranean. Modelled distribution and abundance of hard-shelled turtles (mainly loggerheads) after DiMatteo et al. (2022). The hotspot off the Egyptian coast is generated from extrapolation and requires verification.

Table 36: GES status for marine turtle in relation to Common Indicator 4: Abundance
Green = GES met. Orange = Unsure if GES met. Red = GES not met.

Region	Subregion	Sub-division	Contracting parties
Mediterranean	Western Mediterranean	NWMS	Spain - France
		ALBS	Spain - Morocco
		TYRS	France - Italy - Tunisia
		SWMS	Algeria
	Adriatic Sea	ADRS	Italy - Slovenia - Croatia - Bosnia & Herzegovina - Montenegro - Albania
	Central and Ionian Seas	CENT	Libya - Tunisia
		IONS	Italy - Greece - Malta
	Aegean and Levantine Seas	AEGS	Greece - Türkiye
		LEVS	Türkiye - Cyprus - Syria - Lebanon - Israel - Egypt

Common Indicator 5 (Demography, Marine turtles)

1052. In this Common indicator, many types of data need to be gathered to enable accurate modelling of turtle populations, but only a few can be directly influenced by conservation actions. The rest depend on environmental conditions which can be incorporated in models that predict population trends based on differing scenarios. This CI has received least attention from Contracting Parties, in terms of reporting, though publications containing some data exist. Consequently, GES status for this CI remains undetermined for marine turtles across the board from national to regional level (Tables 3 & 6). Focusing on demographic parameters at nesting sites that can be influenced by conservation measures, such as Hatchling Emergence Success and the incubation durations of nests, the data required for this CI, are derived from the basic nesting beach monitoring that takes place at numerous nesting areas across the region, and hence it is believe the data are being gathered but are simply not being compiled and reported by the CPs in a standardised and systematic way. Key demographic data for turtles at sea, such as survivorship and health indices are logistically difficult to determine requiring access to turtles in remote locations and large sample sizes to validate any statistical inferences, and consequently these data have not been systematically gathered and reported across the region.

Table 37: GES status for marine turtle in relation to Common Indicator 5: Demography
Green = GES met. Orange = Unsure if GES met. Red = GES not met.

Region	Subregion	Sub-division	Contracting Parties
Mediterranean	Western Mediterranean	NWMS	Spain - France
		ALBS	Spain - Morocco
		TYRS	France - Italy - Tunisia
		SWMS	Algeria
	Adriatic Sea	ADRS	Italy - Slovenia - Croatia - Bosnia & Herzegovina - Montenegro - Albania
	Central and Ionian Seas	CENT	Libya - Tunisia
		IONS	Italy - Greece - Malta
	Aegean and Levantine Seas	AEGS	Greece - Türkiye
		LEVS	Türkiye - Cyprus - Syria - Lebanon - Israel - Egypt

Key findings per Common Indicator (CIs 3, 4 and 5 for Marine Turtles)

Key results for CI 3

1053. The most significant development relating to distribution of turtles across the Mediterranean is the increase in loggerhead nesting outside of the traditional range, with nests being made in the western Mediterranean and Malta and to the north in the Ionian and Adriatic Seas (Fig. 4). This may be considered a positive evolution resulting from moderate global warming, but the negative impacts resulting from continued heating and related sea level rise are yet to be revealed. Similarly, green turtle distribution at sea is deemed to be expanding as indicated in the revised RMU distribution, which may mean this species has new safe locations to exploit but could also mean turtles are lured away from established beneficial foraging areas into less productive ones. The overall at-sea distribution of turtles should remain to be considered the entire Mediterranean region for loggerhead turtles and the area covered by the updated RMU boundary for green turtles, unless evidence to the contrary is gathered by a Contracting Party.

Comparison

1054. This 2023 review is again based on variable data from a wide range of sources and not from reports on monitoring activities carried out be CPs. Again, nesting data are more prevalent, and this time highlight the expansion of nesting to new areas. Detailed information on marine habitat use remains patchy but turtle presence can be assumed unless proven to the contrary.

Gaps

1055. As indicated, at-sea monitoring data are lacking which is largely a result of lack of consistent standardised monitoring turtles in marine habitats. Data on nesting populations are more common but are irregularly reported and lacking from certain established nesting areas.

Key results for CI 4

1056. With the recent publication of the marine habitat abundance map (Fig. 5) there is now a region-level assessment for marine turtles that can be used as a framework for estimating abundance. Nesting levels are stable or increasing at all major nesting sites where recent data have been reported and nesting is occurring where there was previously none.

Comparison

1057. Progress has been made towards better understanding of turtle population abundances since the previous report, through modelling at-sea populations using extensive transect datasets and from intensive beach-based fieldwork at nesting sites. However, the need for counts of males at breeding areas has only partially been met with very few studies, and monitoring programs at foraging, wintering and development grounds are still lacking.

Gaps

1058. There is still a lack of standardised monitoring across many nesting areas to determine population abundances present per Contracting Party and where there are programmes, reporting of required data is lacking. The situation is worse for in-water studies on turtle abundance as they are almost entirely lacking and those that are undertaken are not reported.

Key results for CI 5

1059. At the breeding areas, available data suggest that hatchling sex ratios are in favourable condition with sufficient males produced to sustain the populations. Lack of information on hatchling emergence success means annual recruitment cannot be determined, but given the generally increasing nesting populations, it suggests that over the long-term, sufficient hatchlings are being recruiting and surviving through to adulthood. Data on survival rates, threats at sea and other factors are very patchy, precluding any firm analysis, but again, given the general increase in breeding levels across the region there is expectation that populations are in suitable condition to be maintained and potentially increase further. However, direct evidence to support positive outlook are urgently required.

Comparison

1060. As was found with the 2017 assessment, present knowledge on sea turtle demography remains patchy, with certain information more widely available than others, and certain locations generating a disproportionate amount of relevant information. This situation needs to be improved to more robustly support the positive outlook for turtle populations suggested here, and to build population models that can predict which conservation actions should be prioritised to maintain and improve population status.

Gaps

1061. Fundamental monitoring and reporting gaps on the factors that can be influenced to improve the conservation status of sea turtles remain for all Contracting Parties as there are no standardised national monitoring and reporting regimes in place. Data on other topics relating to turtle nesting biology and fecundity lack consistent reporting and estimates of health, survivorship and population structure at sea are similarly lacking due to fundamental absence in relevant monitoring programs.

Measures and actions required to achieve GES (CIs 3, 4 and 5 for Marine Turtles)

1062. Despite this appraisal suggesting overall that GES is met for the marine turtle theme, many data that may support or refute this assessment are lacking and those data that are available have been retrieved from a wide range of sources, from primary scientific literature to unpublished reports and web articles. Consequently, the assessment has necessarily included inferences from expert opinion on various topics where a comprehensive synthesis of data is impossible due to lack of data or impractical due to patchy unstandardised datasets.

1063. Research (Table 8) and conservation (Table 9) priorities set out by Casale et al. (2018) remain relevant for better understanding of turtle populations and improving their conservation status and strongly concur with the requirements elaborated for the marine turtle assessment under IMAP (UNEP/MED WG.514/Inf.12, 2021). The competent authority in each CP needs to understand the data reporting requirements and which entity is undertaking specific monitoring actions. Through doing this it can identify gaps in data acquisition resulting from lack of fieldwork in necessary sites, gaps in reporting at sites where monitoring is carried out and identify entities that could be tasked with additional field monitoring at currently unmonitored sites. In terms of progressing towards adequate reporting, the simplest first step to take is to ensure data from all existing monitoring programmes are collected and reported in a standardised manner. The next most simple change is that in locations where monitoring programs exist, but collection of certain data is lacking, the programs should be adapted to acquire this sought-after information and analyse and report it as required.

1064. Challenges within each nation include knowledge of what work is being carried out where and by whom and do these actions then cover the full requirements of IMAP? Some countries have different entities working in different regions or on different fields (e.g., at-sea work or nesting beach studies etc.) but a national overview is lacking. It is therefore beneficial that each CP has in place some oversight or coordination mechanism to ensure all required monitoring activities are carried out. The coordinator could be a governmental body, scientific institution, or non-governmental organisation, with the important remit that they know what work is being carried out and have the competency to collect and synthesise the information adequately for each six-yearly Mediterranean Quality Status Report.

1065. This IMAP reporting framework, a requirement of all riparian Mediterranean states does not exist in isolation but coincides with other international reporting requirements such as those for the EU Habitats Directive and its Marine Strategy Framework Directive (MSFD). There is much overlap and synergy between these programs, which means data collected if collected in adequately rigorous manner can be used multiple times and not only for the IMAP. Of note is the recently published article highlighting progress towards a common approach for assessing marine turtle population status at European level within the MSFD, which should be considered when designing and coordinating marine turtle monitoring strategies. The resulting economy of scale lessens the burden on competent authorities as suitable coordinated actions obviate the need to repeat work and simplifies the analysis process.

Common Indicators 3, 4 and 5 (Cetaceans)

1066. The Mediterranean Sea harbours altogether 25 species and subspecies of cetaceans (dolphins, whales, porpoises), including 11 regular, three visitor and 11 vagrant species and subspecies (ACCOBAMS, 2021a) (Table 2.1). The presence and distribution of cetaceans is known to be a result of combination of environmental features, (i.e., physicochemical, climatological and geomorphological characteristics), biotic factors (i.e., prey distribution, predation, behavioural changes) and presence, spatial distribution and intensity of anthropogenic activities (Azzellino et al, 2007). In the Mediterranean Sea, the greatest species diversity is recorded in the Western Mediterranean sub-region.

Table 38: Cetacean species and subspecies occurring in the Mediterranean Sea. Based on: ACCOBAMS, 2021a and ACCOBAMS Resolution 8.12, 2022)

	Species/subspecies	**English name**	**Sub-Region*/Presence**	**Habitat**	**IUCN Red List conservation status****
MYSTICETI	*Balaenoptera a. acutorostrata*	North Atlantic minke whale	Rare/absent: WMS, AS, ICM, ALS; less than one reported presence/single occurrence during the past 35 years		
	Balaenoptera b. borealis	Northern sei whale	Rare/absent: WMS, AS, ICM, ALS; Rare sightings and strandings have been reported from the western Mediterranean, in particular from Spain and France		
	Balaenoptera p. physalus	North Atlantic fin whale	Regular/present: WMS (offshore waters of the western and central portions of the region, from the Balearic Sea to the Ionian Sea), southern AS; Rare/absent: northern and central AS; ALS	oceanic, slope, neritic	Endangered
	Eschrichtius robustus	grey whale	Rare/absent: WMS, AS, ICM, ALS		
	Eubalaena glacialis	North Atlantic right whale	Rare/absent: WMS, AS, ICM, ALS; Single occurrences near Taranto (Italy) and the Bay of Castiglione near Algiers (both in 19th century)		
	Megaptera n. novaeangliae	North Atlantic humpback whale	Occasional: WMS, AS, ICM, ALS. Sighted with increasing frequency in the Mediterranean Sea, where they were once considered very rare. Most of the sightings have occurred in the North West Mediterranean.		
ODONTOCETI	*Delphinus d. delphis*	common dolphin	Regular/Present: WMS (Alboran Sea area and small part of the Tyrrhennian Sea), southern ICM, Aegean Sea; Rare/absent: AS, northern and central ICM, Levantine Sea	neritic, slope, oceanic	Endangered for the Inner Mediterranean subpopulation and Critically Endangered for the Gulf of Corinth subpopulation
	Globicephala m. melas	North Atlantic long-finned pilot whale	Regular/Present: WMS; Rare/absent: AS, ICM, ALS	oceanic, slope, neritic	Endangered for the Inner Mediterranean subpopulation and Critically Endangered for the Strait of Gibraltar subpopulation
	Globicephala macrorhynchus	short-finned pilot whale	Very rare/absent: WMS, AS, ICM, ALS		

Species/subspecies	English name	Sub-Region*/Presence	Habitat	IUCN Red List conservation status**
Grampus griseus	Risso's dolphin	Regular/Present: WMS, southern AS, Ionian Sea, ALS; Rare/absent: central and northern AS, southern ICM, southern ALS	slope, oceanic	Endangered
Hyperoodon ampullatus	northern bottlenose whale	Very rare/absent: WMS, AS, ICM, ALS		
Kogia sima	dwarf sperm whale	Very rare/absent: WMS, AS, ICM, ALS		
Mesoplodon bidens	Sowerby's beaked whale	Very rare/absent: WMS, AS, ICM, ALS		
Mesoplodon densirostris	Blainville's beaked whale	Very rare/absent: WMS, AS, ICM, ALS		
Mesoplodon europaeus	Gervais' beaked whale	Very rare/absent: WMS, AS, ICM, ALS		
Orcinus orca	orca	Regular: Gibraltar area; visitor elsewhere	neritic, slope, oceanic	Critically Endangered
Phocoena p. phocoena	Atlantic harbour porpoise	Very rare in the Alborán Sea	neritic	Vulnerable
Phocoena p. relicta	Black Sea harbour porpoise	Presence limited to the North Aegean Sea	neritic	Endangered
Physeter macrocephalus	sperm whale	Regular/present: WMS, southern AS, ICM, ALS; Rare/absent: northern and central AS, the Strait of Sicily and portions of the Aegean Sea	slope, oceanic	Endangered
Pseudorca crassidens	false killer whale	Rare/absent: WMS, AS, ICM, ALS		
Sousa plumbea	Indian Ocean humpback dolphin	Very rare/absent: WMS, AS, ICM, ALS		
Stenella coeruleoalba	striped dolphin	Regular/present: WMS. Southern AS, northern and central ICM, ALS; Rare/absent: southern France, central and northern AS, southern ICM	oceanic, slope	Least Concern for the Mediterranean subpopulation and Endangered for the Gulf of Corinth subpopulation
Steno bredanensis	rough-toothed dolphin	Regular/present: eastern basin; vagrant elsewhere	oceanic, slope, neritic	Near Threatened
Tursiops truncatus truncatus	common bottlenose dolphin	Regular/Present: WMS, AS, ICM, ALS	neritic, oceanic	Least Concern for the Inner Mediterranean subpopulation and Critically Endangered for the Gulf of Ambracia subpopulation

Species/subspecies	English name	Sub-Region*/Presence	Habitat	IUCN Red List conservation status**
Ziphius cavirostris	Cuvier's beaked whale	Regular/present: WMS, AS, ICM, ALS (Hotspots: the Alborán Sea; the northern Ligurian Sea; the northern Tyrrhenian Sea (including the Caprera Canyon); the Ionian Sea east of Sicily; a long, narrow belt connecting the southern Adriatic Sea running along the Hellenic Trench to the west of Cyprus, especially around Anaximander Seamount; and Levantine Sea waters off Lebanon and Israel); Rare/absent: north and central AS, southern Mediterranean along the coasts of Tunisia, Libya and Egypt	slope, oceanic	Vulnerable

* Mediterranean Sub-regions: WMS – Western Mediterranean Sea; AS – Adriatic Sea; ICM – Ionian and Central Mediterranean; ALS - Aegean and Levantine Seas
** ACCOBAMS Resolution 8.12, 2022

Key messages (Cetaceans)

1067. The Mediterranean Sea harbours 25 cetaceans' species, which are subjects to various human pressures, which reflects on their conservation status.

1068. At the present moment, it is not possible to assess whether cetaceans' populations achieved Good Environmental Status (GES) under the EcAp/IMAP framework, since baseline/reference values for the GES assessment were only recently defined. However, the 2018 - 2021 IUCN Red-List Assessment shows that the most of cetacean populations in the Mediterranean Sea are significantly threatened, apart from the wide-spread species, such as common bottlenose dolphin (*Tursiops truncatus*) and striped dolphin (*Stenella coeruleoalba*), the status of which has improved since mid-2000.

1069. In order to improve the current status of cetaceans in the Mediterranean, conservation efforts invested thus far should be intensified and be based on good cooperation between different sectors.

1070. More emphasis should be given to the implementation of the existing conservation tools, such as guidelines for mitigation of certain pressures, best practices and spatial protection mechanisms, adopted under regional agreements; notably ACCOBAMS, the Barcelona Convention and GFCM.

Good environmental status (GES) assessment (CIs 3, 4 and 5 for Cetaceans)

Assessment methodology for CI3, CI4 and CI5 of EO1 regarding Cetaceans

The assessment of the state of cetaceans (GES assessment) under EcAp/IMAP EO1, is foremostly focused on the three common Indicators (CI): CI3 – Species distribution, CI4 – Population abundance and CI5 – Population demographic characteristics. The methodological approach to GES assessment takes stock of the methodological work for cetaceans performed under IMAP, particularly Document UNEP/MED WG.514/Inf.11 "Monitoring and Assessment Scales, Assessment Criteria, Thresholds and Baseline Values for the IMAP Common Indicators 3, 4 and 5 related to marine mammals" (UNEP, 2021). The Decision IG.21/3 2013 defines operational objectives and describes what is GES for each CI, and 2017 Common Indicator Guidance Facts Sheets (Biodiversity and Fisheries) (IMAP 2017) elaborates in more detail GES targets. Furthermore, according to the UNEP/MAP (2021), assessment of CI3 and CI4 is focused on eight representative species; one baleen whale (Mysticeti), two deep-diving toothed whales (Odnonceti) and five shallow-diving toothed whales (Odonoceti).

Alternative assessment for EO1 (CI3 and CI4 topics) - IUCN Red List assessment

The Red listing system of the IUCN is one of the most recognized methods for assessing and understanding the state of biodiversity. The IUCN criteria focus both on changes of population size and abundance over time (Criteria A), as well as changes of size and quality of species habitat (Criteria B), and related pressures, and as such these criteria co-relate with GES Common Indicators. Indeed, thresholds for the CI4 – Population abundance are based on the IUCN criteria on population size changes. Therefore, the results of the assessments of the status of cetaceans in the Mediterranean using IUCN criteria, represent good indicators of the state of cetaceans in this region.

Common Indicator 3: Species Distributional Range (Cetaceans)

Long finned pilot whale (*Globicephala melas*)

1071. Long-finned pilot whale is a cetacean species found in a variety of deep-water environments, including offshore areas, canyons, and seamounts (Cañadas et al. 2005, Azzellino et al. 2008). It is one of the deepest-diving delphinids distributed almost exclusively in the deep pelagic waters of the western basin of the Mediterranean Sea (Verborgh et al., 2016, ACCOBAMS, 2021a) (Figure 60). Largest groups of long finned pilot whales were sighted in the Alborán Sea, along the coast of Morocco and in the Gulf Lion. Relatively smaller pods were observed in the Ligurian Sea within the waters of the Pelagos Sanctuary (ACCOBAMS, 2021a). Based on the 2018 - 2021 IUCN Red List assessment in ACCOBAMS area, long-finned pilot whale is listed as Endangered for the Inner Mediterranean subpopulation and Critically Endangered for the Strait of Gibraltar subpopulation.

Figure 60: Distribution of long-finned pilot whale (Globicephala melas) in the Mediterranean Sea. Source: ACCOBAMS, 2021a

1072. The distribution map shown in Figure 60. is based on experts' interpretation of data from various data sources, with emphasis on ACCOBAMS Survey Initiative data. Since data is the main ingredient for GES assessment, a snapshot is given of various relevant/reliable data sources (databases) with the description of the number of available occurrence data, as data indicative for species distribution (Table 4.2.). It should be emphasized that data given in following paragraphs are indicative only and should be viewed as a contribution to the actual species distribution map given in Figure 60.

1073. A snapshot of occurrence data collected through OBIS, ASI data, GBIF, INTERCET and consolidations over 1100 records of the long-finned pilot whale occurrences over the time range from 1973 to 2021. In addition, species distribution data (polygons) is available, as reported by Member States related to the Habitats Directive, Article 17 (Figure 61 and Figure 62). Observations' data confirm the presence of the long-finned pilot whale almost exclusively in the western Mediterranean Sea, as presented in the distribution map in Figure 60.

Figure 61: Globicephala melas occurrence data from INTERCET Project. Source: INTERCET Presentation map https://www.intercet.it/ (data accessed in December 2022/January 2023)

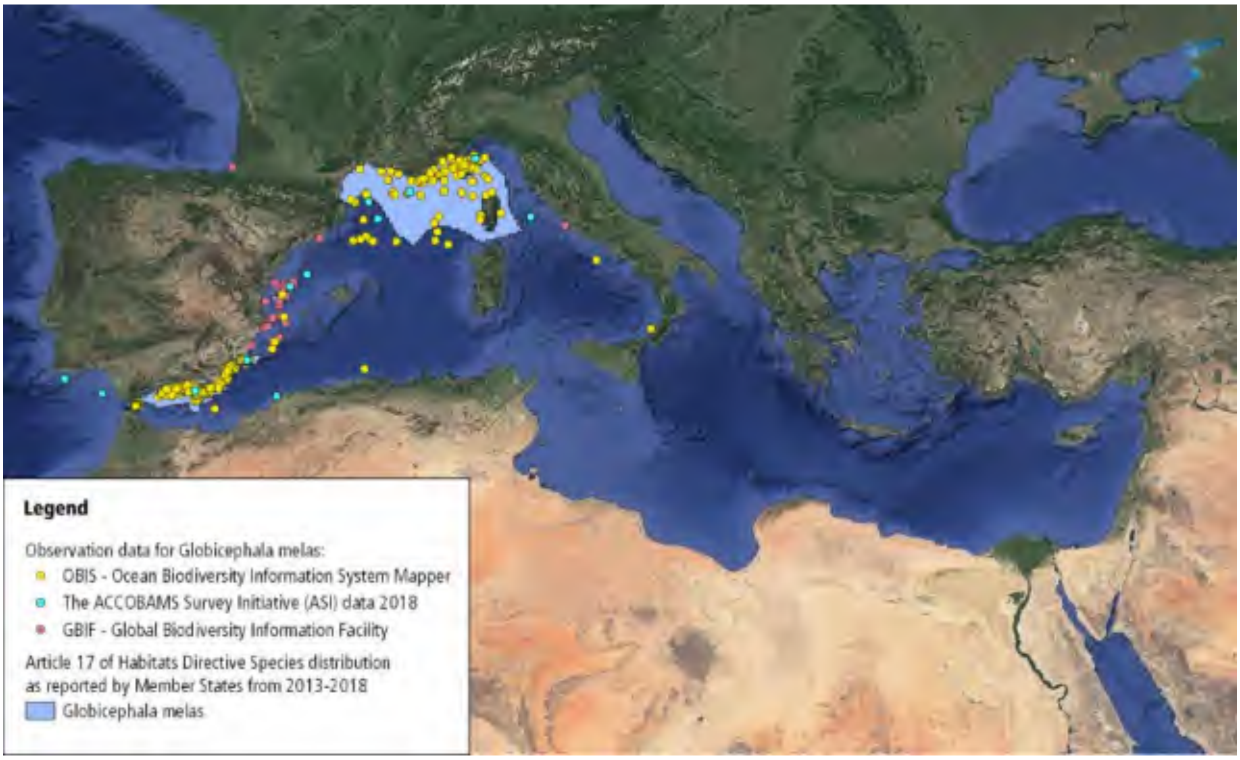


Figure 62: *Globicephala melas* occurrence data from OBIS (1973-2019), ASI (2018), GBIF (1986-2021) and datasets (2013-2018) from reporting in relation to Article 17 of EU Habitats Directive (Public version - Aug. 2020).

GES assessment conclusion (CI 3, Species Distributional Range for *Globicephala melas*)

1074. The baseline/reference distribution map for long-finned pilot whale in the Mediterranean is defined and it shows that this species is present in the western portion of the Mediterranean basin and absent elsewhere (ACCOBAMS, 2021a). However, in order to assess whether the GES is achieved, as expressed through the defined threshold, it is required to have information of trends in spatial distribution. Since the baseline/reference value dates from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10, 2022).

Risso's dolphin (*Grampus griseus*)

1075. Risso's dolphin is present throughout the Mediterranean Sea, with the most frequent observations in the western part of the basin - the Alborán Sea, the Moroccan and Algerian waters and the Balearic Islands (Figure 63). Risso's dolphins have also been frequently spotted in the southern part of the Adriatic Sea as well as the Ionian Sea and the deep Hellenic Trench. In the eastern Mediterranean sightings are usually low and the species is also encountered in mixed-species groups with striped dolphins and short-beaked common dolphins in the deep waters of the Gulf of Corinth (Frantzis and Herzing, 2002; Frantzis et al., 2003). In the Mediterranean region, Risso's dolphins are typically found in deep offshore waters and often in large groups or pods. Based on the 2018 - 2021 IUCN Red List assessment in the ACCOBAMS area, Risso's dolphin is listed as Endangered (ACCOBAMS Resolution 8.12, 2022).

Figure 63: : Distribution of Risso's dolphin (*Grampus griseus*) in the Mediterranean Sea.
Source: ACCOBAMS, 2021a[136]

1076. The distribution map shown in Figure 63 is based on experts' interpretation of data from various data sources, with emphasis on ACCOBAMS Survey Initiative data. Since data is the main ingredient for GES assessment, a snapshot is given of various relevant/reliable data sources (databases) with the description of the number of available occurrence data, as data indicative for species distribution (Table 4.3.). It should be emphasized that data given in following paragraphs are indicative only and should be viewed as a contribution to the actual species distribution map given in Figure 63.

1077. Available data sources provide Risso's dolphins' occurrence data as well as depiction of the distribution area based on the datasets from the Article 17 of the Habitats Directive (Table 4.3.). Collected data consolidates over 1140 records of the Risso's dolphins' occurrences over the time range from 1973 to 2020 (Figure 64 and Figure 65). Observations' data confirm the presence of the Risso's dolphin as presented in the distribution map, as shown in Figure 63.

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[136] Note: The source of distribution maps (ACCOBAMS, 2021a) shows species distribution in the Mediterranean Sea and, when applicable, in the contiguous Atlantic area (as parts of ACCOBAMS area). However, the focus of this report is the Mediterranean Sea, which is supported with written description of distribution. This is also valid for presentations of cetacean distribution maps elaborated in following sections.

Figure 64: *Grampus griseus* occurrence data from INTERCET Project. Source: INTERCET Presentation map [***https://www.intercet.it/***](https://www.intercet.it/)

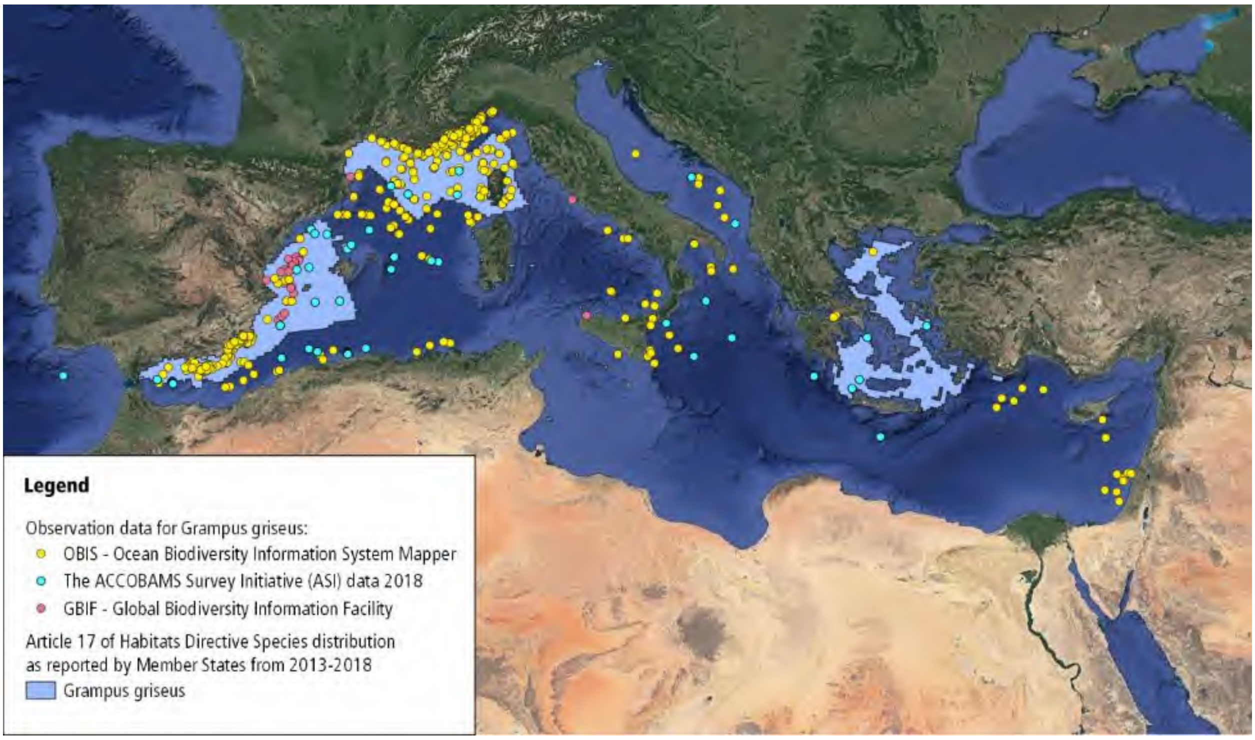


Figure 65: *Grampus griseus occurrence* data from OBIS (1973-2020), ASI (2018), GBIF (1993-2019) and datasets (2013-2018) from reporting in relation to Article 17 of EU Habitats Directive (Public version - Aug. 2020).

<u>GES assessment conclusion (CI 3, Species Distributional Range for *Grampus griseus*)</u>

1078. The baseline/reference distribution map for presence of Risso's dolphin in the Mediterranean is defined and it shows presence of the species throughout the Mediterranean basin, with the highest density and regular observations in the Alboran and Balearic Sea, southern part of the Adriatic as well as the Ionian and Aegean Sea (ACCOBAMS, 2021a). However, in order to assess whether the GES is achieved, as expressed through the defined threshold, it is required to have information on trends in spatial distribution. Since the baseline/reference value dates from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10, 2022).

Common bottlenose dolphin (*Tursiops truncatus*)

1079. Common bottlenose dolphins are regularly present and widely distributed across the Mediterranean Sea, mostly spotted in the continental shelf but also occurring in the deeper offshore waters throughout the region. Most recent aerial data showed a discontinued distribution of the common bottlenose dolphin from the Strait of Gibraltar to the area north of the Balearic Islands towards the Gulf of Lion, Corsica and northern Tyrrhenian Sea. They seem particularly abundant in the northern Adriatic Sea, in the Strait of Sicily and in the Aegean Sea (Figure 66). Based on the 2018 – 2021 IUCN Red List assessment in ACCOBAMS area, common bottlenose dolphin is listed as Least Concern for the Inner Mediterranean subpopulation and Critically Endangered for the Gulf of Ambracia subpopulation (ACCOBAMS Resolution 8.12, 2022).

Figure 66: Distribution of common bottlenose dolphin (*Tursiops truncatus*) in the Mediterranean Sea. Source: ACCOBAMS, 2021a

1080. The distribution map shown in Figure 66 is based on experts' interpretation of data from various data sources, with emphasis on ACCOBAMS Survey Initiative data. Since data is the main ingredient for GES assessment, a snapshot is given of various relevant/reliable data sources (databases) with the description of the number of available occurrence data, as data indicative for species distribution (Table 4.4.). It should be emphasized that data given in following paragraphs are indicative only and should be viewed as a contribution to the actual species distribution map given in Figure 66.

1081. Available data sources provide common bottlenose dolphins' occurrence data as well as depiction of the distribution area based on the datasets from the Article 17 of the Habitats Directive (Table 4.4.) Collected data consolidates almost 14000 records of the common bottlenose dolphins' occurrences over the time range from 1972 to 2022 (Figure 67. and Figure 68). Observations' data confirm the presence of the common bottlenose dolphin as presented in the distribution map, as shown in Figure 66.

Table 39: Common bottlenose dolphin (*Tursiops truncatus*) in the Mediterranean Sea occurrence and distribution data from the relevant data sources (data accessed in December 2022/January 2023)

Data source	**Time range**	**Description**
OBIS - Ocean Biodiversity Information System Mapper	1972 - 2022	4592 occurrences
The ACCOBAMS Survey Initiative (ASI) data	2018	178 occurrences (pod size from 1 – 181)
GBIF - Global Biodiversity Information Facility	1990 - 2021	1322 occurrences
INTERCET	NA	7621 occurrences
Conservation status of habitat types and species: datasets from Article 17, Habitats Directive 92/43/EEC reporting (2013-2018) - PUBLIC VERSION - Aug. 2020	2013 - 2018	species distribution data (10km grid cells) as reported by Member States

Figure 67: *Tursiops truncatus* occurrence data from INTERCET Project. Source: INTERCET Presentation map https://www.intercet.it/

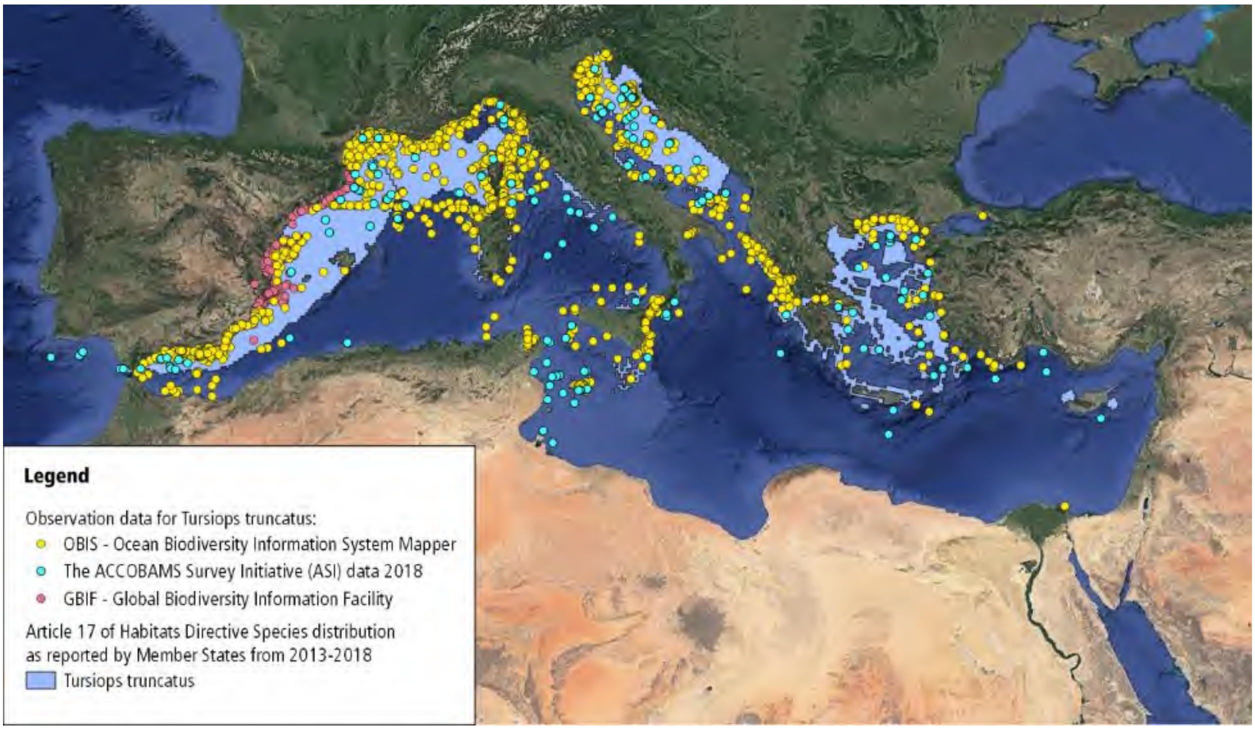


Figure 68: *Tursiops truncatus* occurrence data from OBIS (1972-2022), ASI (2018), GBIF (1990-2021) and datasets (2013-2018) from reporting in relation to Article 17 of EU Habitats Directive (Public version - Aug. 2020).

GES assessment conclusion (CI 3, Species Distributional Range for *Tursiops truncatus*)

1082. The baseline/reference distribution map for presence of common bottlenose dolphin in the Mediterranean is defined and it shows that the species is confirmed throughout the entire Mediterranean basin, especially in the continental shelf (ACCOBAMS, 2021a). However, in order to assess whether the GES is achieved, as expressed through the defined threshold, it is required to have information on trends in spatial distribution. Since the baseline/reference value dates from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10, 2022).

Common dolphin (*Delphinus delphis*)

1083. Common dolphins have been mostly sighted in both deep offshore waters and shallow coastal waters of the Mediterranean (Bearzi et al. 2003, ACCOBAMS 2021a), most abundantly the Alborán Sea, the Strait of Sicily and of the Sardinian, Tyrrhenian and western Ionian seas, including the Gulf of Corinth, the northern and eastern Aegean Sea and along the coastal waters of southern Israel, as shown in Figure 69. The presence of common dolphins from Algeria to Libya has been often reported, but without quantitative indications of abundance (ACCOBAMS 2021a). Based on vast literature and museum collections, common dolphins used to be present throughout the Mediterranean Sea until the first half of the 20th century and as such they are still considered to be potentially present in their former distribution range. Based on the 2018 – 2021 IUCN Red List assessment in ACCOBAMS area, common dolphin is listed as Endangered for the Inner Mediterranean subpopulation and Critically Endangered for the Gulf of Corinth subpopulation (ACCOBAMS Resolution 8.12, 2022).

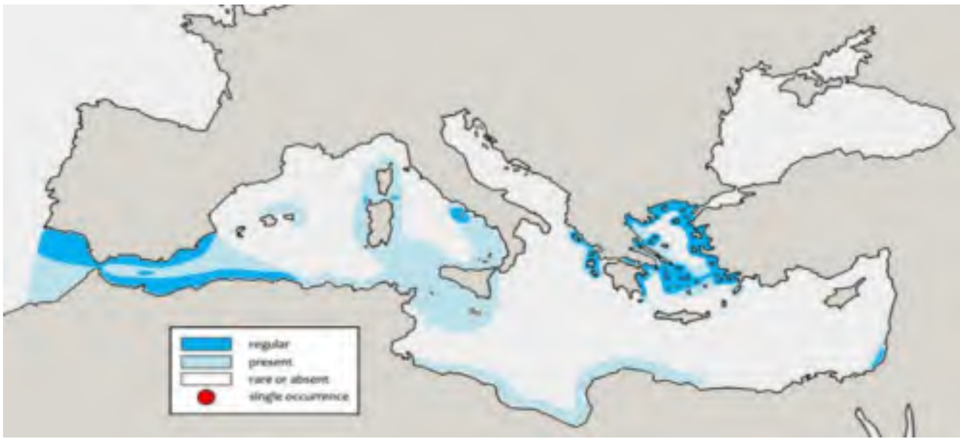


Figure 69: Distribution of common dolphin (*Delphinus delphis*) in the Mediterranean Sea. Source: ACCOBAMS, 2021b

1084. The distribution map shown in Figure 69. is based on experts' interpretation of data from various data sources, with emphasis on ACCOBAMS Survey Initiative data. Since data is the main ingredient for GES assessment, a snapshot is given of various relevant/reliable data sources (databases) with the description of the number of available occurrence data, as data indicative for species distribution (Table 4.5.). It should be emphasized that data given in following paragraphs are indicative only and should be viewed as a contribution to the actual species distribution map given in Figure 69.

1085. Available data sources provide common bottlenose dolphins' occurrence data as well as depiction of the distribution area based on the datasets from the Article 17 of the Habitats Directive (Table 4.5). Collected data consolidates almost 3100 records of the common dolphins' occurrences over the time range from 1934 to 2021 (Figure 70 and Figure 71). Observations' data confirm the presence of the common dolphin as presented in the distribution map (Figure 4.14).

Figure 70: *Delphinus delphis* occurrence data from INTERCET Project. Source: INTERCET Presentation map https://www.intercet.it/

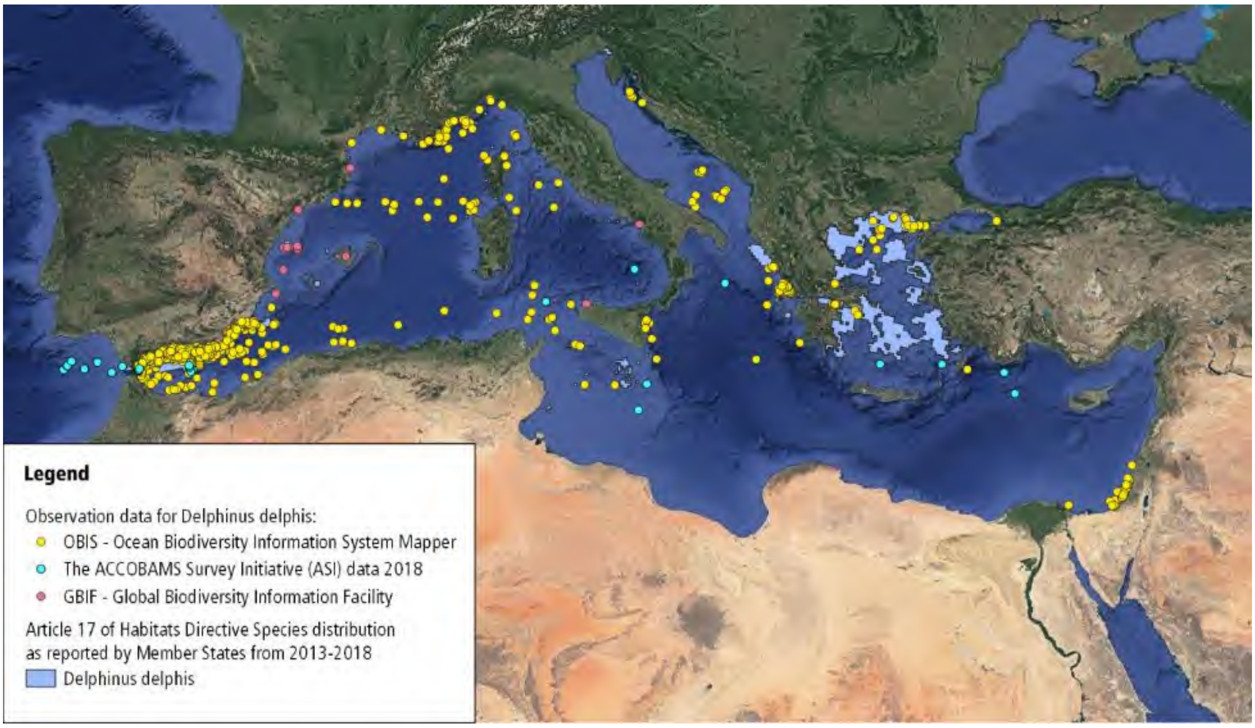


Figure 71: *Delphinus delphis* occurrence data from OBIS (1969-2019), ASI (2018), GBIF (1934-2021) and datasets (2013-2018) from reporting in relation to Article 17 of EU Habitats Directive (Public version - Aug. 2020).

GES assessment conclusion (CI 3, Species Distributional Range for *Delphinus delphis*)

1086. The presence of common dolphin in the Mediterranean is confirmed mostly in the western part of Mediterranean basin, including Alboran Sea, around Sardinia and Sicily but also around the coast of North Africa as well as throughout Aegean Sea (ACCOBAMS, 2021a). However, in order to assess whether the GES is achieved, as expressed through the defined threshold, it is required to have information on trends in spatial distribution. Since the baseline/reference value dates from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10, 2022).

Striped dolphin (*Stenella coeruleoalba*)

1087. Striped dolphin is the most sighted and abundant small cetacean species regularly present almost throughout the Mediterranean Sea where the can be found predominantly offshore and very rarely in waters shallower than 100 m (Notarbartolo di Sciara et al. 1993). It has also been regularly spotted from Gibraltar to the Levantine Sea, most often in the Alborán Sea region, in the waters between the Balearic Islands and the Iberian mainland, in the Gulf of Lions and in the Ligurian Sea as well as the Tyrrhenian and Ionian Seas, including in the Gulf of Taranto, and in the open waters of the southern Adriatic Sea, as well as in the Strait of Sicily, and throughout the Aegean and Levantine seas, all the way to Cyprus, Gulf of Corinth and Israel (Figure 69). Based on the 2018 - 2021 IUCN Red List assessment in ACCOBAMS area, striped dolphin is listed as Least Concern for the Mediterranean subpopulation and Endangered for the Gulf of Corinth subpopulation (ACCOBAMS Resolution 8.12, 2022).

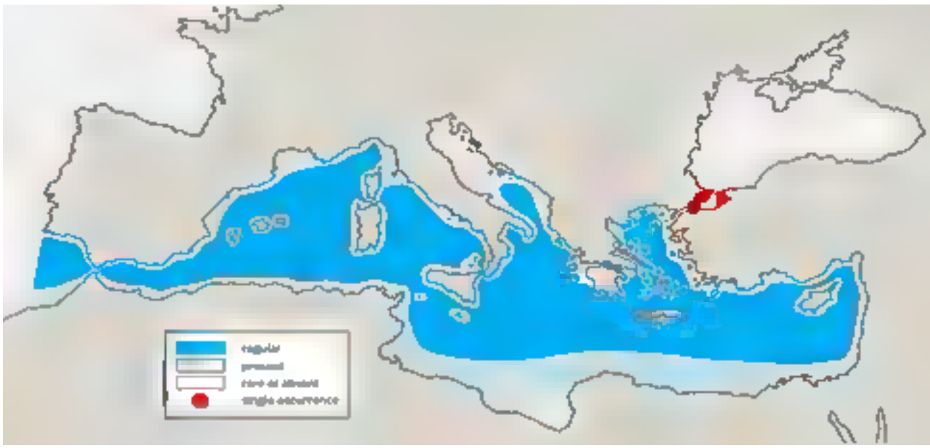


Figure 72: Distribution of Striped dolphin (*Stenella coeruleoalba*) in the Mediterranean Sea. Source: ACCOBAMS, 2021a

1088. The distribution map shown in Figure 72. is based on experts' interpretation of data from various data sources, with emphasis on ACCOBAMS Survey Initiative data. Since data is the main ingredient for GES assessment, a snapshot is given of various relevant/reliable data sources (databases) with the description of the number of available occurrence data, as data indicative for species distribution (Table 4.6.). It should be emphasized that data given in following paragraphs are indicative only and should be viewed as a contribution to the actual species distribution map given in Figure 72.

1089. Available data sources provide striped dolphins' occurrence data as well as depiction of the distribution area based on the datasets from the Article 17 of the Habitats Directive (Table 4.6.). Collected data consolidates almost 25000 records of the striped dolphins' occurrences over the time range from 1972 to 2021 (Figure 73 and Figure 74). Observations' data confirm the presence of the striped dolphin as presented in the distribution map (Figure 72).

Figure 73: *Stenella coeruleoalba* occurrence data from INTERCET Project. Source: INTERCET Presentation map https://www.intercet.it/

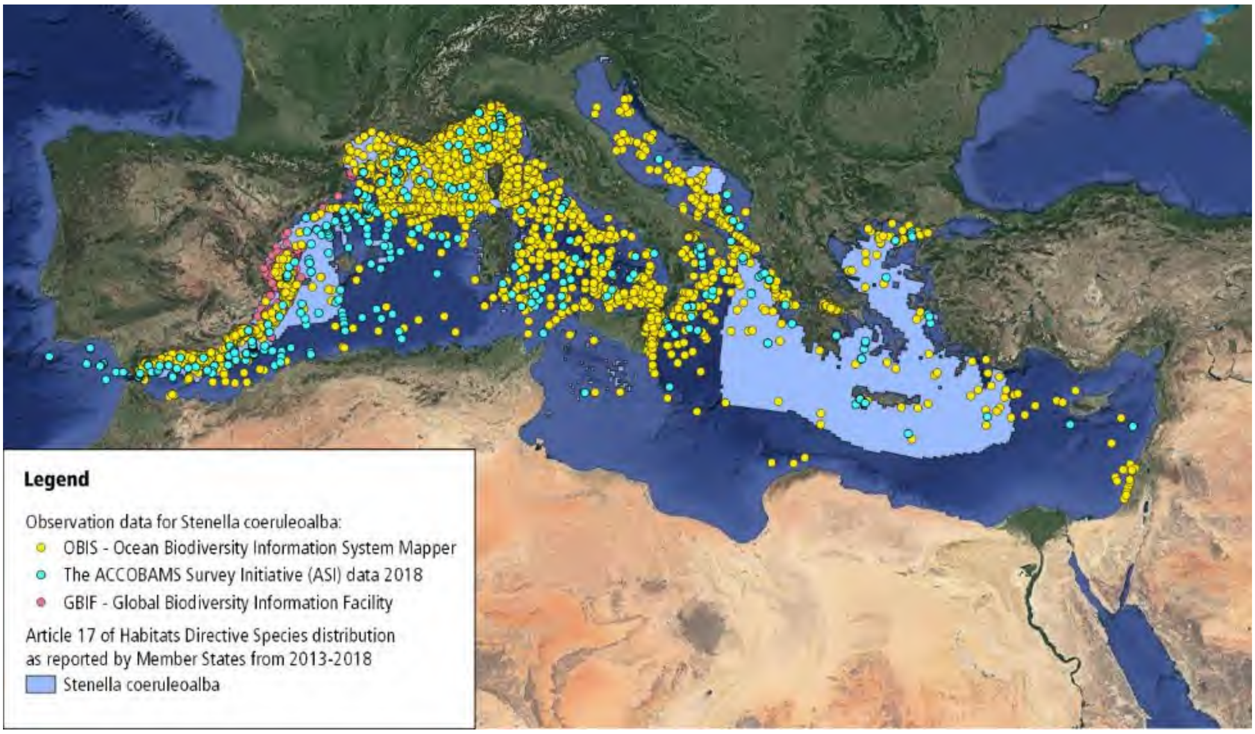


Figure 74: *Stenella coeruleoalba* occurrence data from OBIS (1972-2021), ASI (2018), GBIF (1996-2021) and datasets (2013-2018) from reporting in relation to Article 17 of EU Habitats Directive Public version - Aug. 2020.

<u>GES assessment conclusion (CI 3, Species Distributional Range for *Stenella coeruleoalba*)</u>

1090. The presence of the striped dolphin is confirmed throughout deeper waters of the entire Mediterranean basin, from Gibraltar to Levantine Sea. However, in order to assess whether the GES is achieved, as expressed through the defined threshold, it is required to have information on trends in spatial distribution. Since the baseline/reference value dates from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10, 2022).

Sperm whale (*Physeter macrocephalus*)

1091. Sperm whale is a large cetacean species occurring throughout the deep and slope waters of the Mediterranean Sea, from Gibraltar to the Levantine Sea. Sperm whales have been most frequently spotted in specific areas such as the Strait of Gibraltar as well as in Tunisian waters, Balearic Islands, the Liguro-Provençal Basin, parts of the Tyrrhenian Sea, the Hellenic Trench, and south of Türkiye from Rhodes to Cyprus. Additionally, strandings have been reported in Libya and Egypt, suggesting intermittent use of this area by the species. Sperm whales are rare and occur only sporadically in the shallow waters of the Mediterranean such as the northern and central Adriatic, the Strait of Sicily and portions of the Aegean Sea, as shown in Figure 75. Based on the 2018 - 2021 IUCN Red List assessment in ACCOBAMS area, Mediterranean subpopulation of sperm whale is listed as Endangered (ACCOBAMS Resolution 8.12, 2022).

Figure 75: Distribution of Sperm whale (*Physeter macrocephalus*) in the Mediterranean Sea. Source: ACCOBAMS, 2021a

1092. The distribution map shown in Figure 75 is based on experts' interpretation of data from various data sources, with emphasis on ACCOBAMS Survey Initiative data. Since data is the main ingredient for GES assessment, a snapshot is given of various relevant/reliable data sources (databases) with the description of the number of available occurrence data, as data indicative for species distribution (Table 4.7.). It should be emphasized that data given in following paragraphs are indicative only and should be viewed as a contribution to the actual species distribution map given in Figure 75.

1093. Available data sources provide sperm whales' occurrence data as well as depiction of the distribution area based on the datasets from the Article 17 of the Habitats Directive (Table 4.7.). Collected data consolidates around 3200 records of the Sperm whales' occurrences over the time range from 1913 to 2020 (Figure 76 and Figure 77). Observations' data confirm the presence of the Sperm whales as presented in the distribution map (Figure 75).

Figure 76: *Physeter macrocephalus* occurrence data from INTERCET Project. Source: INTERCET Presentation map https://www.intercet.it/

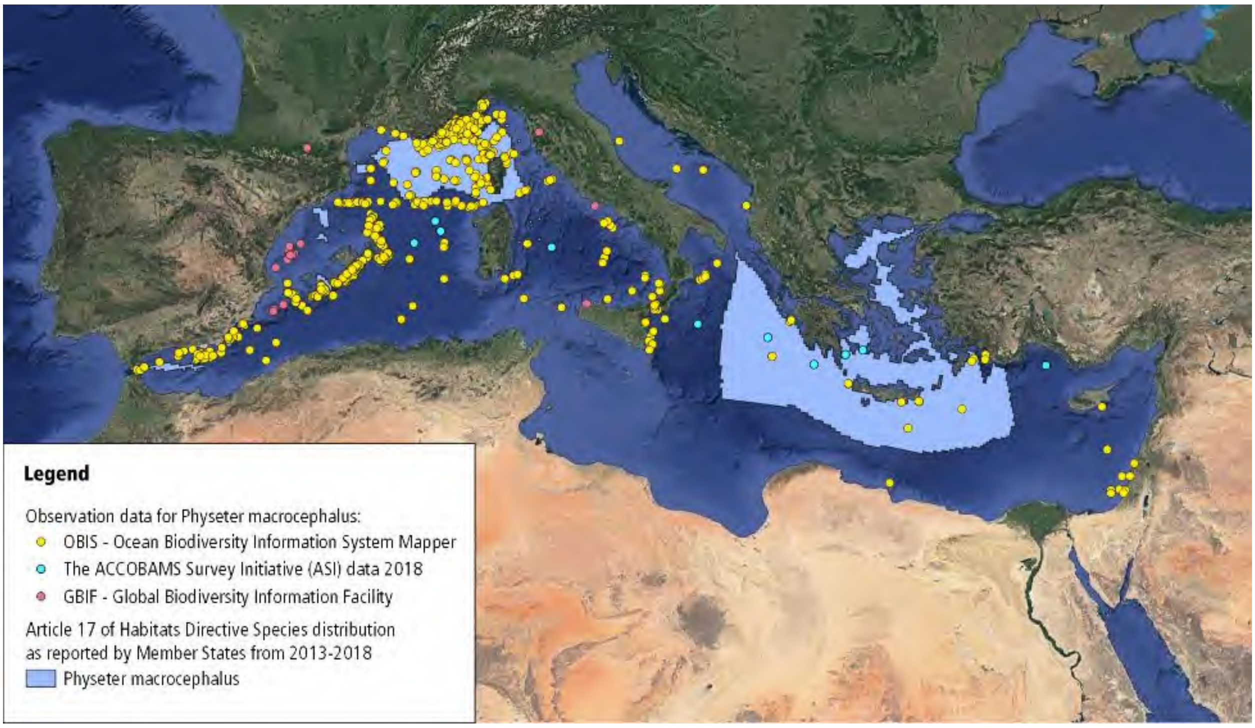


Figure 77: *Physeter macrocephalus* occurrence data from OBIS (1913-2020), ASI (2018), GBIF (1993-2013) and datasets (2013-2018) from reporting in relation to Article 17 of EU Habitats Directive Public version - Aug. 2020.

<u>GES assessment conclusion (CI 3, Species Distributional Range for *Physeter macrocephalus*)</u>

1094. The presence of the sperm whale is confirmed throughout deep offshore waters of the Mediterranean, with only sporadic seasonal occurrences in the shallow waters such as the northern and central Adriatic, the Strait of Sicily and portions of the Aegean Sea. However, in order to assess whether the GES is achieved, as expressed through the defined threshold, it is required to have information on trends in spatial distribution. Since the baseline/reference value dates from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10, 2022).

<u>Cuvier's beaked whale (*Ziphius cavirostris*)</u>

1095. Cuvier's beaked whales are present throughout the Mediterranean basin, most abundantly in the following hotspots: the Alborán Sea, the northern part of Ligurian Sea, the northern Tyrrhenian Sea, the Ionian Sea (east of Sicily), narrow pathway from the southern Adriatic Sea, along the Hellenic Trench to the west of Cyprus and Levantine Sea waters off Lebanon and Israel. The species is rare or absent in the north and central Adriatic Sea as well as the Turkish Strait System, as shown in Figure 78. Cuvier's beaked whale is also considered to be absent from the southern Mediterranean region, along the coast of Tunisia, Libya and Egypt, but this area is yet to be better investigated and monitored in order to make any conclusions. Based on the 2018 - 2021 IUCN Red List assessment in ACCOBAMS area, Mediterranean subpopulation of Cuvier's beaked whale is listed as Vulnerable (ACCOBAMS Resolution 8.12, 2022).

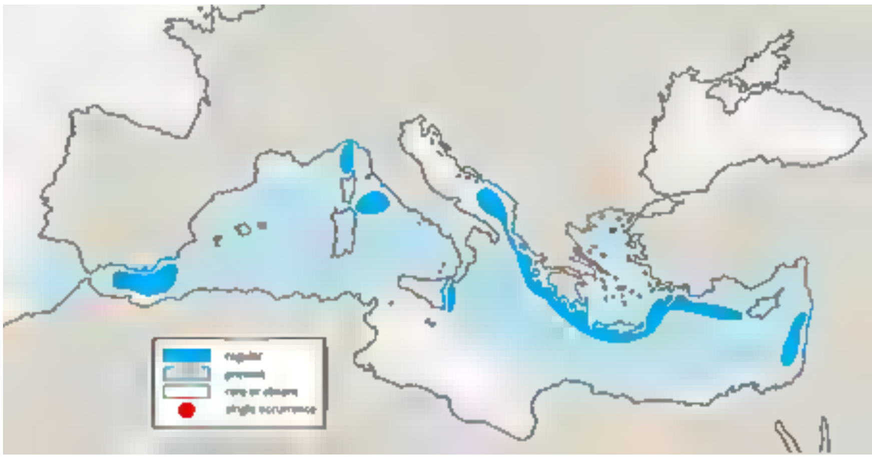


Figure 78: Distribution of Cuvier's beaked whale (*Ziphius cavirostris*) in the Mediterranean Sea. Source: ACCOBAMS, 2021a

1096. The distribution map shown in Figure 78 is based on experts' interpretation of data from various data sources, with emphasis on ACCOBAMS Survey Initiative data. Since data is the main ingredient for GES assessment, a snapshot is given of various relevant/reliable data sources (databases) with the description of the number of available occurrence data, as data indicative for species distribution (Table 4.8.). It should be emphasized that data given in following paragraphs are indicative only and should be viewed as a contribution to the actual species distribution map given in Figure 78.

1097. Available data sources provide Cuvier's beaked whales' occurrence data as well as depiction of the distribution area based on the datasets from the Article 17 of the Habitats Directive (Table 4.8.). Collected data consolidates almost 900 records of the Cuvier's beaked whales' occurrences over the time range from 1974 to 2020 (Figure 79 and Figure 80). Observations' data confirm the presence of the Cuvier's beaked whales as presented in the distribution map (Figure 78).

Figure 79: *Ziphius cavirostris* occurrence data from INTERCET Project. Source: INTERCET Presentation map https://www.intercet.it/

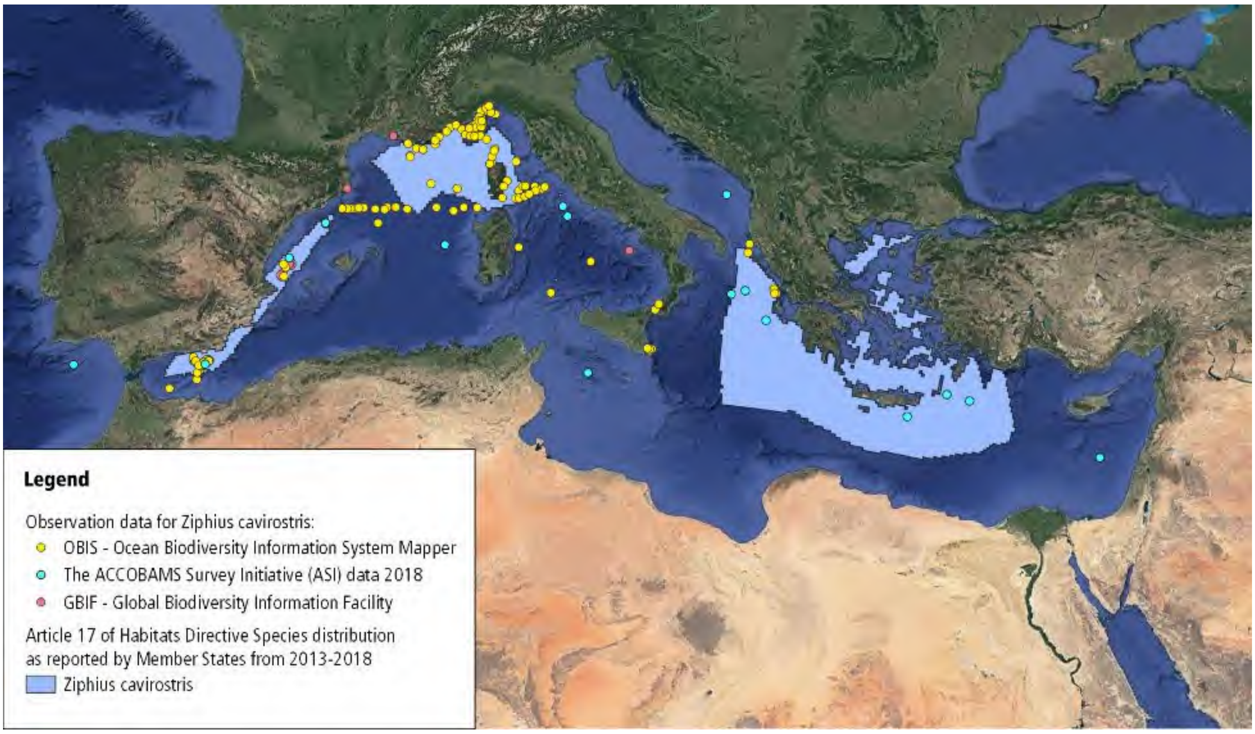


Figure 80: *Ziphius cavirostris* occurrence data from OBIS (1974-2020), ASI (2018), GBIF (2002-2020) and datasets (2013-2018) from reporting in relation to Article 17 of EU Habitats Directive Public version - Aug. 2020.

<u>GES assessment conclusion (CI 3, Species Distributional Range for *Ziphius cavirostris*)</u>

1098. The presence of the Cuvier's beaked whale is confirmed throughout the Mediterranean region, where they occur in relatively small patches at low densities in specific hotspots (such as Ionian Sea and the Hellenic Trench, southern Adriatic Sea, the Central Tyrrhenian Sea, the Balearic and the Alborán Seas). However, in order to assess whether the GES is achieved, as expressed through the defined threshold, it is required to have information on trends in spatial distribution. Since the reference value date from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10, 2022).

Fin whale (*Balaenoptera physalus*)

1099. Fin whale is a large cetacean species regularly present in the deep, pelagic offshore waters of the western Mediterranean basin, with the highest occurrence in the Ligurian Sea, Gulf of Lions, Provençal Basin and the Western part of the Pelagos Sanctuary and less frequent elsewhere. It should be noted that the species is also present in the Gulf of Cadiz in contiguous Atlantic area, due to the importance of the seasonal migration of the species from Strait of Gibraltar and Gulf of Cadiz in the spring and summer, and back to the Mediterranean basin from November to March (ACCOBAMS; 2021a). During the summer time Fin whales are concentrating around their feeding grounds in the Provencal, Corsican, Ligurian and northern Tyrrhenian seas (Notarbartolo di Sciara et al. 2003), as well as the Strait of Sicily in winter (Canese et al. 2006), in the Balearic Sea in spring (EDMAKTUB 2018). It occurs only sporadically in the northern part of the Adriatic, Aegean and Levantine seas (Notarbartolo di Sciara et al. 2003), as shown in Figure 81. Based on the 2018 - 2021 IUCN Red List assessment in ACCOBAMS area, Mediterranean subpopulation of fin whale is listed as Endangered (ACCOBAMS Resolution 8.12, 2022).

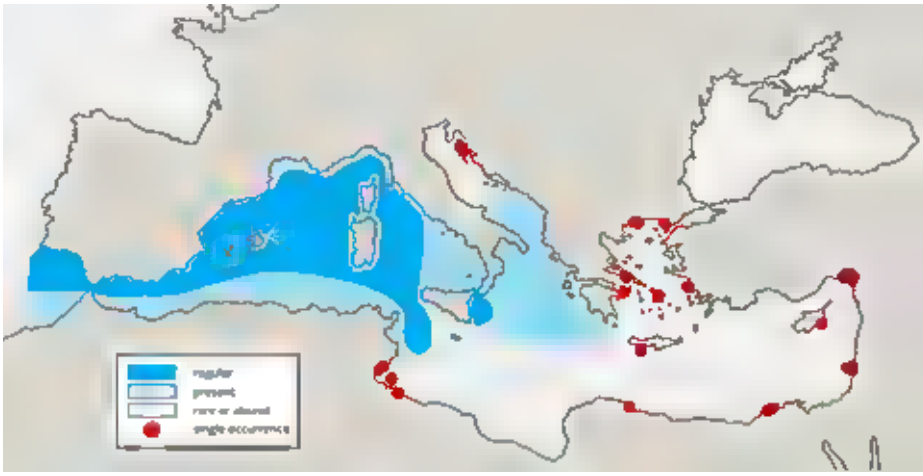


Figure 81: Distribution of Fin whale (*Balaenoptera physalus*) in the Mediterranean Sea. Source: ACCOBAMS, 2021a

1100. The distribution map shown in Figure 81 is based on experts' interpretation of data from various data sources, with emphasis on ACCOBAMS Survey Initiative data. Since data is the main ingredient for GES assessment, a snapshot is given of various relevant/reliable data sources (databases) with the description of the number of available occurrence data, as data indicative for species distribution (Table 4.9.). It should be emphasized that data given in following paragraphs are indicative only and should be viewed as a contribution to the actual species distribution map given in Figure 81.

1101. Available data sources provide fin whales' occurrence data as well as depiction of the distribution area based on the datasets from the Article 17 of the Habitats Directive (Table 4.9.). Collected data consolidates almost 5800 records of the Fin whales' occurrences over the time range from 1934 to 2021 (Figure 82 and Figure 83). Observations' data confirm the presence of the Fin whales as presented in the distribution map (Figure 81).

Figure 82: *Balaenoptera physalus* occurrence data from INTERCET Project. Source: INTERCET Presentation map https://www.intercet.it/

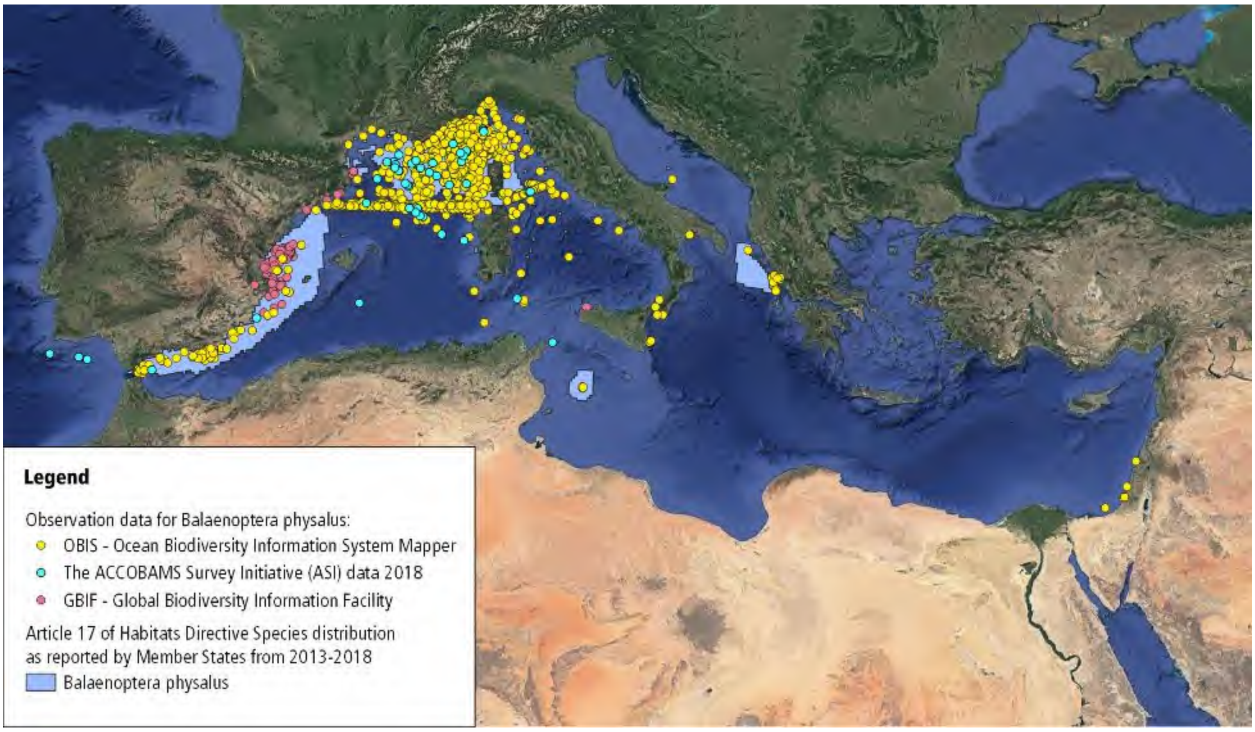


Figure 83: *Balaenoptera physalus* occurrence data from OBIS (1974-2020), ASI (2018), GBIF (2002-2020) and datasets (2013-2018) from reporting in relation to Article 17 of EU Habitats Directive Public version - Aug. 2020.

GES assessment conclusion (CI 3, Species Distributional Range for *Balaenoptera physalus*)

1102. The presence of the fin whale is confirmed throughout deep offshore waters of the western and central Mediterranean basin, with only sporadic seasonal occurrences elsewhere. However, in order to assess whether the GES is achieved, as expressed through the defined threshold, it is required to have information on trends in spatial distribution. Since the baseline/reference value dates from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10, 2022).

Table 40: Assessment of GES for Cetaceans in the Mediterranean Sea for CI3 - Species distribution, based on selected species

Common Indicator	**GES definition**	**GES Assessment** ***Globicephala melas – Long finned pilot whale; Grampus griseus – Risso's dolphin; Tursiops truncatus – common bottlenose dolphin; Delphinus delphis – common dolphin; Stenella coeruleoalba – striped dolphin; Balaenoptera physalus – fin whale; Physeter macrocephalus – sperm whale; Ziphius cavirostris – Cuvier's beaked whale***
CI3 Species distributional range	The species are present in all their *natural* distributional range.	Not possible to assess GES. Namely, the baseline/reference values for CI3, expressed through species distributional maps, are set only recently; with ASI survey actually being carried out in 2018 and 2019 and results published in 2021 and the overview of the state of cetaceans in ACCOBAMS area based on all available data (including ASI and other research), compiled in 2021 (ACCOBAMS, 2021a). However, there is no long-term data series needed to measure whether defined thresholds are achieved. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (ASI 2) is planned for 2024 -2026.

Common Indicator 4: Population Abundance (Cetaceans)

Long finned pilot whale (*Globicephala melas*)

1103. Long-finned pilot whales prefer deep pelagic waters of the western Mediterranean Sea with largest groups observed in the Alborán Sea, along the coast of Morocco and in the Gulf Lion and smaller pods observed in the Pelagos Sanctuary (Figure 84). The species' overall abundance is estimated at 5130 individuals on the Mediterranean level. On the sub-regional level, abundance is estimated as follows: Western Mediterranean Sea 4833, Ionian Sea and the Central Mediterranean Sea 297, Adriatic Sea 0 and Aegean - Levantine Sea 0 (ACCOBAMS, 2021b).

1104. During ASI 2018/2019, 14 long-finned pilot whales' observations were registered with pod sizes ranging from 1 - 30. It should be noted that pilot whales are to some extent difficult to spot during aerial surveys due to the relatively short surfacing periods (Thomson et al., 2012). Hence the abundance and density estimates derived from aerial surveys should be considered with caution.

1105. Based on the 2018 – 2021 IUCN Red List assessment in the ACCOBAMS area, long-finned pilot whale is listed as Endangered for the Inner Mediterranean subpopulation and Critically Endangered for the Strait of Gibraltar subpopulation (ACCOBAMS Resolution 8.12, 2022).

Figure 84: Long finned pilot whale (*Globicephala melas*) observations by pod size (Prepared using ASI 2018/2019 data).

GES assessment conclusion (CI 4, Population Abundance for *Globicephala melas*)

1106. Long- finned pilot whale population abundance has been estimated based on the data collected through ASI 2018/2019, thus providing baseline/reference values for CI4 common indicator. However, in order to assess GES, it is required to examine potential changes in population abundance levels; that is population abundance trends. Since the baseline/reference values date from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10, 2022). In addition, in the scope of ACCOBAMS and in cooperation with IUCN, a revised IUCN conservation status assessment will be carried out in the future.

Risso's dolphin (*Grampus griseus*)

1107. Available observation data confirms Risso's dolphins' strong preference for the western basin of the Mediterranean Sea in summer, with highest abundance and density registered in the Alborán Sea, the Moroccan and Algerian waters and the Balearic Islands. Relatively large groups of Risso's dolphins have also been spotted in the deeper southern part of the Adriatic Sea, the Ionian Sea and the deep Hellenic Trench (Figure 85, Figure 86). During ASI 2018/2019 64 Risso's dolphins' observations were registered with pod sizes ranging from 1 - 40. Estimated species' overall abundance is 23164. On the sub-regional level, abundance is estimated as follows: Western Mediterranean Sea 16651, Ionian Sea and the Central Mediterranean Sea 1540, Adriatic Sea 1467 and Aegean - Levantine Sea 3506.

1108. Based on the 2018 - 2021 IUCN Red List assessment in the ACCOBAMS area, Risso's dolphin is listed as Endangered (ACCOBAMS Resolution 8.12, 2022).

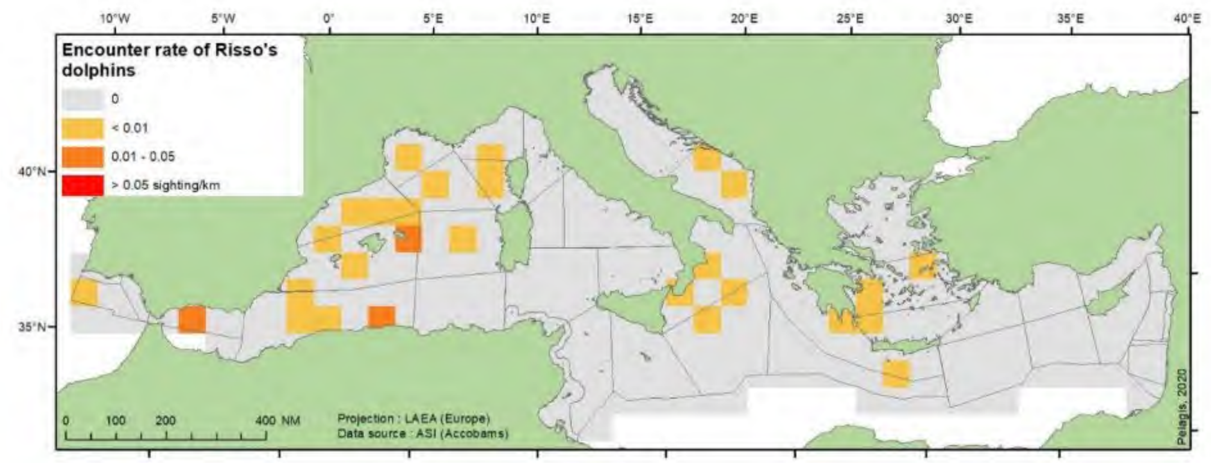


Figure 85: Encounter rate of Risso's dolphins (sightings per km) on a grid of 100x100 km. Source: ACCOBAMS, 2021b.

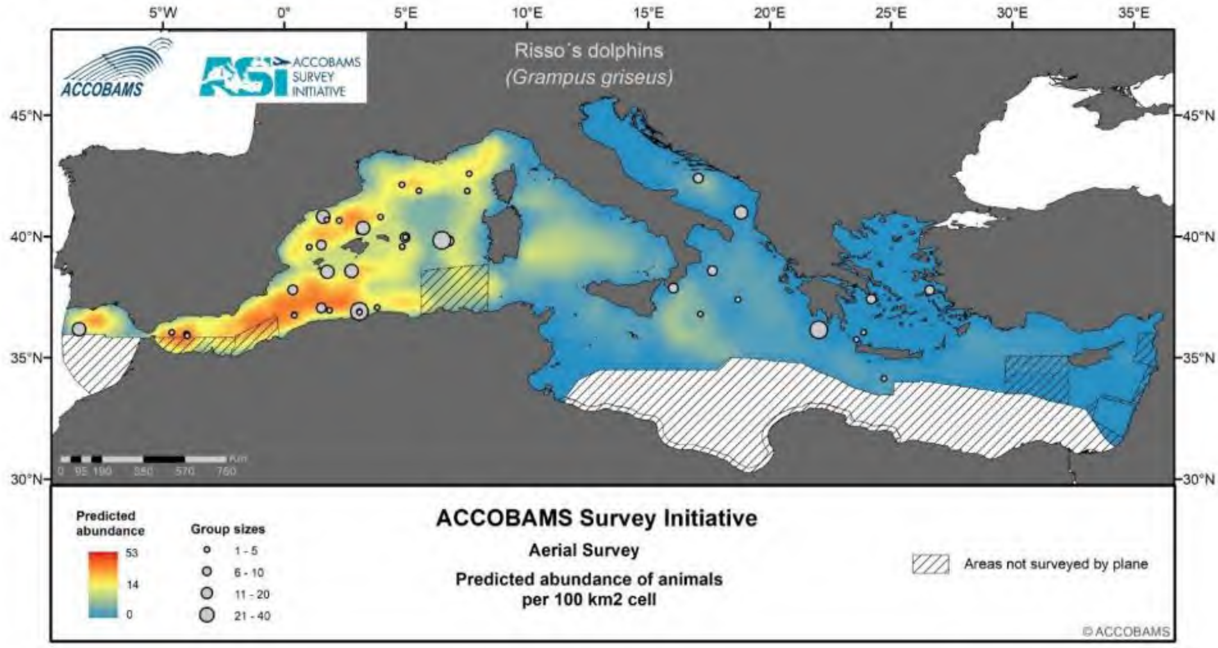


Figure 86: Predicted abundance of Risso's dolphins (*Grampus griseus*). Source: ACCOBAMS, 2021b.

GES assessment conclusion (CI 4, Population Abundance for *Grampus griseus*)

1109. Risso's dolphin population abundance has been estimated based on the data collected through ASI 2018/2019, thus providing baseline/reference values for CI4 common indicator. However, in order to assess GES, it is required to examine potential changes in population abundance levels; that is population abundance trends. Since the baseline/reference values date from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10, 2022). In addition, in the scope of ACCOBAMS and in cooperation with IUCN, a revised IUCN conservation status assessment will be carried out in the future.

Common bottlenose dolphin (*Tursiops truncatus*)

1110. Common bottlenose dolphin is the second most abundant species mostly observed in coastal areas during the latest aerial survey ASI 2018/2019. Species distribution was strongly fragmented with patches of higher abundance in the Strait of Gibraltar and Alborán Sea, the Balearic Sea and the Gulf of Lion, the waters surrounding the Island of Corsica and north of Tyrrhenian Sea. Common bottlenose dolphins appeared regularly in the northern Adriatic Sea, in the Strait of Sicily and in the Aegean Sea (Figure 85).

1111. During ASI 2018/2019 178 common bottlenose dolphins' observations were registered with pod sizes ranging from 1 to 181 (Figure 86). Estimated species' overall abundance is 61391. On the sub-regional level, abundance is estimated as follows: Western Mediterranean Sea 23363, Ionian Sea and the Central Mediterranean Sea 16010, Adriatic Sea 10350 and Aegean - Levantine Sea 11669.

1112. On the IUCN Red List assessment in the ACCOBAMS area, *Tursiops truncatus* is listed as Least Concern for the Inner Mediterranean subpopulation and Critically Endangered for the Gulf of Ambracia subpopulation (ACCOBAMS Resolution 8.12, 2022).

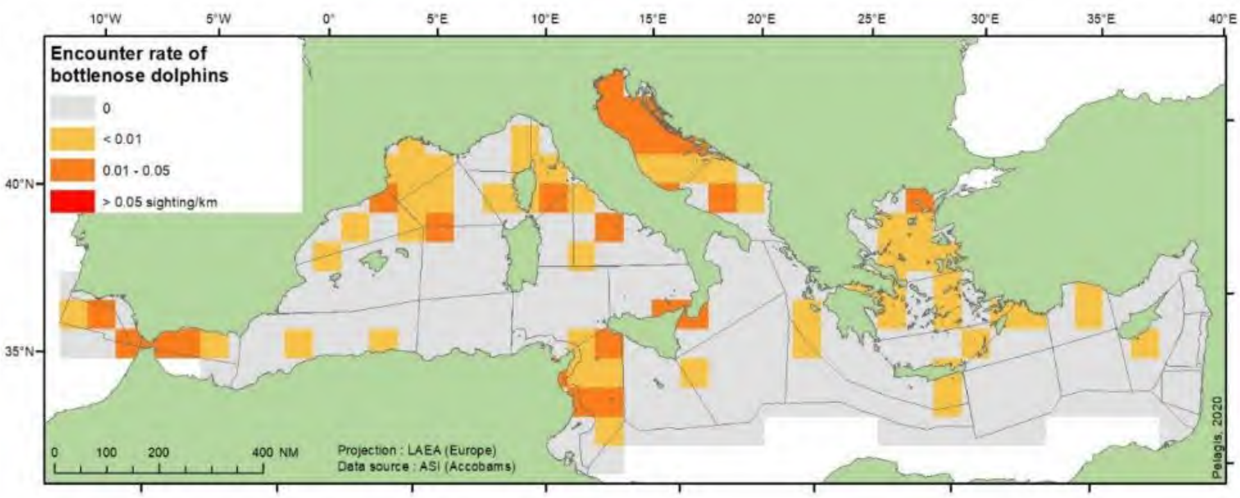


Figure 87: Encounter rate of common bottlenose dolphins (sightings per km) on a grid of 100x100 km. Source: ACCOBAMS, 2021b.

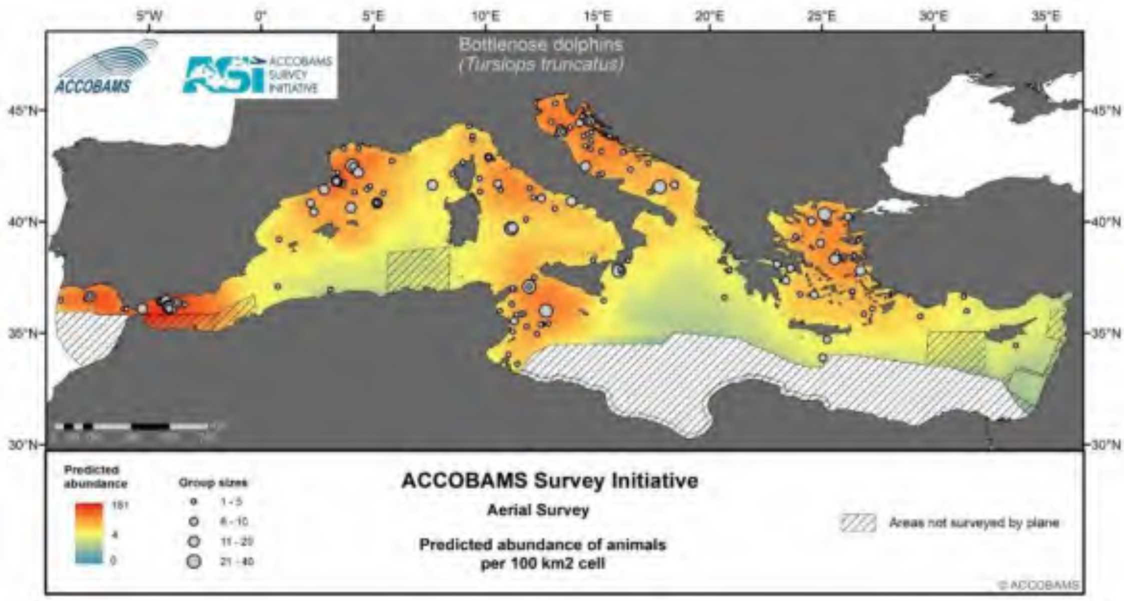


Figure 88: Predicted abundance of common bottlenose dolphins (*Tursiops truncatus*). Source: ACCOBAMS, 2021b

<u>GES assessment conclusion (CI 4, Population Abundance for *Tursiops truncatus*)</u>

1113. Common bottlenose dolphin population abundance has been estimated based on the data collected through ACCOBAMS Aerial Survey (ASI) 2018, thus providing baseline/reference values for CI4 common indicator. However, in order to assess GES, it is required to examine potential changes in population abundance levels; that is population abundance trends. Since the baseline/reference values date from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10, 2022). In addition, in the scope of ACCOBAMS and in cooperation with IUCN, a revised IUCN conservation status assessment will be carried out in the future.

Common dolphin (*Delphinus delphis*)

1114. Common dolphins have been mostly sighted in the Western portion of the Mediterranean basin, with the highest encounter rates in the Tyrrhenian Sea and the Strait of Sicily (Figure 89). During the ASI 2018/2019 aerial survey the common dolphins were sighted usually in mixed-species groups with striped dolphins, often resulting in unclear species identification. Sightings identified as common dolphins were only 32 with pod sizes ranging from 1 - 150 (without striped/common dolphin undistinguished observations) (Figure 90, Figure 91). The overall abundance for the Mediterranean was estimated at 29647. On the sub-regional level, abundance is estimated as follows: Western Mediterranean Sea 24430, Ionian Sea and the Central Mediterranean Sea 1214, Adriatic Sea 0 and Aegean - Levantine Sea 4003. Based on the 2018 – 2021 IUCN Red List assessment in the ACCOBAMS area, *Delphinus delphis* is listed as Endangered for the Inner Mediterranean subpopulation and Critically Endangered for the Gulf of Corinth subpopulation (ACCOBAMS Resolution 8.12, 2022).

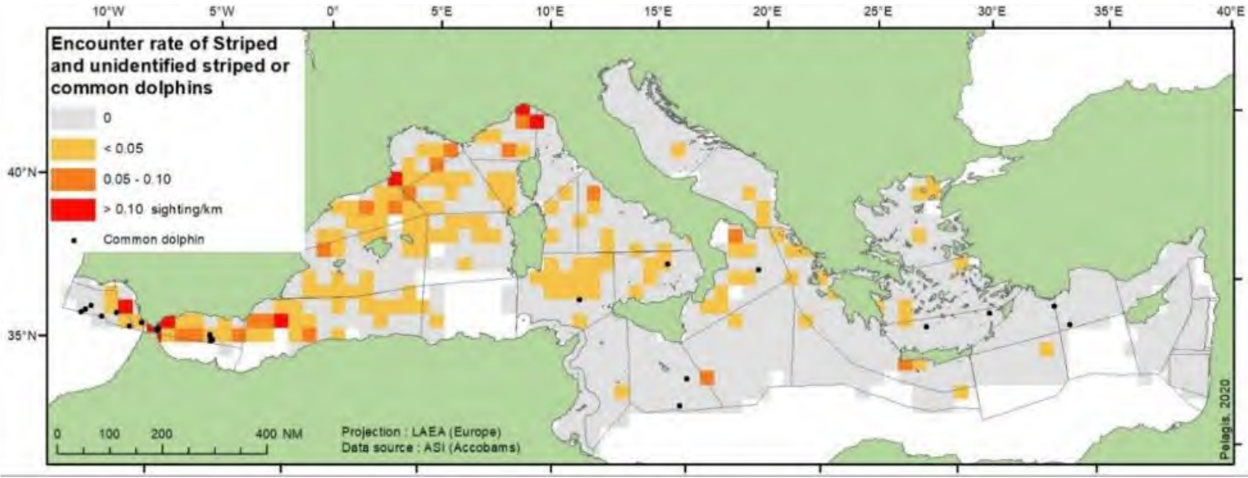


Figure 89: Encounter rate of Striped and unidentified striped or common dolphins (sightings per km) on a grid of 50x50 km. Source: ACCOBAMS, 2021b.

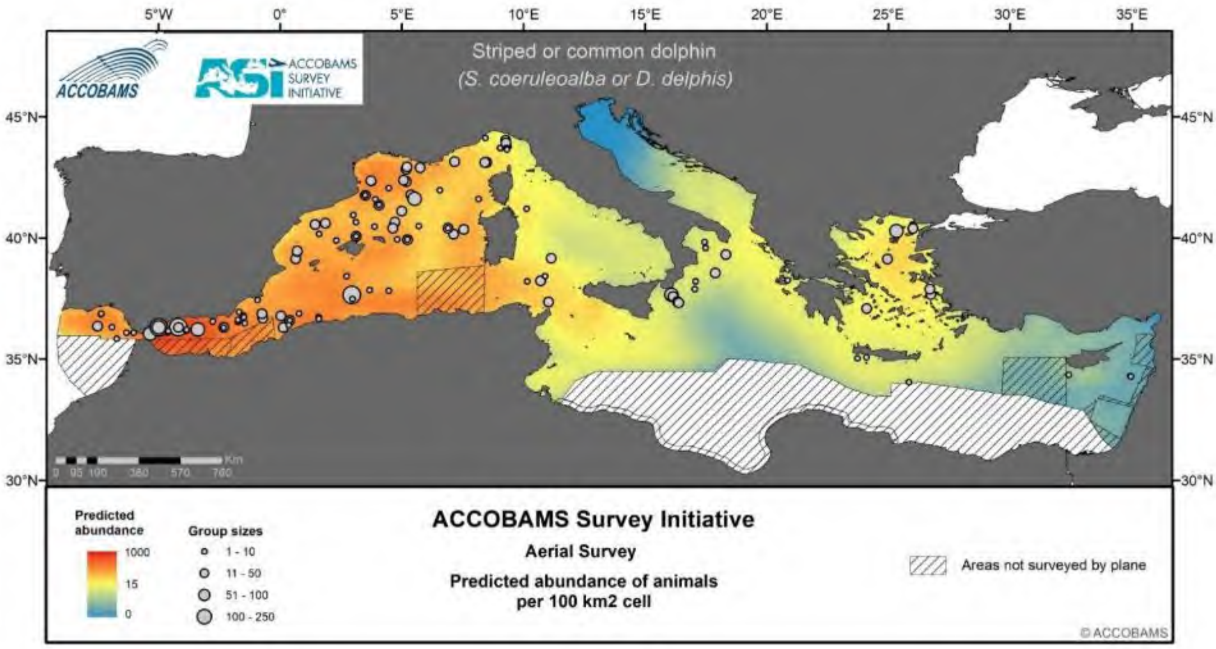


Figure 90: Predicted abundance of undetermined striped or common dolphins. Source: ACCOBAMS, 2021b.

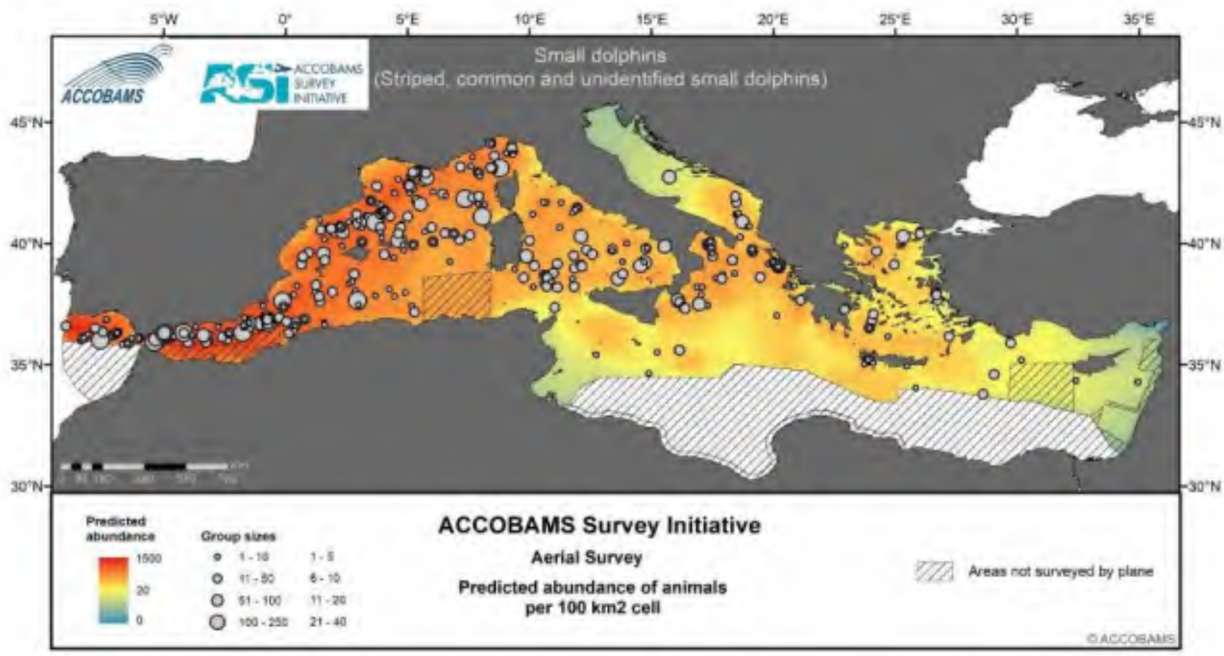


Figure 91: Predicted abundance of small dolphins (striped, common dolphins). Source: ACCOBAMS, 2021b.

<u>GES assessment conclusion (CI 4, Population Abundance for *Delphinus delphis*)</u>

1115. Common dolphin population abundance has been estimated based on the data collected through ASI 2018/2019, thus providing baseline/reference values for CI4 common indicator. However, in order to assess GES, it is required to examine potential changes in population abundance levels; that is population abundance trends. Since the baseline/reference values date from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10, 2022). In addition, in the scope of ACCOBAMS and in cooperation with IUCN, a revised IUCN conservation status assessment will be carried out in the future.

Striped dolphin (*Stenella coeruleoalba*)

1116. Both aerial and vessel surveys resulted in the striped dolphin being the most sighted and abundant species in the Mediterranean, with a clear preference for the Western Basin (Figure 89). Striped dolphins were registered in 451 occurrences with pod sizes ranging from 1 – 250 (Figure 4.42). The overall abundance was estimated at about 419456 individuals. On the sub-regional level, abundance is estimated as follows: Western Mediterranean Sea 315789, Ionian Sea and the Central Mediterranean Sea 66311, Adriatic Sea 10264 and Aegean - Levantine Sea 27092.

1117. It is important to note that during the ASI survey the striped dolphins were commonly sighted within mixed-species groups with common dolphins, often resulting in unclear species identification imperfect species detection.

1118. Based on the 2018 - 2021 IUCN Red List assessment in the ACCOBAMS area, striped dolphin is listed as Least Concern for the Mediterranean subpopulation and Endangered for the Gulf of Corinth subpopulation (ACCOBAMS Resolution 8.12, 2022).

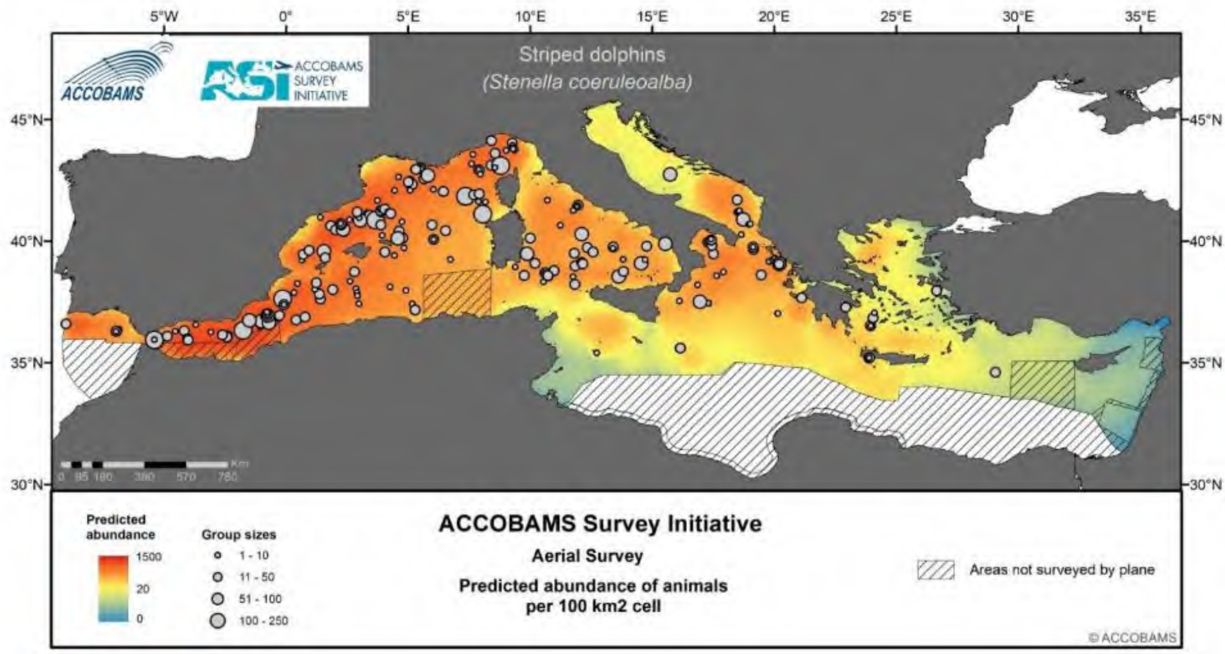


Figure 92: Predicted abundance of Striped dolphins. Source: ACCOBAMS, 2021b.

<u>GES assessment conclusion (CI 4, Population Abundance for *Stenella coeruleoalba*)</u>

1119. Striped dolphin population abundance has been estimated based on the data collected through ACCOBAMS Aerial Survey (ASI) 2018, thus providing baseline/reference values for CI4 common indicator. However, in order to assess GES, it is required to examine potential changes in population abundance levels; that is population abundance trends. Since the baseline/reference values date from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2022 – 2026 (ACCOBAMS Resolution 8.10, 2022). In addition, in the scope of ACCOBAMS and in cooperation with IUCN, a revised IUCN conservation status assessment will be carried out in the future.

Sperm whale (*Physeter macrocephalus*)

1120. During ASI 2018/2019, sperm whales were detected acoustically throughout the western basin of the Mediterranean Sea, from Alboran to Tyrrhenian Sea, with additional detections in the Strait of Gibraltar (Figure 93). A total of 249 individual sperm whales were detected from Song of the Whale and additional 71 individuals were detected off the track-line (**Error! Reference source not found.**). The overall abundance of sperm whales was estimated at about 1416. On the sub-regional level, abundance is estimated as follows: Western Mediterranean Sea 356, Ionian Sea and the Central Mediterranean Sea 324, Adriatic Sea 0 and Aegean - Levantine Sea 737.

1121. Based on the 2018 - 2021 IUCN Red List assessment in the ACCOBAMS area, Mediterranean subpopulation of sperm-whale is listed as Endangered (ACCOBAMS Resolution 8.12, 2022).

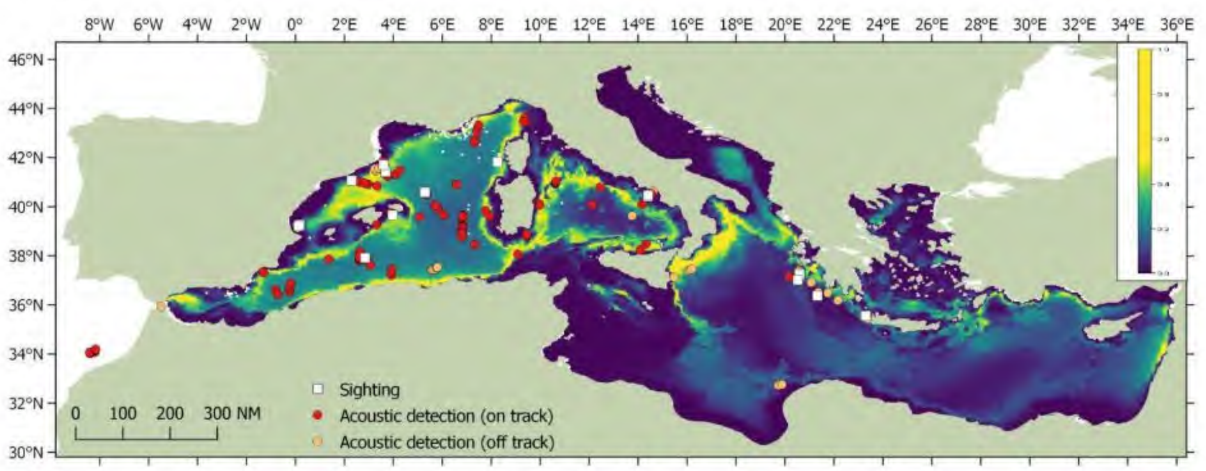


Figure 93: Sightings and detections of sperm whales made by the Song of the Whale team during the ASI survey (white squares and red/orange circles respectively). A predicted density map from Mannocci et al., 2018b is overlaid showing regions of ideal sperm whale habitat (yellow = highest likelihood, blue = lowest likelihood). Source: ACCOBAMS, 2021b.

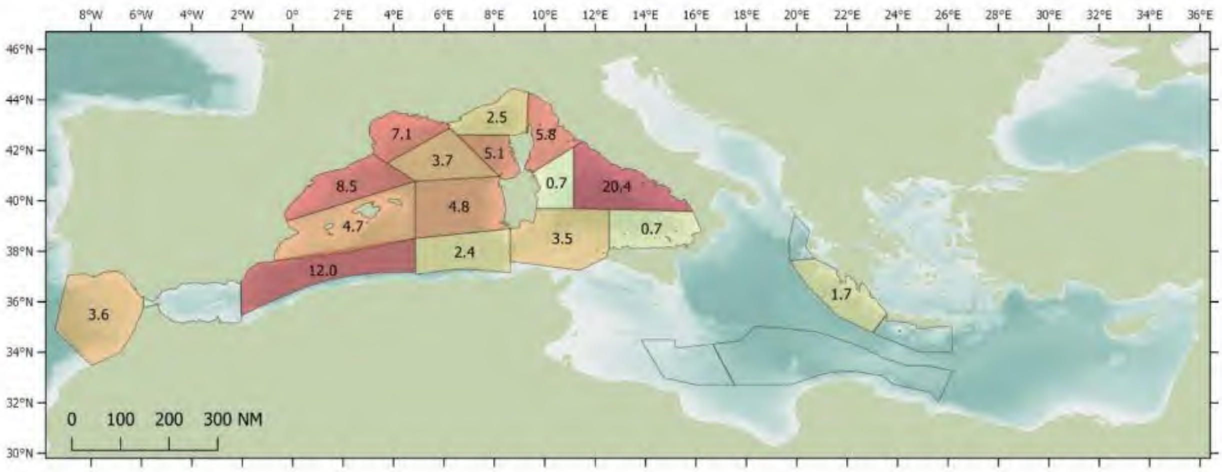


Figure 94: Sperm whale acoustic densities (individuals per 1000 km2) derived for each block surveyed by the Song of the Whale team. Empty blocks represent those areas where no on-track detections were made. Source: ACCOBAMS, 2021b.

GES assessment conclusion (CI 4, Population Abundance for *Physeter macrocephalus*)

1122. Sperm whale population abundance has been estimated based on the data collected through ACCOBAMS Aerial Survey (ASI) 2018/2019, thus providing baseline/reference values for CI4 common indicator. However, in order to assess GES, it is required to examine potential changes in population abundance levels; that is population abundance trends. Since the baseline/reference values date from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10, 2022). In addition, in the scope of ACCOBAMS and in cooperation with IUCN, a revised IUCN conservation status assessment will be carried out in the future.

<u>Cuvier's beaked whale (*Ziphius cavirostris*)</u>

1123. Cuvier's beaked whale is a deep diver species sighted in the scope of ASI throughout Mediterranean regions, with highest abundance and encounter rates in specific hotspots such as the Alborán Sea, the northern part of Ligurian Sea, the northern Tyrrhenian Sea, the Ionian Sea (east of Sicily), narrow pathway from the southern Adriatic Sea, along the Hellenic Trench to the west of Cyprus and Levantine Sea waters off Lebanon and Israel (Figure 95, Figure 96). Cuvier's beaked whales were spotted within 17 occurrences with pod sizes ranging from 1 - 10 individuals. The overall abundance for the Mediterranean was estimated at about 2724. On the sub-regional level, abundance is estimated as follows: Western Mediterranean Sea 1406, Ionian Sea and the Central Mediterranean Sea 616, Adriatic Sea 66 and Aegean - Levantine Sea 637.
1124. Based on the 2018 - 2021 IUCN Red List assessment in the ACCOBAMS area, Mediterranean subpopulation of Cuvier's beaked whale is listed as Vulnerable (ACCOBAMS Resolution 8.12, 2022).

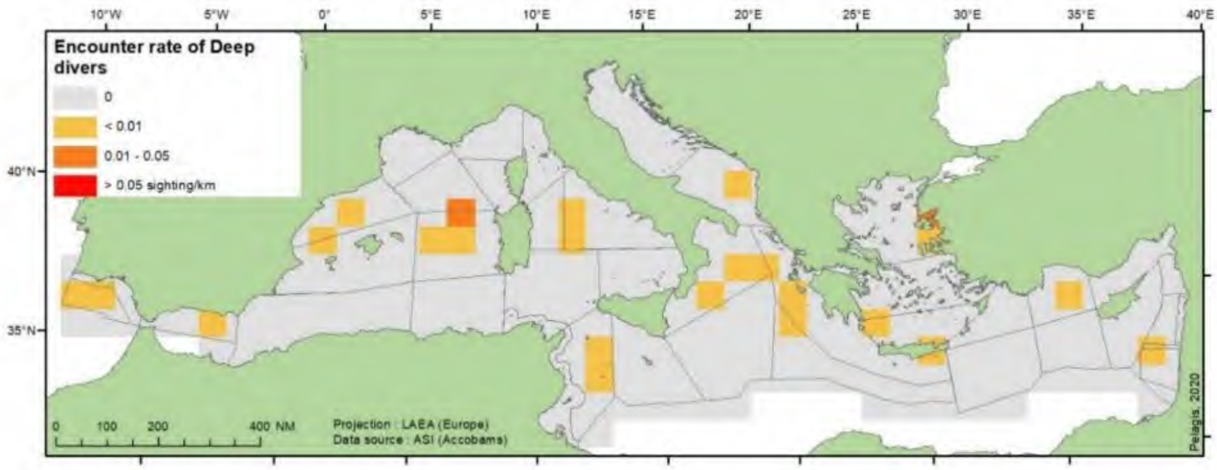


Figure 95: Encounter rate of deep divers (sightings per km): Kogia spp., sperm whales and Ziphiidea on a grid of 100x100 km and effort surveyed with sightings by species with class of pod size (a number of sightings by class) during aerial survey. Source: ACCOBAMS, 2021b.

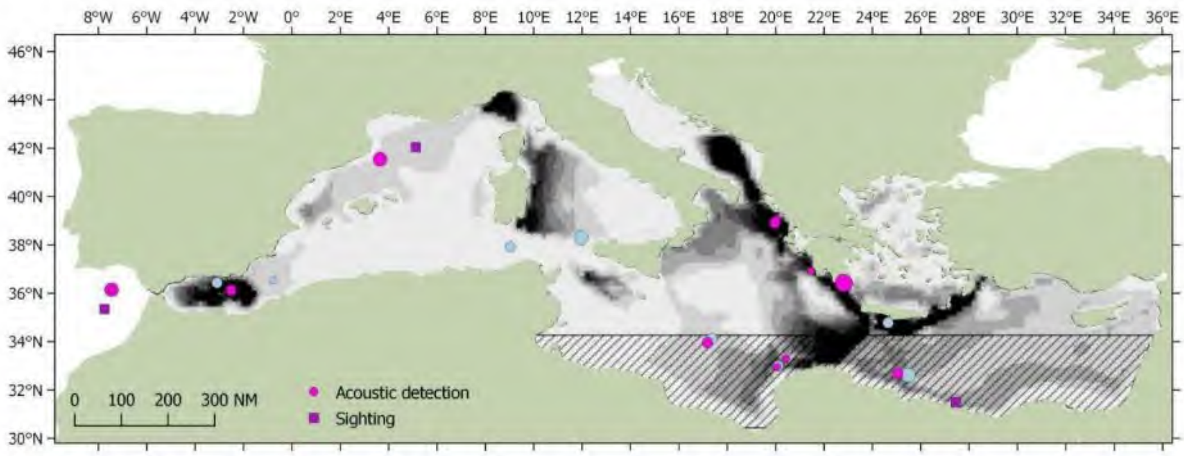


Figure 96: Sightings/detections of beaked whales made by all survey vessels during the ASI survey (pink squares/circles respectively). A predicted density map from Cañadas et al., 2018 is overlaid in monochrome showing those regions likely to contain ideal habit for Cuvier's beaked whale (the predictions in the striped region were considered unreliable due to low sample size).
Source: ACCOBAMS, 2021b.

<u>GES assessment conclusion (CI 4, Population Abundance for *Ziphius cavirostris*)</u>

1125. Cuvier's beaked whale population abundance has been estimated based on the data collected through ACCOBAMS Aerial Survey (ASI) 2018/2019, thus providing baseline/reference values for CI4 common indicator. However, in order to assess GES, it is required to examine potential changes in population abundance levels; that is population abundance trends. Since the baseline/reference values date from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10). In addition, in the scope of ACCOBAMS and in cooperation with IUCN, a revised IUCN conservation status assessment will be carried out in the future.

Fin whales (*Balaenoptera physalus*)

1126. During ASI 2018/2019 aerial survey, fin whales were mostly sighted in the deep, offshore waters of the western Mediterranean basin, with the highest abundance in the Ligurian Sea, Gulf of Lions and Gulf of Cadiz, Provençal Basin and the Western part of the Pelagos Sanctuary. Species was spotted within 50 occurrences with pod sizes ranging from 1 - 4 individuals (Figure 97). The overall abundance in the Mediterranean was estimated at about 1960. On the sub-regional level, abundance is estimated as follows: Western Mediterranean Sea 1765, Ionian Sea and the Central Mediterranean Sea 195, Adriatic Sea 0 and Aegean - Levantine Sea 0.
1127. Based on the 2018 - 2021 IUCN Red List assessment in the ACCOBAMS area, Mediterranean subpopulation of Balaenoptera physalus is listed as Endangered (ACCOBAMS Resolution 8.12, 2022).

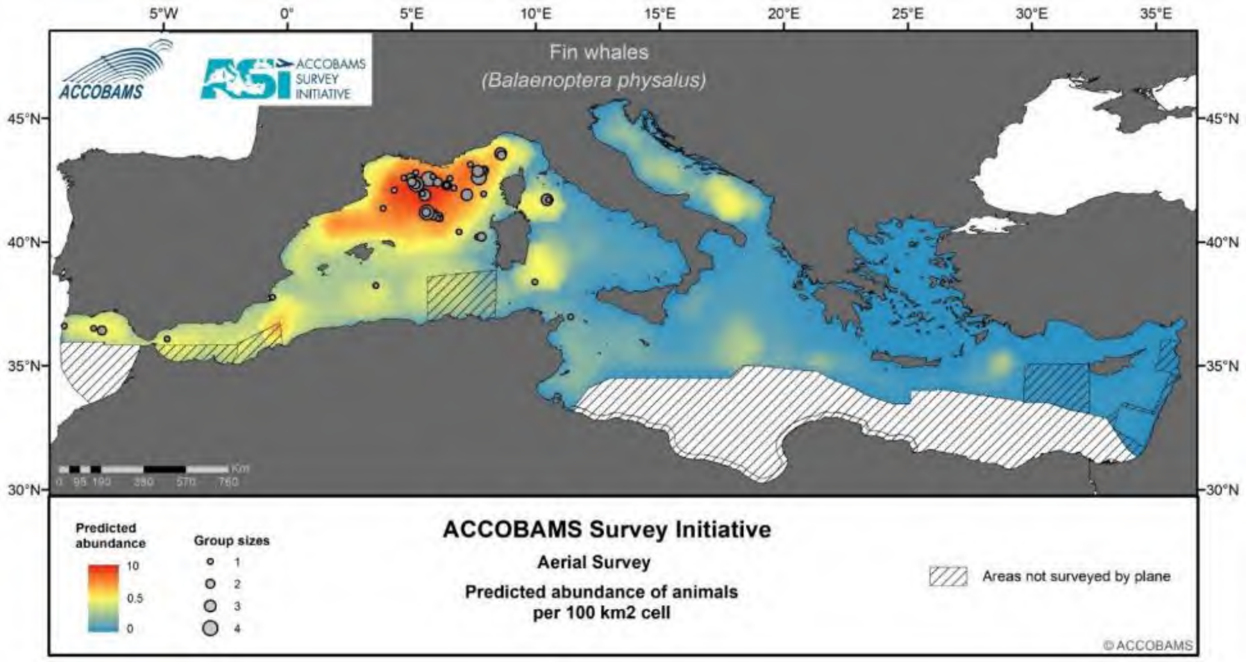


Figure 97: Predicted abundance of Fin whales. Source: ACCOBAMS, 2021b.

GES assessment conclusion (CI 4, Population Abundance for *Balaenoptera physalus*)

1128. Fin whale population abundance has been estimated based on the data collected through ASI 2018/2019, thus providing baseline/reference values for CI4 common indicator. However, in order to assess GES, it is required to examine potential changes in population abundance levels; that is population abundance trends. Since the baseline/reference values date from 2018 and 2019 (ASI results published in 2021), there is no long-term data series and GES could not be assessed. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (next ASI) is planned for 2024 – 2026 (ACCOBAMS Resolution 8.10, 2022). In addition, in the scope of ACCOBAMS and in cooperation with IUCN, a revised IUCN conservation status assessment will be carried out in the future.

Table 41: Assessment of GES for Cetaceans in the Mediterranean Sea for CI4, based on selected species.

Criteria Indicator	**GES definition**	**GES Assessment** ***Globicephala melas – Long finned pilot whale; Grampus griseus – Risso's dolphin; Tursiops truncatus – common bottlenose dolphin; Delphinus delphis – common dolphin; Stenella coeruleoalba – striped dolphin; Balaenoptera physalus – fin whale; Physeter macrocephalus – sperm whale; Ziphius cavirostris – Cuvier's beaked whale***
CI4 Population abundance	The species population has abundance levels allowing qualification to Least Concern Category of IUCN Red List or has abundance levels that are improving and moving away from the more critical IUCN category.	Not possible to assess GES. Namely, the regional baseline/reference values for CI4 are set only recently; with ASI survey actually being carried out in 2018 and 2019 and results published in 2021, and there is no long-term data series needed to measure whether defined thresholds are achieved. However, data for some species, notably long-finned pilot whale, should be taken with particular caution. GES assessment should be possible in the future (for the next Med QSR), particularly since the next Mediterranean Sea basin wide survey (ASI 2) is planned for 2024 -2026, and the IUCN Red List assessment for the ACCOBAMS area will also be revised.

Common Indicator 5: Population Demographic Characteristics (Cetaceans)

1129. The Document UNEP/MED WG.514/Inf.11 "Monitoring and Assessment Scales, Assessment Criteria, Thresholds and Baseline Values for the IMAP Common Indicators 3, 4 and 5 related to marine mammals" (UNEP, 2021) proposes to move GES definitions for *State* and *Pressures* to CI12 and reformulate definition for CI5. So that it reflects better the population demographic characteristics such as sex ratio, calf production etc.

1130. Furthermore, methodologically, according to Document UNEP/MED WG.514/Inf.11, it is not possible to develop baseline/ reference and threshold values for the assessment of CI5, due to lack of data. Although there are various available data sources with cetacean bycatch and strandings data, this data is still partial, inconsistent and it is not possible to draw concrete conclusions about level of bycatch and other human impacts, and subsequently to which level these issues represent the problem for conservation of cetaceans.

1131. The GES assessment methodology in relation to cetaceans for CI5 should further developed with the view to elaborate and agree on options allowing to reflect the population demographic characteristics such as sex ratio, calf production etc.

Summary of GES assessment for CI3, CI4 and CI5

Table 42: GES assessment summary for CI3, CI4 and CI5 for representative cetacean species in the Mediterranean

EO1 Common Indicators	***CETACEAN SPECIES***							
	Globicephala melas	*Grampus griseus*	*Tursiops truncatus*	*Delphinus delphis*	*Stenella coeruleoalba*	*Physeter macrocephalus*	*Ziphius cavirostris*	*Balaenoptera physalus*
CI3 Species distributional range								
CI4 Population abundance								
CI5 Population demographic characteristics	**X**	**X**		**X**		**X**	**X**	

Colour scheme: Grey - GES not possible to assess; X – species not representative for specific CI

Summary of alternative assessment - IUCN Red List assessment

1132. Based on the results of the IUCN Red List assessments carried out in the scope of ACCOBAMS in the 2018 - 2021 period, and focussing on eight species that are representative for the GES assessment, it could be concluded that the state of cetaceans is not good (Table 4.25.). Still, when comparing the recent results with the mid-2000s assessment, there are some positive trends. Most notably, the status improved for common bottlenose dolphin and striped dolphin populations. In addition, thanks to the improved data, it was possible to assess the status of previously data deficient species, notably Cuvier’s beaked whale and long-finned pilot whale. However, for fin whale, the status has worsened.

Table 43: IUCN Red List assessments status comparison for cetacean species representative for the GES assessment

Species	Previous IUCN Red List status		IUCN Red List status following the 2018-2021 assessments		Change in the status since mid-2000s
Globicephala melas	Mediterranean subpopulation	**Data Deficient**	Inner Mediterranean subpopulation	**Endangered**	NA
			Strait of Gibraltar subpopulation	**Critically Endangered**	NA
Grampus griseus	Mediterranean subpopulation	**Data Deficient**	Mediterranean subpopulation	**Endangered**	NA
Tursiops truncatus	Mediterranean subpopulation	**Vulnerable**	Inner Mediterranean subpopulation	**Least Concern**	↑
			Gulf of Ambracia subpopulation Critically	**Endangered**	↓
Delphinus delphis	Mediterranean subpopulation	**Endangered**	Inner Mediterranean subpopulation	**Endangered**	↔
			Gulf of Corinth subpopulation Critically	**Endangered**	↔
Stenella coeruleoalba	Mediterranean subpopulation	**Vulnerable**	Mediterranean subpopulation	**Least Concern**	↑
			Gulf of Corinth subpopulation	**Endangered**	↓
Balaenoptera physalus	Mediterranean subpopulation	**Vulnerable**	Mediterranean subpopulation	**Endangered**	↓
Physeter macrocephalus	Mediterranean subpopulation	**Endangered**	Mediterranean subpopulation	**Endangered**	↔
Ziphius cavirostris	Mediterranean subpopulation	**Data Deficient**	Mediterranean subpopulation	**Vulnerable**	NA

Status: ↑ - status improved; ↓ - status worsened; ↔ - status unchanged; NA - not applicable

<u>Towards integrated GES Assessment</u>

1133. The state of cetaceans, as measured through GES assessment under EO1, could be linked to majority of measured EOs under IMAP: EO3 (Fisheries), EO5 (Eutrophication), EO7 (Hydrographic characteristics), EO8 (physical loss of coastal ecosystems and landscapes), EO9 (Pollution) and E10 (marine litter). The relevance of EO11 (Underwater noise) for cetaceans should also be mentioned, even though the CIs under EO11 are not yet elaborated. In any case, due to limited knowledge, it is not yet fully possible to evaluate the significance of these interrelations. Further in the text, most relevant qualitative characteristics of interlinkages between EO1 for cetaceans and other EOs are summarised. It should also be noted that all EOs are very much interlinked between themselves.

1134. As already elaborated under Chapter 3, interactions with fisheries represent significant challenges for cetaceans, particularly through bycatch and loss of fish as cetaceans prey. The most concrete link between EO3 - Fisheries and measurements of GES for cetaceans under EO1 is EO3's CI12, which measures bycatch of vulnerable and non-target species.

1135. Eutrophication (EO5) can have severe impacts on the entire marine ecosystem through nutrient and organic matter enrichment. As such, eutrophication can also be linked to fisheries and alternation of food webs, which can have consequences to cetaceans too. According to the available knowledge, eutrophication is not yet perceived as relevant for the cetaceans in the Mediterranean Sea.

1136. Hydrographic characteristics (EO7) (such as temperature, salinity, currents, waves, turbulence etc.) play a crucial role in the dynamics of marine ecosystems and are therefore interlinked with all other EOs. Changes of hydrographic characteristics are particularly linked to climate change, with the obvious example of more extreme sea temperatures occurring. These changes affect not only the habitats and entire food-chain, but they could facilitate spread of marine litter and redistribution of contaminants.

1137. The alternations of coastal ecosystems and landscapes (EO8), particularly urbanizations and all pressures on environment it entails, may also cause nutrient enrichment in near-shore marine areas, as well as bring pollutants (EO9), and as such, indirectly affect food-webs and higher trophic levels, such as cetaceans.

1138. Pollution (EO9) may also affect cetaceans. This could be demonstrated through toxicological effects of harmful chemicals and microbial pathogens.

1139. Marine litter (EO10) has certain impacts on cetaceans; such as causing suffocation through ingestion of plastic, and entanglement of animals in fishing gear. As already indicated, microplastic is also quite problematic, entering the food-web, starting with shellfish and fish and subsequently culminating in cetaceans. Recent research studies also show that chemical plasticizers and other known persistent substances can leach from marine litter (both macro and microlitter items). However, present knowledge on marine litter-cetaceans' interactions at the Mediterranean Sea level is still not sufficient to draw more quantifiable conclusions.

<u>Key findings per Common Indicator (CI3, CI4 and CI5 for Cetaceans)</u>

CI3 – Species distribution

1140. The first methodological step in GES assessment for cetaceans has been made for CI3 – Species distribution under UNEP/MAP with definition of GES assessment criteria, particularly baseline/reference values and thresholds, as elaborated in the 21WG.514/Inf.11. However, quantification of measurement of changes in distribution, which will be relevant for the next

Med QSR report, is not clear (for example, which measurement unit will be used to compare baseline/reference values with thresholds).

1141. The first regional level based synoptic survey of cetaceans, carried out in the scope of the ACCOBAMS Survey Initiative project (aerial and vessel boat surveys were carried out in 2018 and 2019, and data processed in 2021) acquired cetacean distribution data for most of the region (except for the parts of the southern Mediterranean – particularly its central and eastern section). Complemented with data from previous research on national and regional levels, baseline/reference values were determined, expressed through species distribution maps. Identification of baseline values is a significant improvement when compared to the Med QSR 2017.

1142. ACCOBAMS Survey Initiative project was a joint coordinated venture of international organisations, national institutions and cetacean expert, supported by the international and national funding, and this effort displays clearly the necessity of regional – national cooperation in monitoring and subsequently conservation of migratory species, such as cetaceans, in the Mediterranean.

1143. ASI results are available and accessible via web (including spatial GIS data). In addition, there are also other web-based data sources, which include, among all, occurrence data in spatial format, most notably OBIS, GBIF and INTERCET.

1144. Regional surveys, such as ASI, establish and represent an important effort to assess cetaceans' distribution and monitor trends through a coordinated and standardised system.

1145. GES could not be assessed for the CI3, since the baseline/reference values are recently established (2018 – 2021), and there is no longer-time data series necessary for GES assessment. However, the next ASI project, planned in the scope of ACCOBAMS for 2024 - 2026 should contribute with a new set of data needed for the GES assessment in the scope of the next Med QSR report.

Knowledge gaps for CI3

1146. There is still a disparity in research effort, with the most significant gaps in the southern part of the Mediterranean, which was also shown during the implementation of the ASI project.
1147. Long-term data series are missing, which would be based on systematic monitoring. For the Med QSR 2023 report it is understandable, since the baseline/referent values for cetaceans are determined only recently (2018 – 2021).

1148. There is lack of more quantified thresholds for CI3

CI4 – Population abundance

1149. The same as for the CI3, the first methodological step in GES assessment for cetaceans has been made for CI4 – Population abundance under UNEP/MAP with definition of GES assessment criteria, particularly baseline/reference values and thresholds, as elaborated in the 21WG.514/Inf.11.

1150. The first regional level based synoptic survey of cetaceans, carried out in the scope of the ACCOBAMS Survey Initiative project (aerial and vessel boat surveys were carried out in 2018 and 2019, and data processed in 2021) acquired cetacean abundance data for the most of the region (except for the parts of the southern Mediterranean – particularly its central and eastern section) and baseline/reference values were determined at the Mediterranean regional level, with estimation being also done atof the level of 4 sub-regions, Western Mediterranean, Ionian and Central Mediterranean, Adriatic Sea, Aegean and Levantine Seas. Identification of baseline values is significant improvement when compared to the Med QSR 2017.

1151. ACCOBAMS Survey Initiative project was a joint coordinated venture of international organisations, national institutions and cetacean expert, supported international and national funding, and this effort displays clearly the necessity of regional – national cooperation in monitoring and subsequently conservation of migratory species, such as cetaceans, in the Mediterranean.

1152. Regional surveys, such as ASI, establish and represent an important effort to assess cetacean's abundance and monitor trends through a coordinated and standardised system.

1153. GES could not be assessed for the CI4, since the baseline/reference values date recently (2018 – 2021), and there is no longer-time data series necessary for GES assessment. However, the next ASI project, planned in the scope of ACCOBAMS for 2024 - 2026 should contribute with a new set of data needed for the GES assessment in the scope of the 2029 Med QSR report.

Knowledge gaps for CI4

1154. There is still a disparity in research effort, with the most significant gaps in the southern part of the Mediterranean, which was also shown during the implementation of the ASI project.

1155. Long-term data series are missing, which would be based on systematic monitoring. For the Med QSR 2023 report it is understandable, since the baseline/referent values for cetaceans are determined only recently (2018 – 2021).

CI5 - Population demographic characteristics

1156. The attempt was made under UNEP/MAP **to define GES assessment criteria** for the CI5 – Population demographic characteristics, particularly baseline/reference values and thresholds, but it was **not yet possibl**e due to lack of data and knowledge in general (as elaborated in the 21WG.514/Inf.11).

1157. As currently defined under IMAP 2016, **GES assessment for CI5 is based on measurement of human induced mortality**. However, 21WG.514/Inf.11 proposes future reorganization and reformulation of GES definitions, notably to address human induced mortality under CI12 and to be more focussed on characteristics such as sex ration, calf production etc.

1158. Despite methodological limitations, **the attempt was made to collect and process data on bycatch and strandings** in general. Indeed, there are several regional data sources, notably: GFCM, ICES (for the EU Member States only) and MEDACES - cetacean specific regional strandings database under the auspices of SPA/RAC, management and support from the Spanish institutions.

1159. **The collected data are very partial and unreliable**, and in many cases, **not regularly updated**, and in general, bycatch is fairly underestimated.

1160. **GES could not be assessed for the CI5** due to both lack of defined assessment criteria and lack of adequate data and information.

Knowledge gaps for CI5

1161. There is a lack of systematic bycatch data collection and lack of reliable data and information; biased estimates, only some data are reported.

1162. Stranding data are also not systematically collected, and even if they are available via MEDACES or other databases, there is a lack of information on the cause of the stranding, which would allow assessment of whether stranding occurred due to particular human activities or naturally.

1163. There is lack of (defined) thresholds for CI5, which is directly linked to lack of knowledge.

IUCN Assessment

1164. **IUCN Red List assessment** could be used as a **valuable tool for assessing the state of cetaceans**. As such, it is already linked to thresholds for CI4 under IMAP/GES assessment.

1165. **Thanks to the two IUCN Red List assessments of cetaceans in the Mediterranean Sea, Black Sea and contiguous Atlantic area (ACCOBAMS area),** performed **in the scope of ACCOBAMS**, in cooperation with IUCN and cetacean experts, **several conclusions could be drawn** both on the current status of cetaceans and their status trend since the mid-2000s.
1166. In general, the **cetaceans** (based on 8 GES assessment relevant cetaceans species) **in the Mediterranean are significantly threatened**, since the majority of species are assessed as Endangered (EN). **There is improvement in the status of common bottlenose dolphin and striped dolphins**, since previous assessments, which results were officially adopted in 2007 in the framework of ACCOBAMS as the IUCN Red Status List of Cetaceans in the ACCOBAMS area (Resolution 3.19)

1167. **The knowledge of cetaceans has improved to a certain extent, which enables assessment of previously Data Deficient** (DD) **specie**s such as Cuvier's beaked whale and long-finned pilot whale.

1168. **The status of fin whale has worsened compared to previous assessments,** which results were officially adopted in 2007 in the framework of ACCOBAMS as the IUCN Red Status List of Cetaceans in the ACCOBAMS area (Resolution 3.19).

Knowledge gaps

1169. Although current knowledge enabled IUCN Red List Assessment, the data and information should be collected and processed through systematic monitoring at all levels (regional and national).

<u>Measures and actions required to achieve GES for Cetaceans</u>

- ***Understanding and addressing pressures/state of cetaceans' linkages***

1170. **Continue the work on definition of pressures/cetaceans' interaction hotspots**; particularly extension of anthropogenic noise/cetaceans' hotspots analysis to maritime traffic and identification of marine litter/cetaceans' hotspots, as already envisaged in the ACCOBAMS Resolutions 8.17. and 8.20. respectively, both adopted by ACCOBAMS MOP 8 in 2022.

1171. **Intensify efforts to improve knowledge on interrelations between climate change and cetaceans**, including identification of sensitive cetaceans' species and monitoring of their state related to climate change.

1172. **Continue efforts in data collection and processing regarding the ship strikes**, in cooperation with international organisations on marine traffic, notably IMO, as already included in the ACCOBAMS resolution 8.18.

1173. **Develop techniques and models to assess cumulative/synergistic effects** of pressures and impacts on cetaceans, including underwater anthropogenic noise, chemicals, marine litter, climate change and emerging pathogens, taking into consideration the existing recommendations (such as from the 2021 IWC Intersessional Workshop "Pollution 2025" etc).

1174. **Intensify efforts to implement the existing pressures' mitigation tools,** such as guidelines and best practices already developed in the scope of ACCOBAMS, UNEP/MAP and IWC.

<u>GES assessment</u>

- ***Methodological issues***

1175. **Reformulate GES definitions and linked GES assessment elements under CI5**, as proposed in the 21WG.514/Inf.11, notably to shift human induced mortality assessment to CI12 and focus on actual population demographic characteristics (sex ration, calf productivity etc).

1176. **Define GES assessment criteria**, particularly baseline/reference and threshold values, **for CI5**, **as soon as sufficient data is collected/available**. Possibly select representative pilot areas where adequate data could be collected on regular bases.

1177. **Invest efforts in further quantification of thresholds for CI3.**

1178. **Encourage sub-regional level of cooperation** between countries in **reviewing and adjusting GES assessment criteria**.

- ***Data collection, availability and GES assessment.***

CI3 and CI4

1179. **Replicate and conduct regularly regional synoptic surveys (ASI)** (possible dates for ASI 2 – 2024 - 2026), and complement with other monitoring efforts, as already foreseen in the Long-Term Monitoring Programme (LTMP), adopted in the ACCOBAMS framework (Resolution 8.10).

1180. Continue to ensure ASI **data availability and easy accessibility** (in standard spatial GIS format) (as it is currently possible via NETCCOBAMS).

1181. **Promote and support research of cetaceans in the southern Mediterranean**, particularly in the areas that could not be covered by ASI.

CI5

1182. **At the national level (or where possible at sub-regional level), establish or ensure functioning of the stranding networks**, with the particular support of regional agreements/organisations (ACCOBAMS, SPA/RAC) in the segment of capacity building and application of new technologies, as already stipulated in the ACCOBAMS Resolution 8.15.

1183. **Regularly submit national strandings data to MEDACES,** including information on causes of mortality,

1184. **Upgrade MEDACES** and ensure MEDACES **data availability and easy accessibility** (in standard spatial GIS format) via MEDACES website.

1185. **Intensify research efforts on population genetics**, taking into account the ongoing work in the ACCOBAMS framework (reference: ACCOBAMS Resolution 8.11).

2.2.2 EO2 Non-Indigenous Species

Common Indicator 6: Trends in abundance, temporal occurrence, and spatial distribution of non-indigenous species, particularly invasive, non-indigenous species, notably in risk areas (EO2, in relation to the main vectors and pathways of spreading of such species)

1186. Biological invasions are globally identified as one of the main drivers of biodiversity loss, with impacts ranging from loss of genetic diversity to native population losses, species displacements, habitat modifications and even whole ecosystem shifts (IPBES, 2019). Consequently, the role of non-indigenous species (NIS) as a pressure that threatens ecosystems is addressed in the framework of numerous policies and strategies worldwide. In the Mediterranean Sea and in the context of the Barcelona Convention, the Protocol concerning specially protected areas and biological diversity in the Mediterranean (SPA/BD Protocol) invites the Contracting Parties to take “all appropriate measures to regulate the intentional or non-intentional introduction of non-indigenous into the wild and prohibit those that may have harmful impacts on the ecosystems, habitats or species” (UNEP/MAP, 2017a).

1187. In the Mediterranean Sea, one of the most invaded ecosystems in the world (Costello et al., 2021), it is currently estimated that the number of NIS is in the range of 1000 with no sign of decline in their introduction rate. Recent work has demonstrated that, besides the unabated rate of new introductions, the rate of alien species spread and establishment is also increasing, with upwards of 70% of the introduced species being considered established (Zenetos & Galanidi, 2020; Zenetos et al., 2022a; b), causing the degradation of distinctive Mediterranean communities and habitats (Katsanevakis et al., 2014). In the western Mediterranean, negative impacts are caused primarily by invasive macrophytes, whereas in the Levantine and the Aegean Sea by fishes, and in the Adriatic Sea by introduced molluscs (Tsirintanis et al., 2022). Competition for resources, habitat creation/modification through ecosystem engineering, and predation are the primary mechanisms of negative effects of Mediterranean NIS. Pathway analysis has revealed that shipping, through ballast water and hull fouling, corridors, recreational boating and aquaculture transfers are primarily responsible for NIS introductions and spread in the region, while the ornamental trade and live food trade, among other activities, also contribute to NIS pressure (Katsanevakis et al., 2013, Tsiamis et al., 2018).

Methodology for data analysis in relation to CI 6
Following the recommendations in the document on Monitoring and Assessment Scales, Assessment Criteria and Thresholds Values for the IMAP Common Indicator 6 Related to Non-Indigenous Species (UNEP/MED WG.500/7, 2021), analysis of the temporal trends of new NIS occurrences was conducted at the subregional level. Thresholds and quantitative targets for GES have not been determined yet for CI6, but rather GES is based on directional trends, i.e., the reduction or minimization of the introduction and spread of NIS linked to human activities (see BOX 1). Consequently, trends in occurrence were analysed in two different ways. The first method involves breakpoint analysis in order to identify structural changes in the dataset, representing dates (i.e., years) when the mean introduction rate displays significant changes (increases or decreases). Breakpoint analysis was performed on the 1970-2011 time-series, i.e., excluding the 2012-2017 assessment period, with which comparisons are made. Once time periods with stable mean values were detected, 95% Confidence Intervals around the means were calculated as a measure of uncertainty. Subsequently, the mean NIS introduction rate of the 2012-2017 assessment period with its 95%CI was calculated and compared with the respective values of the breakpoint generated segments, providing a qualitative assessment (for details of the approach see Galanidi & Zenetos, 2022; Östman et al., 2020; Zeileis et al., 2003).

Species selection for spatial distribution maps
A small number of NIS with high impacts on a variety of habitats were selected for spatial distribution mapping. Starting from the CIMPAL evaluation of the 60 species in Katsanevakis et al. (2016), a shortlist of species was created on the basis of three criteria; habitats they invade, magnitude of impacts and introduction pathway. More specifically, the 13 habitat types examined by Katsanevakis et al. (2016) were merged into six broader habitat types, namely: estuaries & lagoons, Posidonia oceanica and other seagrass and seaweed meadows, coralligenous habitats, soft sediments (0-200 m depth), rocky substrates (0-200 m depth) and pelagic habitats (0-200 m). Subsequently, NIS species with massive impacts on each of these habitats were marked and a subset was selected for mapping. Since many of these species have impacts on more than one habitat types, all broad habitat types were well represented in the final group of 10 species (Table 1). Finally, primary and secondary pathways of introduction were examined for each species to ensure that all the major pathways are also sufficiently represented.
List of species selected for spatial distribution mapping. EC-Aqua = Escape from large aquaria (accidental), EC-Mar = Escape from mariculture, REL = Release (intentional), TC = Transport-Contaminant, UNA = Unaided, TS = Transport-Stowaway, TS-Shipping indicates both/either ballast water and/or hull fouling as vectors.

Habitats	Species	Pathway	
lagoons/seagrass/soft/rocky	*Lagocephalus sceleratus*	Corridor	Unaided
seagrass/soft/rocky/coral	*Pterois miles*	Corridor	Unaided
Seagrass/soft/rocky/pelagic	*Plotosus lineatus*	Corridor	UNA
lagoons/pelagic	*Mnemiopsis leidyi*	TS-Ballast	Unaided
lagoons/soft	*Callinectes sapidus*	TS-Ballast	TS, UNA
Soft	*Anadara transversa*	TS-Fouling	TC
seagrass/rocky/coral	*Acrothamnion preissii*	EC / TS-Angling	TS-Shipping
Rocky	*Codium fragile subsp. fragile*	TC	TS-ball
lagoons/seagrass	*Caulerpa taxifolia var. distichophylla*	EC-Aqua	TS-angling, TS-hull, UNA
lagoons/rocky	*Rugulopteryx okamurae*	TC	

Key Messages (Non-Indigenous Species)

1188. The results of trends analyses indicate that for the past 15-20 years new NIS introduction rates have been relatively stable in the West Mediterranean and the Adriatic, slightly but not statistically significantly increasing in the East Mediterranean but increasing in the Central Mediterranean. However, even if the rate is staying constant the total (cumulative) number of NIS in the basin is increasing steadily, with corridors and shipping the main pathways responsible.

1189. At the same time, there has been a notable increase in research effort and reporting, spurred by both policy requirements but also scientific interest coupled with citizen science initiatives, particularly in the southern Mediterranean. Consequently, clear interpretation of these trends is hampered by the lack of long-term standardised monitoring data, as it is not possible to disentangle the confounding effects of differential recording efforts spatially and temporally from real changes in pathway pressure or vector management.

1190. Nevertheless, a number of invasive, high-impact NIS have displayed an increased geographic expansion in the last decade or so, which can be deduced even behind the “noise” of increased detection and reporting. NIS species of warm affinities with long-range pelagic dispersal appear to have been favoured by climate change and increased seawater temperatures to penetrate the cooler regions of the Mediterranean, secondary anthropogenic dispersal however still plays an important role in the spread of the more sedentary species.

1191. To the extent that Good Environmental Status in relation to CI6 is defined as “Introduction and spread of NIS linked to human activities are minimised, in particular for potential IAS” it is concluded that GES has not been achieved in any of the Mediterranean subregions.

1192. Progress towards achieving GES requires coordinated actions by all the Contracting Parties (CPs) in order to mitigate and reduce invasion pressure. This is already considered by the draft updated Action Plan concerning Species Introductions and Invasive Species in the Mediterranean Sea, which, in conjunction with the Ballast Water Management (BWM) Strategy for the Mediterranean (2022-2027), place emphasis on preventative measures and activities to help CPs design and enact pathway action plans.

Good environmental status (GES) / alternative assessment (CI 6)

Descriptive characteristics of the entire baseline (1791-2020)

1193. At the pan-Mediterranean level, a total of 1008 validated, non-indigenous species have been found throughout the basin until the end of 2020, of which 143 are Macrophytes, 223 Mollusca, 188 Arthropoda, 172 Fishes, 29 Ascidiacea, 83 Annelida, 32 Bryozoa, 42 Cnidaria, 47 Foraminifera and 49 taxa belong to other taxonomic groups. Among the 1008 validated marine NIS, 742 are currently considered established, which makes the overall establishment rate in the Mediterranean Sea almost 74%. This value varies in the different subregions, with the lowest establishment rate in ADRIA (62%) and the highest in EMED (73%). When it comes to actual numbers, as expected, the eastern Mediterranean has the highest number of NIS with 788 species, followed by WMED (N=338), CMED (N=304) and ADRIA (N=211).

1194. During the validation process of the national baselines, 66 species emerged as data deficient: 59 characterised by divergence of opinion as to their alien or cryptogenic status and 7 as suspected questionable records. The highest number of species is observed in Israel and Türkiye, followed by Italy, Greece, Lebanon and Egypt, with values generally decreasing towards the Adriatic and western Mediterranean countries.

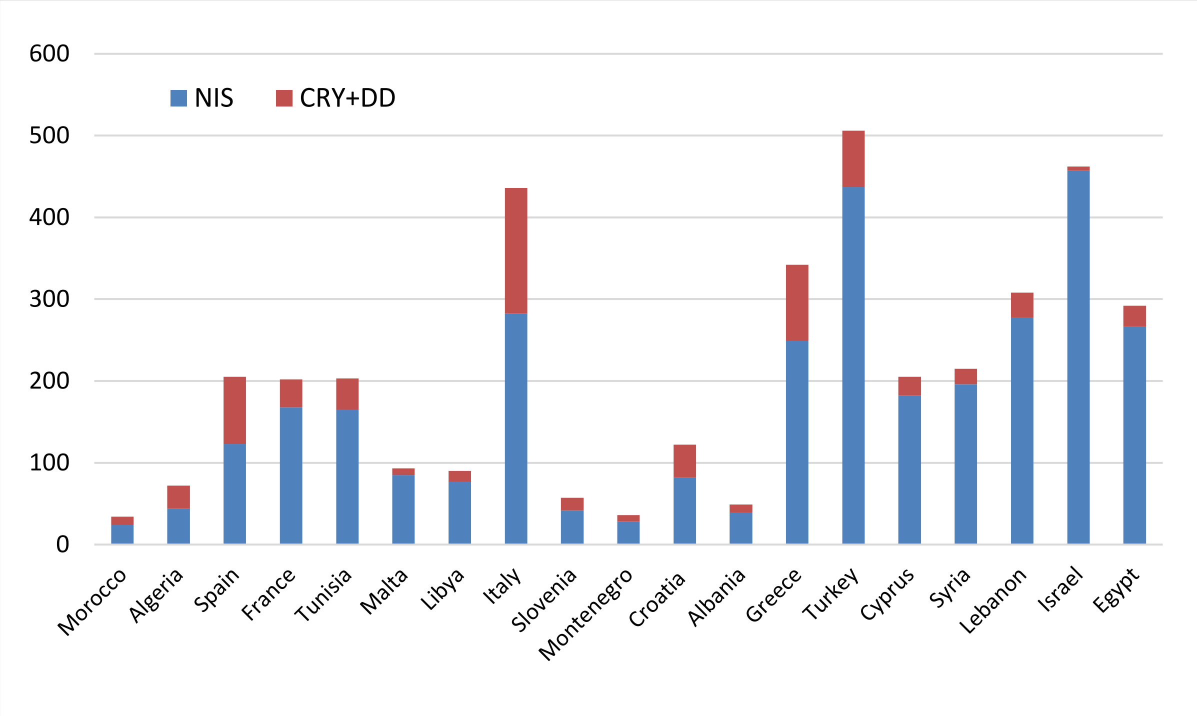


Figure 98: Number of NIS, cryptogenic (CRY) and data deficient (DD) species, detected in each Mediterranean country by December 2020.

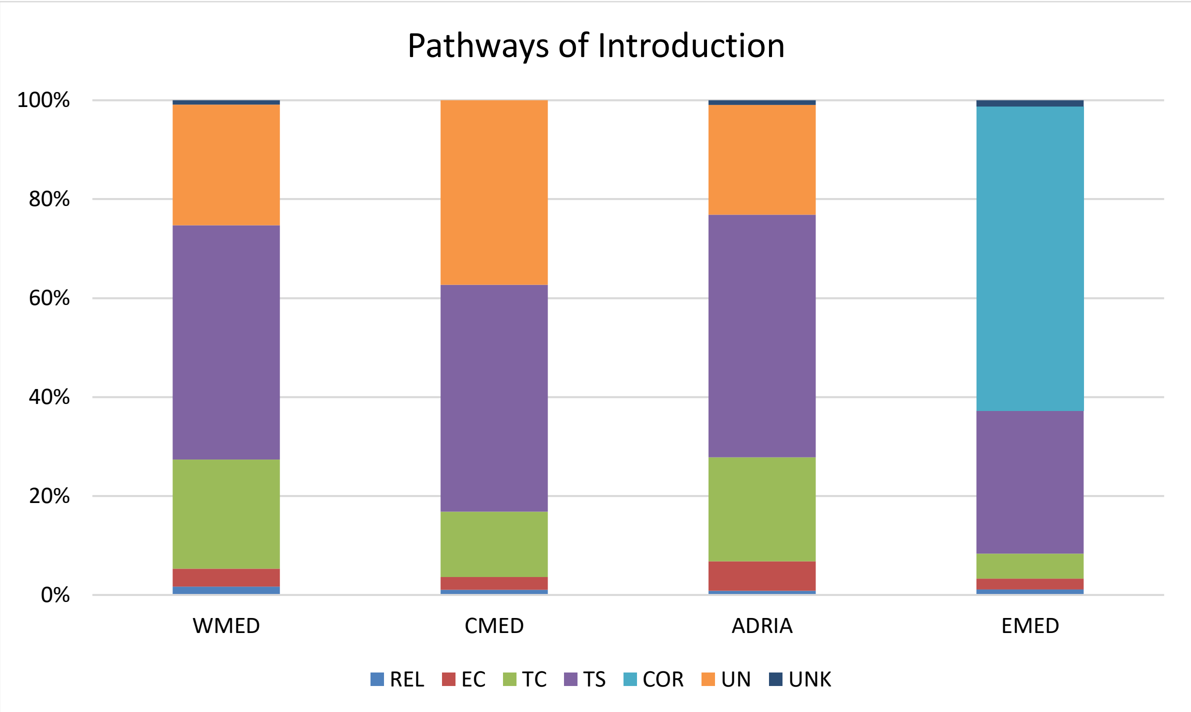


Figure 99: Primary pathways of introduction of marine NIS per Mediterranean subregion. REL = Release in nature, EC = Escape from Confinement, TC = Transport-Contaminant on animals, TS = Transport- Stowaway (including Ship/boat ballast water, Hull fouling and Other means of transport), COR = Corridor, UN = Unaided, UNK = Unknown.

1195. Roughly half the non-indigenous species present in the Mediterranean have Corridor as their primary pathway of introduction, Figure). This number reaches 61% in the Eastern Mediterranean, but this pathway is not applicable moving westwards and northwards to the other subregions, where Lessepsian species migrate to a large extent by natural dispersal (pathway Unaided). CMED has the largest proportion of Unaided species (37%, 77% of which are Lessepsian species), as it accepts naturally dispersing NIS propagules from all other subregions. In the WMED, 24% of the introductions are Unaided (72% of which Lessepsian species), while ADRIA has the lowest percentage of Unaided species at 22% (of which 68% Lessepsian). Noteworthy also is the higher percentage of Contaminant species in ADRIA (21%) and the WMED (22%), which are inadvertently transported with aquaculture activities, while escapees have their largest representation in ADRIA, with 6 % of the species assumed to have escaped from mariculture or from non-domestic aquaria. Intentional releases from domestic aquaria represent only 1-2% of all introductions, with the highest number of species appearing in the western and eastern Mediterranean. The two main shipping vectors together (i.e., Ballast water and Hull fouling) constitute the primary pathway for almost one third of the NIS entering the Mediterranean but as high as 49% of the NIS present in ADRIA.

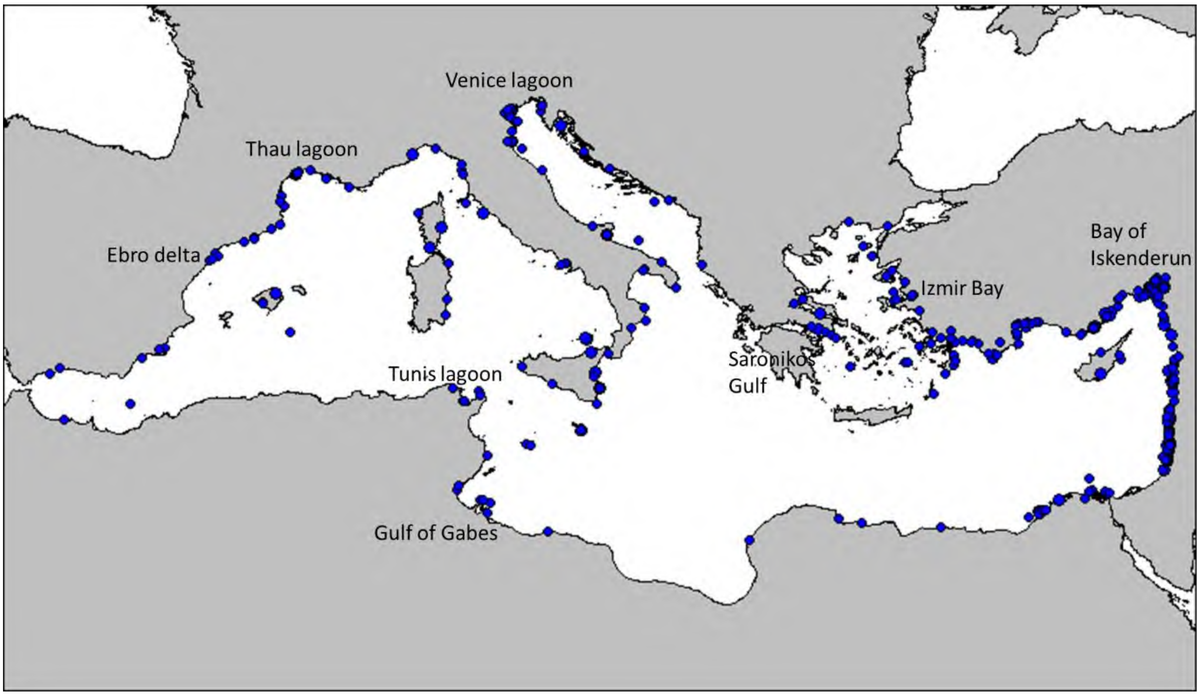


Figure 100: First new NIS records in the Mediterranean, observed between 1988-2017.

1196. Figure 100 illustrates the gateways of new NIS records in the Mediterranean since 1988. The above pattern corresponds clearly to the pathways of introduction a) Indo-Pacific species invade [either freely moving via Corridor (Lessepsian NIS) or via shipping] and become visible firstly in the Levantine basin (Egypt, Israel, Lebanon, Syria, south Türkiye); b) accidental introductions with oysters appear in Thau lagoon (France), Venice lagoons (Italy), Ebro delta (Spain), Tunis lagoon (north Tunisia); c) vessel transferred species from the Atlantic are reported mostly from port areas e.g., Bay of Iskenderun, Izmir Bay, Türkiye; Saronikos Gulf (Greece) Gulf of Gabes (Tunis). Research effort and contribution of citizen science has revealed new species across the Mediterranean and has been particularly significant in reporting new records in previously unexplored areas such as Libya.

Temporal trends in occurrence

1197. Average NIS introduction rates per 6-year reporting period in the Mediterranean and its subregions between 1970-2017 can be seen in Figure 101.

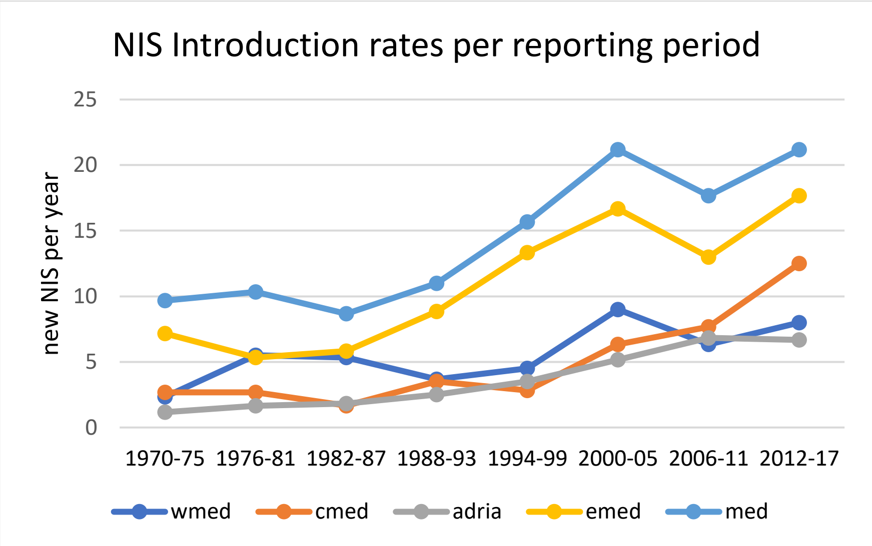


Figure 101: Average NIS introduction rates in the Mediterranean and its subregions per 6-year reporting period between 1970-2017.

1198. Breakpoint analysis, carried out on the 1970-2011 subset with 2012-2017 as the assessment period, demonstrated that there are indeed different points in time when the NIS introduction rate significantly increased in each Mediterranean subregion, spanning from the mid-1990's to the mid-2000's (Figure). During the almost 50 years of the analysed time period NIS introduction rates have more than doubled in EMED, CMED and ADRIA and almost doubled in WMED (Table 4). After the identified breakdates, introduction rates have remained stable in the western Mediterranean and the Adriatic but have markedly increased in the Central Mediterranean (Table 44). In the eastern Mediterranean new NIS records appear slightly elevated for the 2012-2017 period but the value still overlaps with the confidence intervals of the previous time segment (1997-2011).

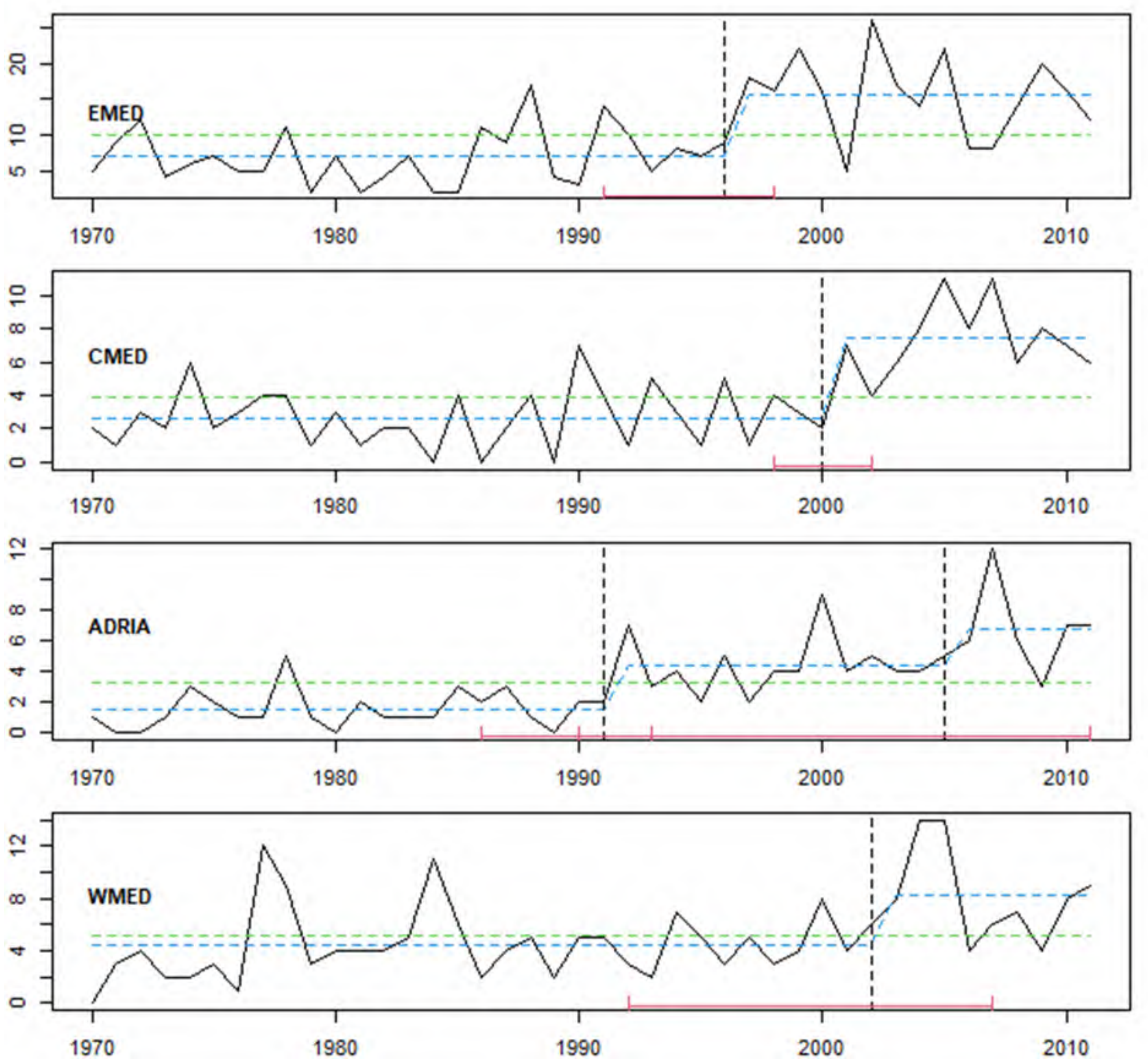


Figure 102: Number of new NIS introductions per year (y-axis) in different Mediterranean subregions for the period 1970-2011 (continuous black line) with breakpoints and fitted mean values superimposed: vertical dashed line indicates breakpoint or year of significant change in the mean values of new NIS, with 95% confidence intervals around the breakdate (CIs) in red brackets; dashed green line shows the null model of no temporal change in new NIS numbers; and dashed blue line represents fitted mean values before and after the identified breakpoint.

Table 44: Results of the breakpoint structural analysis for each Mediterranean subregion for the period 1970-2011, with 2012-2017 considered as the assessment period. Segment yearly means are the fitted mean values of the yearly number of new NIS before and after the breaks, with 95% Confidence Intervals of the fitted means (95% CI) in parentheses. EMED = eastern Mediterranean (i.e., Aegean and Levantine), CMED = central Mediterranean (i.e., Central and Ionian Sea), ADRIA = Adriatic, WMED = western Mediterranean

	Breakdate	**Segment yearly means (95% CI)**			**2012-2017 mean (95% CI)**
		Segment 1	Segment 2	Segment 3	
EMED	1996	6.9 (5.4, 8.5)	15.6 (12.4, 18.8)	na	17.7 (11.1, 24.2)
CMED	2000	2.7 (2, 3.3)	7.5 (6, 8.9)	na	12.5 (6.7, 18.3)
ADRIA	1991/2005	1.5 (1, 2)	4.4 (3.4, 5.5)	6.8 (3.8, 9.9)	6.7 (4.9, 8.4)
WMED	2002	4.4 (3.5, 5.4)	8.2 (5.4, 11.1)	na	8 (6.1, 9.9)

1199. Linear regression was applied to the five 6-year reporting periods that span and capture the significant changes in NIS introduction rates in the 4 Mediterranean subregions (1988-1993, 1994-1999, 2000-2005, 2006-2011, 2012-2017). The introduction rates (i.e., 6-year regression slopes) produced by this analysis are rather similar to the previous approach and reveal the same broad patterns in each subregion (Figure), the only difference being that comparisons between introduction rates of the last assessment period (2012-2017) and the rest of the timeline are not as straightforward to interpret with regards to GES targets due to short term fluctuations. Nevertheless, it is still evident that a significant increase in new NIS records occurred in the period between the mid-1990's and the mid-2000's in all Mediterranean subregions, with relatively stable rates from then onwards and no sign of decrease until 2017. On the contrary, there has been a significant increase in NIS introduction rates in the CMED after 2011 and a slight increase, albeit not statistically significant in the EMED.

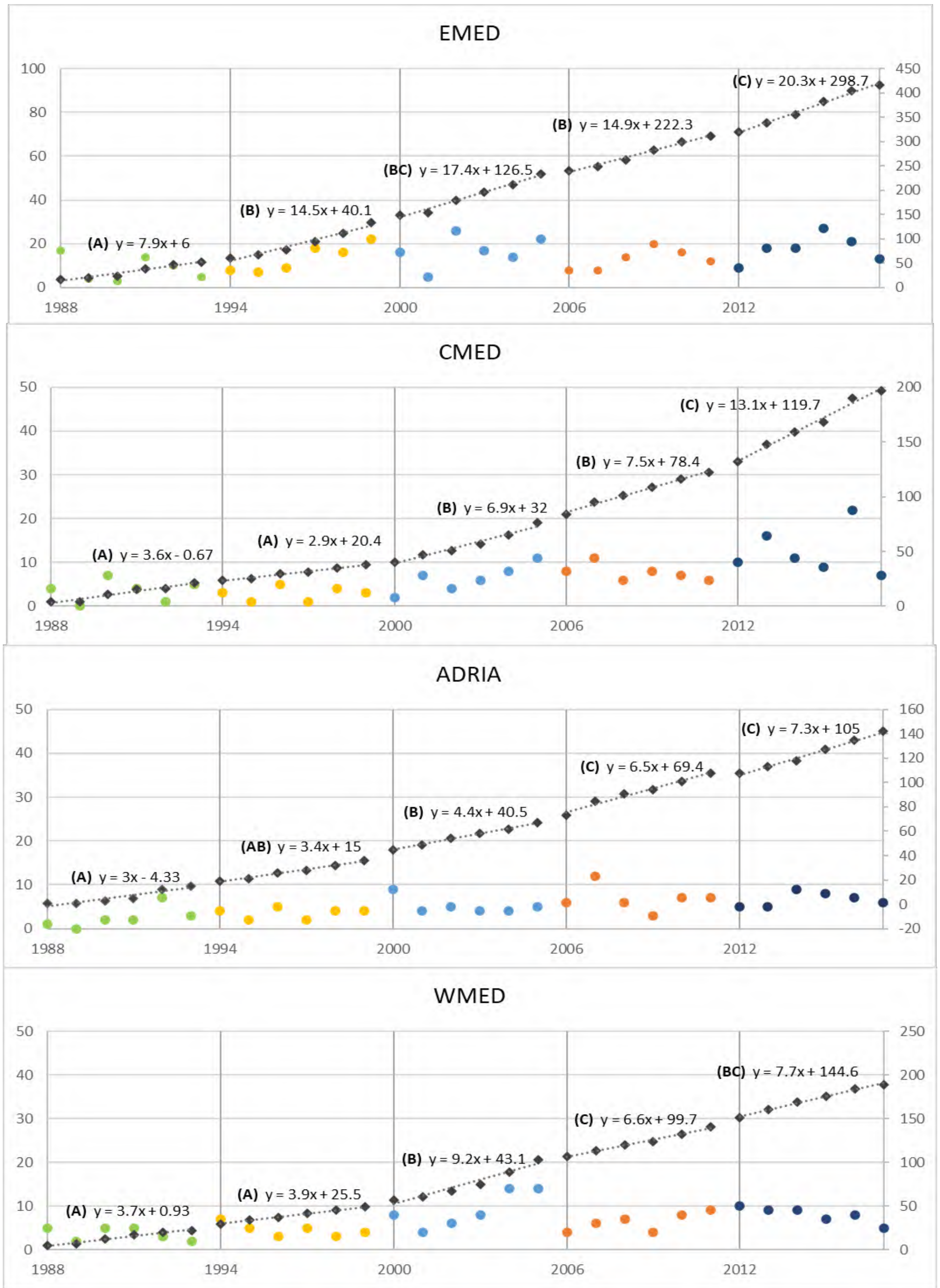


Figure 103: Annual new NIS records (coloured symbols) for each Mediterranean subregion and the trends in cumulative NIS records (dark grey symbols and fitted lines) for the five assessment periods between 1988 and 2017. The equations from the linear regression models are displayed above the fitted curves; letters in parentheses indicate statistically different regression slopes (yearly introduction rates) i.e., slopes that belong to different letter groups are different at the 0.05 level of significance.

Trends in spatial distribution

Total xenodiversity

1200. An informative way to summarise the changes in the distribution of NIS at the total xenodiversity level is by employing Venn diagrams to visualise the overlap between NIS species in each subregion and how this has changed over time (Figure). The eastern Mediterranean contains the highest number of unique species, even though the percentage has declined from 69% to 50% since 1970. An overall decline in the proportion of unique species is also evident in the Western Mediterranean and the Adriatic but an increase is observed in the Central Mediterranean. Meanwhile, the total number of species shared among all subregions has risen from 6 in 1970 to 84 in 2020 (2.2% to 8.3% respectively), signalling the increasing homogenisation of NIS species in the basin.

Figure 104: Cumulative number of species that are unique to or shared between the 4 Mediterranean subregions in 1970, 2000 and 2020

Individual species

1201. Distribution maps of selected species are displayed to give a general overview of their spread patterns over time. The associated frequency histograms (number of observations in each time bin) certainly highlight an increase in recording effort over the last 10-15 years but at the same time serve as an indication of the rate and intensity of dispersal. Lessepsian fish species (Figure105 to Figure 107), first appearing in the Mediterranean after 1990, are characterised by a typical progression from the southern Levantine northwards but then these patterns vary, depending on life cycle characteristics and environmental tolerances. ***Lagocephalus sceleratus***, with adult active migration as well as pelagic larval dispersal, proliferated rapidly throughout the Levantine and the southern Central Mediterranean but also penetrated the Central Aegean during the warm summer of 2007 and reached the northern Aegean already in the 2006-2011 period. In 2012-2017 it expanded its distribution and has been slowly advancing in the Adriatic and the southern Western Mediterranean. ***Pterois miles*** was first recorded in Israel in 1991 (Golani & Sonin, 1992) but, with the exception of a single record in Greece in 2008, only started its invasion process after 2012. Until 2017 it had rapidly expanded throughout the Levantine and the southern Aegean, with sporadic records in the Central Mediterranean (Ionian coast of Greece, Sicily and Tunisia). In the last few years, being in the radar of Citizen Science initiatives as an emblematic and highly impactful invasive species (Galanidi et al., 2018), *P. miles* is characterised by a dramatic explosion of observations but more importantly it has penetrated into the Adriatic and is spreading north, an indication that its lower thermal tolerance limit is a critical factor for future spread (Dimitriadis et al., 2020). ***Plotosus lineatus***, a venomous, swarming catfish, is a typical example of the boom-and-bust dynamics often characterising invasive species. After the first report in 2001 (Golani, 2002), it underwent a population explosion and rapidly expanded along the Israeli coast already by 2008-2011 (Edelist et al., 2012). [Note: the distribution records in the current map reflect geo-referenced data availability]. While the species remains widespread in the eastern Levant, its spread northwards has advanced at a slower pace, presumably due to the demersal nature and short duration of its larval phase (Galanidi et al., 2019). *Plotosus lineatus* is the first fully marine species to be included in the list of species of Union concern of Council Regulation 1143/2014 on IAS (EU, 2014).

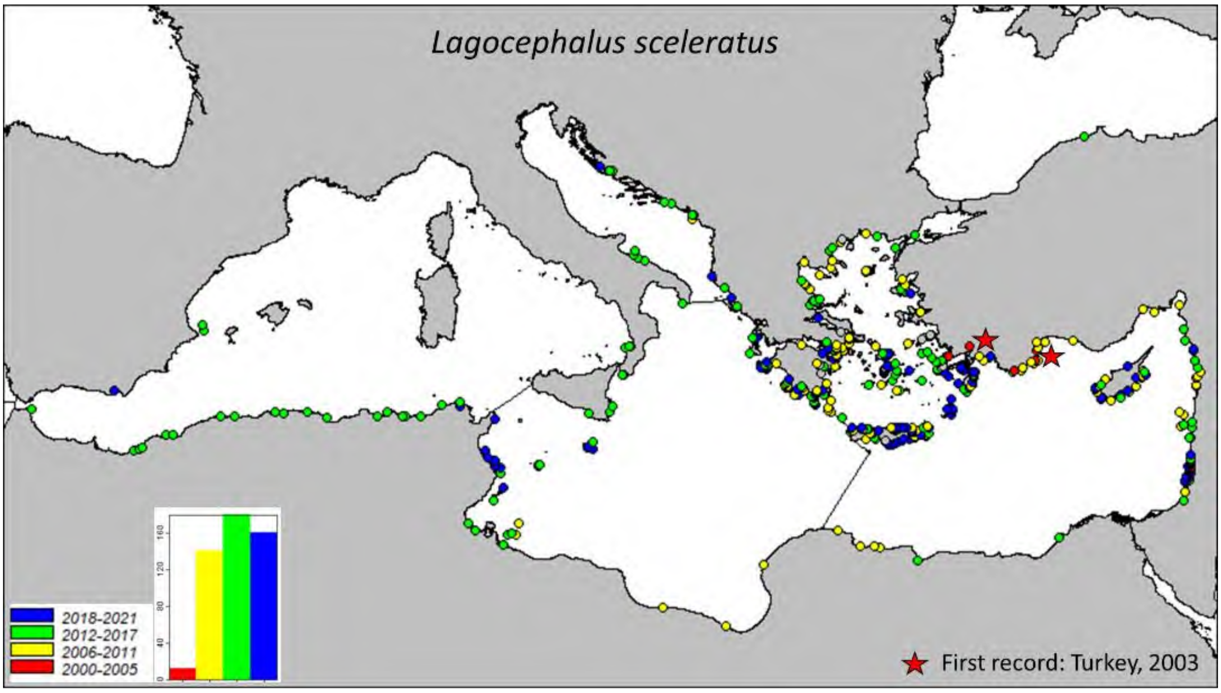


Figure105: Distribution of *Lagocephalus sceleratus* in the Mediterranean Sea. First record(s) annotated with an asterisk, different colour symbols correspond to different 6-year reporting periods, corresponding frequency histograms depict number of records in each time bin.

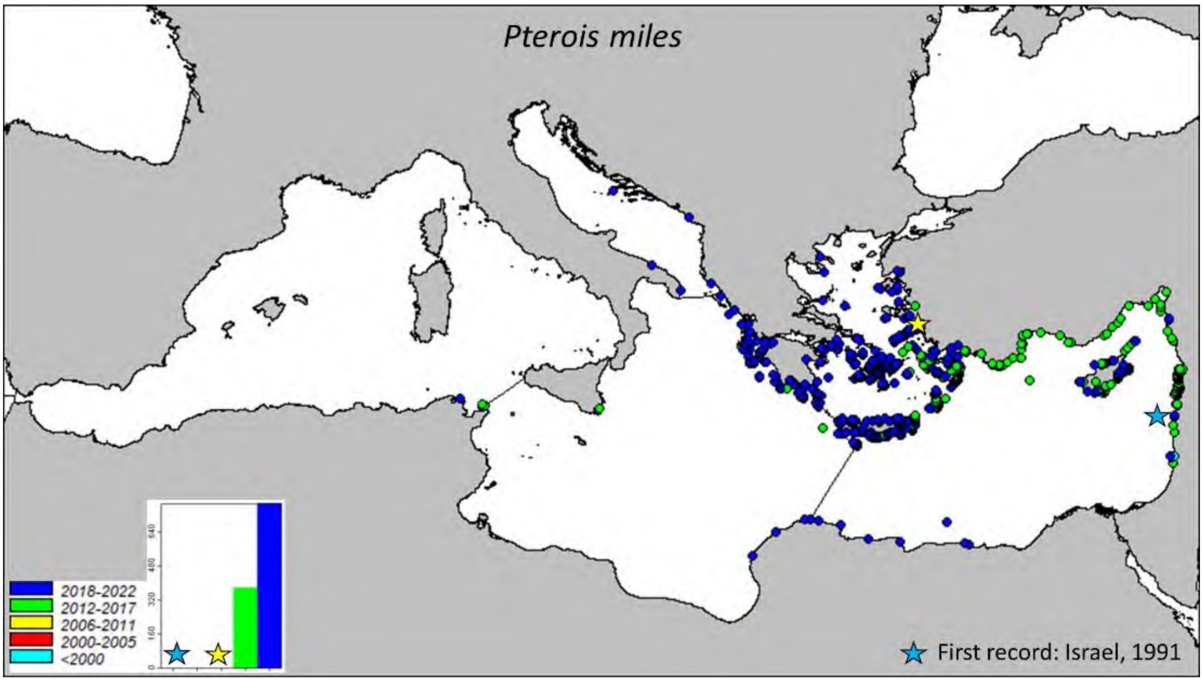


Figure 106: Distribution of *Pterois miles* in the Mediterranean Sea. Details as in Figure105.

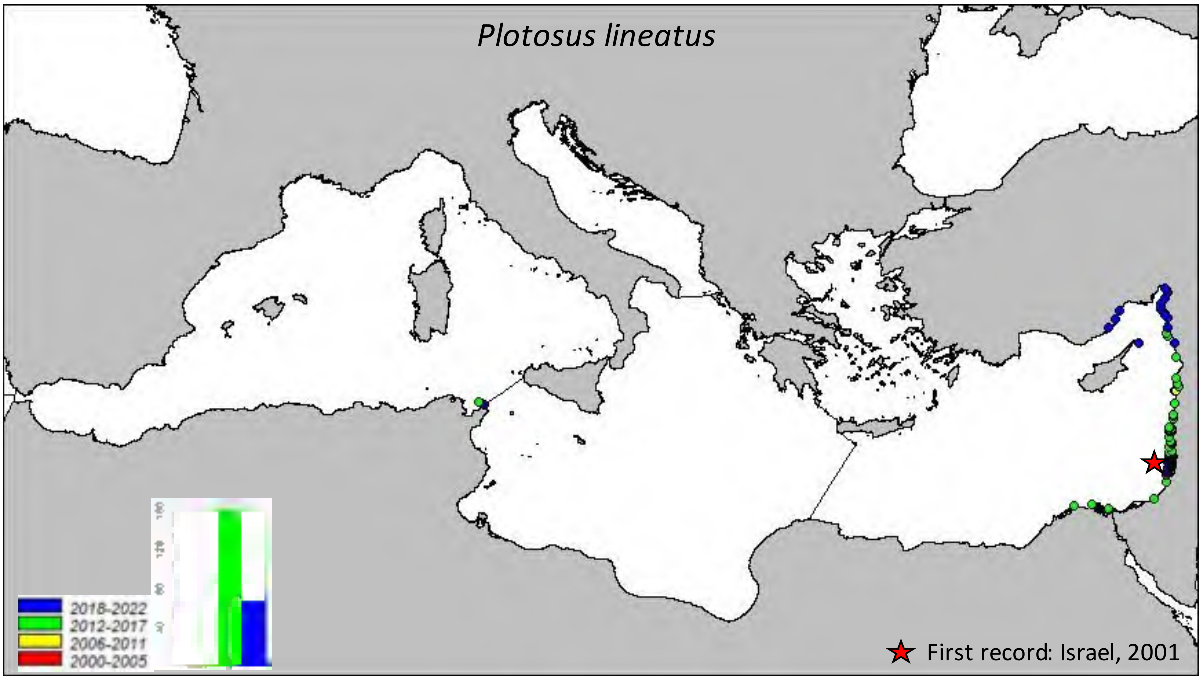


Figure 107: Distribution of *Plotosus lineatus* in the Mediterranean Sea. Details as in Figure105.

1202. The distribution pattern of ***Mnemiopsis leydyi*** in the current map (Figure 108) is largely a result of the spatial and temporal distribution of recording effort, following distinct bloom events (e.g., more than 60% of all mapped observations stem from two data series, one from large scale surveys in the Northern Aegean between 2004-2010 – Siapatis pers.comm. to ELNAIS - and the other from sampling in the Northern Adriatic in 2016 – Malej et al., 2017). The species is clearly present throughout the basin, having arrived in the early 1990's as a range expansion of a Black Sea population or with ballast water following its introduction into the Black Sea (Shiganova et al., 2001, Bolte et al., 2013) and subsequently spread in all subregions, aided by ballast water transport or unaided with water currents. Despite a considerable lag time from first introduction to population growth in the Mediterranean (Bolte et al., 2013), *M. leydyi* is undoubtedly established in most subregions.

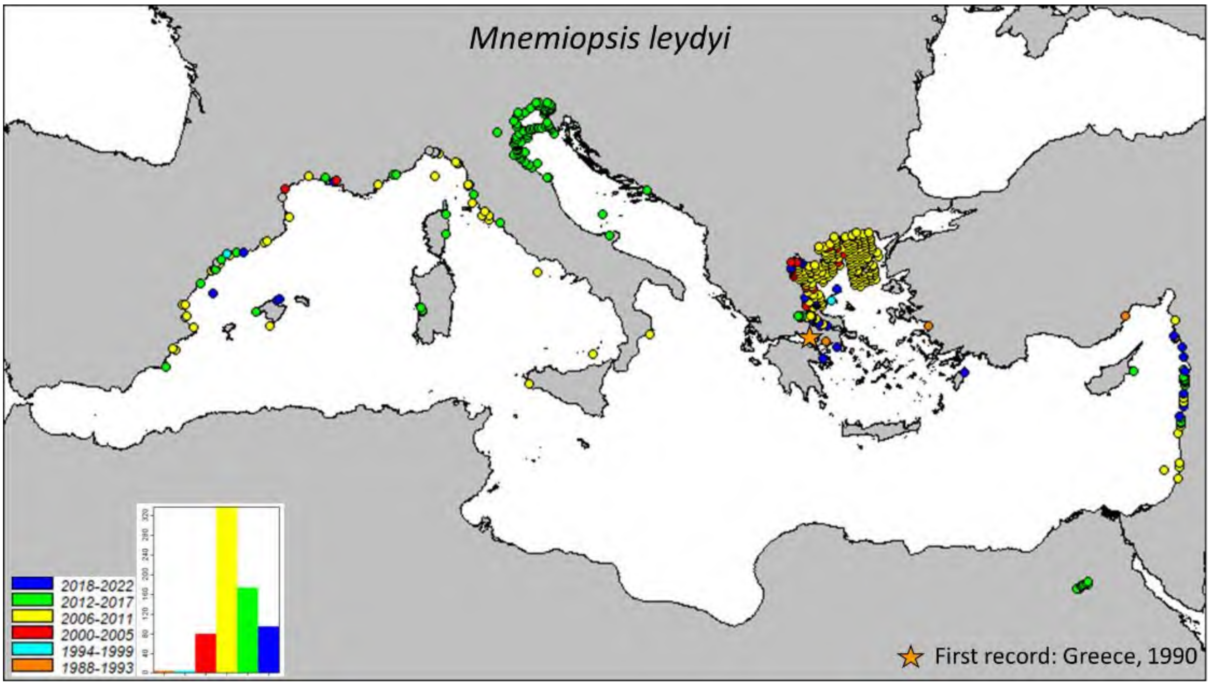


Figure 108: Distribution of *Mnemiopsis leydyi* in the Mediterranean Sea. Details as in Figure105

1203. ***Callinectes sapidus*** is believed to have been introduced multiple times in the Mediterranean through a variety of pathways, among which ballast water transfer and accidental escape or intentional release through live food trade and mariculture are the most likely (Nehring, 2011). Even though sporadically recorded for decades, the species exhibited a massive proliferation in the last decade (Figure *109*), including in the western Mediterranean, with increasing and invasive populations, and it is gaining commercial importance throughout the basin (Kevrekidis & Antoniadou, 2018; López and Rodon, 2018). Aside from natural dispersal, anthropogenic secondary introductions are suspected in many cases (Zenetos et al., 2020).

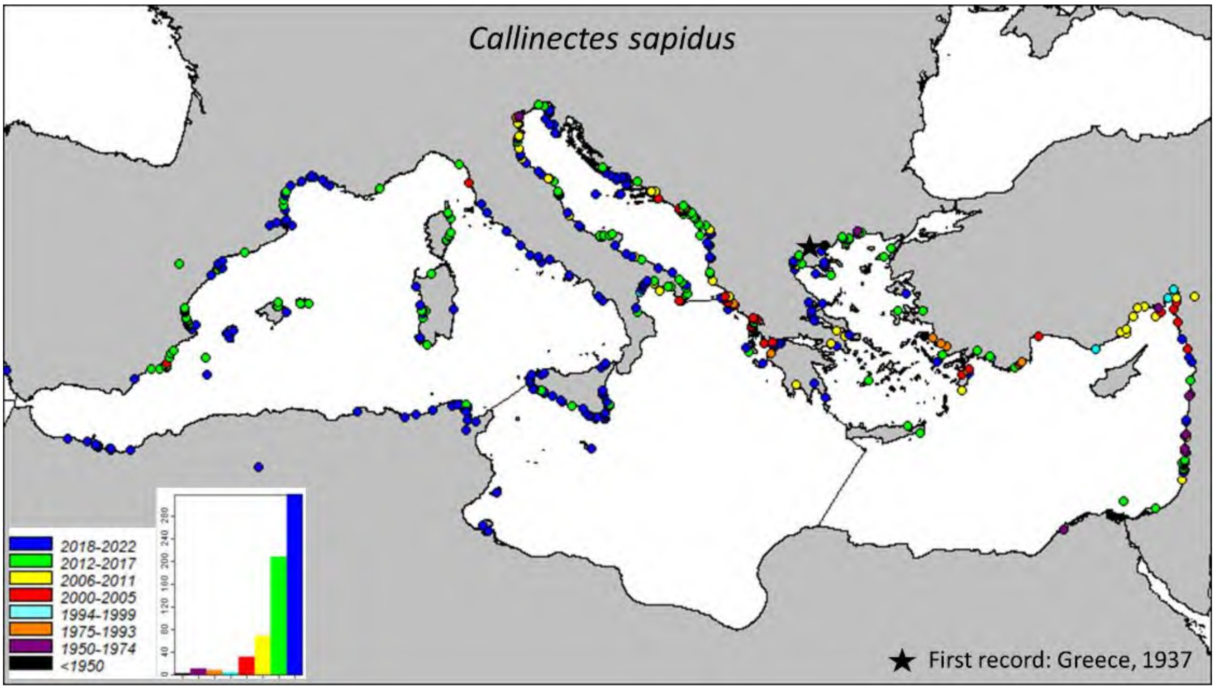


Figure 109: Distribution of *Callinectes sapidus* in the Mediterranean Sea. Details as in Figure105.

1204. ***Anadara transversa*** is a marine bivalve native to the Northwest Atlantic, that has been introduced to the Aegean and Adriatic Seas (Figure 110). Its first records from the Aegean Sea [Izmir Bay (Demir, 1977) and Bay of Thessaloniki (Zenetos, 1994)], were attributed to introduction in ships hulls. Very few records were reported until 2000 and then it was simultaneously found along a 200-km coastline from Venice to Ancona in the northern Adriatic Sea, its presence attributed to accidental introduction with oyster transfers. However, study of subfossil assemblages enabled Albano et al (2018) to disentangle the distinct stages of invasion of *A. transversa*. They concluded that the species was introduced in the 1970s but failed to reach reproductive size until the late 1990s because of metal contamination, resulting in an establishment and detection lag of 25 years. Very scarce records of the species exist after 2017 although the species is established in the Northern Adriatic. In fact, abundances reaching 42 ind. m−2 day−1 were documented in artificial collectors used for settlement analyses deployed at commercial mussel parks (Marčeta et al. 2022).

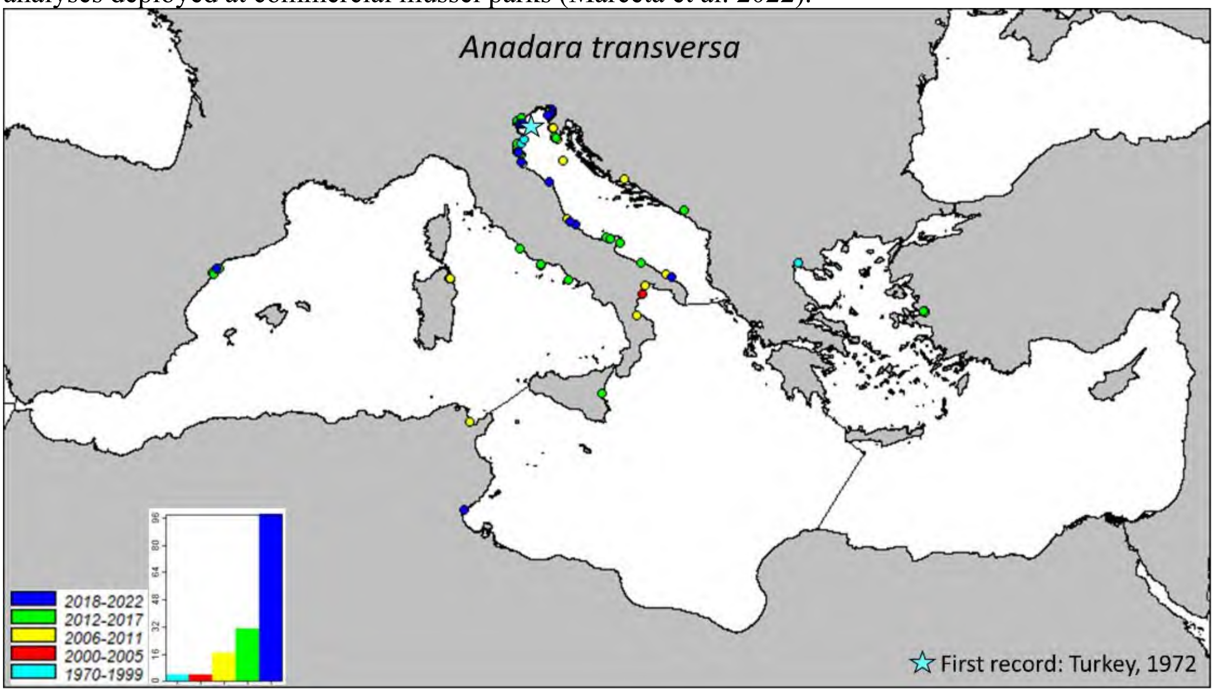


Figure 110: Distribution of *Anadara transversa* in the Mediterranean Sea. Details as in Figure105.

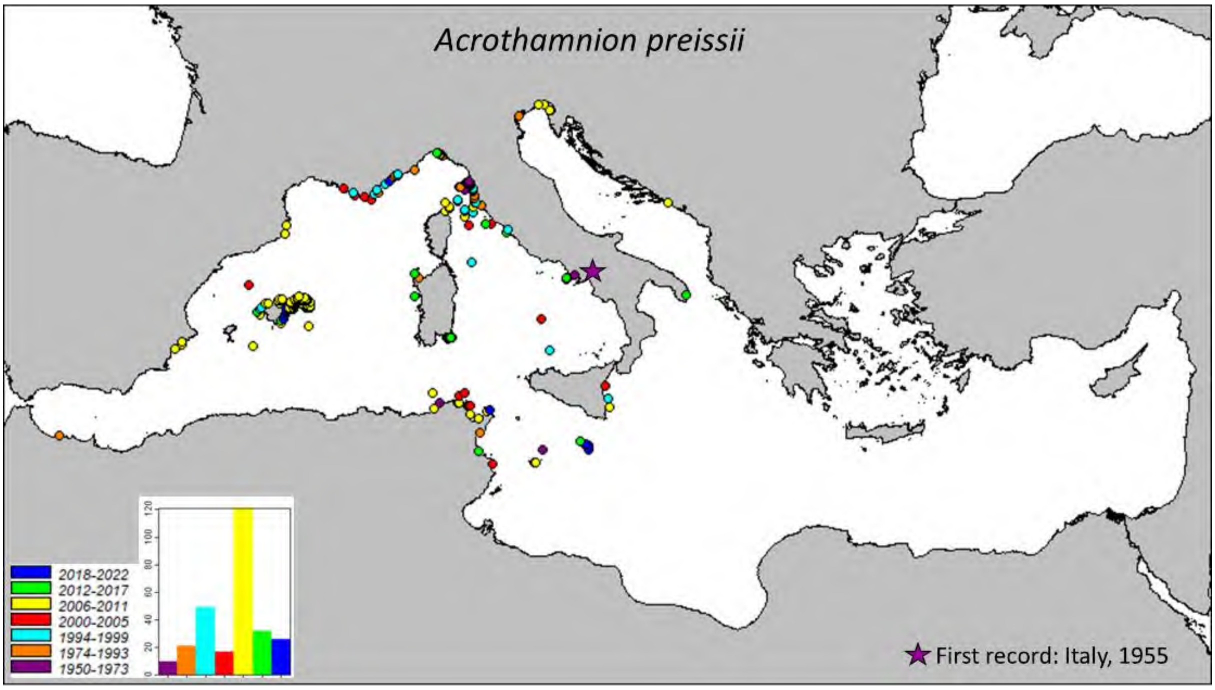


Figure 111: Distribution of *Acrothamnion preissii* in the Mediterranean Sea. Details as in Figure105.

1205. ***Acrothamnion preissii*** is a tropical rhodophyte of Indo-Pacific origin that was first reported in the Mediterranean Sea in 1955 from Naples, Italy, introduced presumably with vessels (Figure 111). It has become invasive in many localities, particularly in the western part of the basin (Verlaque et al. 2015). Its expansion in the Ligurian Sea in the 1994-1999 period may be linked to climate change in the 1980-90s (Bianchi et al., 2019). *Acrothamnion preissi* is classified among the ten worst invasive species in the Mediterranean, based on their negative impact score (accounting only for impacts on biodiversity) (Tsirintanis et al. 2022).

1206. The green alga ***Codium fragile* subsp. *fragile*** is a global invader that originates from NW Pacific that was first detected in front of the Banyuls marine station (France). A first wave of expansion took place in the period 1971-87 mostly in the northwestern Mediterranean and the Adriatic Sea (Figure 112). After that, a peak in number of occurrence records was observed between 2006-2011 presumably due to scientific effort as well as to citizen science. Along the Spanish coastline in particular, this peak is related to some extent to long-term monitoring data availability. The species is easy to identify as it forms dense sponge-like fronds of low height that become a major structural element of the invaded habitat and dominate the macroalgal community and thus it is not a surprise that many of the latest records (2018-22) have come from citizen scientists reporting to inaturalist. Its introduction has been attributed to vessels but accidental introduction with oysters is also suspected. It appears to be absent from the south-east coasts of the Mediterranean, while in the Levantine Sea it was detected after 2000.

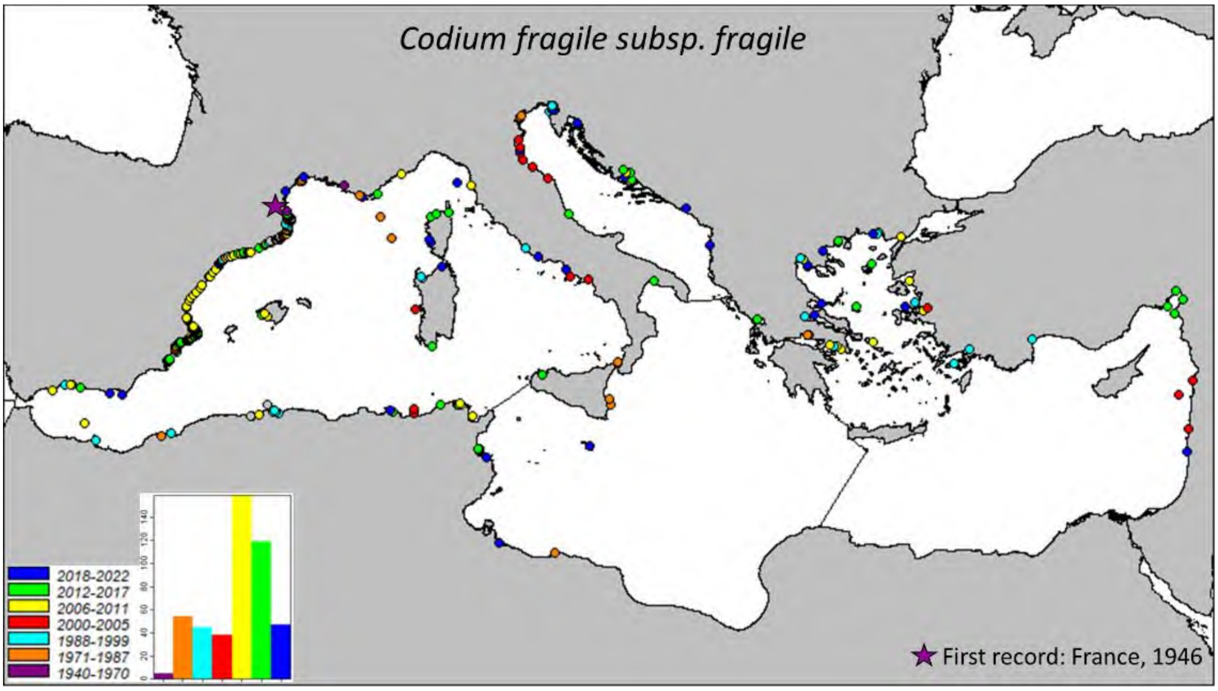


Figure 112: Distribution of *Codium fragile subsp. fragile* in the Mediterranean Sea.

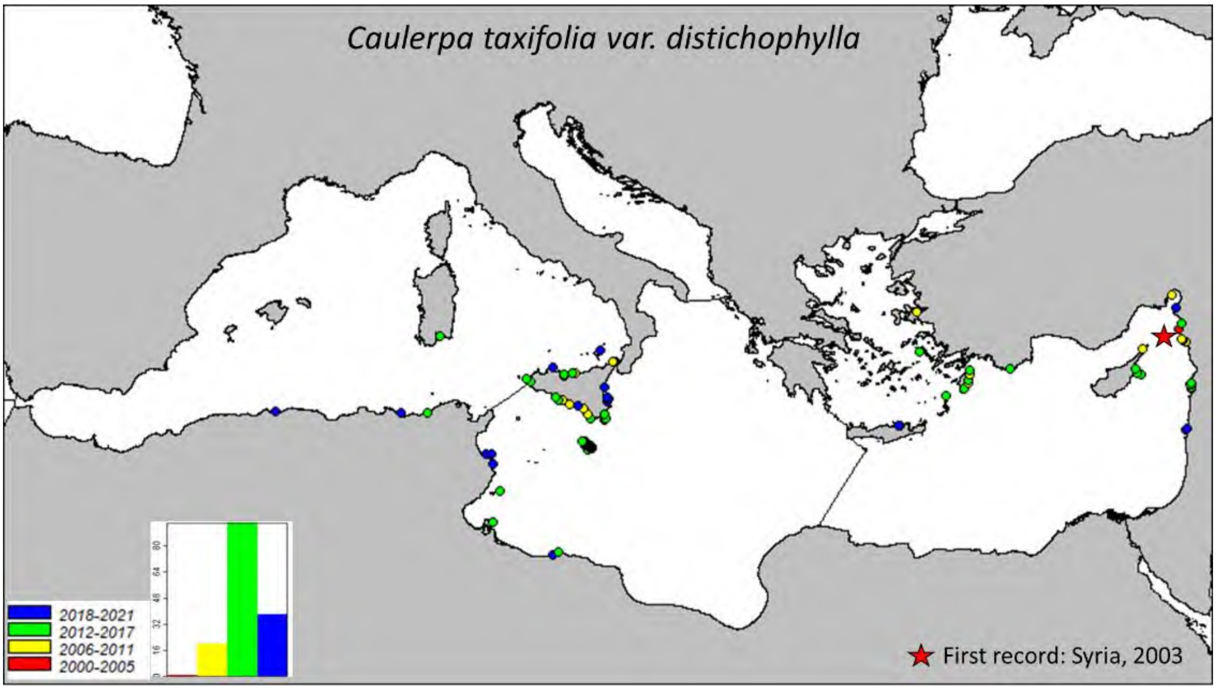


Figure 113: Distribution of *C. taxifolia var. distichophylla* in the Mediterranean Sea. Details as in Figure105.

1207. The temporal distribution ***Caulerpa taxifolia var. distichophylla*** does not follow any obvious pattern but is rather a typical example of research effort combined with taxonomic expertise. Initially reported as *C. mexicana* from Syria in 2003 (Bitar et al. 2017) and as *C. taxifolia* from Iskenderun in 2006 (Cevik et al., 2007), identification of this slender *Caulerpa taxifolia* strain was proposed by Jongma et al. (2012). Subsequently in the period 2012-17 many records of the species have been published and this continued as the scientific effort increased in the Western and eastern Mediterranean populations of *C. taxifolia var. distichophylla* are probably the result of introduction events from southwestern Australia. Although the vector of primary introductions remains unknown (aquarium trade or shipping), maritime traffic appears to be the most likely vector of secondary dispersal. *Caulerpa taxifolia var. distichophylla* is closely related to *C. taxifolia*, hence interbreeding with the other *C. taxifolia* strains in the Mediterranean Sea might be expected to occur.

1208. With only one record since its first finding in 2002, presumably resulting from shellfish transfers, the brown alga ***Rugulopteryx okamurae*** was considered as locally established in France (Verlaque et al (2015). Following a record in Ceuta in 2015, a massive expansion was observed within the strait of Gibraltar and the Alboran Sea coasts of Spain in 2017 and the species became invasive in record time (García-Gómez et al. 2020). The lifecycle of this species, its ecological characteristics such as its euthermia and allelopathy as well and high competitiveness over other native and invasive species may be highly responsible of its invasive behaviour (García-Gómez et al., 2018). In the period 2020-21, *R. okamurae* extended its distribution in Morocco, France and Spain, reaching Madeira (Bernal-Ibáñez et al., 2022). In France, despite occurring for 20 years in the Thau lagoon, *R. okamurae* has not displayed an invasive behaviour in the area. Conversely, in Marseille, with the winter sea surface temperature usually above 13 °C, this alga persists throughout the winter, and therefore, rapidly spreading when conditions are favourable (Ruitton et al. 2021). The new Commission Implementing Regulation (EU) 2022/1203 of 12 July 2022 amending Implementing Regulation (EU) 2016/1141 to update the list of invasive alien species of Union concern now includes *Rugulopteryx okamurae*.

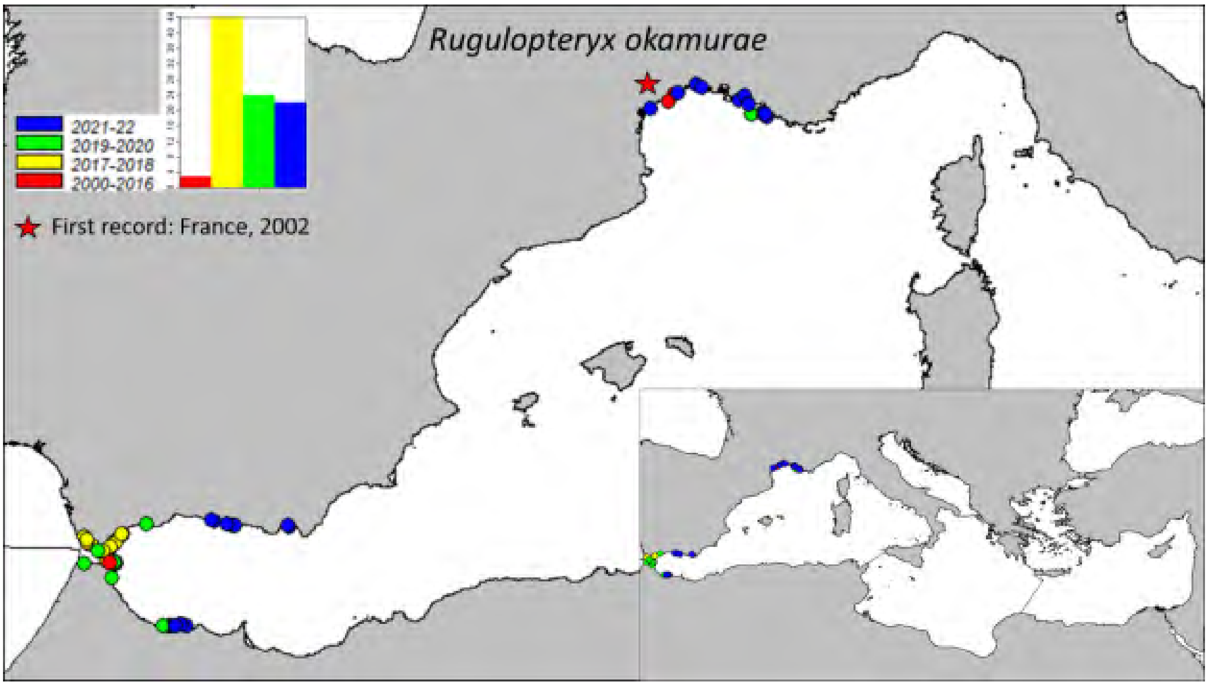


Figure 114: Distribution of Rugulopteryx okamurae in the Mediterranean Sea. Details as in Figure 111.

Key findings for Common Indicator 6 (CI6): Non-Indigenous Species

1209. To the extent that Good Environmental Status in relation to CI6 is defined as "Introduction and spread of NIS linked to human activities are minimised, in particular for potential IAS" it is concluded that GES has not been achieved in any of the Mediterranean subregions. The results of trends analyses indicate that for the past 15-20 years new NIS introduction rates have been relatively stable in the West Mediterranean and the Adriatic slightly but not statistically increasing in the East Mediterranean but increasing in the Central Mediterranean. In none of the subregions has a reduction in new NIS introductions been observed based on data up to 2020. Furthermore, even if the rate is staying constant the total (cumulative) number of NIS in the basin is increasing steadily, with corridors and shipping the main pathways responsible. The appearance of some new NIS in each subregion is the result of range expansion from different subregions where they were initially introduced, as evidenced by the increasing proportion of NIS shared among all Mediterranean subregions. Nevertheless, and in contrast with the other subregions, the proportion of unique new NIS is steadily rising in the Central Mediterranean, thus the increasing new NIS introduction rates there cannot be solely attributed to natural dispersal from the other subregions. Furthermore, a number of invasive, high-impact NIS have displayed an increased geographic expansion in the last decade or so, which can be deduced even behind the "noise" of increased detection and reporting. NIS species of warm affinities with long-range pelagic dispersal appear to have been favoured by climate change and increased seawater temperatures to penetrate the cooler regions of the Mediterranean, secondary anthropogenic dispersal however still plays an important role in the spread of the more sedentary species.

1210. Clear interpretation of these trends is hampered by the lack of long-term standardised monitoring data, as it is not possible to disentangle the confounding effects of differential recording efforts spatially and temporally from real changes in pathway pressure or vector management. An additional challenge, also pertinent to the DPSIR analysis for NIS, is that spatially explicit, quantitative pathway pressure data are not uniformly available throughout the Mediterranean, such that any attempted correlations would be skewed or incomplete. This was already identified in UNEP/MED WG.502/Inf.11 (2021) and emerges as a priority in order to strengthen further GES assessments of CI6.

1211. Trends in abundance were not assessed as they require long time series of standardised monitoring data from the same locations, the collection and collation of which at the regional level is not sufficiently co-ordinated. Furthermore, an agreed methodology has not been developed for a formal quantification of changes in spatial distribution, which cannot be properly assessed without true presence-absence data.

1212. With regards to NIS impacts, even though assessment and mapping have been conducted at the regional level (Katsanevakis et al., 2014; 2016), there is plenty of scope for refinement and improvement as most reported impacts are still based on weak evidence (Tsirintanis et al., 2022). Thus, conducting manipulative and field experiments to examine impacts on species, habitats and ecosystems remains a priority for NIS research. Moreover, considering that species distributions have changed since the first Mediterranean-wide CIMPAL, but also new information has emerged regarding impact strength, NIS impacts need to be re-evaluated.

Measures and actions required to achieve GES for Common Indicator 6 (CI6): Non-Indigenous Species

1213. With regards to suitable data availability, the majority of the CPs have developed, and many are already implementing IMAP-compliant monitoring programmes. Furthermore, the IMAP Data and Information System is operational and has already started receiving NIS data, such that standardised time series are anticipated to be available for the next assessment cycle. This should make possible the formal quantification of abundance and spatial distribution changes and increase our confidence in the assessment of trends in temporal occurrence. If CPs have not already initiated the process, IMAP can assist in co-ordinating the development of priority NIS lists for monitoring of abundance through risk analysis and risk assessment. Early detection and early warning systems can be informed by regularly updating the spatial distribution information entered into MAMIAS and the IMAP Info System.

1214. Threshold values for trends in temporal occurrence have not been set yet but methodologies and approaches are under discussion through regional co-operation. Quantifying/modelling pathway pressure can assist in specifying quantitative targets (percentage reduction) by introduction pathway. Importantly, all these methodological steps need to be adapted for GES assessment at the national level. The effect of reporting lags on new NIS data and trends analysis in this assessment was circumvented by not using the data of the last 3 years (2018-2020), however it would be beneficial to adopt a commonly agreed methodology to deal with this issue in order to avoid loss of information.

1215. Next important steps for GES assessment of NIS include the elaboration of the remaining aspects of CI6 that relate to impacts, by further developing assessment criteria and quantitative targets for the most vulnerable/important species and habitats at risk. This is work that ideally should be co-ordinated with the implementation of EO1 Common Indicators CI1 and CI2 and EO6 on sea floor integrity.

1216. Besides methodological considerations with regards to IMAP and the assessment of GES, working towards achieving GES requires actions to mitigate and reduce invasion pressure, especially coordinated actions by all the states. Towards that effect, the draft updated Action Plan concerning NIS has already taken consideration the Mediterranean NIS baselines and the results of the MedQSR2023, such that in its proposed actions there is emphasis on preventative measures, including encouraging and facilitating CPs to strengthen their legislative and institutional framework in order to systematically risk assess and manage pathways, as well as elaborate early warning systems, rapid response plans and mechanisms to control intentional introductions. The other axis of focus of the Action Plan relates to the impacts of NIS, where targeted impact studies for priority species are proposed in order to identify density-response relationships and acceptable abundance levels. The implementation of the NIS Action Plan will progress in parallel with the Ballast Water Management (BWM) Strategy for the Mediterranean (2022-2027) which focuses on the management of ship-mediated introductions from ballast water, by facilitating the implementation of the Ballast Water Management Convention, and biofouling, by developing national strategies and action plans to manage this vector.

2.2.3 EO3 Harvest of Commercially Exploited Fish and Shellfish

Methodology for data analysis in relation to E03

Assessment methods

The complete set of main fishery indicators adopted to assess current status of Mediterranean stocks as well as their temporal trend is reported in the last SAC Report (FAO, 2021). Below is a list of the ones for which a common methodology has been already developed (GFCM, 2017b) and discussed during the meeting of the Correspondence Group on Monitoring (CORMON), Biodiversity and Fisheries (UNEP/MAP, 2017a) as well as the 6th meeting of the Ecosystem Approach Coordination Group (UNEP/MAP, 2017b):

- Fishing mortality (F) and/or Exploitation rate (E) (Indicator assessment factsheet code EO3 CI7).
- Total Landings (TL) (Indicator assessment factsheet code EO3CI8).
- Spawning Stock Biomass (SSB) (Indicator assessment factsheet code EO3CI9).

Area

For the present analysis, the study area is corresponding to GFCM area of application (FAO major fishing area 37), in most cases with a focus on the Mediterranean Sea from the Straits of Gibraltar to Bosphorus, which comprises 27 Geographical Sub-Areas (GSAs) (Figure). Whenever possible, information was aggregated to provide a subregional (the Western, Central and Eastern Mediterranean and the Adriatic Sea; Figure) and regional outline of the status of resources. Stock assessments are mostly conducted by management units based on the mentioned GSAs. This method does not ensure that the whole stock is assessed, since stocks may cover several different management units. In some cases, when there is scientific evidence of a stock spreading through different GSAs, as well as information on species from different GSAs, existing information is combined across GSAs. This is then defined as a “joint stock assessment of a shared stock”.

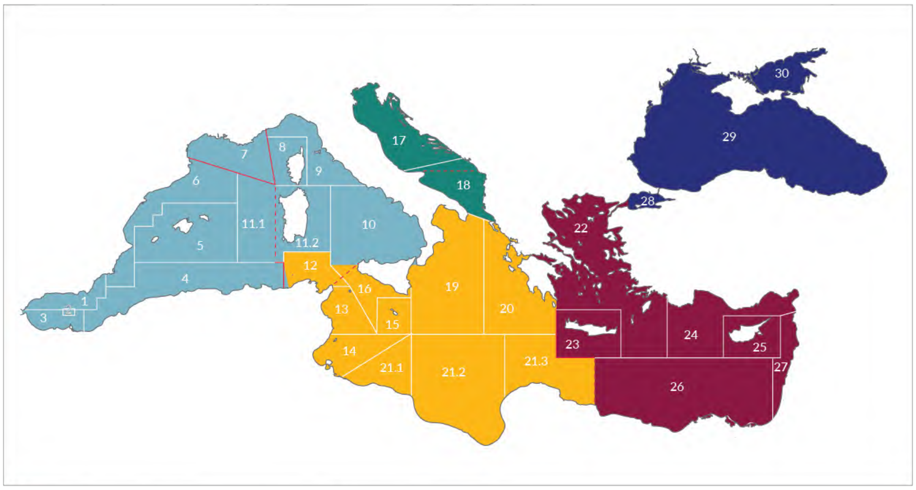
Species

Special attention was given to priority stocks agreed upon by the GFCM (Table 45).

Table 45: Main species analysed in The State of Mediterranean and Black Sea Fisheries: priority species driving fisheries for which assessments are regularly (or planned to be) carried out.

	GFCM subregions →	Western Mediterranean Sea	Central Mediterranean Sea	Adriatic Sea	Eastern Mediterranean Sea	Black Sea
	GFCM geographical subareas →	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11	12, 13, 14, 15, 16, 19, 20, 21	17, 18	22, 23, 24, 25, 26, 27	28, 29, 30
	Countries →	Algeria, France, Italy, Monaco, Morocco, Spain	Italy, Greece, Libya, Malta, Tunisia	Albania, Bosnia and Herzegovina, Croatia, Italy, Montenegro, Slovenia	Cyprus, Egypt, Greece, Israel, Lebanon, Syrian Arab Republic, Türkiye	Bulgaria, Georgia, Romania, Russian Federation, Türkiye, Ukraine
Scientific name	Common name					
Pelagic species						
Engraulis encrasicolus	European anchovy	■	■	■	■	■
Sardina pilchardus	Sardine	■	■	■	■	
Sardinella aurita	Round sardinella	■	■		■	
Sprattus sprattus	European sprat					■
Trachurus mediterraneus	Mediterranean horse mackerel					■
Demersal species						
Aristaeomorpha foliacea	Giant red shrimp		■		■	
Aristeus antennatus	Blue and red shrimp		■		■	
Lagocephalus sceleratus	Silver-cheeked toadfish	■	■	■	■	
Merlangius merlangus	Whiting					■
Merluccius merluccius	European hake	■	■	■	■	
Mullus barbatus	Red mullet	■	■	■	■	
Mullus surmuletus	Surmullet	■	■		■	
Nephrops norvegicus	Norway lobster	■	■	■		
Pagellus bogaraveo	Blackspot seabream	■				
Parapenaeus longirostris	Deep-water rose shrimp	■	■	■	■	
Pterois miles	Devil firefish	■	■	■	■	
Rapana venosa	Rapa whelk					■
Scophthalmus maximus	Turbot					■
Sepia officinalis	Common cuttlefish			■		
Solea solea	Common sole			■		
*Squalus acanthias**	Piked dogfish					■
Squilla mantis	Spottail mantis shrimp			■		
Additional species						
Anguilla anguilla	European eel	■	■	■	■	
Corallium rubrum	Red coral	■	■	■	■	
Coryphaena hippurus	Common dolphinfish		■	■	■	
Sarda sarda	Atlantic bonito					■
Saurida lessepsianus	Lizardfish				■	

Note: * indicates species included in Appendix III (species whose exploitation is regulated) of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol) of the Convention for the Protection of the Mediterranean Sea Against Pollution (Barcelona Convention).



FAO statistical divisions — GFCM geographical subareas (GSAs)

GFCM subregions
Western Mediterranean — Central Mediterranean — Adriatic Sea — Eastern Mediterranean — Black Sea

01. Northern Alboran Sea	07. Gulf of Lion	13. Gulf of Hammamet	19. Western Ionian Sea	25. Cyprus
02. Alboran Island	08. Corsica	14. Gulf of Gabès	20. Eastern Ionian Sea	26. Southern Levant Sea
03. Southern Alboran Sea	09. Ligurian Sea and northern Tyrrhenian Sea	15. Malta	21.1. Southwestern Ionian Sea 21.2. Southern Ionian Sea 21.3. Southeastern Ionian Sea	27. Eastern Levant Sea
04. Algeria	10. Southern and central Tyrrhenian Sea	16. Southern Sicily	22. Aegean Sea	28. Marmara Sea
05. Balearic Islands	11.1. Western Sardinia 11.2. Eastern Sardinia	17. Northern Adriatic Sea	23. Crete	29. Black Sea
06. Northern Spain	12. Northern Tunisia	18. Southern Adriatic Sea	24. Northern Levant Sea	30. Azov Sea

Note: At its forty-fifth session in November 2022, the GFCM agreed to divide GSA 21 (Southern Ionian Sea) into three marine subareas. The subdivision of GSA 21 into GSAs 21.1, 21.2 and 21.3 will be applied in 2023.

Figure 115: Map of the GFCM area of application (Subregions and GSA- Geographical Subareas). Note; for the purpose of this QSR most of the analysis presented, with the exception to overall indexes as included in SoMFi (FAO 2022) include only the Mediterranean Sea.

1217. The indicators of Good Environmental Status of Commercially Exploited fish are quantitative proxies to describe the status of a specific fish stock (i.e. the fish population from which catches are taken in a given fishery) as well as the anthropogenic pressure imposed on it through fishing activities. These indicators are regularly used in fisheries management to assess the sustainability of fisheries, as well as the performance of management measures (Miethe et al., 2016), by monitoring how far the indicator is from previously agreed targets (i.e. reference points).

1218. The assessment of the size and state of exploited fish stocks is one of the pillars of fisheries management. Generally, stock status is determined by estimating both current levels of fishing mortality (EO3 CI7) and spawning-stock biomass (see EO3 CI9), and comparing these with reference points, which are typically associated with maximum sustainable yield (MSY - Brooks et al., 2010).

1219. Total catch refers to the total amount of fish of a commercially exploited fish and shellfish species taken by any fishing gear, while total landings (EO3 CI8) are the total amount of fish and shellfish landed and officially registered. Total catch is composed of total landings plus discards and unreported catches. As information on the latter quantities is fragmented, total landing is often used as a proxy indicator of fisheries production as well as of the removal of organisms from the ecosystem, although for areas where the latter are important a sizeable shift from real values may occur.

Key Messages (CI-7 Spawning stock biomass)

1220. While the biomass of some species under management plans is already increasing as a result of decreased fishing pressure, others have yet to show any improvement. Across the region, 44 percent of the stocks were found to have low relative biomass levels, with 19 percent intermediate and 37 percent high.

Key Messages (CI-8 Total landings)

1221. Capture fisheries production in the region has been stalled since the mid-1990s, with a decrease in 2020 likely exacerbated by the COVID 19 pandemic. Landings for the Mediterranean and the Black Sea (2018–2020 average) amount to 1 189 200 tonnes (excluding tuna-like species), very similar to the landings reported in The State of Mediterranean and Black Sea Fisheries 2020 (2016–2018 average). However, landings in 2020 show a 16 percent decline in comparison with 2019, likely related to some extent to the impacts of the COVID-19 pandemic on fleet dynamics, demand and trade. The total production for the Mediterranean Sea alone was 743 100 tonnes (62 percent of the total capture fish production in the region).Key Messages (CI-9 Fishing mortality)

1222. The overexploitation of stocks has decreased over the past decade, with an accelerated reduction of fishing pressure in the last two years, particularly for key species under management plans. However, most commercial species are still overexploited, and fishing pressure is still double what is considered sustainable.

1223. Most stocks for which validated assessments are available continue to be fished outside biologically sustainable limits, and average fishing pressure is still twice the level considered sustainable (average F/FMSY = 2.25). Nevertheless, there has been a 10 percent decrease in the percentage of stocks in overexploitation since 2012 and a continuous gradual decrease in fishing pressure since 2012 (a 21 percent decrease since 2012, double what was reported in 2020).

1224. For some priority species under management plans, fishing pressure has declined by considerably more over the past decade, including European hake (-39 percent) and common sole (-75 percent). However, fishing pressure continues to increase on certain other stocks, notably commercially important blue and red shrimp in the central and eastern Mediterranean.

Good environmental status (GES) / alternative assessment (EO3)

Spatial and temporal coverage of advice on stock status

1225. The number of non-deprecated validated stocks increased progressively between 2006 and 2020, peaking in 2020 with 99 in total; of these, since 2018, more than 75 percent were carried out in the terminal year (i.e. less than 25 percent of the assessments used are more than one year old) (Table 3), reflecting an improvement in spatial and temporal coverage. The percentage of catch assessed by the Scientific Advisory Committee on Fisheries (SAC) and the Working Group on the Black Sea (WGBS) reached 53 percent in 2015 (Figure 116), fluctuating between 30 to 50 percent since then, mostly due to the percentage of catch of key Black Sea small pelagic species, e.g. Black Sea anchovy (*Engraulis encrasicolus ponticus*) and sprat (Sprattus sprattus), whose landings are around 200 000 tonnes and 64 000 tonnes in 2021, respectively. Pending the finalization of a benchmark process, the last validated assessment for Black Sea anchovy was carried out in 2017, and therefore this assessment is considered deprecated in 2020, causing the percentage of catch assessed to fall below 30 percent. The number of stocks for which advice was provided on a qualitative (precautionary) basis remained around 25 percent since the reference year 2018 (Figure 116), while the percentage of the catch assessed on a qualitative basis decreased from 14 percent to 8 percent over the same period. Status and trends of priority species.

Table 46: Number of validated and non-deprecated stock assessments available per year, 2003–2020

Year	Validated assessments	Non-deprecated assessments
2003	1	1
2006	17	18
2007	27	32
2008	32	46
2009	28	47
2010	37	57
2011	25	59
2012	35	65
2013	29	66
2014	25	67
2015	38	60
2016	57	70
2017	56	79
2018	50	84
2019	71	95
2020	79	99

Notes:
The red line represents the number of stock units and the bar chart represents the percentage of declared landings assessed per year.
Stock units are defined as a combination of species and management units. Only validated and non-deprecated assessments (e.g. less than three years old for small pelagic species or five years old for demersal species) are considered in this plot; stock units for which several assessments exist in a given year are only counted once.
Qualitative advice refers to validated advice on a precautionary basis, with no quantitative estimates.
Quantitative advice refers to advice based on quantitative estimates generated by stock assessments in terms of current fishing mortality and/or biomass and respective reference points.

Figure 116: Number of stock units and percentage of declared landings assessed per year, 2008–2020, with an indication of the quality of the advice emerging from the assessments

1226. The overall increase in validated assessments compared to 2018 is consistent across all Mediterranean subregions. The central Mediterranean showed the steepest increase in the number of validated assessments since 2018, although the degree of increase varied among geographical subareas (GSAs) in the subregion (Figure 117). Coverage increased visibly in the central Mediterranean in GSAs

12–16 (northern Tunisia, Gulf of Hammamet, Gulf of Gabès, Malta and southern Sicily) and GSA 20 (eastern Ionian Sea) and in the Adriatic Sea (GSAs 17–18). Furthermore, GSA 5 (Balearic Islands), GSA 9 (Ligurian Sea and northern Tyrrhenian Sea), GSA 19 (western Ionian Sea), GSA 21 (southern Ionian Sea), GSA 24 (northern Levant Sea) and GSA 25 (Cyprus) increased by one stock assessed between 2018 and 2020, bridging the gap between areas with low and high assessment coverage in the GFCM area of application (Figure 117).

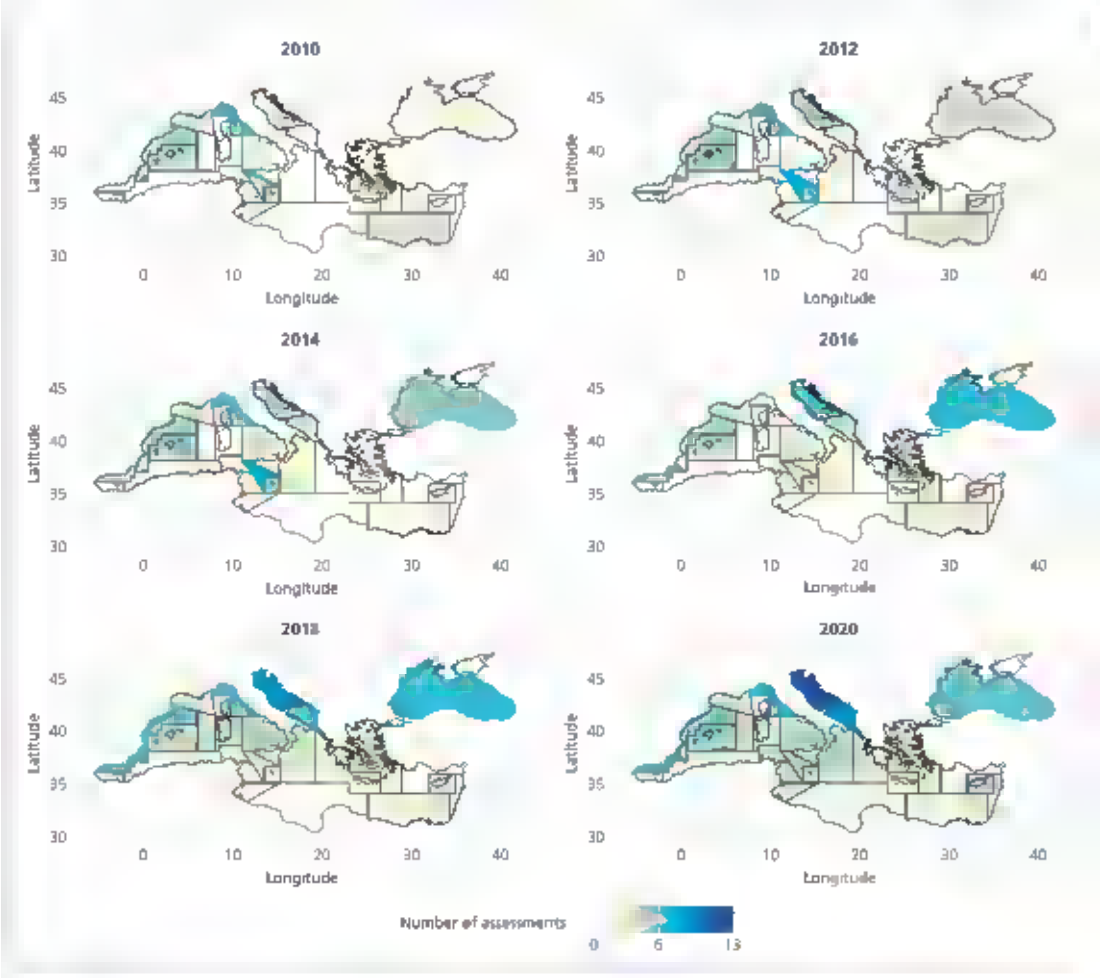


Figure 117: Number of validated stock assessments per year by GFCM subregion, 2008–2020

Overview of the status of stocks in the Mediterranean and the Black Sea

1227. Biomass reference points are not commonly available for assessed stocks. Therefore, the percentage of stocks fished outside biologically sustainable limits is mainly estimated by comparing the level of fishing mortality to the fishing mortality reference point. Most stocks for which validated assessments are available continue to be fished outside biologically sustainable limits (Figure 98). Nevertheless, there has been a 10 percent decrease in the percentage of stocks in overexploitation since 2012; in 2020, 73 percent of stocks were found to be outside biologically sustainable limits (the same value as in 2016 and the lowest since 2009) (Figure 98).

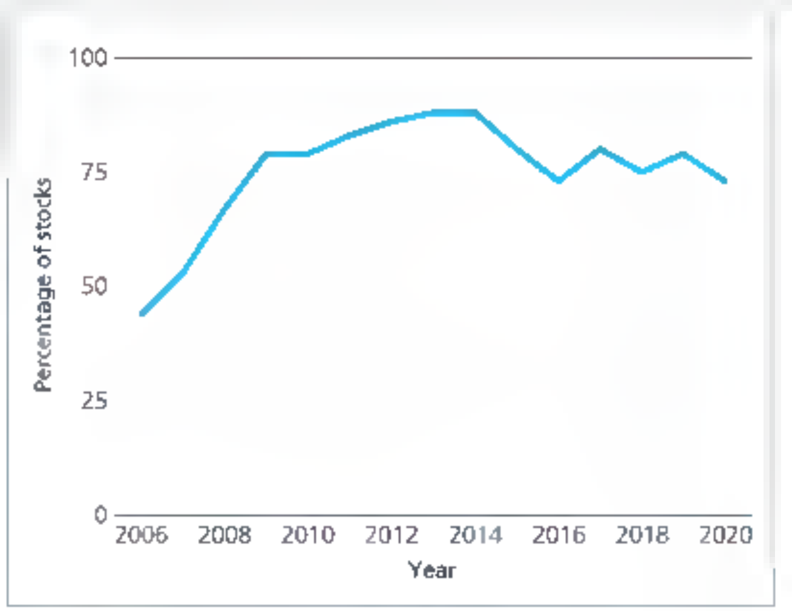


Figure 98: Percentage of stocks in overexploitation in the GFCM area of application, 2008–2020

Key findings per Common Indicator CI-7 (Spawning stock biomass)

1228. The overall analysis of the current biomass levels of Mediterranean stocks reveals a prevalence of stocks with relatively low biomass, although the percentage remains lower than the sum of the intermediate and high biomass percentages (Figure 99; Table 47).

1229.

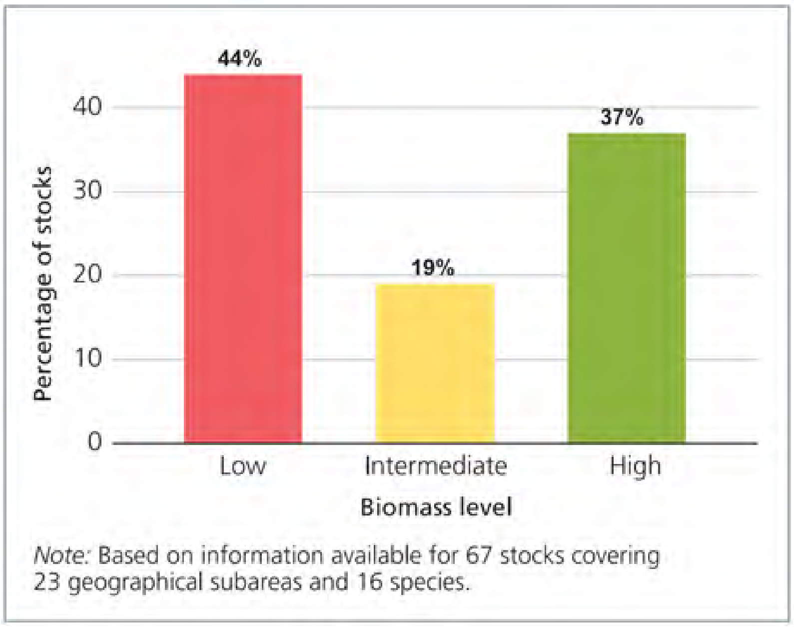
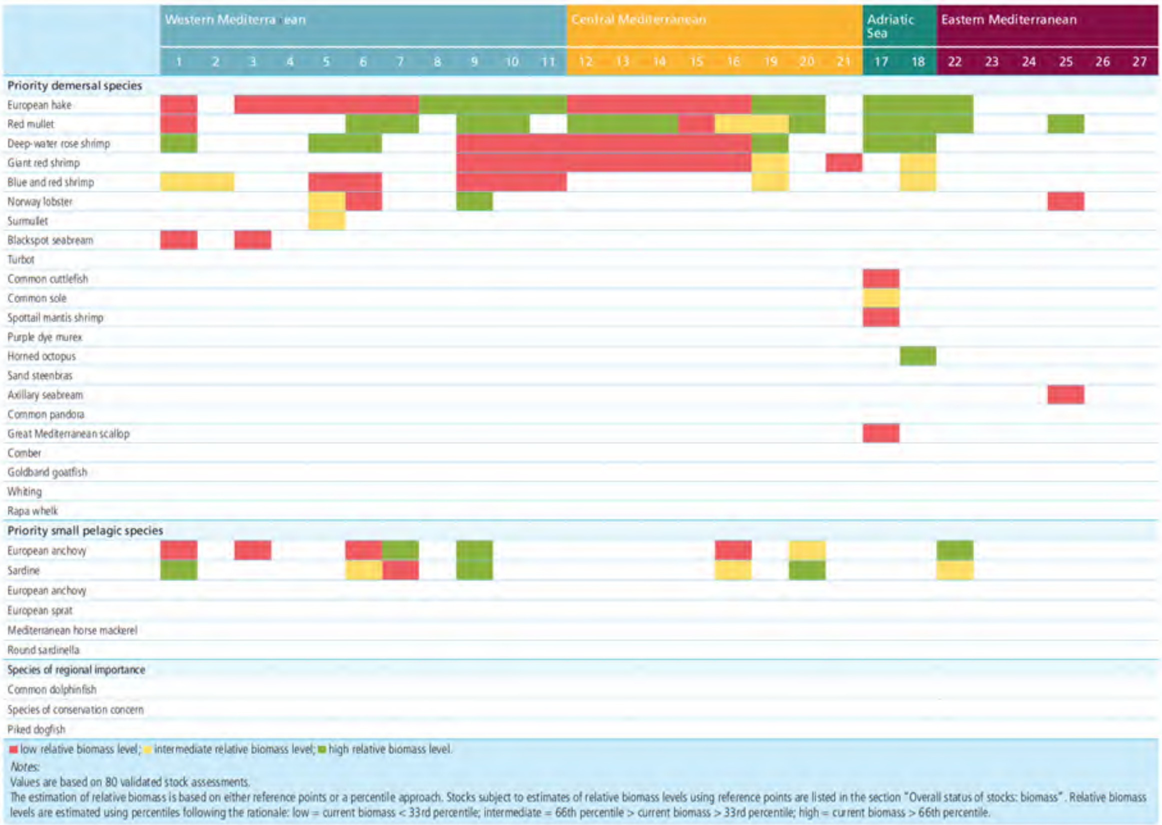


Figure 99: Percentage of Mediterranean stocks at low, intermediate, and high relative biomass levels

Table 47: Relative biomass level by priority species and geographical subarea in the Mediterranean Sea



1230. A comparative analysis with the reference year 2018, based on the 45 stocks for which biomass information was available in both years, reveals that most stocks remain in the same biomass level group (30 stocks), while 10 stocks have dropped to lower levels of biomass and 5 stocks have improved (Figure 100). Notably, the relative biomass of deep-water rose shrimp in GSAs 9–11, as well as of European hake in GSAs12–16 appears to have declined in these two years, while European hake in GSAs 8–11, deep-water rose shrimp in GSA 5 and common sole in GSA 17 show improvements, among other stocks (Figure 7). Considering the comparable stocks between the current edition and previous edition (FAO, 2020), the decrease in stocks with a high relative level of biomass was partially compensated for by improvements in other stocks to the intermediate category.

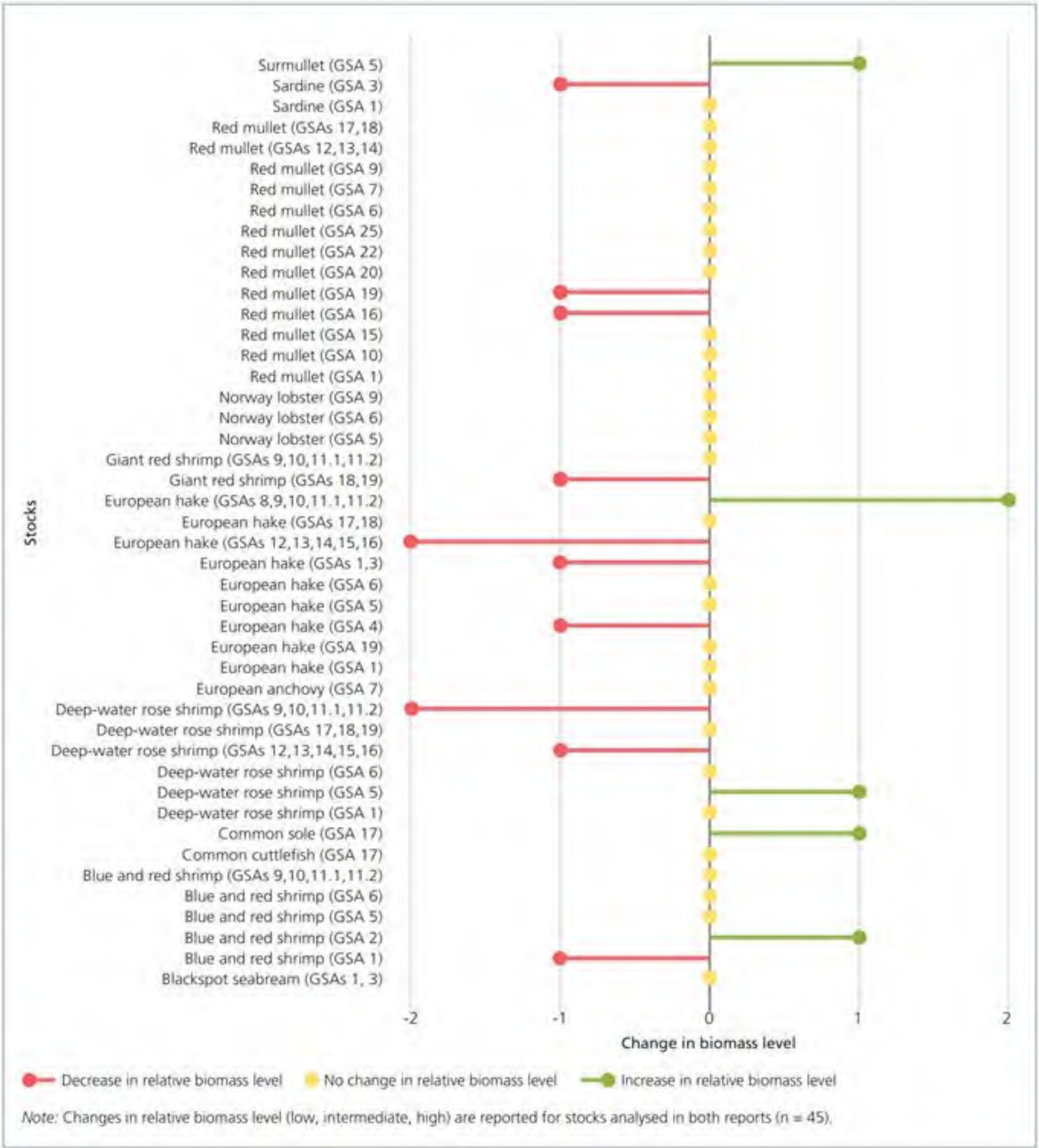


Figure 100: Comparison of biomass levels between the previous and current edition of The State of Mediterranean and Black Sea Fisheries

Key findings per Common Indicator CI-8 (Total landings)

1231. Overall, total capture fisheries production in the Mediterranean and the Black Sea increased irregularly from 1 000 000 tonnes in 1970 to almost 1 788 000 tonnes in 1988. Total landings remained relatively stable during most of the 1980s, before declining abruptly in 1990 and 1991, largely due to the collapse of pelagic fisheries in the Black Sea. In the Mediterranean Sea, landings continued to increase until 1994, reaching 1 087 100 tonnes, and subsequently declined irregularly to 760 000 tonnes in 2015. Over the following three years, production reached 805 700 tonnes in 2018, but it notably decreased to 674 500 tonnes in 2020 (Figure 101). The drop in catch in 2020 was also likely exacerbated by COVID-19 restrictions, which not only included temporal closures on fishing activity, but also led to a decrease in demand linked to the nearly total shutdown of tourism and impacts on trade (GFCM, 2020a, 2020b). The combined average landings for the Mediterranean and the Black Sea over the 2018–2020 period amount to 1 189 200 tonnes (743 100 tonnes in the Mediterranean, accounting for 62.5 percent of the total, and 446 100 tonnes in the Black Sea). This value is slightly higher (1.1 percent) than the catch from the 2016–2018 period, with a decrease of 5.7 percent in the Mediterranean Sea and an increase of 15 percent in the Black Sea.

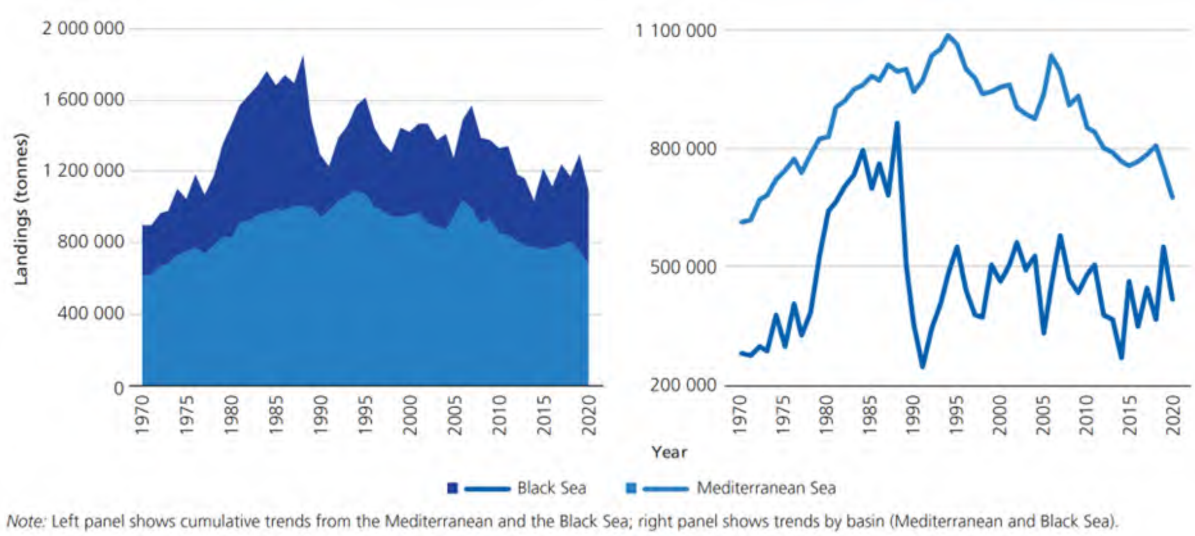


Figure 101: Total landings in the Mediterranean and the Black Sea per year, 1970–2020

1232. The main species groups comprising Mediterranean Sea landings show very similar percentages in calculations for the whole GFCM area of application, except for “Clams, cockles, arkshells” (2.7 percent in the Mediterranean Sea and 4.6 percent in the whole GFCM area of application) and “Abalones, winkles, conchs”, which are not present in Mediterranean Sea catches. Nonetheless, the contribution of small pelagic species (i.e. the combination of “Herrings, sardines, anchovies” and “Miscellaneous pelagic fishes”) is moderately lower (52.4 percent of Mediterranean landings versus 63.4 percent of total GFCM area of application landings). A slight increase is noted for “Miscellaneous coastal fishes” (5.1 percent more than in the whole GFCM area of application) and “Squids, cuttlefishes, octopuses” (2.8 percent more) (Figure 102).

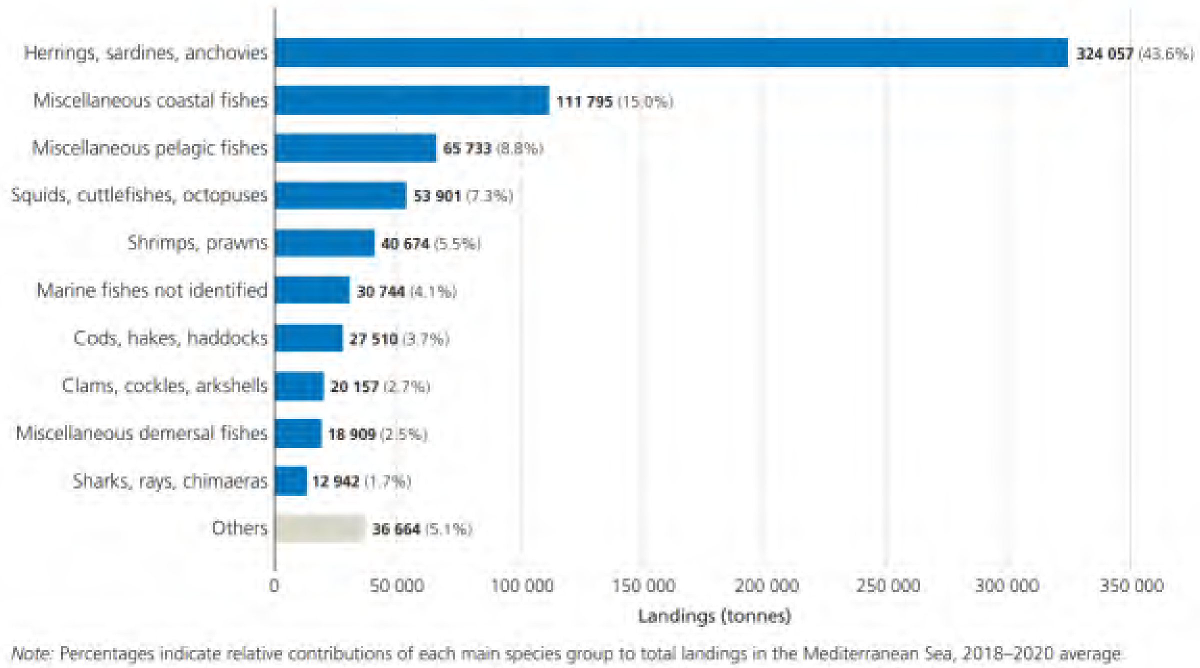


Figure 102: Total landings by main species group in the Mediterranean Sea, 2018–2020 average

1233. In the Mediterranean basin, sardine (14.8 percent) and European anchovy (22.4 percent) continue to be the most prevalent species, together accounting for 37.2 percent of total landings (in line with data from the period 2016–2018, which also showed a large diversity of species significantly contributing to the catch, i.e. 17 species accounting for at least 1 percent of total landings) (Figure 103).

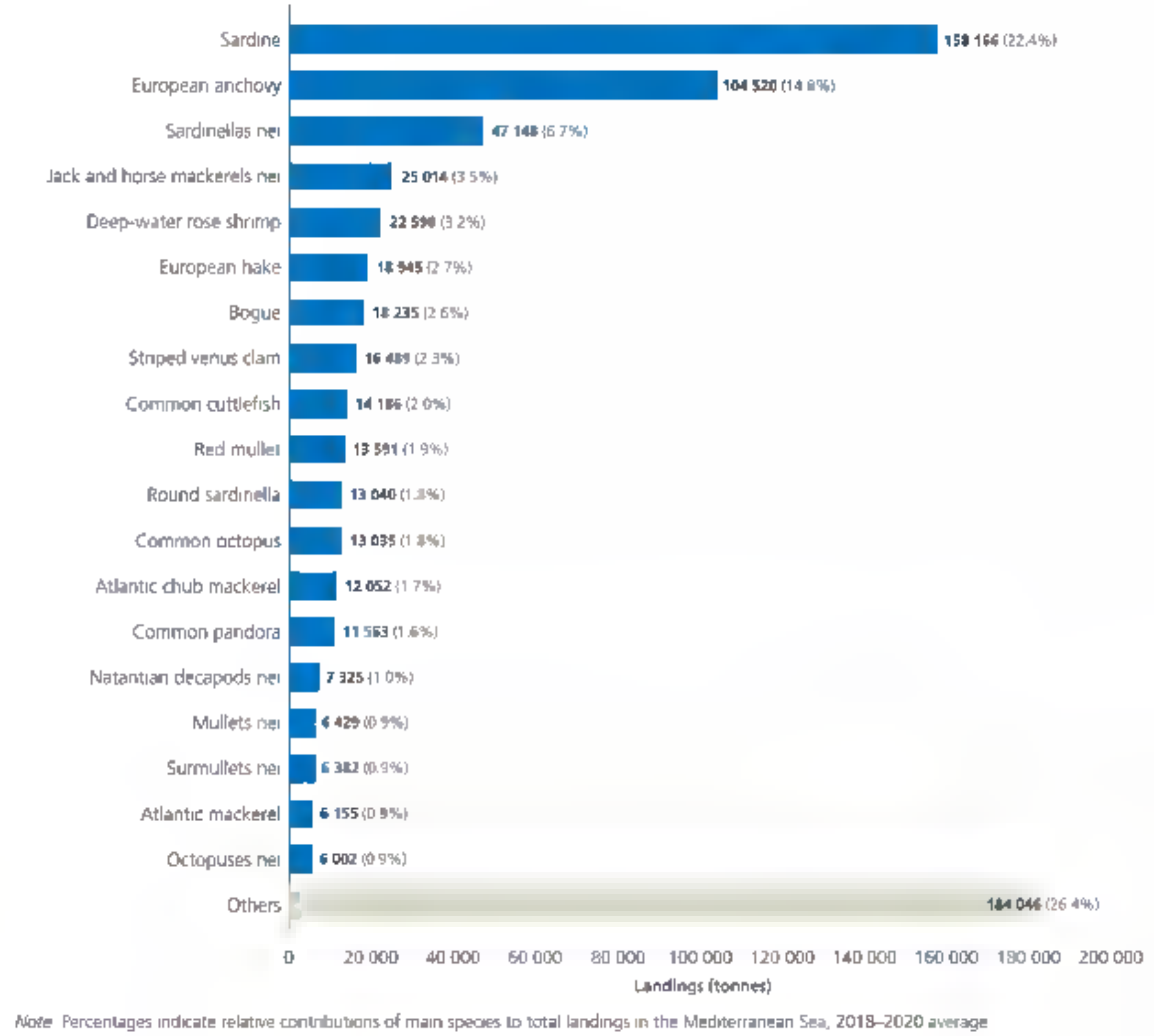


Figure 103: Total landings by main species contributing at least 1 percent of the total catch in the Mediterranean Sea, 2018–2020 average.

1234. The breakdown of capture fisheries production by GFCM subregion is here reproduced on the basis of the available landing data as transmitted by countries to the GFCM through the DCRF (Task I “Global figures of national fisheries”, Task II.1 “Landing data” [operating vessels by GSA and fleet segment] and Task II.2 “Catch data per species” [total catch by GSA and fleet segment for main commercial species]) for the period 2018–2020. After submission, the data were then extrapolated to produce the total catch statistics for the Mediterranean and the Black Sea that are stored in the STATLANT 37A database (FAO, 2020b). The results of the analysis show that the western Mediterranean continues to be the most productive Mediterranean subregion (20.3 percent of total landings, with 241 600 tonnes). The eastern Mediterranean, the Adriatic Sea and the central Mediterranean have almost the same share of landings, accounting for 14.8 percent (176 000 tonnes), 13.7 percent (163 400 tonnes) and 13.6 percent (162 100 tonnes), respectively. The Black Sea has the highest capture fisheries production in weight overall (37.5 percent of the total, with 446 100 tonnes) (Figure 104).

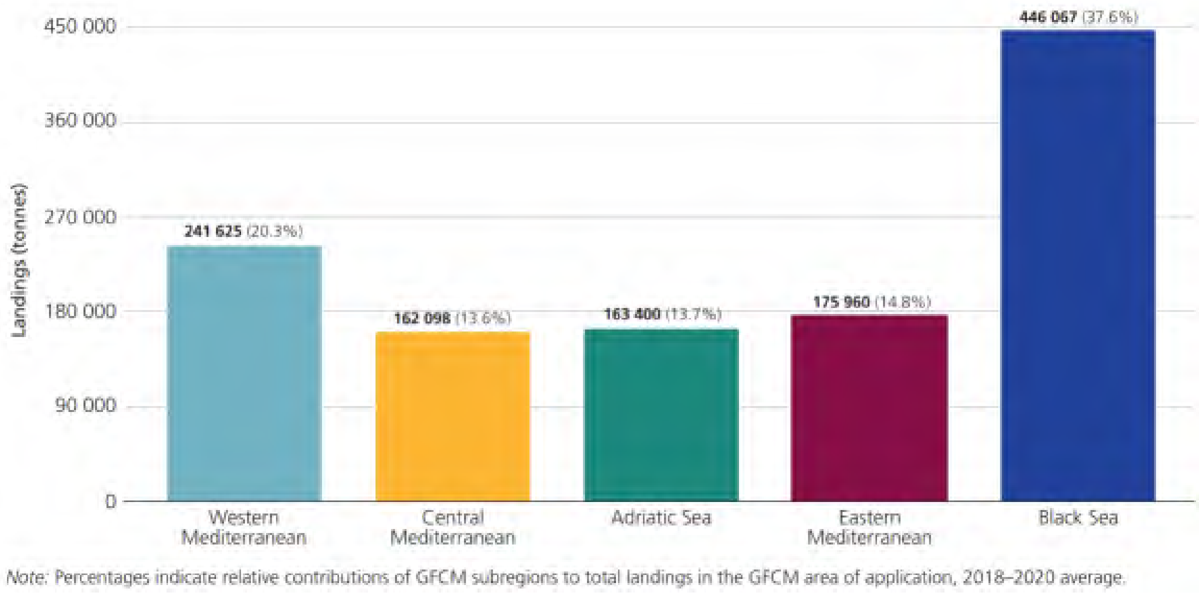


Figure 104: Total landings by GFCM subregion, 2018–2020 average

1235. In general, the dynamics reported in The State of the Mediterranean and Black Sea Fisheries 2020 (FAO, 2020a) continue to hold true, with the large majority of the catch in each subregion being declared by countries belonging to this subregion and only a few cases of fleets from countries outside the subregion contributing a small percentage of its total catch (Figure 105). In the western Mediterranean, Algeria (39.5 percent) brings in the largest share of landings by weight, followed by Spain (29.2 percent) and Italy (16.3 percent). The three together account for 85 percent of all landings in the subregion, with Morocco, France and “Others” contributing the remaining 10.3 percent, 4.6 percent and 0.1 percent, respectively. In the Adriatic Sea, landings by weight are dominated by Italy (54.7 percent) and Croatia (41.3 percent), which account for 96 percent of all landings in the subregion, followed by Albania (3.4 percent) and “Others” (0.6 percent). In the central Mediterranean, landings by weight are dominated by Tunisia (59 percent), followed by Libya (18.5 percent) and Italy (16.5 percent), the three of which account for 94 percent of all landings in the subregion, followed by Greece (4.5 percent) and “Others” (1.5 percent). In the eastern Mediterranean, landings by weight are mostly split between Greece (37.7 percent), Türkiye (29.4 percent) and Egypt (27.9 percent), which together account for 95.1 percent of all landings in the subregion, followed by “Others” (5 percent).

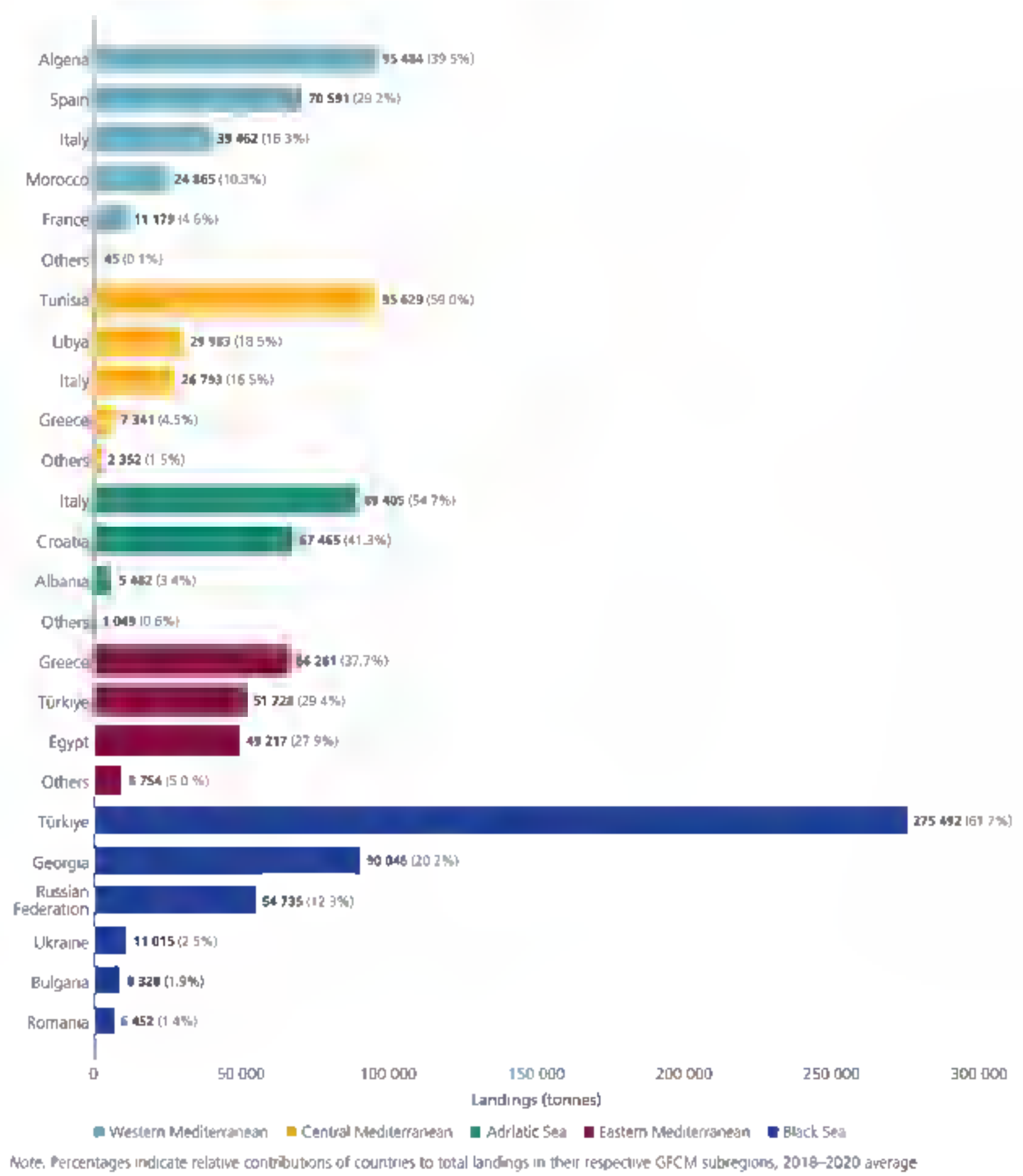
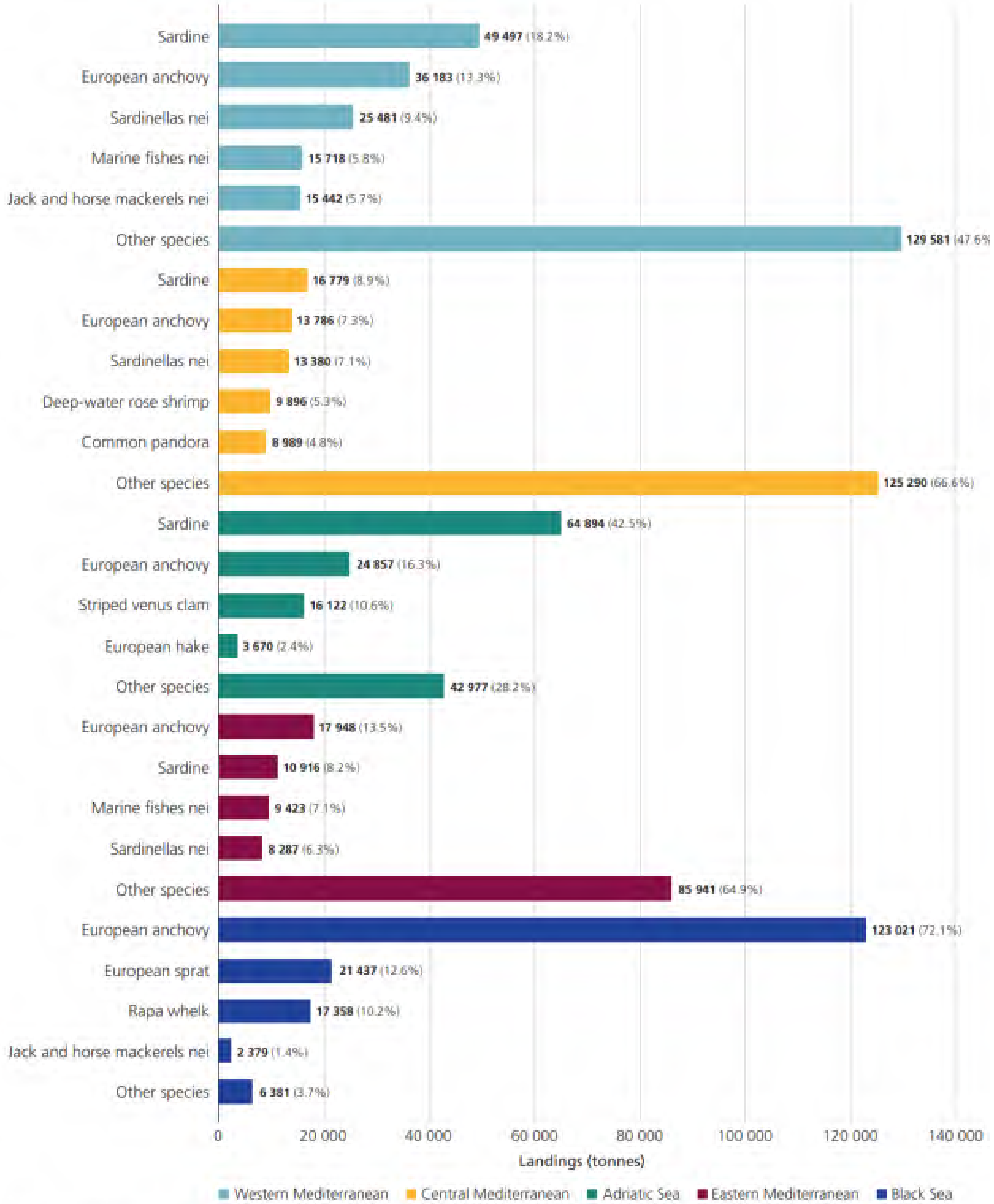


Figure 105: Average annual landings by country in each GFCM subregion, 2018–2020

1236. In terms of species contributions to the landings of the different subregions (Figure 106), sardine is the main captured species in the Adriatic Sea (64 900 tonnes, 42.5 percent), the western Mediterranean (49 500 tonnes, 18.2 percent) and the central Mediterranean (16 800 tonnes, 8.9 percent), while European anchovy is the predominant species in the eastern Mediterranean (17 900 tonnes, 13.5 percent) and the Black Sea (123 000 tonnes, 72.1 percent). In the western Mediterranean, European anchovy (36 200 tonnes, 13.3 percent) and sardinellas nei (Sardinella spp.) (25 500 tonnes; 9.4 percent) are the second and the third main species, whereas the remaining 59.1 percent (160 700 tonnes) corresponds to a large number of species contributing to the catch in this region (Figure 106).

1237. In the central Mediterranean, other prevalent species are European anchovy (13 800 tonnes; 7.3 percent), sardinellas nei (13 400 tonnes; 7.1 percent), deep-water rose shrimp (9 900 tonnes; 5.3 percent) and common pandora (9 000 tonnes; 4.8 percent). The sum of all other species, each of which contributes less than 5 percent of the total, constitutes the remaining 66.6 percent, at 125 300 tonnes

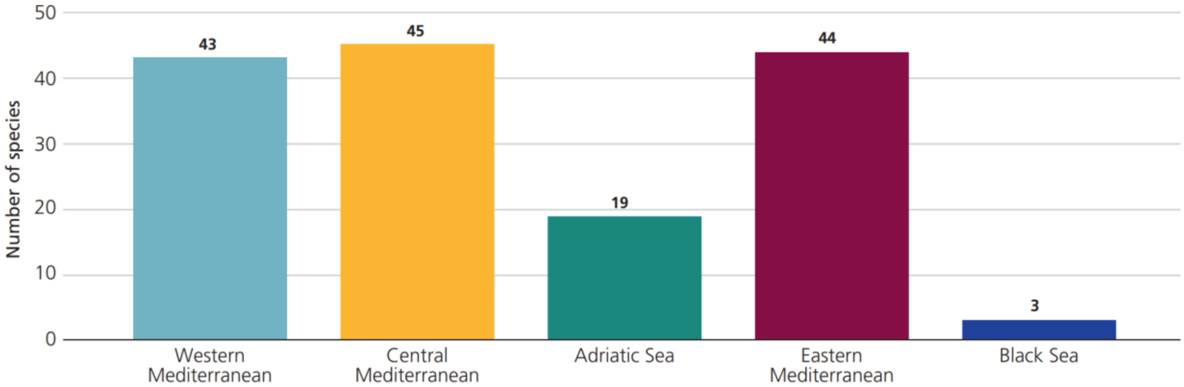
(Figure 106). In the Adriatic Sea, four species, namely sardine (64 900 tonnes; 42.5 percent), European anchovy (24 900 tonnes; 16.3 percent), striped venus clam (16 100 tonnes; 10.6 percent) and European hake (3 700 tonnes; 2.4 percent), account for 71.8 percent of the landings. The sum of all other species, each of which contributes less than 5 percent of the total, constitutes the remaining 28.2 percent, at 43 000 tonnes (Figure 106). In the eastern Mediterranean, sardine (10 900 tonnes; 8.2 percent), marine fishes nei (9 400 tonnes; 7.1 percent) and sardinellas nei (8 300 tonnes; 6.3 percent) are the other prevalent species, with all others together accounting for the remaining 64.9 percent with 85 900 tonnes (Figure 106).



Note: Percentages indicate relative contributions of main landed species to total landings in each respective GFCM subregion, 2018–2020 average.

Figure 106: Average annual landings of the main landed species in each GFCM subregion, 2018–2020

1238. Overall, the diversity of species in the catch is much higher in the central, eastern and western Mediterranean (roughly 44 species). In comparison, the lowest number of species that can be summed together to account for 90 percent of the total catch in the Adriatic and the Black Sea is smaller (slightly less than 20 for the Adriatic and less than five for the Black Sea).
1239.



1240.
Figure 107).

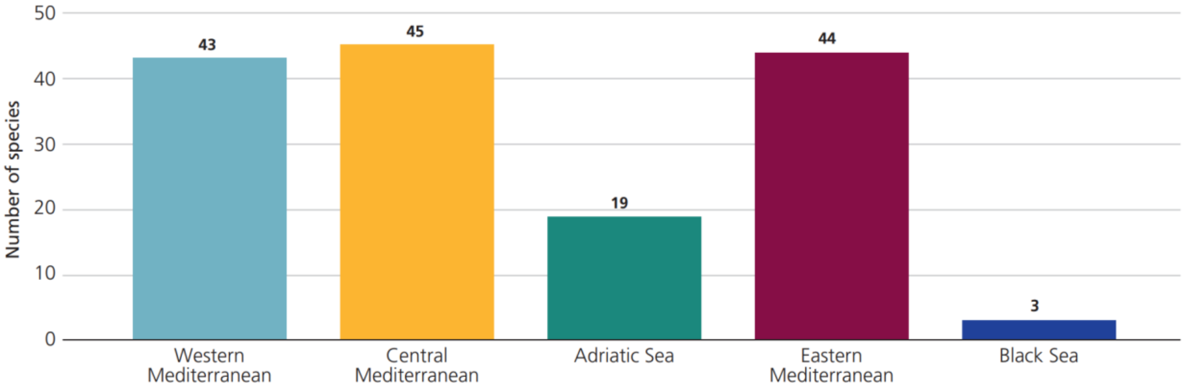


Figure 107: Number of species or species groups accounting for 90 percent of the total catch of each GFCM subregion, 2018–2020

<u>Key findings per Common Indicator CI-9 (Fishing mortality)</u>

1241. Overall, fishing mortality for all species and management units combined continues to be more than twice the target (Table 4). However, there has been a 21 percent reduction in this ratio since 2012 (when it was nearly three times higher), with the current ratio (F/FMSY = 2.25) representing the lowest of the time series. The highest average values of exploitation ratios are found for blue and red shrimp (Aristeus antennatus), followed by European hake and some small pelagic species, e.g., sardine (Table 4). Most of the highest values (i.e., fishing mortality higher than four times the value of FMSY), have been found in the western Mediterranean for European hake, blue and red shrimp and red mullet.

1242. European hake deserves a special mention as this species has experienced a very large reduction in F/FMSY throughout the Mediterranean Sea, excluding the western Mediterranean where some very high ratios are still found (Table 4). In detail, the average overexploitation ratio (F/FMSY) of European hake in the region has declined by 39 percent since 2013, although it remains on average four times higher than the reference point.

1243. A total of 16 stocks show exploitation rates below FMSY (although some show very low biomass and are still considered to be overexploited); of these, the majority are found in the western Mediterranean, while the central Mediterranean hosts only one stock with exploitation rates below the reference point (Table 4).

Table 48: Exploitation ratio (F/FMSY) by priority species and geographical subarea, with average value per species

	Western Mediterranean											Central Mediterranean								Adriatic Sea		Eastern Mediterranean						Black Sea			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	19	20	21	17	18	22	23	24	25	26	27	28	29	30	Mean
Demersal species																															
European hake	4.41		8.08		4.41	4.41	4.41	3.12	3.12	3.12	3.12	1.24	1.24	1.24	1.24	1.24	1.86	1.86		2.47	2.47					4.13					3.01
Red mullet	6.48					5.06	1.37		0.71	0.78		3.13	3.13	3.13	1.95	0.81	1.87	1.10				0.96			1.42				1.27		2.21
Deep-water rose shrimp	1.73		2.14	2.14	2.07	1.60			1.22	1.22	1.22	1.34	1.34	1.34	1.34	1.34	2.30			2.30	2.30										1.68
Giant red shrimp									2.14	2.14	2.14						1.38				1.38										1.84
Blue and red shrimp	1.64	1.68			3.61	6.20			4.60	4.60	4.60																				3.85
Norway lobster					0.69	3.80			0.50											1.58	1.58										1.63
Surmullet					1.97																					3.70					2.84
Blackspot seabream	0.78		0.78																												0.78
Turbot																													1.75		1.75
Common cuttlefish																				1.17											1.17
Common sole																				0.81											0.81
Spottail mantis shrimp																	2.54			0.79	2.54										1.95
Purple dye murex																				1.08											1.08
Horned octopus																					0.77										0.77
Sand steenbras																											2.07				2.07
Axillary seabream																									1.05						1.05
Common pandora																									0.45		1.90				1.17
Great Mediterranean scallop																				2.86											2.86
Comber																									0.67						0.67
Goldband goatfish																															
Whiting																															
Rapa whelk																															
Peregrine shrimp																										2.85					2.85
Caramote prawn																				2.11											2.11
Brushtooth lizardfish																											1.87				1.87
Bogue																									1.20						1.20
Small pelagic species																															
Sardine			2.77			1.72	0.05		0.19							2.78				4.49	4.49										2.36
European anchovy							0.05		0.35							1.55				1.51	1.51										0.99
European sprat																													0.9		0.90
Mediterranean horse mackerel																															
Round sardinella																															
Species of regional importance																															
Common dolphinfish																															
Species of conservation concern																															
Piked dogfish																															
European eel																															
Red coral																															

Note: Ratios of stocks in sustainable exploitation are highlighted in green.

1244. Overall, all priority species with enough available information show an improved situation concerning fishing pressure in comparison with the previous edition of The State of Mediterranean and Black Sea Fisheries (FAO, 2020). Blue and red shrimp presents an exception, with average fishing pressure having steadily increased since 2015, as well as deep-water rose shrimp, which shows an overall stable fishing pressure at nearly twice the level considered sustainable (Figure 108). In contrast, European anchovy shows a general decreasing trend in its exploitation ratio, driven also by low exploitation ratios in the western Mediterranean. The exploitation ratios of sardine across the Mediterranean are characterized by high variation and the average exploitation ratio steadily increased until 2018, at which point the trend reversed, again owing to low exploitation ratios of stocks in the western Mediterranean (Figure 108). Among demersal species, previously observed decreasing trends in exploitation ratios for European hake and common sole (Figure 108) are showing a reduction of 75 percent since 2011, and European hake showing a reduction of 39 percent and 62 percent, respectively, since 2013. The fishing mortality of deep-water rose shrimp has increased by 3.5 percent since its lowest level in 2017 (F/FMSY = 1.71). Likewise, blue and red shrimp continues to show a rather significant increase in its exploitation ratio (F/FMSY = 4) since a lowest recorded value in 2015 (F/FMSY below 2), coupled with increasing catch. Finally, the catch of Norway lobster has decreased since 2017, as has the exploitation ratio (34 percent decrease) (Figure 108).

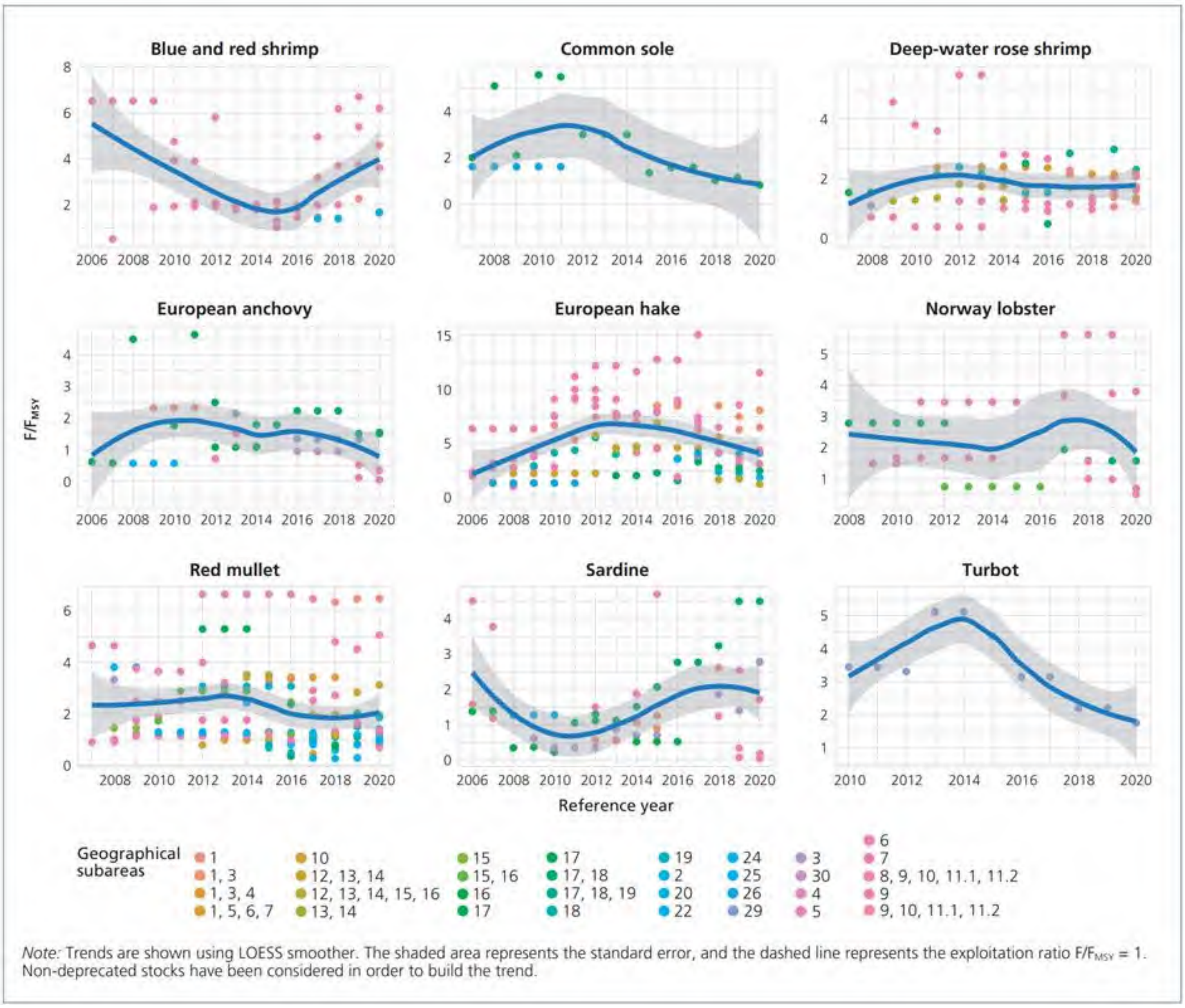


Figure 108: Trends in the exploitation ratios (F/FMSY) of select priority species until 2020

<u>Measures and actions required to achieve GES in relation to EO3</u>

1245. The percentage of stocks with validated assessments has continued to increase since the last edition of The State of Mediterranean and Black Sea Fisheries (FAO, 2020a), particularly in the western Mediterranean, as has the geographical coverage of assessments. Nevertheless, efforts are still required to extend assessment coverage to all GSAs, while the decrease observed in the percentage of landings assessed highlights the need to ensure the regular assessment of key stocks with high landings.

1246. Results show that since 2012, the average fishery exploitation ratio in the Mediterranean has consistently decreased. However, in the Mediterranean Sea, the percentage of stocks with low biomass remains high, although lower than the cumulative percentage of stocks with intermediate and high biomass. Low biomass in an overall scenario of decreasing exploitation rates may be explained by either a delay in the response of stock biomass to declining fishing pressure or a reduction in fishing pressure insufficient to promote a recovery of biomass, or both. In the reference year 2020, 87 percent of the stocks assessed in the GFCM area of application were of medium- or long-lived demersal species, which may require several years to show an observable response in biomass.

1247. A number of stocks of priority species (e.g., European hake in the Strait of Sicily, and common sole in the Adriatic Sea) have consistently shown improvements in their exploitation ratios over recent years. In contrast, the decrease in the exploitation ratio observed for a number of hake stocks (e.g. in the Tyrrhenian Sea and the Strait of Sicily) is not matched so closely by corresponding increases in biomass; this disparity not only reflects the different biological characteristics of the two species, but also serves as an important reminder that early signs of reversing the trend in fishing mortality should not be taken as a guarantee of sustainability (Figure 109).

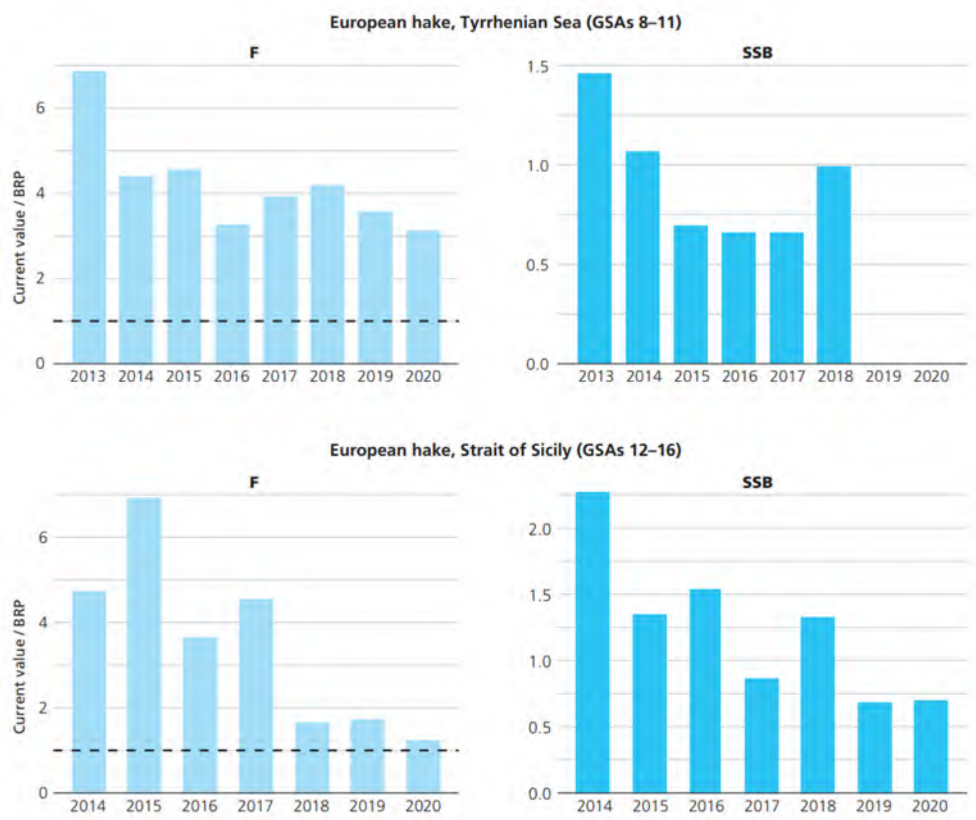


Figure 109: Annual progression in biomass (B/BPA) (right) and exploitation ratio (F/FMSY) (left) for European hake in the Tyrrhenian Sea and the Strait of Sicily

1248. Conversely, blue and red shrimp shows an increasing trend in exploitation ratio, though this observation rests on an overall lack of assessments, as only seven stocks have been assessed to date, mostly in the western Mediterranean. Along with a lack of information on the origin of catch in the eastern-central Mediterranean, this shortcoming has hindered a fully informed implementation of the multiannual management plans and management measures in place in the Ionian Sea, Levant Sea and the Strait of Sicily, respectively.

1249. The positive signs for fishing pressure provided by this overall analysis are most likely related to the adoption of a significant number of national and regional management measures in the recent past, underpinned by an increase in the quality and coverage of scientific advice, particularly on priority species and key fisheries. Measures consist of adopting multiannual management plans that include effort control measures and/or the introduction of quota-based management for some species, as well as the establishment of fisheries restricted areas (FRAs) and spatio-temporal limits to protect essential habitats and life stages. Nevertheless, the slow recovery in biomass of certain key stocks and the need to honour the objectives of the GFCM 2030 Strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea point to the importance of continuing to implement an effective and generalized management framework, including through strengthening existing management plans and defining new ones, as well as ensuring the effective implementation of those in place. Since 2018, research programmes have been incorporated, through specific recommendations, into the GFCM workplans for the Mediterranean. Research programmes share the common aim of improving the scientific basis for the provision of advice on existing and potential management measures through dedicated actions towards increasing the quality and quantity of information on resources and addressing previously identified knowledge gaps and shortcomings in relevant scientific or technical advice. More recently, research programmes have been complemented by pilot studies and projects. Pilot studies and projects rest on similar principles, i.e. conducting scientific data collection and analysis on specific themes, fisheries or species, but have a more limited geographical and temporal scope. In all cases, the core principle is to take full advantage of ongoing research at the country level by providing experts with a regional platform for coordination, knowledge exchange and capacity building enriched by new activities developed based on common methodologies. The data collected through these initiatives are generally aimed at providing the scientific basis for determining the most appropriate management measures for selected fisheries.

1250. The advice on the status of Mediterranean commercially exploited stocks, as provided by the GFCM SAC have largely improved in recent years, as recognized by Mediterranean riparian states. However, the level of information differs between species and geographical areas, with information concentrating on a few stocks and lacking or being fragmented in other commercially exploited stocks.

1251. The correct estimation of fishing mortality requires a precise understanding of riparian states' fishing capacity. Due to the specificities of the Mediterranean fleet, composed of a large majority of small-scale polyvalent vessels, information on fishing capacity is sometimes incomplete or inaccurate. Furthermore, the estimation of robust reference points for fishing mortality requires the use of long time series and the incorporation of environmental and ecosystem variables, as well as the design of robust methods that can integrate information from different sources.

1252. Even if stock assessments and advice are now available for an increasing number of stocks, the number of stocks for which MSY-based SSB reference points (or its proxy) exist is still very limited. Thus, it is not possible to establish reproductive potential levels relative to MSY, and the indication on current biomass levels is often based (as in this assessment) on an empirical analysis of often short time series.

1253. The update and adoption of new specific binding recommendations related to the mandatory requirements for data collection and submission, underpinned by the GFCM Data Collection Reference Framework (DCRF) has greatly improved the quality of the data in support of advice, in line with the need expressed by riparian states. The GFCM 2030 strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea is also contributing in this endeavour through specific actions such as, for example, the execution of harmonized scientific surveys-at-sea.

Total landings

1254. The correct estimation of total landings requires a precise knowledge of the fishing activities carried out by the active fishing fleet operating in the Mediterranean. The specificities of the Mediterranean fleet, composed by a large majority of small scale polyvalent vessels, as well as the existing variety of landing sites, and the different capacity of Mediterranean riparian states to accurately monitor the landings in such sites, make difficult an accurate estimation of landings in the region.

1255. Furthermore, Illegal, Unregulated or Unreported (IUU) fishing activities in the area also affects the estimates.

1256. Ultimately, the ideal indicator for the production of fisheries as well as the removal of organisms due to fisheries should be total catch, but information on discards is still fragmented, despite large efforts are being deployed for the implementation of discards monitoring programmes across the region under the hat of the GFCM 2030 strategy for sustainable fisheries and aquaculture in the Mediterranean and the Black Sea.

1257. The GFCM has proposed a number of solutions to improve the quality of the estimation of total catch. On one hand, the GFCM DCRF provides the technical elements to improve and harmonize the collection of information on fisheries throughout the Mediterranean and on the other the GFCM 2030 strategy provides an effective instrument to guide an increase in the collection of sound information (e.g. bycatch monitoring programme and a survey of small-scale fisheries), as well as the implementation of dedicated actions to assess and curb IUU fishing, which are expected to largely improve the quality of the estimates for this indicator.

1258. Care needs to be taken in interpreting trends in the indicator for total landings because variations in total catch/landing may be a result of various factors, including the state of the stock, changes over time in the selectivity of fishing gear, changes in the species targeted by fishing activities, as well as inconsistencies in the reporting.

2.3 Coast and Hydrography

2.3.1 EO7 Alteration of hydrographical conditions

Methodology:

- The EO7 Common Indicator 15 reflects the location and extent of the habitats impacted directly by hydrographic alterations due to new developments (QSR 2017, 2018), i.e., upcoming constructions. It concerns area/habitat and the proportion of the total area/habitat where alterations of hydrographical conditions are expected to occur. The GES is achieved when negative impacts due to a new structure are minimal with no influence on the larger scale coastal and marine system.In relation to the 2017 Med QSR countries still have difficulties to provide monitoring data according to the Guidance Factsheet, although the methodology has been simplified. The information received by majority of the countries is of a descriptive nature, rather inhomogeneous, regardless of the same annotated questionnaire developed in the frame of the EcAp MED III and IMAP MPA projects. However, some scientific partners provided very relevant information of the hydrographic parameters based on satellite data and mainly related to climate change impacts. It seems that all these parameters that are increasing their values due to climate change have significant impacts on all other EOs and should be taken into account for an integrated assessment.
- No monitoring data were reported so GES assessment could not be made according to the Guidance Factsheet (UNEP/MAP, 2019). Therefore, for this assessment other sources of information were used to provide a general overview of the hydrography in the Mediterranean, such as national reports prepared in the context of the EcAp MED III project, IMAP MPA project and by some other countries, and those provided by the scientific partners (i.e., Mercator Ocean) in particular on hydrographic parameters that are changing due to climate change.

Common Indicator 15: Location and extent of the habitats impacted directly by hydrographic alterations

1259. Large-scale coastal and off-shore developments have the potential to alter the hydrographical regime of currents, waves and sediments in marine environment (UNEP/MAP/PAP, 2015). To address this, UNEP/MAP has included the Ecological Objective 7 “Alteration of hydrographical conditions”, as part of the IMAP of the Mediterranean Sea and Coast (UNEP/MAP, 2016a). EO7’s Common Indicator 15 “Location and extent of habitats impacted directly by hydrographic alterations” considers marine habitats which may be affected or disturbed by changes in hydrographic conditions due to new developments. The main target of this indicator is to ensure that all possible mitigation measures are taken into account when planning the construction of new structures, in order to minimize the impact on coastal and marine ecosystem and its services, integrity, and cultural/historic assets. Good environmental status (GES) regarding EO7 Hydrography is achieved when negative impacts due to new structures are minimal with no influence on the larger scale coastal and marine systems.

Key Messages (CI15)

1260. All countries had difficulties with the monitoring of this indicator according to the Guidance factsheet and could not provide monitoring data therefore, the Good Environmental Status has not been assessed. GES should be defined in close coordination with the EO1 and EO6.

1261. A baseline assessment has been made using data from the national reports prepared in the frame of EcAp MED III and IMAP MPA projects, including some other countries that used the same report format, and from the data provided by scientific partners, Mercator Ocean in particular.

1262. Climate change seems to have far bigger impacts on the habitats and marine ecosystems in long term, however at a local scale the hydrographic alterations caused by coastal structures can have a significant and direct impact on coastal habitats.

1263. Due to the difficulties that countries have with reporting on this indicator further simplification of the Guiding Factsheet is needed so to allow countries to report on the physical loss of habitats, i.e., the footprint of the structure on seabed habitats.

Key assessment findings per theme / indicator

1264. GES has not been assessed for EO7 CI 15 because countries had difficulties to monitor this indicator according to the Guidance Factsheet and therefore, monitoring data was not provided.

1265. There are insufficient surveys and monitoring data provided by the countries according to the Guidance Factsheet. This is mainly related to the complex and demanding methodology, as well as institutional and scientific capacities. Assessments that estimate the extent of hydrographic alterations (knowing conditions before and after construction) and its intersection with marine habitats were not provided. Also, related studies such as EIA and SEA reports are either publicly inaccessible or conducted by various different methods. The use of numerical models in EIA to assess hydrographic alterations is costly and time-consuming and requires technical expertise and knowledge as well as statistically significant sets of hydrographic parameters;

1266. The link to EO1 and EO6 is essential for this indicator. Maps of benthic habitats in the zone of interest (broad habitat types and/or particularly sensitive habitats) are required. Therefore, identifying the priority benthic habitats for consideration in EO7, together with assessment of impacts, including cumulative impacts is a cross-cutting issue of priority for EO1, EO6 and EO7. Efforts need to be given to detect the cause-consequence relationship between hydrographic alterations due to new structures and habitat deterioration (i.e., scientific gaps and uncertainties exist).

1267. Spatial resolution and temporal scope (historic data) of openly available spatial data on hydrographic alterations (i.e., CMEMS products) are not sufficient. Due to the scale of the locations where structures are constructed or planned are rather local (micro-location).

1268. Although there are certain systematic databases of spatial data (e.g., EMODnet, CMEMS), the availability and spatial resolution of certain spatial data varies significantly at the level of countries (for example, Malta and Slovenia have bathymetric data measured by LIDAR technology, while some countries do not have these at all).

Measures and actions to achieve GES in relation to CI15

1269. Establishment of the national IMAP, monitoring programme that will systematically collect statistically significant data of the hydrographic parameters is required – first, to allow modelling of hydrographic alterations of the planned structures at the very local scale in the EIA/SEA and second, to provide subsequent monitoring data once the structures have been built. A close cooperation has to be established with the authorities that are responsible for planning of such structures including those responsible for EIA. In parallel, mapping of habitats in a surrounding area that could possibly be impacted by such hydrographic alterations should be prepared (link to EO1 and EO6).

1270. Creation of a digital spatial database of all data from EIA/SEA including spatial coverage and location of the intervention, existing and planned structures and marine habitats. The Copernicus Marine services, the EMODnet service and the spatial planning information system of individual countries (via WMS or WFS layers) (Baučić et al., 2022b) should be used, thus providing necessary data for the CI 15 assessments and monitoring.

1271. As the rational possibility, a revision of the existing indicator Factsheet should be considered that will simplify the method to allow countries to report on the physical loss of habitats, i.e., the structure’s footprint only.

1272. Considerations should also be given to the possibility of proposing a set of climate change related indicators in the frame of IMAP. This could include monitoring of hydrographic parameters (e.g., salinity, temperature, waves and currents) that are changing rapidly due to climate change. The use of hydrographic parameters reported within EO 5 on eutrophication should be taken into account with the use of remote sensing and other available sources for climate change in order to determine the hydrographic alterations in the Mediterranean region. In-situ data are equally important and should be used to monitor changes in variables due to climate effects that is required also by the EU Marine Strategy Framework Directive (MSFD). Such alterations may have much stronger impacts on marine habitats and ecosystems than those monitored by the CI 15 itself.

2.3.2 EO8 Coastal ecosystems and landscapes

1273. EO8 focuses on the terrestrial part of the coastal areas where human activities are continuously altering coastal ecosystems and landscapes. The objective of EO 8 is to ensure that the natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved. The monitoring under EO 8 addresses coastal artificialisation: construction of buildings and infrastructure along the coastline (such as defence structures, ports and marinas, etc.) and land cover change in accordance with the Guidance factsheet (UNEP/MAP, 2019). Two CIs are established for monitoring coastal artificialisation:

- Common indicator 16 (CI 16): Length of coastline subject to physical disturbance due to the influence of human-made structures; and
- Candidate common indicator 25 (CCI 25): Land cover change.

1274. The assessment of CI16 in the 2017 Med QSR was rather subjective as no monitoring data was available at the time. The current assessment is based on the data provided by the majority of the countries and gives a good insight into the baseline status. It will be with the second set of monitoring data when changes could be assessed with regard to GES that is country-specific. A Guiding document has been prepared that includes a list of criteria which may be used by the countries when defining their GES (PAP/RAC, 2021). It was successfully tested in Morocco (PAP/RAC, 2022). The Candidate CI 25 has not been presented in the 2017 Med QSR.

1275. The relationship with other EOs is important with relation to land sea interactions and communication between the terrestrial and marine habitats. Within the Ecological Objective 8 (EO8) however, there is no possibility for integration between the two indicators, i.e., land cover and the coastline, because there is no firm correlation.

1276. For CI 16 data is aggregated from the national reports (seventeen out of twenty Mediterranean countries reported). Assessment results for the candidate CI 25 Land cover change is presented for the Adriatic sub-region.

Common Indicator 16: Length of coastline subject to physical disturbance due to the influence of human-made structures

Methodology: - Construction of various structures along the coastlines such as ports, marinas, break walls or jetties causes irreversible damage to landscapes, losses in habitat and biodiversity and permanently changes the shoreline configuration, thus disturbing the natural dynamic of coastal zones. Even though coastline structures are sometimes introduced to reduce erosion. Thus, it is of high importance to monitor the length of coastline subject to physical disturbance by human-made structures. The monitoring aim of the CI 16 is twofold: (i) to quantify the rate and the spatial distribution of the Mediterranean coastline artificialisation and (ii) to provide a better understanding of the impact of those structures to the shoreline dynamics. - CI 16 monitoring entails an inventory of the length and location of human made coastline (hard coastal defence structures, ports, marinas) while soft techniques e.g., beach nourishment are not considered as artificial coastline. Monitoring data of the CI 16 are presented as: • km of artificial coastline and % of total length of coastline; • percentage (%) of natural coastline in the total coastline length. - Following the CI 16 methodology, the Contracting Parties prepared the national reports of the CI 16 assessments. The first sets of monitoring data are provided for seventeen out of twenty Mediterranean countries. By summarising the national data, a good overview of the baseline status of CI 16 is obtained for the Mediterranean level, i.e., ratio between the natural and artificial coastline. CI 16 is calculated for two periods for Italy, Spain and Malta thus first results showing trends are available, too. The Good Environmental Status (GES) for CI 16 serves to minimise physical disturbance to coastal areas induced by human activities, i.e., whether the coastline has been further developed and country's specific targets have been achieved. The definition of GES is country-specific and has not yet been defined. Therefore, the assessment will only be possible once country-specific GES are defined, and once the second set of monitoring data is provided by all countries.

1277. The UN Environment/MAP emphasizes the integrated nature of the coastal zone, particularly through consideration of marine and terrestrial parts as its constituent elements required by the Integrated Coastal Zone Management (ICZM) Protocol. The aim of monitoring the EO8 common indicator 16 "Length of coastline subject to physical disturbance due to the influence of human-made structures" is twofold: to quantify the rate and the spatial distribution of the Mediterranean coastline artificialisation; and to provide a better understanding of the impact of those structures to the shoreline dynamics.

1278. GES for Common Indicator 16 can be achieved by minimizing physical disturbance to coastal areas close to the shoreline induced by human activities. Definition of targets, measures and interpretation of results regarding this common indicator is left to the countries, due to strong socio-economic, historic and cultural dimensions in addition to specific geomorphological and geographical conditions.

Key messages for CI16

1279. The assessment of CI 16 is done for 31 283 km out of 54,992 km of total Mediterranean coastline (or 57 %) as provided by the national reports referring to various years for baseline data

(2018 - 2022) out of which 26 658 km (85.2%) of coast is natural and 4 625 km (14.8%) is artificial. This provides a good overview of the baseline situation (Figure *110*).

1280. Two sets of monitoring data were elaborated only for three countries for periods of 6 and 10 years, to observe the change. Change of artificial coast fluctuates around zero (+0.4, - 1.1 and 0,1 %) when expressed as a proportion of reference coastline length. In absolute value there is an increase of artificial coastline of 50 km in these three countries.

1281. The majority of human-made structures belong to ports and marinas (49%).

1282. GES could not be assessed because only the first set of monitoring data was provided (except for the three countries that provided two sets of data).

1283. Changes in the percentage or total length of coastline subject to physical disturbance due to the influence of human-made structures could only be assessed for three countries.

Figure 110: Overview map of the baseline situation for CI 16.

<u>Key assessment findings for CI-16</u>

1284. Aggregation of national assessments for CI 16 parameters for the Mediterranean reported here provides the first set of monitoring data. CI 16 assessments are provided for 57% of the Mediterranean coastline or 31 283 km out of which 14.8% or 4,625 km revealed as artificial coast. The proportion (percentage) of artificial coast vary a lot among countries: from 4% to 75% which clearly demonstrates the necessity for country specific GES definitions in terms of percentages or thresholds. Looking at the length of artificial structures, their length is 8 109 km of which 49% have maritime use as ports and marinas (as structures are mapped with all details, they have much longer length then artificial coast itself. Looking at the trend, even for only three countries, there is a slight increase of artificial coast in percentage terms. Still, in a monitoring period of 6 or 10 years, it amounted to a total of 50 km.

1285. Detailed baseline data at the country level is illustrated by Figure 129 . The countries that have uploaded the data to the INFO/MAP System, i.e. validated the results through an elaborated and agreed procedure of data submission are: Algeria, Bosnia and Herzegovina, France, Italy, Libya, Malta, Montenegro, Morocco, Slovenia, Spain and Türkiye (status as of 30 June 2022).

1286. As data has various reference years, scales, mapping methods and data sources one should take these into consideration before interpreting the values, particularly if comparing data among the countries. However, in terms of proportion of artificial coastline, Slovenia stands out with 75% and Lebanon with 64%, while Libya has only 4% of artificial coastline.

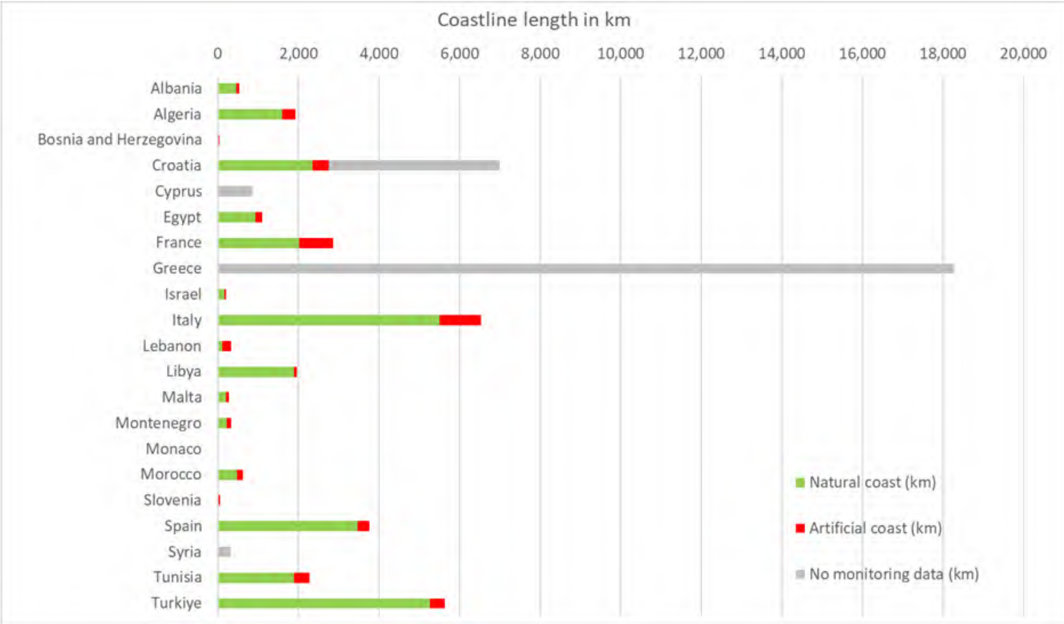


Figure 129: Length of natural and artificial coastline per countries in km

1287. Artificial coastline infrastructure is further mapped showing all details of the structures and described as Breakwaters, Seawaters/Revetments/Sea dike, Groins, Jetties, River mouth structures and Port and marinas. Lengths and artificial structures' proportion of total artificial coastline are aggregated at the Mediterranean level (Table 49). Artificial structure of Ports and marinas dominates with 49% or 3 955 km.

Table 49: Artificial structures in km and in % of total artificial coastline

	Breakwaters	Seawalls/ Revetments/ Sea dike	Groins	Jetties	River mouth structures	Port and marinas	Unclassified	Total
Mediterranean coast	918 km	1 625 km	392 km	567 km	193 km	3 955 km	457 km	8 107 km
	11%	20%	5%	7%	2%	49%	6%	

There are significant differences between countries on the interpretation of the methodology when measuring the length of the artificial structures. Some countries have followed the methodology provided in the Guiding Factsheet and reported the projection of the artificial structure to the coastline. But others (such as Italy, Spain, Egypt) reported the total length of the structures.

1288. It should be emphasised that there are well-known difficulties in unambiguously defining the coastline and its length. A coastline is a geographical feature that can change significantly over time, and its length significantly depends on the level of detail with which the coastline is depicted. Additionally, the national assessments were made for different reference years and with different mapping techniques, caused by different national data sets and geographic specifics, but also by different interpretation of instructions given in the Guidance factsheet (UNEP/MAP, 2019) and related Data Dictionaries and Data Standard (UNEP/MAP, 2019a). Thus, countries' data cannot be completely compared. However, applying the same criteria as provided at the regional level to ensure synchronization of national efforts to set GES and threshold, and therefore, to prevent biased treatment of countries within regional assessment will allow a more objective assessment of trends once the second monitoring datasets are provided for the next QSR. The GES in the Guidance Factsheet is defined in a descriptive manner as minimised physical disturbance (negative impacts) to coastal areas induced by human activities. Future sets of monitoring data will allow more objective assessments of coastline status: whether it has been further artificialised or it has stayed within GES. This need for a systematic monitoring in Mediterranean regarding the physical disturbance of coastline due to the influence of human-made structures was also a major conclusion in the 2017 QSR.

Measures and actions to achieve GES for CI-16

1289. First, technical issues that have to be considered in future monitoring and assessments of CI 16 are as follows:

a. Monitoring of the coastline (second and following assessments) should use the same level of details and spatial resolution as the initial assessment (baseline data). Otherwise, monitoring results could be compromised by the fact that coastline length increases by using larger scales, more so on more indented coasts.
b. The calculation of the length of the coastline varies also due to deformations caused by the choice of the cartographic projection (i.e., calculated in plane by using one of the cartographic projection or by using the ellipsoid). It is recommended to use the ellipsoid lengths calculated on WGS84 as required by the Guidance Factsheet and related Data Dictionaries and Data standards.
c. Methods of mapping coastline vary between the national reports which results in semantic differences of assessed CI 16, in particular with regard to mapping of the length of artificial structures. This should be taken into account while interpreting aggregate data for the Mediterranean. Classification of artificial structures should be unambiguous, regardless of the monitoring period, country or the method used (visual inspection of aerial images or field survey). A manual that will elaborate on various situations should be prepared so that interpretation is unambiguous, i.e., harmonised.

1290. Second, measures and actions to achieve GES include the following:

a. The country-specific GES should be defined based on the first set of monitoring data in order to allow assessment of changes for the next QSR. Country specificities could significantly affect the assessment, i.e., interpretation of calculated CI 16. Therefore, issues such as the following need to be taken into account. For example, a country with a significant length of coastline on uninhabited islands, islets and rocks and with a small proportion of artificial coast can be interpreted as a very good condition, while in fact there is a lot of construction on the mainland part of the coast. Another issue is the total length of the coastline per country. If a country has a short coastline than it is expected that the proportion of the artificial coastline will be larger to provide facilities for all human coastal and maritime activities. When defining GES thresholds, these should be considered; i.e., different thresholds could be defined for different parts of coastline. For the definition of country specific GES, the list of assessment criteria and the Guiding document prepared by PAP/RAC can be utilised (PAP/RAC, 2021), including the results of testing the Guiding document in Morocco (PAP/RAC, 2022).

1291. Also, measures and actions to achieve GES should be specified and may, in general, include the following three types:

a. Particular management actions needed in order to move towards GES.
b. Measures aimed at obtaining new knowledge for assessing and achieving GES (e.g., scientific research, application of innovative solutions at pilot locations).
c. Measures with the aim of disseminating knowledge to all stakeholders and involving them in defining measures and actions for achieving GES.

1292. Particular management actions regarding coastline artificialisation could include:

a. Analysis of existing artificial coastlines and their categorization into those that are necessary, those that can be reduced and those that can be returned to nature (e.g., abandoned jetties, etc.).
b. When planning new artificial structures on the coastline, first analyse whether human needs can be achieved through better management of existing artificial structures and their functional transformations.
c. Along existing artificial coastlines: improve monitoring of environmental impacts and implement measures to reduce negative impacts (such as pollution, habitat fragmentation, noise, light pollution, water cycle).
d. For new artificial coastlines, examine the use of nature-based solutions and ensure financial or other benefits for their implementation.
e. Encouraging the use of coastline in a way that consumes spatial/natural resources as little as possible: e.g., restricting land-take for the second homes.
f. Protect, restore, conserve and enhance threatened and degraded coastal habitats.

1293. Results of above measures and actions could be measured by km of reversed coastline (from artificial to natural), km of recovered coastal habitats, % of nature-based solutions used in e.g., coastal protection, number of innovative projects tested (e.g., beach nourishments without impacts on coastal habitats), number of people involved in GES awareness, number of people actively working on the measures, and alike.

Candidate CI25 Land cover change

Methodology:

The assessment of the CCI 25 Land cover change was prepared for the Adriatic sub-region. It serves as an example on how the assessment of this indicator could be prepared for the entire Mediterranean coastal region once data is available for the next QSR and once the CCI 25 is designated as a mandatory IMAP Common indicator.

CCI 25 monitoring entails an inventory of the land cover change in the coastal zone (10 km belt from the coastline, following the practice of the European Environment Agency). The coastal zone is further divided into reporting units by coastal strips (<300 m, 300 m-1 km, 1-10 km from the coastline), Low Elevation Coastal Zone (LECZ) and coastal administrative units. The minimum mapping unit is 1 ha and 100 m for linear elements, and the minimum change detection is 1 ha. CCI 25 units for the first monitoring (i.e., establishing the baseline) are the following:

- km^2 of built-up area in coastal zone;
- % of built-up area in coastal zone;
- % of other land cover classes in coastal zone;
- % of built-up area within coastal strips of different width compared to wider coastal units;
- % of other land cover classes within coastal strips of different width compared to wider coastal units;
- km^2 of protected areas within coastal strips of different width;
- km^2 of LECZ in coastal zone;
- km^2 of built-up area within LECZ in coastal zone;
- % of built-up area within LECZ in coastal zone;
- % of other land cover classes within LECZ in coastal zone;
- km^2 of protected areas within LECZ in coastal zone.

For the second monitoring (i.e., assessment of change) the following units are relevant:

- % of increase of built-up area, or land take;
- % of change of other land cover classes;
- % of change of protected areas;
- % of increase of built-up area, or land take within LECZ;
- % of change of other land cover classes within LECZ;
- % of change of protected areas within LECZ

The Candidate CI 25 has been assessed for the Adriatic sub-region of the Mediterranean based on open-source data from the Copernicus Land Monitoring – Coastal zones service, OpenStreetMap, World Database on Protected Areas, and Forest and Buildings removed Copernicus DEM (FABDEM) global elevation map for 2012 and 2018. All data retrieved per countries from the open-sources are available here (Password: IMAP#2023). Coastal urbanisation or land take is almost an irreversible process. Therefore, the CCI 25 indicator provides, among other indications, an inventory of the urbanisation pressures on coastal ecosystems but also reveals changes between land cover classes. With an additional assessment of these processes within the Low Elevation Coastal Zone (LECZ) (**Error! Reference source not found.**), i.e., the zone below the elevation of 5 m above sea level, important findings related to adaptation to climate change are provided. The calculation of data and analysis has been prepared by PAP/RAC by using the above-mentioned sources, therefore countries have not provided their own assessments. The draft report (Baučić M. et al 2022 b) was discussed with the Adriatic countries at the meeting in Tunis on 10 November 2022. Upgraded with the LECZ it represents the main input to this QSR.

For the purpose of integration of CIs within EO8 the question of correlation between the CI 16 on coastline and CCI 25 on coastal land cover has been studied, particularly between the land used by human activities and related artificial coastline. Typical situations that can be observed along the Adriatic coast vary from situations with strong correlation (in front of settlement there is the artificial coast) to situations of no correlation (natural beaches in front of a settlement). It can be concluded that there is no firm correlation between land cover and the type of the coastline.

1294. Due to the candidate status of this indicator, it was not included in the 2017 Med QSR. Since then, the indicator has been tested through the implementation of several projects such as the EcAp MED II and III, the GEF MedProgramme and alike. With the active support of the CORMON meetings the Guiding Factsheet was improved and upgraded. So, it is now for the first time that this indicator is presented; however, it still at the sub-regional scale (Adriatic Sea) where data was available from the open sources and therefore, required no major contribution from the countries.

1295. Good environmental status for CCI 25 is specified in the Guidance Factsheet (UNEP/MAP, 2019) as “Linear coastal development minimised, with perpendicular development being in balance with integrity and diversity of coastal ecosystems and landscapes. Mixed land-use structure achieved in predominantly human-made coastal landscapes”.

Key messages for CCI25 (Land cover change)

1296. The assessment of CCI 25 in the Adriatic sub-region (coastal zone of 10 km width) shows the following:

1297. In 2018 the built-up areas occupy 8.77% (2 500 km^2) of the Adriatic coastal zone. The largest land cover change from 2012 is the increase of the built-up area by 27 km^2 representing a land take trend of 1% in six years (Figure 130).

1298. In the 2012-2018 period the land cover changed from forest and semi-natural land (24 km^2), water bodies (3 km^2) and agricultural land (2 km^2) to built-up (27 km^2) and wetlands (2 km^2).(Figure 131).

1299. In 2018 the narrowest coastal strip of 300 m has the highest share of built-up area (18%), more than twice as much as in the coastal zone of 10 km width. The increase in the narrowest coastal strip between 2012-2018 is 4.4 km^2 while in the 300 m-1km coastal strip the increase is 3.5km^2, mainly at the expense of the decrease of forests and semi-natural land, as well as water bodies and wetlands.

1300. There are no countries with a decrease of the built-up areas in the reporting period.

1301. Protected areas covered 20% in 2012, reaching 37% in 2018.

1302. The low elevation coastal zone (up to 5 m above sea level) occupies 17% (4 955 km^2) of the coastal zone (10 km width), of which the built-up areas is 10% (484 km^2).

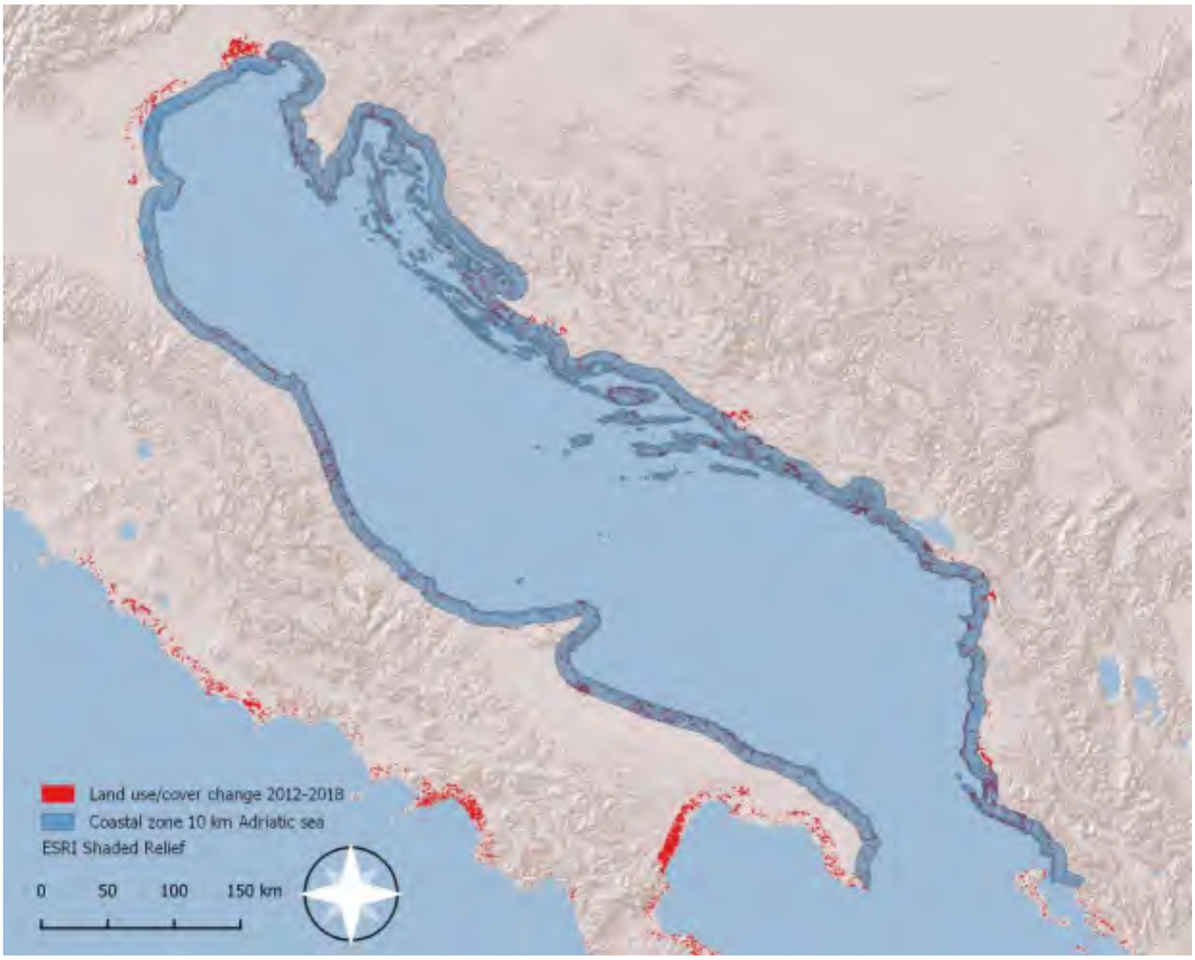


Figure 130: Adriatic sub-region Land cover change 2012 to 2018 for coastal zone (0 – 10 km)

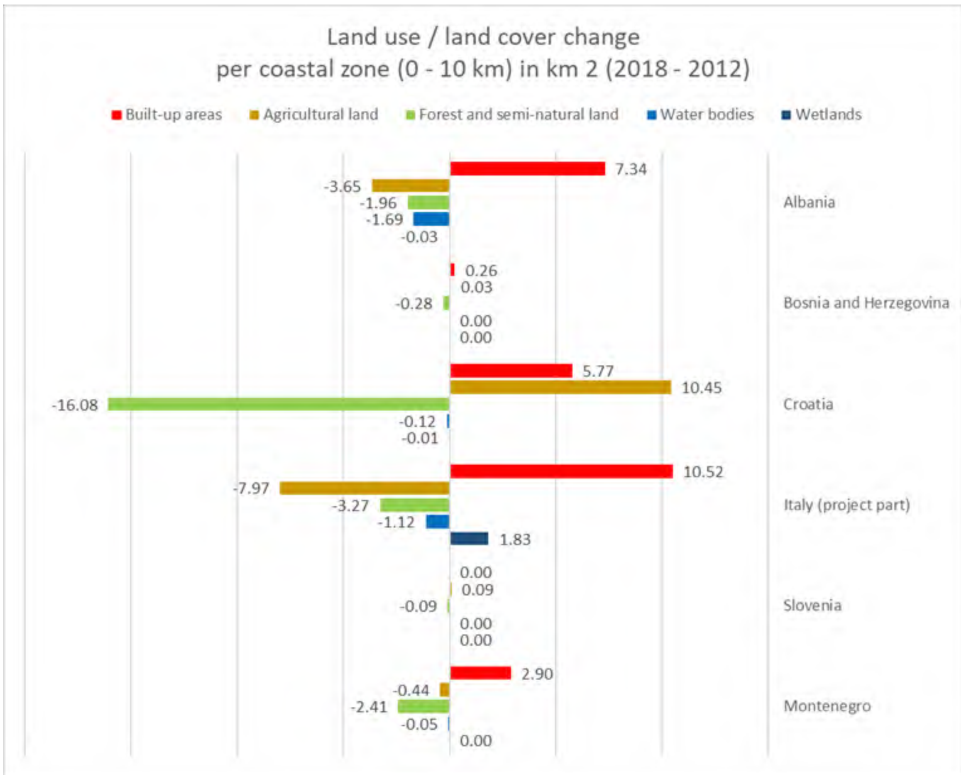


Figure 131: Land cover change in km^2 from year 2012 to 2018 on country level for coastal zone (0 – 10 km)

Key assessment findings for CCI-25

1303. The results of the CCI 25 assessment for the Adriatic sub-region show the increasing trend of coastal urbanisation, i.e., increase of built-up areas (27km^2 out of 29 km^2 land cover change was land-take mostly from natural areas) On the other hand, the areas under protection have also increased showing good practice of preserving and improving GES. However, there is a slight increase of built-up areas in the protected areas. CCI 25 indicator parameters clearly identify the linear coastal development, especially pronounced in Croatia. The assessment could help countries in establishing the right measures and actions to achieve GES.

1304. Figure 133Figure 132 illustrates land-take in km^2 (increase of built-up areas) from year 2012 to 2018 per coastal strips on country level. Looking at the distribution of land-take among the coastal strips, in Croatia, followed by Albania the narrower coastal strip (by absolute area the smallest among other coastal strips), has the largest amount of land-take. This clearly identifies that urban sprawl is located at the nearest vicinity to the coastline e.g., 0-300 m and that the Article 8 of the ICZM Protocol on the setback zone should be better respected. In Albania, Italy and Montenegro, the coastal strips 1-10 km have the largest land-take meaning that majority of urban areas have not been constructed in the narrow strip along the coastline.

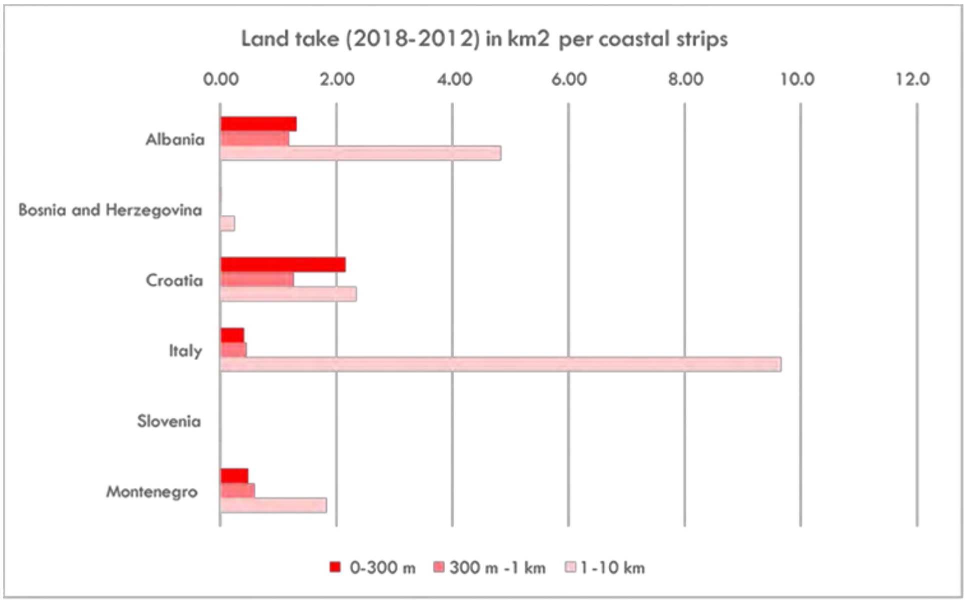


Figure 132: Land take (increase of built-up areas) from year 2012 to 2018 per coastal strip

1305. The reporting unit of LECZ, i.e. areas with highest risk to be impacted by flooding, shows that large areas of coastal zones are located in the low-lying terrain and that the built-up areas continue to increase there as well. This sheds new light on the problem of coastal artificialization, which will lead to a decrease of resilience to climate change. A detailed analysis at the level of municipalities and cities could help address the problem and set new requirements for urban planning, e.g., no land-take in LECZ (Figure 132).

Figure 132: LECZ of the Adriatic sub-region

1306. The assessment reveals also that land cover change (2012-2018) within LECZ goes towards an increase of built-up areas in all countries within the Adriatic sub-region (increase of 6km^2 that corresponds to 1% relative to built-up area in 2012). Figure 133 illustrates land-take in countries per coastal strips. Albania has the largest increase of built-up areas within LECZ and most of the land-take took place in the coastal strip 1-10 km, while in Croatia in the narrowest coast strip.

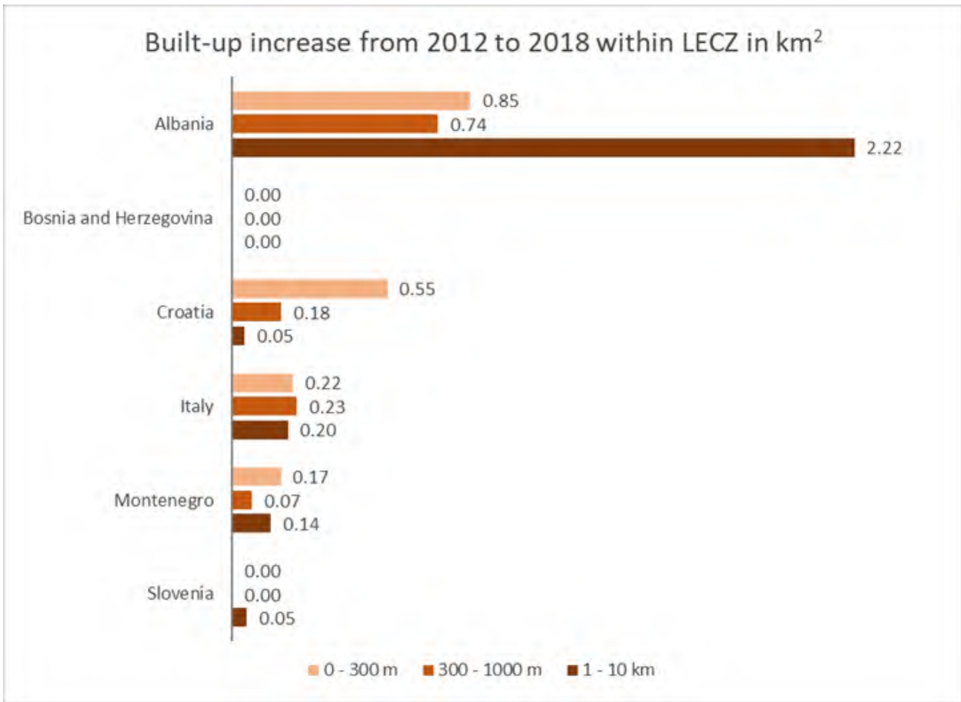


Figure 133: Land take in the LECZ per country per coastal strips in km^2

1307. A plethora of GIS data was prepared for the elaboration of this assessment report and is available to be used for other statistics and analyses, and for further GES assessment and setting up measures and actions.

1308. The methodology applied in this study confirms that the CCI 25 assessment can be made with open-source data such as OpenStreetMap, World Database on Protected Areas and Forest and Buildings removed Copernicus DEM (FABDEM) global elevation map. All these datasets are available for the whole Mediterranean. The key data for CCI 25 is land cover data, here the Copernicus Land Monitoring – Coastal zones service was used. Currently, it is not available for the entire Mediterranean. However, the best available data for the future could be the ESA World Cover Project providing global land cover maps at 10m spatial resolution, in particular if national most updated and accurate datasets are not available. As new global land cover maps are emerging monthly, having better and better spatial, thematic and temporal resolution land cover monitoring is becoming feasible for the whole Mediterranean at relatively low cost.

Measures and actions to achieve GES for CCI-25

1309. Varying geographic, socio-economic, cultural and environmental contexts of coastal zones require the application of specific measures and actions in order to achieve GES. First, in order to define GES in a more objective way a technical manual should be prepared that will allow better understanding of concepts of integrity and diversity of coastal ecosystems and landscapes and their importance for ecosystem approach. This will also allow better assessment of land cover changes in the next QSR period, in particular for the areas with significant changes.

1310. Second, more objective GES should be prepared either at the sub-regional level or at country level that will allow more objective assessments for the future QSR.

1311. The main targets under EO8 could include the following:

a. Avoid further construction within the setback zone and the flooding prone low-lying coastal zone;
b. Give priority to low-lying coastal zone when preparing adaptation plans to climate change;
c. Maintain diverse and harmonised coastal land cover structure, and reverse dominance of urban land cover;
d. Keep and increase landscape diversity.

1312. These general recommendations should be further elaborated and adapted to particular regions. In general, measures and action could be of the following types:

a. Particular management actions needed in order to move towards GES;
b. Measures aimed at obtaining new knowledge about assessing and achieving GES (e.g., scientific research, application of innovative solutions at pilot locations);
c. Measures with the aim of disseminating knowledge to all stakeholders and involving them in the actions for achieving GES.

1313. Particular management actions regarding land cover change could include:

a. Analysis of existing built-up areas and their categorization into those that are necessary, those that can be reduced and those that can be returned to nature (e.g., abandoned industrial zones, etc.).
b. When planning new built-up areas, first analyse whether human needs can be achieved through better management of existing built-up areas and their functional transformations.
c. In existing built-up areas: improve monitoring of environmental impacts and implement measures to reduce negative impacts (such pollution, habitat fragmentation, noise, light pollution, water cycle).
d. For new construction areas, examine the use of nature-based solutions and ensure financial or other benefits for their implementation.
e. Encouraging the use of space in a way that consumes spatial/natural resources as little as possible: e.g., restricting land-take for second homes.
f. Protect, restore, conserve and enhance threatened coastal ecosystems and habitats (e.g., dunes, wetlands and coastal forests and woods, in particular)

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3. Main Actions and Measures Supported the work of UNEP/MAP for the Protection of the Mediterranean Sea and Coast since 2017 Med QSR

1314. Since the adoption of MedQSR of 2017, a series of actions and measures were undertaken that supported the efforts made within the framework of UNEP/MAP-Barcelona Convention. The main measures adopted by the Contracting Parties to the Barcelona Convention since 2017 are:

- The **UNEP/MAP Medium-Term Strategy 2022-2027** (MTS) adopted in 2021 as a key strategic framework for the development and implementation of the Programmes of Work of UNEP/MAP. It aims at achieving transformational change and substantial progress in the implementation of the Barcelona Convention and its Protocols, also providing a regional contribution to relevant Global processes[137].
- **Designation of the Mediterranean Sea Emission Control Area for Sulphur Oxides and Particulate Matter**: The Contracting Parties to the Barcelona Convention successively adopted two consensual decisions at their 21st meeting (Naples, Italy, 2-5 December 2019) and 22nd meeting (Antalya, Türkiye, 7-10 December 2021) concerning the designation of the Mediterranean Sea Emission Control Area for Sulphur Oxides and Particulate Matter (Med SOX ECA), pursuant to Annex VI to the International Convention for the Prevention of Pollution from Ships (MARPOL).
- **The Regional Plan on Urban Wastewater Treatment.** It applies to the collection, treatment, reuse and discharge of urban wastewaters and the pre-treatment and discharge of industrial wastewater entering collecting systems from certain industrial sectors. Its objective is to protect the coastal and marine environment and human health from the adverse effects of the wastewater direct and or indirect discharges, in particular regarding adverse effects on the oxygen content of the coastal and marine environment and eutrophication phenomena as well as promote resource water and energy efficiency.
- **Regional Plan on Sewage Sludge Management**. It applies to the treatment, disposal and use of sewage sludge from Urban Wastewater Treatment Plants. Its objective is to ensure effective reuse of beneficial substances and exploitation of energy potential of sewage sludge, while preventing harmful effects on human health and the environment.
- **The Updated Regional Plan on Marine Litter Management in the Mediterranean.** The updated version of the Regional Plan further expands the provision of the version adopted in 2013, to include a number of additional elements, i.e., new definitions, expanded scope of measures in 4 principal areas (economic instruments, circular economy of plastics, land-based and sea-based sources of marine litter), and amendments targets for plastic waste and microplastics.
- The under development **Regional Plans on (a) Agriculture, (b) Aquaculture, and (c) Storm Water, Management in the Mediterranean,** which are expected to be approved by COP23 in December 2023.
- **The Common Regional Framework for Integrated Coastal Zone Management**. It provided the Methodological Guidance for Reaching Good Environmental Status (GES) through ICZM. Its objective is to support the implementation of the EcAp in a coordinated and integrated manner so to take all EOs and their GES into account through the implementation of the ICZM Protocol and other Protocols and related key documents.
- Following the emerging need to introduce MSP in the entire Mediterranean Region and to provide a planning tool to assist achieving GES of marine environment, the COP 20 (17-20 December 2017, Tirana, Albania) adopted the **Conceptual Framework for Marine Spatial**

[137] In particular the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs), the UN Decade on Ecosystem Restoration, the UN Decade of Ocean Science for Sustainable Development and the UNEP's Medium-Term Strategy 2022-2025, approved at UNEA-5 in February 2021.

Planning as a guiding document to facilitate the introduction of this management tool into the Barcelona Convention framework, with the aim to further support achieving Good Environmental Status (GES) of the Mediterranean Sea and Coasts; investigate in more details connections between land and sea areas; and propose coherent and sustainable land and sea-use planning frameworks relating with key economic sectors and activities that may affect the coastal and marine resources.

- In order to provide best assistance to the CPs for the implementation of Marine Spatial Planning a **MSP Workspace** has been prepared and training provided for the region's planners and other MSP practitioners who can access information and tools, and share knowledge, news and insight on MSP. https://msp.iczmplatform.org/
- The **Post-2020 SAPBIO**[138] and the **Post-2020 Regional MCPAs and EOCMs Strategy**[139], both adopted in 2021 as action-oriented policies for the preservation of the marine and Coastal Biodiversity that contribute to achieve the respective targets of the Sustainable Development Goals and the CBD Post-2020 Global Biodiversity Framework, through the optic of the Mediterranean context.
- The **Mediterranean Strategy for the Prevention of, Preparedness, and Response to Marine Pollution from Ships** (2022-2031). Adopted in 2021 to enhance the implementation of the Protocol concerning Cooperation in Preventing Pollution from Ships and, in Cases of Emergency, Combating Pollution of the Mediterranean Sea. It sets seven Common Strategic Objectives addressing key ships related environmental issues (pollution, climate change, air emission, marine litter (plastic and), Nin-Indigenous Species, designation of special areas, emerging issues related to pollution from ships in the Mediterranean). Its implementation is supported by an Action Plan made of 190 specific actions expected to be implemented in the next ten years.
- The **Strategic Action Programme to address pollution from land-based activities** (SAP-MED) adopted in 1997 as a long-term policy (2000-2025) focused on combatting pollution from land-based sources and activities and their impact on marine and coastal environment. Its objective is to improve the quality of the marine environment of the Mediterranean through facilitating the implementation by the Contracting Parties of the LBS Protocol and promoting shared-management of the land-based pollution. The SAP-MED was designed to assist Parties in taking actions individually or jointly within their respective policies, priorities and resources, which will lead to the prevention, reduction, control and/or elimination of the degradation of the marine environment, as well as to its recovery from the impacts of land-based activities.
- The **Ballast Water Management Strategy for the Mediterranean Sea** (2022-2027) adopted in 2021 updates a first strategy in 2012. The overall objectives of this Strategy are to: (i) establish a framework for a regional harmonised approach in the Mediterranean on ships' ballast water control and management which is consistent with the requirements and standards of the Ballast Water Management Convention; (ii) initiate some preliminary activities related to the management of ships' biofouling in the Mediterranean region; and (iii) contribute to the achievement of GES with respect to NIS as defined in IMAP.
- The **Regional Action Plan on Sustainable Consumption and Production in the Mediterranean** adopted in 2016 as a substantive contribution by the Mediterranean Region to the implementation of the 2030 Agenda for Sustainable Development. It defines common objectives and identifies actions guiding the implementation of the sustainable consumption and production at the national level, addressing, as appropriate, key human activities which have a particular impact on the marine and coastal environment and related transversal and cross-cutting issues.

[138] The Strategic Action Programme for the Conservation of Biodiversity and Sustainable Management of Natural Resources in the Mediterranean Region (Post-2020 SAPBIO). It was adopted in 2021
[139] The Post-2020 Regional Strategy for marine and coastal protected areas and other effective area-based conservation measures in the Mediterranean

1315. The UNEP/MAP efforts for the preservation of the Mediterranean Sea and Coast are a contribution from the region to achieve global objectives in relation to the marine environment. In addition to providing a regional contribution to achieve the relevant Sustainable Develop Goals, the action of UNEP/MAP is harmonised with the following global processes since 2017:

- UN Decade on Ecosystem restoration (2021-2030).
- UN Decade of Ocean Science for Sustainable Development (2021-2030).
- UNEP Regional Seas Strategic Directions 2022-2025.
- The Ecosystem Approach: Towards a practical application across Regional Seas Conventions and Action Plans.
- UNEP Marine and Coastal Strategy 2020-2030.
- Post-2020 global biodiversity framework (CBD).
- United Nations Environment Assembly: UNEA-3 (December 2017), UNEA-4 (March 2019), UNEA-5 (February 2021).
- The relevant Decisions of UNFCCC COP 27 (Sharm el-Sheikh from 6 to 20 November 2022).
- The Intergovernmental Negotiating Committee (INC) mandated to develop legally binding global treaty to control plastic pollution.

1316. In addition to the measures undertaken within the framework of the UNEP/MAP, the conservation of the Mediterranean Sea and Coast benefited from measures adopted as part of European Union policies of relevance for the Mediterranean marine and coastal environment. These included in particular:

- The EU Sustainable blue economy, new approach.
- The EU Biodiversity strategy for 2030.
- The EU Nature restoration Law proposal.
- The EU Circular economy action plan.
- The EU MSP Directive and implementation.
- The EU Green Deal for the Climate neutrality.
- The EU Marine Strategy Framework Directive.
- The EU Plastics Strategy.
- The EU Single-use Plastic Directive.
- The EU Green Deal Policy Framework.
- The EU Waste Framework Directive.
- The EU Revised Port Reception Facilities Directive.

Annex I

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OPEN SOURCE DATA *(used for CCI25 calculation for the Adriatic countries)*

1. Land use/land cover data

Copernicus Coastal zones (CLMS-CZ) *It is a part of the Copernicus Land Monitoring Service and it covers coastal area of EEA39 countries that is within 10 km of the coastline (partly modified EU-Hydro coastline). Currently, CLMS-CZ is available for 2012 and 2018, and it is planned to produce a new dataset every six years.*
https://land.copernicus.eu/local/coastal-zones
CLMS-CZ data for year 2012 can be downloaded from https://land.copernicus.eu/local/coastal-zones/coastal-zones-2012?tab=download
CLMS-CZ data for year 2012 can be downloaded from https://land.copernicus.eu/local/coastal-zones/coastal-zones-2018?tab=download
CLMS-CZ data for change 2012-2018 can be downloaded from https://land.copernicus.eu/local/coastal-zones/coastal-zones-change-2012- 2018?tab=download

2. Coastline and administrative units

OpenStreetMap (OSM) data
OpenStreetMap (OSM) is based on crowdsourced volunteered geographic information, it is often being used as a valuable data source for extracting useful information.
OSM coastline can be downloaded from https://osmdata.openstreetmap.de/.
Administrative boundaries from https://osm-boundaries.com/.

3. Elevation data

Copernicus DEM 30
Copernicus DEM is a digital surface model (DSM) in resolution of 30 m, it has world cover and is freely available.
https://land.copernicus.eu/global/content/annual-100m-global-land-cover-maps-available.

4. Protected areas

World Database on Protected Areas
World Database on Protected Areas is the most exhaustive global database on terrestrial and marine protected areas, managed by UNEP World Conservation Monitoring Centre (UNEP-WCMC) and is being updated on a monthly basis.
https://www.protectedplanet.net/en/thematic-areas/wdpa?tab=WDPA.