



UNEP



UNITED NATIONS
ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

23 April 2015
Original: English

Twelfth Meeting of Focal Points for Specially Protected Areas

Athens, Greece, 25-29 May 2015

Agenda item 7: Ecosystems conservation

7.5 : Action Plan concerning Species Introductions and Invasive Species in the Mediterranean Sea

Status of implementation of the Action Plan concerning species introduction and invasive species in the Mediterranean Sea

For environmental and economy reasons, this document is printed in a limited number and will not be distributed at the meeting. Delegates are kindly requested to bring their copies to meetings and not to request additional copies.

Note:

The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of RAC/SPA and UNEP concerning the legal status of any State, Territory, city or area, or of its authorities, or concerning the delimitation of their frontiers or boundaries.

© 2015 United Nations Environment Programme / Mediterranean Action Plan (UNEP/MAP)
Regional Activity Centre for Specially Protected Areas (RAC/SPA)
Boulevard du Leader Yasser Arafat
B.P. 337 - 1080 Tunis Cedex - Tunisia
E-mail: car-asp@rac-spa.org

The original version of this document was prepared for the Regional Activity Centre for Specially Protected Areas (RAC/SPA) by Stelios Katsanevakis, RAC/SPA consultant.

Status of the implementation of the Action plan concerning species introduction and invasive species

I. Introduction

Biological invasions are considered to be one of the most important direct drivers of biodiversity loss and a major pressure on several types of ecosystems, severely challenging the conservation of biodiversity and natural resources (Katsanevakis et al. 2014a). In marine ecosystems, alien marine species may become invasive and displace native species, cause the loss of native genotypes, modify habitats, change community structure, affect food web properties and ecosystem processes, impede the provision of ecosystem services, impact human health, and cause substantial economic losses (Molnar et al. 2008; Vilà et al. 2010; Katsanevakis et al. 2014a).

In recent years there has been a strong interest from the scientific community and international organisations, such as UNEP/MAP, in monitoring biological invasions in the Mediterranean Sea, assessing their impact on biodiversity and ecosystem services, investigating their pathways and gateways of introduction, and proposing management measures. Within this framework, a great effort has been made during the last decade to compile fragmentary and sporadic information on the presence and distribution of alien species in the Mediterranean Sea. Scientists from several Mediterranean countries have created and continuously update databases of marine alien species, and have published national or basin-wide inventories, usually including information on the origin of each species, the pathway of introduction, and the establishment success.

To mitigate the impacts of invasive alien species on biodiversity, human health, ecosystem services and human activities there is an increasing need to take action to control biological invasions. With limited funding, it is necessary to prioritise actions for the prevention of new invasions and for the development of mitigation measures. This requires a good knowledge of the impact of invasive species on ecosystem services and biodiversity, their current distributions, and the pathways of their introduction (Molnar et al. 2008; Katsanevakis et al. 2013, 2014a; Galil et al. 2014). Prevention is generally more cost-effective and environmentally desirable than post-introduction measures, such as eradication or long-term containment. In the marine environment, prevention seems to be the only feasible alternative, as eradication is impossible in almost all cases except in the very early stages of introduction, e.g. the eradication of *Caulerpa taxifolia* in California (Anderson, 2005) and of *Mytilopsis sallei* in an enclosed lagoon at Darwin, Australia (Bax et al. 2002).

To this aim, it is necessary to control the routes and mechanisms by which new alien species arrive. Identification and assessment of the 'pathways of introduction' is essential for predicting future trends of new introductions, identifying management options to mitigate invasions and to prevent new introductions, and communicating related risks and costs to policy makers and high level administration (Hulme et al., 2008).

Aichi Target 9 of the CBD states that "by 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment". Aichi Target 9 is reflected in Target 5 of the EU Biodiversity Strategy (European Commission COM/2011/244) and is one of the objectives of the new EU Regulation (No 1143/2014) on the prevention and management of the introduction and spread of invasive alien species.

The Protocol concerning specially protected areas and biological diversity in the Mediterranean (SPA Protocol) of the Mediterranean Action Plan invites the Contracting Parties to take “all appropriate measures to regulate the intentional or non-intentional introduction of non-indigenous or genetically modified species into the wild and prohibit those that may have harmful impacts on the ecosystems, habitats or species” (Article 13). Towards this direction the Contracting Parties have agreed on an Action Plan concerning species introductions and invasive species in the Mediterranean Sea (UNEP-MAP-RAC/SPA 2005). The aim of this document is to assess the status of the implementation of this Action plan. Therefore, the present document (1) reviews the progress in increasing knowledge on species introductions and invasive species in the Mediterranean since the update of the Action Plan in 2005, (2) reviews regional activities carried out in compliance with the 2005-2012 timetable of the Action Plan, and (3) evaluates the implementation of the Action Plan by the contracting parties by reviewing the reports submitted by the Parties.

II. Progress in increasing knowledge on alien and invasive species in the Mediterranean Sea

The following assessment of the progress in increasing knowledge on alien and invasive species in the Mediterranean Sea is based exclusively on the published peer-reviewed literature.

II.1 Alien species inventories

Two basin-wide inventories of the marine alien species of the Mediterranean have been published the last years, by Zenetos et al. (2010, 2012) and by Galil (2012). The inventory by Zenetos et al. (2010), later updated by Zenetos et al. (2012), reported a total of 986 alien and cryptogenic species in the Mediterranean. It included both multicellular and unicellular species, and also species flagged as questionable or cryptogenic. The Galil (2012) inventory included 660 multicellular alien species in the Mediterranean Sea; it did not include cryptogenic species.

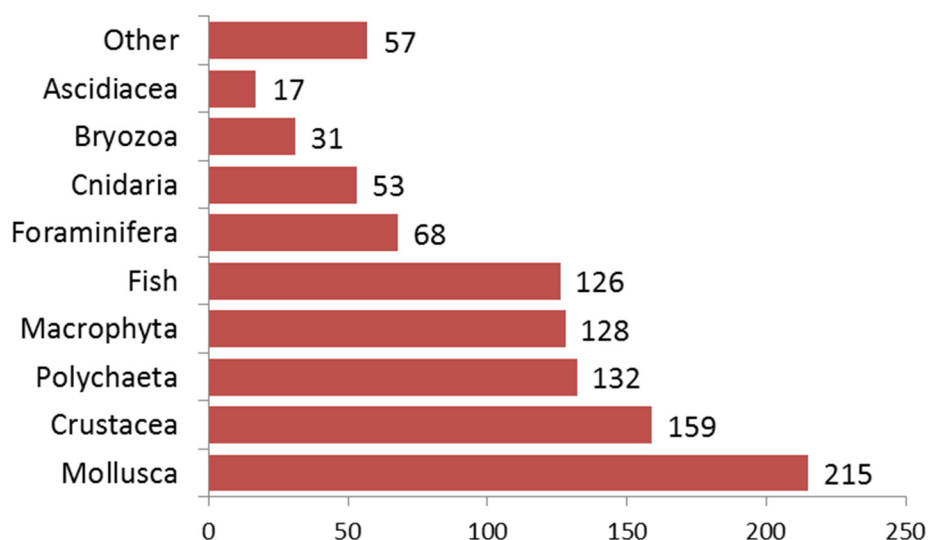


Figure 1: Contribution of marine alien taxa in the Mediterranean Sea (modified from Zenetos et al. 2012)

In terms of alien species richness, the dominant group is Mollusca, followed by Crustacea, Polychaeta, Macrophyta, and Fish (Fig. 1). The vast majority of alien species occur in the eastern Mediterranean

(775), whereas a lower number of species has been reported in the western (308) and central Mediterranean (249), and the lowest in the Adriatic Sea (190) (Zenetos et al. 2012). The taxonomic identity of alien species differs in the four sub-basins, with Macrophytes being the dominant group in the western and central Mediterranean and in the Adriatic Sea (Fig. 2).

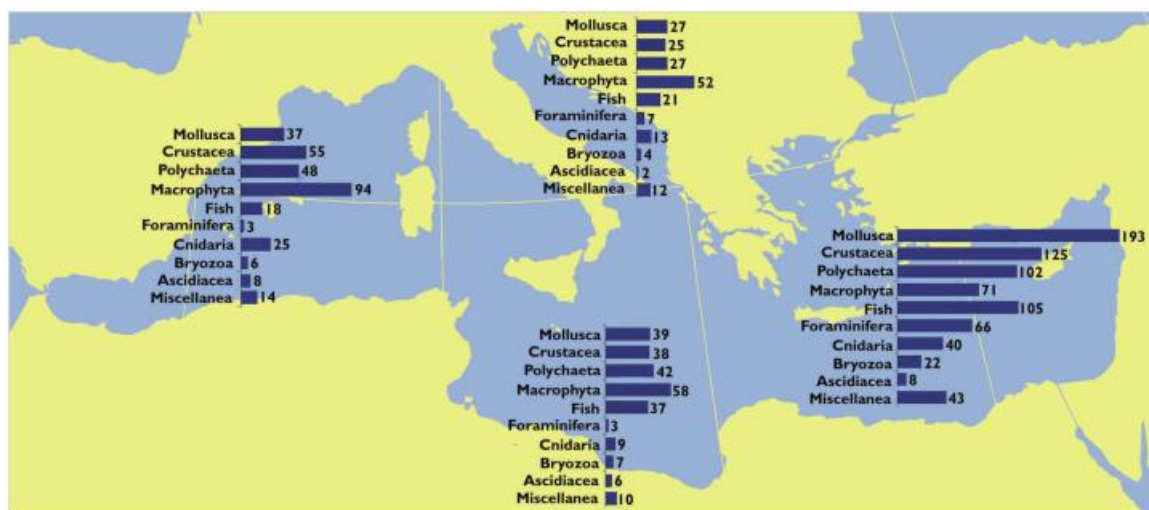


Figure 2: Number of marine alien species by taxonomic group in the four sub-basins of the Mediterranean Sea: eastern, western, central Mediterranean, and Adriatic (Source: Zenetos et al. 2012).

Apart from the abovementioned basin-wide inventories, many national lists of alien species have been published, most of them the last decade (Table 1). These inventories critically reviewed published and grey literature and involved many taxonomic experts, substantially improving our knowledge on the spatial distribution of alien species in the Mediterranean. National inventories have also been submitted by EU member states for the fulfilment of their obligations for the initial assessment of their territorial waters as provisioned by the Marine Strategy Framework Directive. Furthermore, national lists of alien species can be easily derived from the European Alien Species Information Network (EASIN) through its online multiple-criteria search and mapping tools (Katsanevakis et al. 2015).

Table 1: National inventories of marine alien species in the Mediterranean Sea.

Country	Reference
Croatia	Pećarević et al. 2013
Cyprus	Katsanevakis et al. 2009
Greece	Zenetos et al. 2009, 2011
Israel	Galil 2007
Italy	Occhipinti-Ambrogi et al. 2011
Libya	Bazairi et al. 2013
Malta	Sciberras & Schembri 2007; Evans et al. 2015
Slovenia	Lipej et al. 2012
Turkey	Cinar et al. 2005, 2011

II.2 Assessment of pathways and gateways of introduction

Alien species in the Mediterranean Sea are linked to four main pathways of introduction, i.e. the Suez Canal, shipping (ballast waters and hull fouling), aquaculture, and aquarium trade. Zenetos et al. (2012) assessed the pathway of introduction of all alien species in the Mediterranean. They found that:

- More than half (53.9%) of the marine alien species in the Mediterranean were probably unintentionally introduced through the Suez Canal.
- Shipping is blamed directly for the introduction of only 12 species, whereas it is assumed to be the most likely pathway of introduction (via ballasts or fouling) of another 300 species. For approximately 100 species shipping is a probable pathway along with the Suez Canal and/or aquaculture.
- Approximately 20 species have been introduced with certainty via aquaculture, while >50 species (mostly macroalgae), occurring in the vicinity of oyster farms, are assumed to be introduced accidentally as contaminants of imported species.
- A total of 18 species are assumed to have been introduced by the aquarium trade.

In the Mediterranean, the Suez Canal is the most important pathway, contrary to the situation in Europe (Katsanevakis et al. 2013) and globally (Molnar et al. 2008), where canals rank second and third respectively, and shipping is the most important pathway (Fig. 3). The role of marine litter as a vector of introduction or secondary spread of alien species in the Mediterranean has not been considered and studied so far, but a recent study by Katsanevakis and Crocetta (2014) highlighted its potential role.

New introductions of alien species in the Mediterranean Sea have an increasing trend, reaching almost 200 new species introductions per decade (Fig. 4). Many more species are expected to invade the Mediterranean Sea through the Suez Canal, as it has been continuously enlarged and the barriers for the invasion of Red Sea species have been substantially decreased (Katsanevakis et al. 2013). Moreover there are currently plans to create a second parallel canal to assist vessel traffic, which is expected to further increase the trend of introduction of new lessepsian species (Galil et al. 2015). The observed increasing trend in new introductions by shipping is not expected to halt unless effective measures are taken, such as the ratification and implementation of IMO's (International Maritime Organisation) "International Convention for the Control and Management of Ships' BallastWater and Sediments" (BWM Convention). Nevertheless, introductions by hull-fouling, which was identified as the most common vector for marine alien species so far introduced in European seas (Katsanevakis et al. 2013), will remain or even increase due to the recent adoption of the IMO Anti-fouling Convention in 2004 and the banning of the most effective (i.e. most toxic) of the anti-fouling hull coatings.

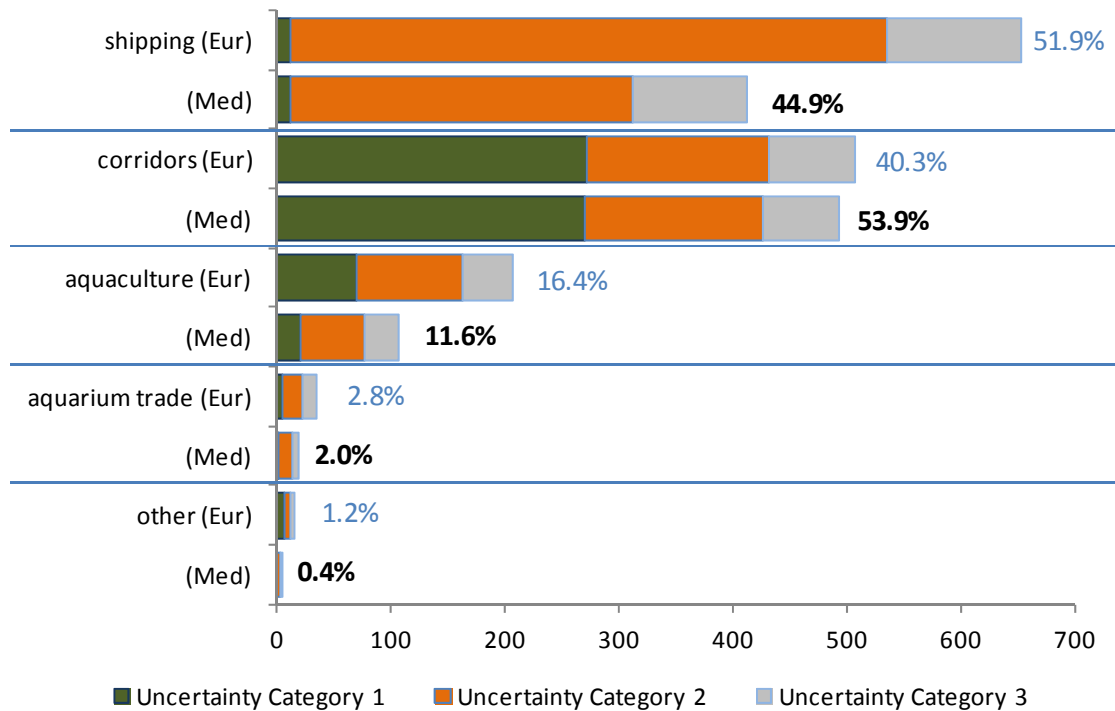


Figure 3: Number of marine alien species known or likely to be introduced by each of the main pathways, in Europe (Eur) and the Mediterranean (Med). Percentages add to more than 100% as some species are linked to more than one pathway (blue percentages refer to the European total, while black percentages to the Mediterranean total). Uncertainty categories: (1) there is direct evidence of a pathway/vector; (2) a most likely pathway/vector can be inferred; (3) one or more possible pathways/vectors can be inferred; (4) unknown (not shown in the graph). Modified from Katsanevakis et al. (2013), Zenetos et al. (2012), and Katsanevakis and Crocetta (2014).

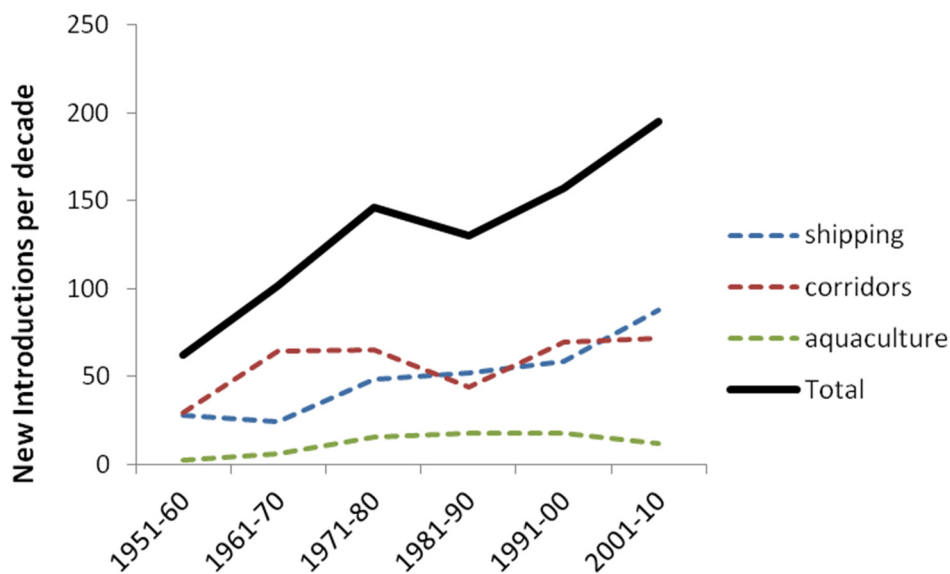


Figure 4: Trends in new introductions of alien marine species in the Mediterranean per decade (trends in total introductions and by the three most important pathways) (modified from Zenetos et al. 2012)

An assessment of the ‘gateways’ (i.e. countries of initial introduction) to alien invasions in the European Seas by Nunes et al. (2014) revealed marked geographic patterns depending on the pathway of introduction (Fig. 5). Lessepsian migration was the predominant pathway of first introductions in Egypt, Lebanon, Israel, Syria and the Palestine Authority (all in the eastern Mediterranean), representing more

than 70% of each country's first introduction events. For the other Mediterranean countries, shipping was the predominant pathway of initial introduction. Israel is the country with the highest number of recorded first introductions in the Mediterranean and adjacent seas, followed by Turkey (including also the Black Sea), France (including also the Atlantic waters), and Italy (Fig. 5).

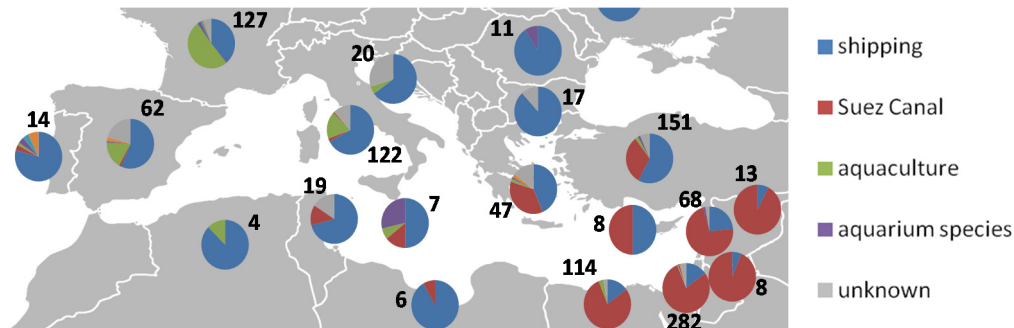


Figure 5: Proportion of marine alien species introduced for the first time in the Mediterranean and adjacent Seas through different pathways of introduction, per recipient country (i.e. countries of initial introduction). For clarity, data is shown for countries with more than two recorded first introduction events (numbers shown next to the charts). Modified from Nunes et al. (2014).

II.3 Spatial distribution

The first comprehensive maps of the spatial distribution of marine alien species in the Mediterranean Sea were published by CIESM, covering Crustacea (Galil et al. 2002), fish (Golani et al. 2002), molluscs (Zenetos et al. 2004), and recently (currently available only online) macrophytes (Verlaque et al. in press). Since 2012, the launching of the European Alien Species Information Network (EASIN) provided new opportunities for assessing the spatial distribution of alien species in all European Seas (Katsanevakis et al. 2015). The EASIN online mapping tools allow the mapping in real time of the distribution of any single species or aggregated combination of species at four levels: by country, marine ecoregions, river basins, and on a standard 10×10 km grid. EASIN harmonizes and integrates information from many different sources. For marine species in the Mediterranean, it includes the CIESM data and also data from the Global Biodiversity Information Facility (GBIF; <http://www.gbif.org/>), the Global Invasive Species Information Network (GISIN; <http://www.gisin.org/>), the Regional Euro-Asian Biological Invasions Centre (REABIC; <http://www.reabic.net/>), the Hellenic Network on Aquatic Invasive species (ELNAIS: <https://services.ath.hcmr.gr/>), the HCMR/EEA database (managed by the Hellenic Centre for Marine Research), the Mediterranean Marine Invasive Species information system (MedMIS, managed by IUCN; <http://www.iucn-medmis.org/>), and EASIN-Lit (<http://easin.jrc.ec.europa.eu/About/EASIN-Lit>). EASIN-Lit is an EASIN product providing georeferenced records as retrieved from published literature (Trombetti et al. 2013).

Based on the EASIN mapping tools, Katsanevakis et al. (2014b) assessed the spatial distribution of marine alien species in the Mediterranean by pathway of introduction (Fig. 6). An aggregated map of the distribution of species introduced through the Suez Canal (Fig. 6 top) shows a characteristic pattern of high species richness in the south-eastern Levantine Sea, which declines anticlockwise along the coastline of the Levantine Sea and further westwards and northwards along the northern Mediterranean coast, and also westwards along the north-African coastline. A maximum of 129 species per 10 x 10 km cell is reached in the Haifa coastal areas, along the Israeli coastline. The distribution of species introduced by shipping is strikingly different to the one of Lessepsian species, with hotspot areas along the north-western Mediterranean coastline from Martigues and Marseille (France) to Genova (Italy),

eastern Sicily (Italy), the Saronikos, Thermaikos and Evvoikos Gulfs (Greece), and the coastlines of the eastern Levantine (SE Turkey, Syria, Israel, and Lebanon) (Fig. 6 middle). Two main hotspots are observed for species introduced by aquaculture, the Tau lagoon (Gulf of Lion, France) and the Venice lagoon (northern Adriatic, Italy) (Fig. 6 bottom).

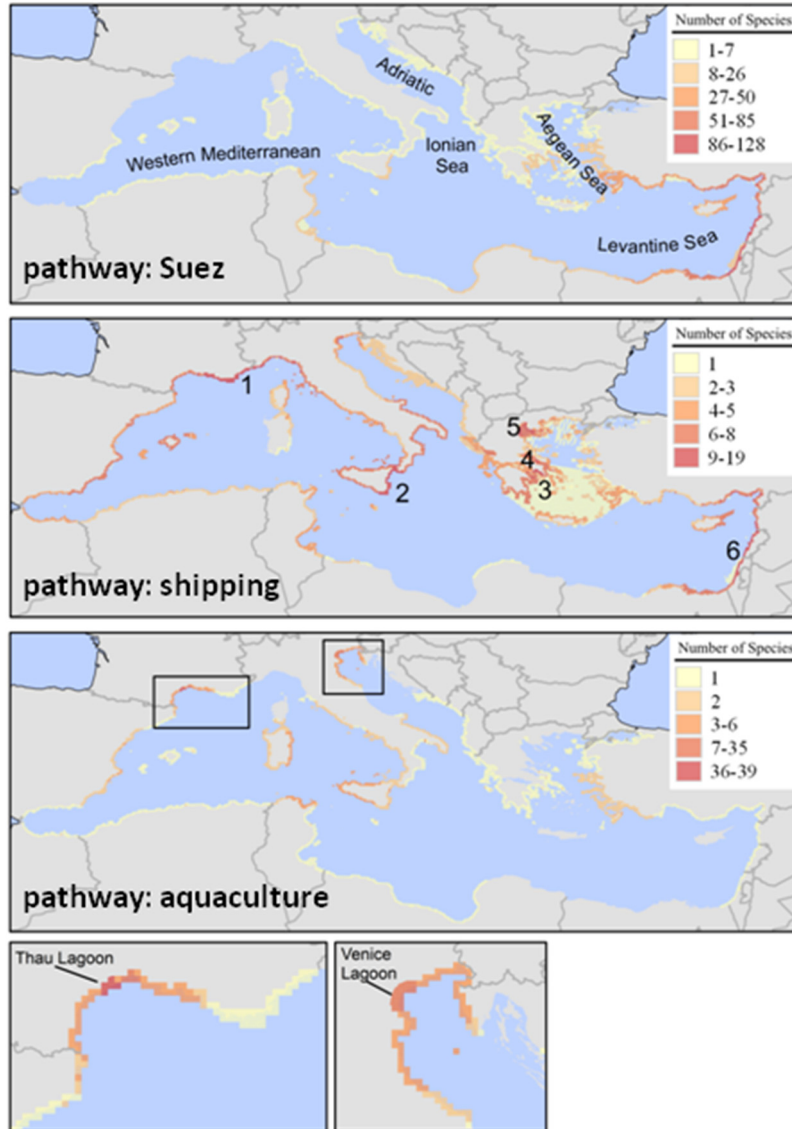


Figure 6: Richness (number of species in a 10 × 10 km grid) of marine alien species introduced in the Mediterranean Sea through the Suez Canal (top), by shipping (middle), and by aquaculture (bottom). High-richness areas in the middle map: (1) north-western Mediterranean coastline from Martigues and Marseille (France) to Genova (Italy); (2) eastern Sicily; (3) Saronikos Gulf; (4) Evvoikos Gulf; (5) Thermaikos Gulf; (6) the coastlines of SE Turkey, Syria, Israel, and Lebanon. The maps were produced by EASIN’s mapping widget and are modified from Katsanevakis et al. (2014b).

II.4 Impact assessments

A systematic review of the impacts of marine invasive species on biodiversity and ecosystem services in the European Seas has been conducted recently (Katsanevakis et al. 2014a), also covering the entire

Mediterranean Sea. It was found that food provision was the ecosystem service that was impacted by the highest number of alien species. Of the 87 assessed invasive species (of which 60 occur in the Mediterranean Sea), thirty percent had an impact on entire ecosystem processes or wider ecosystem functioning, more often in a negative fashion. Forty-nine of the assessed species were reported as being ecosystem engineers, which fundamentally modify, create, or define habitats by altering their physical or chemical properties. There are many mechanisms through which invasive alien species impact biodiversity and ecosystem services (Figs. 7 & 8). Katsanevakis et al. (2014a) reported not only negative impacts but also many positive impacts of alien species and stressed that the “native good, alien bad” view is a misconception, and the role of most of the alien species in marine ecosystems is rather complex. Many alien species often benefit some components of native biodiversity and can enhance or provide new ecosystem services.

One of the main outcomes of the study by Katsanevakis et al. (2014a) was that evidence for most of the reported impacts is weak, as it is based on expert judgement or dubious correlations, while only for very few cases the reported impacts were inferred via manipulative or natural experiments. A need for stronger inference is evident, to improve our knowledge base of marine biological invasions and better inform environmental managers. As a step forward, quantification and mapping of impacts as well as a better understanding of how anthropogenic changes and human pressures facilitate many invasions will greatly assist managers and policy makers.

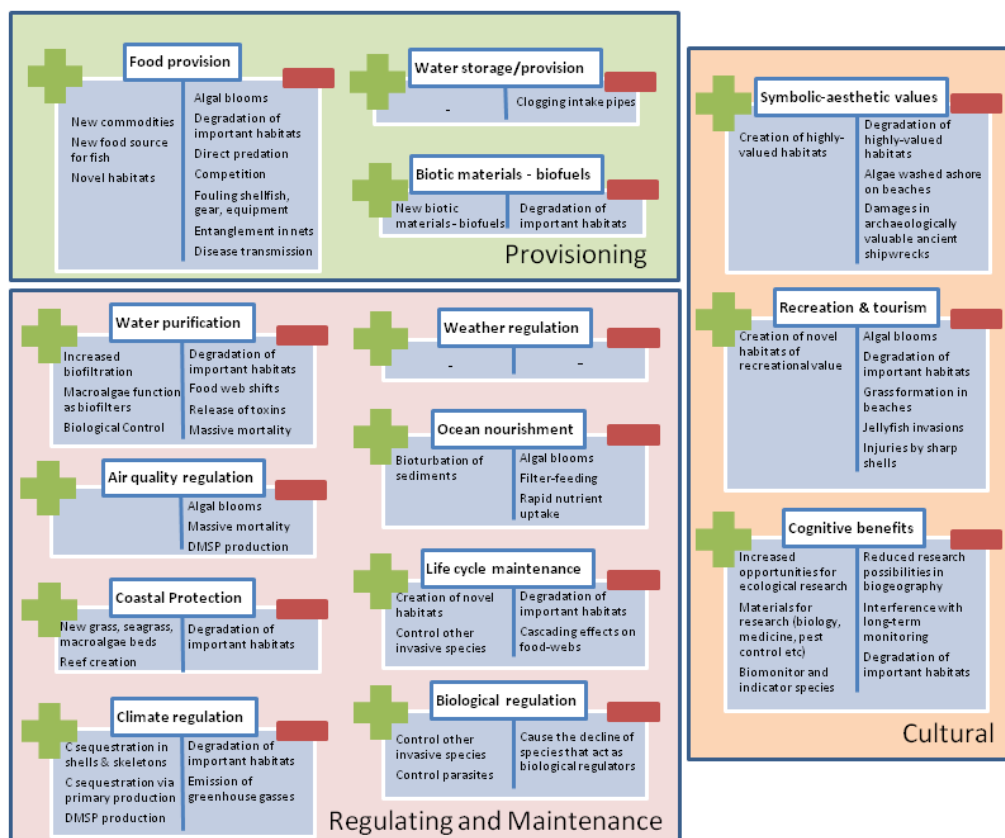


Figure 7: Main mechanisms through which alien species impact ecosystem services (sensu Liqueste et al. 2013). Green cross: positive impacts, Red minus sign: negative impacts. Source: Katsanevakis et al. (2014a).

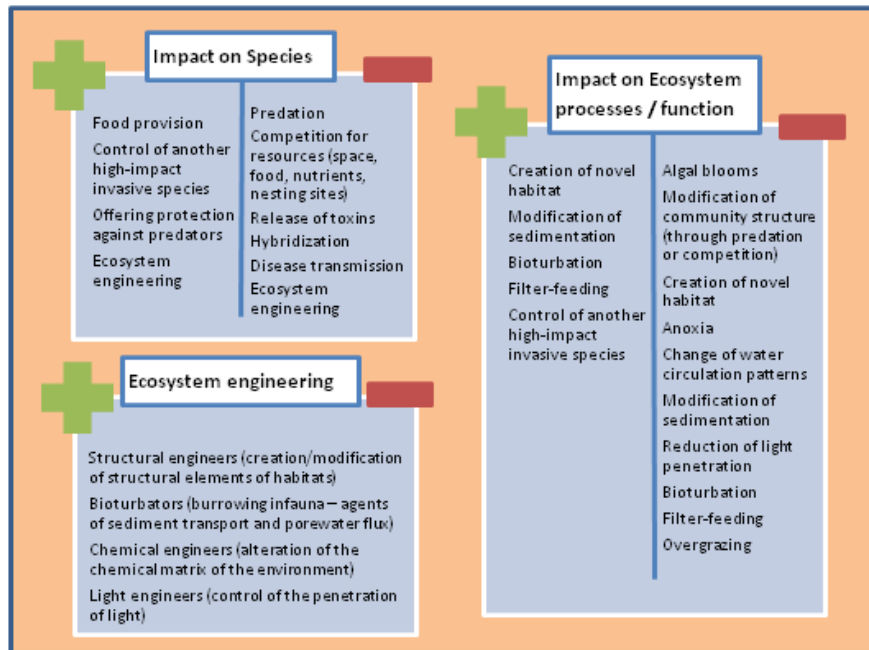


Figure 8: Main mechanisms through which alien species impact biodiversity. Green cross: positive impacts, Red minus sign: negative impacts. Source: Katsanevakis et al. (2014a).

III. Regional Activities carried out in compliance with the 2005-2012 timetable

During the Action Plan's implementation period, RAC/SPA conducted the following activities:

1. Organising a regional workshop on non-native species in the Mediterranean (Rome, 6-7 December 2005)

A workshop on non-native species in the Mediterranean was held on 6-7 December 2005 in Rome, in collaboration with ICRAM. The workshop attracted Mediterranean specialists and representatives from regional and international bodies working on the subject. The workshop's recommendations were:

- (i) Ensure that funding exists to develop an adequate knowledge base (distribution, biology, invasive characteristics, impacts and control options of alien species).
- (ii) Provide assistance for capacity-building related to developing an adequate knowledge base in the region.
- (iii) Provide an open-access, transparent database, balancing scientific rigor with practicability, and timelines, easily accessible through a global database (or linked databases), for receiving and disseminating data.

2. Elaborating technical tools on managing introductions of species into the Mediterranean

At the workshop, draft "Guidelines for checking vectors of introductions of marine non-native species and invasive species into the Mediterranean" and "Guide for the analysis of risks and assessment of impacts of introductions of non-native species" were presented and discussed. These two tools, finalized after debate at the workshop, were submitted for the opinion of the National Focal Points for SPAs at 8th meeting of the Focal Points and were respectively given as UNEP(DEPI)/MED WG:308/11 and UNEP(DEPI)/MED WG:308/12.

3. Implementation of the GloBallast Partnerships Project in collaboration with REMPEC and IMO

The MAP collaborated with IMO through its regional activity centres REMPEC and RAC/SPA in the consultation process that led to the elaboration of the second phase of the GEF-UNDP-IMO GloBallast Partnerships project (Building Partnerships to Assist Developing Countries to Reduce the Transfer of Harmful Aquatic Organisms in Ship's Ballast Water). The GEF Council during its meeting from 12 to 15 June 2007 approved the GEF-UNDP-IMO GloBallast Partnerships (GBP) Project. GBP will be a five year project (2008-2012). REMPEC has been appointed as the Regional Coordinating Organization for the Mediterranean region. RAC/SPA is technically and financially participating in the project by supporting all regional activities and mainly those of relevance to bio-invasions associated with ballast waters transfer. REMPEC and RAC/SPA collaborated in convening the First Regional Task Force Meeting (Dubrovnik, Croatia, 11-12 September 2008) and the Training Course on Port Biological Baseline Survey (Gebze, Turkey, 21-24 October 2008; UNEP(DEPI)/MED WG.331/4).

4. Implementation of the Action Plan on Species Introductions and Invasive Species

Within this framework, RAC/SPA convened from 3-6 February 2008 in Sharm El-Sheikh (Egypt), a Mediterranean Training Course on the Management of Marine and Coastal Invasive Species. About thirty participants from fifteen Mediterranean countries participated in this training. The training provided an improved modular course that has been developed by the UNEP Regional Seas Programme and the Global Invasive Species Programme (GISP).

5. Raising awareness concerning the risks associated with non-indigenous species

RAC/SPA edited two important technical tools that have been elaborated within the Action Plan context: the "Guidelines for Controlling the Vectors of Introduction into the Mediterranean of Non-indigenous Species and Invasive Marine Species" and the "Guide for Risk Analysis assessing the Impacts of the Introduction of Non-indigenous Species".

6. Second GloBallast Regional Task Force Meeting and the Regional Harmonisation Workshop on Management Approaches

RAC/SPA collaborated with REMPEC to organise the 2nd GloBallast Regional Task Force Meeting in Istanbul, Turkey, from 1 to 3 June 2010. The Meeting was devoted to finalizing and approving the regional strategy on managing ballast water and the related Action Plan. REMPEC and RAC/SPA presented a joint note on the progress made in the GloBallast Partnerships project in the Mediterranean region and the Action Plan concerning species introductions and invasive species in the Mediterranean Sea. During the Meeting, the participants agreed on the text of a Mediterranean Strategy on Ships' Ballast Water Management and Invasive Species that was approved by the REMPEC 10th meeting of the Focal Points.

7. Feasibility study of a Marine Alien Invasive Species database to enhance regional and sub-regional mechanisms for data collection and circulation of information on alien species

To improve the collection and circulation of information on non-indigenous marine species, RAC/SPA undertook to assess the feasibility of a regional mechanism for collecting, compiling and circulating information on non-indigenous marine species. This feasibility study goes hand in hand with an operational programme and includes a Mediterranean database and a regional warning system (UNEP(DEPI)/MED WG.359/Inf.9).

8. Strengthening the Regional Mechanism for collecting, compiling and circulating information on invasive non-indigenous species

An Ad-Hoc expert meeting was organized on November 2011 in Tunis to discuss an operational plan for the establishment of a regional mechanism to collect, compile and circulate information on invasive non-indigenous species in the Mediterranean sea, following the feasibility study prepared for the RAC/SPA (see section 7 above).

The structure of a complete and comprehensive mechanism was highlighted with three steps including, among others, national networks for collecting data, a Mediterranean database and a regional warning system (more details are given in the section 9 below).

9. Implementation of the Marine Mediterranean Invasive Alien Species (MAMIAS) database

As provided for by the Action Plan concerning species introduction and invasive species in the Mediterranean Sea, RAC/SPA in collaboration with the Hellenic Centre for Marine Research (HCMR) developed the first version of a regional system for the collection, analysis and dissemination of information on alien and invasive species in line with the feasibility study realised during the last biennium. The online database on marine invasive species in the Mediterranean sea (MAMIAS; www.mamias.org) gives information on invasive non-indigenous species in the Mediterranean (list of alien species, list of marine invasive species, list of vectors, etc) and allows the use of different filters to find required data and retrieve statistics at regional and national level about aliens and invasive species.

The system was already useful for the preparation of a scientific paper on introduced marine species in Croatian waters (Eastern Adriatic Sea) and on the update of the introduced species list in Tunisian waters. The proposal for further development of the system and its promotion in the Mediterranean region is presented in the documents UNEP(DEPI)/MED WG.382/14 and UNEP(DEPI)/MED WG.382/Inf.14.

10. Educational document on alien and invasive species

An educational document on introduced species and invasive species in the Mediterranean region was elaborated in collaboration with Nice University (France). This is intended for the wider public, NGOs and decision-makers. The document was published in English and French.

11. ALBAMONTE project

RAC/SPA funded a rapid assessment survey (ALBAMONTE project) of marine alien species in the Albanian and Montenegrin coasts, jointly with the Hellenic Centre for Marine Research (HCMR), the Association for the Protection of Aquatic Wildlife of Albania (APAWA) and the Institute of Marine Biology of Kotor (IBMK, Montenegro). A total of 31 sites along the Albanian and Montenegrin coastlines were prospected. The study brought the number of known non-indigenous species up from 12 to 20 for Albania and from 6 to 10 for Montenegro.

The occupancy of six alien marine species (*Caulerpa racemosa*, *Percnon gibbesi*, *Ganonema farinosum*, *Lophocladia lallemandii*, *Asparagopsis taxiformis* and *Pinctada radiata*) in the upper infralittoral zone of rocky bottoms across the Ionian–Adriatic border was modelled. A general pattern of declining occupancy from northern Ionian Albanian coastal waters towards the southeastern Adriatic coastline was documented.

A novel methodology for monitoring marine alien species was developed and applied in this study. This method allowed the unbiased modelling of occupancy by co-estimating detectability, based on repetitive surveys of the same sites by different observers and analysing the data by maximum-likelihood techniques. This method was proposed for conducting similar monitoring studies of alien species in coastal waters.

Furthermore, a brochure on exotic species that may well be introduced into the Albanian and Montenegrin Adriatic coasts was prepared in English and translated into Albanian and Serbian and was distributed to fishermen, divers, and NGOs in Albania and Montenegro.

IV. Evaluation of the implementation of the Action Plan at National level

Evaluation of the implementation of the Action Plan at national level on the basis of the national reports and on the basis of questionnaires sent to the Focal Points for SPAs in view of the preparation of the previous report on the progress made in implementing the Action Plan (June 2007) has been reported in UNEP(DEPI)/MED WG.308/Inf.9 and will not be repeated herein.

The present evaluation of the implementation of the Action Plan at national level covers the reporting periods 2010-2011 and 2012-2013 and is based on the relevant national reports of the contracting parties. Eleven national reports were submitted for the period 2010-2011 (by Bosnia-Herzegovina, Croatia, Cyprus, France, Israel, Italy, Monaco, Montenegro, Slovenia, Spain, and Turkey), and 14 reports were submitted for the period 2012-2013 (by Bosnia-Herzegovina, Croatia, Cyprus, European Community, France, Greece, Israel, Italy, Lebanon, Montenegro, Morocco, Slovenia, Spain, and Turkey). In total, 15 contracting parties have submitted reports in at least one of the two reporting periods, while 7 contracting parties did not submit any such report.

In the following analysis, the results of both reporting periods were combined, as the questions relevant to the Action Plan on the introduction of nonindigenous species into the Mediterranean Sea were the same in both reports.

Table 2: Response to the five questions of the questionnaires of the National Reports, regarding the implementation of the Action plan on the introduction of nonindigenous species into the Mediterranean Sea.

	Has the Party adopted legislation to control the introduction of marine species and taken the necessary steps to express in its national laws the provisions of the pertinent international treaties?	Does the Party have an assessment of the situation regarding the introduction of marine species?	Does the Party have a mechanism to monitor and control ballast water discharged into territorial waters?	Has the Party established an action plan to control the introduction of nonnative marine species and mitigate the negative impact of such introduction?	Has the Party developed training and awareness raising programmes on risks, legal aspects, ballast water management, fouling?
Boznia-Herzegovina	no	no	no	no	no
Croatia	yes	in process	yes	no	other
Cyprus	yes	yes	not applicable	other	no
European Community	other	-	-	-	-
France	yes	yes	yes	no	no
Greece	yes	yes	no	no	in process
Israel	in process	yes	in process	in process	in process
Italy	yes	yes	in process	in process	no
Lebanon	no	other	yes	no	no
Monaco	no	yes	no	no	no
Montenegro	yes	no	no	no	no
Morocco	yes	no	yes	no	-
Slovenia	yes	in process	yes	no	no
Spain	yes	yes	-	yes	-
Turkey	in process	yes	in process	no	in process

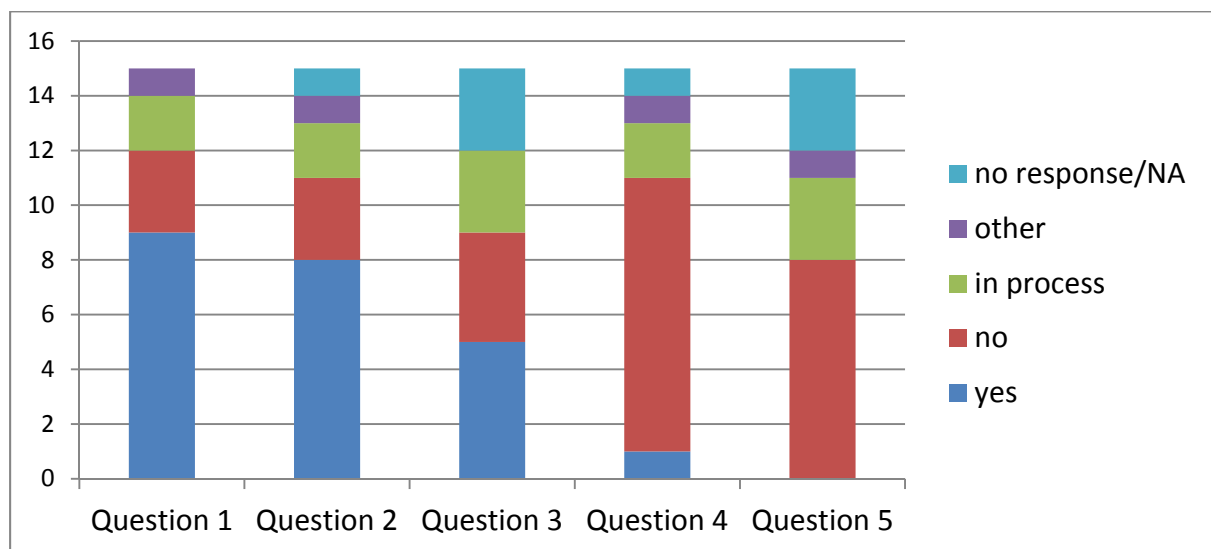


Figure 9: Bar chart of the responses to the five questions of the questionnaires of the National Reports, regarding the implementation of the Action plan on the introduction of nonindigenous species into the Mediterranean Sea.

Has the Party adopted legislation to control the introduction of marine species and taken the necessary steps to express in its national laws the provisions of the pertinent international treaties?

Nine Parties out of fifteen reported that they have adopted legislation to control the introduction of marine species, or are implementing the relevant measures decreed by the European Community. Two Parties reported that actions are being prepared in this field. The adopted new legislative instruments

include the Royal Decree 1628/2011 in Spain, Ministerial Decision No. 3702/76929/2013 in Greece concerning the implementation of the Council Regulation (EC) No 708/2007 on the use of alien and locally absent species in aquaculture, and the Nature protection Act (OG Nos.80/2013) in Croatia.

On the EU level, the new Regulation 1143/2014 on invasive alien species was published in the Official Journal on 4 November 2014, and has entered into force on 1 January 2015. This is beyond the latest SPA and Biodiversity Reporting period, but should be mentioned as it is very relevant and will affect all EU Mediterranean States. This Regulation seeks to address the problem of invasive alien species in a comprehensive manner so as to protect native biodiversity and ecosystem services, as well as to minimize and mitigate the human health or economic impacts that these species can have. The regulation foresees three types of interventions; prevention, early detection and rapid eradication, and management. A list of invasive alien species of Union concern will be drawn up and managed with Member States using risk assessments and scientific evidence.

Does the Party have an assessment of the situation regarding the introduction of marine species?

Eight Parties out of fifteen reported that they have an assessment of the situation concerning the introduction of marine species. One Party replied with “other” but seems to have a relevant monitoring program established. Two of the Parties reported that steps are being taken. Three Parties reported that there was no progress, of which two mentioned the following difficulties/challenges: financial resources, technical capabilities, policy framework, public participation, and administrative/management.

Does the Party have a mechanism to monitor and control ballast water discharged into territorial waters?

Five Parties out of fifteen reported to have a mechanism to monitor and control the discharge of ballast water into their territorial waters. One of them said it has ratified the IMO Convention on the management of ballast waters during the reporting period. One Party stated that this issue is “not applicable”. Two Parties reported that steps are being taken in this aspect.

The most common difficulty/challenge mentioned by the Parties was the lack of financial resources, followed by the need of a policy framework, technical capabilities, and administrative/management.

Has the Party established an action plan to control the introduction of non-native marine species and mitigate the negative impact of such introduction?

Only one Party out of fifteen reported that an Action Plan to control the introduction of non-native marine species has been set up. Two of the parties reported that there is progress in this regard. One Party stated that “mitigation measures after an introduction are futile”. Parties reported the following difficulties/challenges: financial resources, administrative/management, technical capabilities, policy framework.

Has the Party developed training and awareness raising programmes on risks, legal aspects, ballast water management, fouling?

No Party gave a positive answer to this question. Three Parties out of fifteen reported that they have set up a training and awareness programme on the risks linked to the introduction of non-native species and on ways of handling this problem. The most commonly reported difficulty/challenge was the lack of financial resources (by 4 Parties); other difficulties/challenges mentioned include administrative/management, policy framework, and technical capabilities.

V. Conclusions

The last decade our knowledge on alien species in the Mediterranean, their pathways and gateways of introduction, their spatial distribution, and their impacts has been substantially improved through many basin-wide, national, and local studies. However, as new species arrive and the already established species keep expanding their range, continuous efforts for monitoring and reporting are needed. Many Mediterranean countries still lack national inventories of alien species, and the monitoring and reporting efforts vary substantially across the Mediterranean. There are still important gaps in our knowledge on the impacts of alien species on biodiversity and ecosystem services. Most reported impacts are based on weak evidence. Quantification and mapping of impacts is missing, as well as a better understanding of how human pressures facilitate many invasions. RAC/SPA made substantial efforts to support the Action Plan on species introductions and invasive species, especially by initiating the development of the MAMIAS database, providing technical tools and educational documents, raising awareness on the risks associated with alien species, and funding a rapid assessment survey of marine alien species in the Albanian and Montenegrin coasts. Many Contracting Parties made important steps in adopting legislation to control the introduction of alien species, assessing the status regarding biological invasions in their territorial waters, and improving the monitoring and control of ballast waters. However, progress in these issues was not made by all Parties. Most of the Parties have not established national action plans to control the introduction of alien species and mitigate the negative impacts of such introductions, and they have not yet developed training and awareness raising programmes on risks, legal aspects, ballast water management and fouling, as provisioned by the Action Plan. Despite the progress made, much still needs to be done to reach all the objectives set out in the Action Plan.

VI. References

- Anderson LWJ, 2005. California's reaction to *Caulerpa taxifolia*: a model for invasive species rapid response. *Biological Invasions* 7: 1003–1016.
- Bax N, Hayes K, Marshall A, Parry D and Thresher R, 2002. Man-made marinas as sheltered islands for alien marine organisms: establishment and eradication of an alien invasive marine species. In: Veitch CR and Clout MN (eds) *Turning the Tide: the Eradication of Invasive Species*, pp 26–39. Occ. Pap. IUCN Species Survival Commission 27
- Bazairi H, Sghaier YR, Benamer I, Langar H, Pergent G, Bourass EM, Verlaque M, Ben Soussi J, Zenetos A, 2013. Alien marine species of Libya: first inventory and new records in El-Kouf National Park (Cyrenaica) and the neighbouring areas. *Mediterranean Marine Science* 14(2): 451–462.
- Çınar ME, Bilecenoğlu M, Öztürk B, Katağan T, Aysel V, 2005. Alien species on the coasts of Turkey. *Mediterranean Marine Science* 6(2): 119–146
- Çınar ME, Bilecenoğlu M, Öztürk B, Katağan T, Yokes MB, Aysel V, Dağlı E, Açık S, Özcan T, Erdoğan H, 2011. An updated review of alien species on the coasts of Turkey. *Mediterranean Marine Science* 12(2): 257–315.
- Evans J, Barbara J, Schembri PJ, 2015. Updated review of marine alien species and other 'newcomers' recorded from the Maltese Islands (Central Mediterranean). *Mediterranean Marine Science* 16(1): 225–244.
- Galil BS, 2007. Seeing Red: Alien species along the Mediterranean coast of Israel. *Aquatic Invasions* 2(4): 281–312
- Galil BS, 2012. Truth and consequences: the bioinvasion of the Mediterranean Sea. *Integrative Zoology* 7 (3): 299–311.
- Galil BS, Froglija C, Noel PY, 2002. CIESM Atlas of exotic species in the Mediterranean. Vol. 2 Crustaceans: decapods and stomatopods. Monaco, CIESM Publishers, 192 pp.
- Galil BS, Marchini A, Occhipinti-Ambrogi A, Minchin D, Narščius A, Ojaveer H, Olenin S, 2014. International arrivals: widespread bioinvasions in European Seas. *Ethology Ecology and Evolution* 26(2-3): 152–171.
- Galil BS, Boero F, Campbell ML, Carlton JT, Cook E, Fraschetti S, Gollasch S, Hewitt CL, Jelmert A, Macpherson E, Marchini A, McKenzie S, Minchin D, Occhipinti-Ambrogi A, Ojaveer H, Olenin S, Piraino S, Ruiz GM, 2015. 'Double trouble': the expansion of the Suez Canal and marine bioinvasions in the Mediterranean Sea. *Biological Invasions* 17: 973–976.
- Golani D, Orsi-Relini L, Massuti E, Quingnard JP, 2002. CIESM Atlas of exotic species in the Mediterranean. Vol. 1 Fishes. Monaco, CIESM Publishers.
- Hulme PE, Bacher S, Kenis M, Klotz S, Kühn I, Minchin D, Nentwig W, Olenin S, Panov V, Pergl J, Pyšek P, Roques A, Sol D, Solarz W, Vilà M, 2008. Grasping at the routes of biological invasions: a framework for integrating pathways into policy. *Journal of Applied Ecology* 45: 403–414.
- Katsanevakis S, Crocetta F, 2014. Pathways of introduction of marine alien species in European waters and the Mediterranean – A possible undermined role of marine litter. In: F. Briand (ed) CIESM

Workshop Monograph n°46 - Marine litter in the Mediterranean and Black Seas, 180 p., CIESM Publisher, Monaco, pp. 61–68.

- Katsanevakis S, Tsiamis K, Ioannou G, Michailidis N, Zenetos A, 2009. Inventory of alien marine species of Cyprus (2009). *Mediterranean Marine Science* 10(2): 109–133.
- Katsanevakis S, Zenetos A, Belchior C, Cardoso AC, 2013. Invading European Seas: assessing pathways of introduction of marine aliens. *Ocean and Coastal Management* 76: 64–74.
- Katsanevakis S, Wallentinus I, Zenetos A, Leppäkoski E, Çinar ME, Oztürk B, Grabowski M, Golani D, Cardoso AC, 2014a. Impacts of marine invasive alien species on ecosystem services and biodiversity: a pan-European review. *Aquatic Invasions* 9(4): 391–423.
- Katsanevakis S, Coll M, Piroddi C, Steenbeek J, Ben Rais Lasram F, Zenetos A, Cardoso AC, 2014b. Invading the Mediterranean Sea: biodiversity patterns shaped by human activities. *Frontiers in Marine Science* 1:32.
- Katsanevakis S, Deriu I, D'Amico F, Nunes AL, Pelaez Sanchez S, Crocetta F, Arianoutsou M, Bazos I, Christopoulou A, Curto G, Delipetrou P, Kokkoris Y, Panov V, Rabitsch W, Roques A, Scalera R, Shirley SM, Tricarico E, Vannini A, Zenetos A, Zervou S, Zikos A, Cardoso ACC, 2015. European Alien Species Information Network (EASIN): supporting European policies and scientific research. *Management of Biological Invasions*, in press.
- Lipej L, Mavrić B, Orlando-Bonaca M, Malej A, 2012. State of the Art of the Marine Non-Indigenous Flora and Fauna in Slovenia. *Mediterranean Marine Science* 13(2): 243–249.
- Molnar JL, Gamboa RL, Revenga C, Spalding MD, 2008. Assessing the global threat of invasive species to marine biodiversity. *Frontiers in Ecology and the Environment* 6(9): 458–492.
- Nunes AL, Katsanevakis S, Zenetos A, Cardoso AC, 2014. Gateways to alien invasions in the European Seas. *Aquatic Invasions* 9(2): 133–144.
- Occhipinti-Ambrogi A, Marchini A, Cantone G, Castelli A, Chimenz C, Cormaci M, Froglija C, Furnari G, Gambi MC, Giaccone G, Giangrande A, Gravili C, Mastrototaro F, Mazziotti C, Orsi-Relini L, Piraino S, 2011. Alien species along the Italian coasts: an overview. *Biological Invasions* 13: 215–237.
- Pećarević M, Mikuš J, Bratoš Cetinić A, Dulčić J, Čalić M, 2013. Introduced marine species in Croatian waters (Eastern Adriatic Sea). *Mediterranean Marine Science* 14(1): 224–237
- Sciberras, M., Schembri, P.J., 2007. A critical review of records of alien marine species from the Maltese Islands and surrounding waters (Central Mediterranean). *Mediterranean Marine Science* 8 (1): 41–66.
- Trombetti M, Katsanevakis S, Deriu I, Cardoso AC, 2013. EASIN-Lit: a geo-database of published alien species records. *Management of Biological Invasions* 4(3): 261–264.
- UNEP-MAP-RAC/SPA, 2005. Action Plan concerning species introductions and invasive species in the Mediterranean Sea. RAC/SPA, Tunis, 30 pp.
- Verlaque M, Ruitton S, Mineur F, Boudouresque CF, in press. CIESM atlas of exotic species in the Mediterranean. Vol. 4 Macrophytes. Monaco, CIESM Publishers.

- Vilà M, Basnou C, Pyšek P, Josefsson M, Genovesi P, Gollasch S, Nentwig W, Olenin S, Roques A, Roy D, Hulme PE, 2010. How well do we understand the impacts of alien species on ecosystem services? A pan-European, cross-taxa assessment. *Frontiers in Ecology and the Environment* 8(3): 135–144.
- Zenetos A, Gofas S, Russo G, Templado J, 2004. CIESM Atlas of exotic species in the Mediterranean. Vol. 3 Molluscs. Monaco, CIESM Publishers.
- Zenetos A, Pancucci-Papadopoulou MA, Zogaris S, Papastergiadou E, Vardakas L, Aligizaki K, Economou AN, 2009. Aquatic alien species in Greece: tracking sources, patterns and effects on the ecosystem. *Journal of Biological Research-Thessaloniki* 12: 135–172.
- Zenetos A, Katsanevakis S, Poursanidis D, Crocetta F, Damalas D, Apostolopoulos G, Gravili C, Vardala-Theodorou E, Malaquias M, 2011. Marine alien species in Greek Seas: additions and amendments by 2010. *Mediterranean Marine Science* 12(1): 95–120.
- Zenetos A, Gofas S, Verlaque M, Çinar ME, Garcia Raso JE, Bianchi CN, Morri C, Azzurro E, Bilecenoglu M, C. Frogia C, Siokou I, Violanti D, Sfriso A, San Martín G, Giangrande A, Katagan T, Ballesteros E, Ramos-Esplá A, Mastrototaro F, Ocaña O, Zingone A, Gambi MC, Streftaris N, 2010. Alien species in the Mediterranean Sea by 2010. A contribution to the application of European Union's Marine Strategy Framework Directive (MSFD). Part I. Spatial distribution. *Mediterranean Marine Science* 11 (2): 318–493.
- Zenetos A, Gofas S, Morri C, Rosso A, Violanti D, García Raso JE, Çinar ME, Almogi Labin A, Ates AS, Azzuro E, Ballesteros E, Bianchi CN, Bilecenoglu M, Gambi MC, Giangrande A, Gravili C, Hyams-Kaphzan O, Karachle V, Katsanevakis S, Lipej L, Mastrototaro F, Mineur F, Pancucci-Papadopoulou MA, Ramos Esplá A, Salas C, San Martín G, Sfriso A, Streftaris N, Verlaque M, 2012. Alien species in the Mediterranean Sea by 2012. A contribution to the application of European Union's Marine Strategy Framework Directive (MSFD). Part 2. Introduction trends and pathways. *Mediterranean Marine Science* 13(2): 328–352.