3rd Mediterranean Symposium on Ecology and Conservation of Marine and Coastal Bird Species

UN environment programme | Mediterranean Action Plan Barcelona Convention | SPA/RAC

The Specially Protected Areas Regional Activity Center of UNEP/MAP

PROCEEDINGS

Association "Les Amis des Oiseaux" | BirdLife International PARTNER | IUCN | ISPRA Istituto Superiore per la Protezione e la Ricerca Ambientale | Sistema Nazionale per la Protezione dell'Ambiente | Tour du Valat

Disclaimer

Copyright:

United Nations Environment Programme

Mediterranean Action Plan

Specially Protected Areas Regional Activity Centre (SPA/RAC),

Boulevard du Leader Yasser Arafat B.P. 337 - 1080 Tunis Cedex - Tunisia,

car-asp@spa-rac.org

For bibliographic purposes, this document may be cited as:

UNEP/MAP – SPA/RAC, 2025. Proceedings of the Third Mediterranean Symposium on Ecology and Conservation of Marine and Coastal Bird Species (13-15 February 2024, Djerba, Tunisia). Feltrup-Azafzaf C., Baccetti N., Metzger B. J., Ramadan-Jaradi G. and Azafzaf H., edits, SPA/RAC publi., Tunis, 199 p.

Designed by: Hichem Azafzaf

Cover photo: © Benjamin J. Metzger

Unless otherwise noted, photos are © SPA/RAC.

Available from www.spa-rac.org

Specially Protected Areas Regional Activity Centre (SPA/RAC):

The Specially Protected Areas Regional Activity Centre (SPA/RAC) was established in Tunis in 1985 by the contracting Parties to the Barcelona Convention to help Mediterranean countries implement the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol), which came into force in 1999. The Centre works under the umbrella of the Mediterranean Action Plan of the United Nations Environment Programme - Secretariat of the Barcelona Convention, based in Athens, Greece.

The main objective of SPA/RAC is to contribute to the protection, preservation and sustainable management of marine and coastal areas of particular natural and cultural value and threatened and endangered species of flora and fauna in the Mediterranean.

www.spa-rac.org

www.facebook.com/SPARACinfos

Association “Les Amis des Oiseaux” (AAO/BirdLife in Tunisia):

Association "Les Amis des Oiseaux" (AAO/BirdLife in Tunisia) is a Tunisian NGO working for the study, monitoring and protection of bird populations in Tunisia. It carries out conservation programmes for birds and their habitats through awareness-raising, advocacy, research, monitoring, capacity-building, networking, etc.

Over the past twenty years, the organisation is committed to knowledge and conservation of marine and coastal birds, particularly by monitoring populations, key sites and threats (bycatch, pollution, habitat loss, etc.).

Founded in 1975, AAO/BirdLife in Tunisia has integrated national and international networks and is the official Partner of BirdLife International in Tunisia, a member of IUCN and a founding member of both the MedWaterbirds network and the Mediterranean Alliance for Wetlands. It is responsible for the national coordination of the International Waterbird Census (IWC), in partnership with the General Forestry Directorate, and participates, in collaboration with the Ministry of the Environment, in the development and promotion of the national red list of birds. In 2015, it was a co-organiser of the 2nd Symposium on the conservation of marine and coastal birds in the Mediterranean.

www.aao-birdlife.tn

Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA):

ISPRA (Italian Institute for Environmental Protection and Research) is Italy's national public research institute established by Law No. 133/2008 and operates under the supervision of the Italian Ministry for the Environment and Energy Security. ISPRA is part of Italy's National System for Environmental Protection (SNPA).

ISPRA essentially serves as Italy's primary environmental research and monitoring authority, providing scientific expertise to support national environmental policies and international environmental commitments. The Institute performs scientific, technical and research functions as well as assessment, monitoring, control, communication, training and education activities. Research and monitoring activities cover multiple environmental sectors, from terrestrial to marine and water environments, air quality, habitats, ecosystems and fauna.

ISPRA provides technical and scientific support to terrestrial and marine protection policies, including pollution emergency responses, hunting regulations, EU reporting, and supports Italian official delegations in multilateral environmental international agreements.

www.isprambiente.gov.it

www.facebook.com/ISPRAmbiente

IUCN Centre for Mediterranean Cooperation (IUCN Med):

IUCN is a membership Union uniquely composed of both government and civil society organisations, the world's largest and most diverse environmental network, comprising 1,400 Member organisations and 17,000 experts worldwide. As a global biodiversity and sustainable development authority, its mission is to inform and empower conservation efforts worldwide through science-based solutions, policy advocacy, and local community engagement. It facilitates a neutral space in which diverse stakeholders can work together and provides public, private and nongovernmental organisations with the knowledge and tools that enable human progress, economic development and nature conservation to take place together. The IUCN Centre for Mediterranean Cooperation (Malaga, Spain) is one of its regional centres. With over 258 Members in the Mediterranean region, including 14 states, 23 government agencies, and 205 international and national NGOs, its mission is to influence, encourage and assist Mediterranean societies to conserve and sustainably use the region's natural resources and to cooperate with its Members and all other agencies that share IUCN's objectives.

www.iucn.org

www.iucn.org/mediterranean

Tour du Valat
Research institute for the conservation of Mediterranean wetlands

Tour du Valat Research Institute for the Conservation of Mediterranean Wetlands:

The Tour du Valat, located in the heart of the Camargue (southern France), is a private research institute that aims to improve our understanding of Mediterranean wetlands to improve their conservation. Our mission is to generate and share knowledge to strengthen the capacities of stakeholders — such as site managers, users, and scientists — enhance the effective management of these ecosystems, and inform public policy.

Since 2012, Tour du Valat has led the Mediterranean Waterbirds Network, in collaboration with the French Office of Biodiversity. This initiative brings together partners from across the Mediterranean involved in monitoring and conserving waterbirds and wetlands, in support of the Agreement on the Conservation of African-Eurasian Migratory Waterbirds (AEWA).

Tour du Valat also coordinates the International Network for the study and conservation of the Greater Flamingo, a long-term project launched in 1977 by Alan Johnson. It aims to identify the mechanisms driving flamingo population dynamics across their range, mainly in the Mediterranean and West Africa.

www.tourduvalat.org

www.facebook.com/tourduvalat

ECOLOGY AND CONSERVATION OF MARINE AND COASTAL BIRD SPECIES IN THE MEDITERRANEAN

PROCEEDINGS OF THE UNEP/MAP-SPA/RAC SYMPOSIUM, DJERBA – TUNISIA
13 TO 15 FEBRUARY 2024

Editors:

Claudia FELTRUP-AZAFZAF

Nicola BACCETTI

Benjamin J. METZGER

Ghassan RAMADAN-JARADI

Hichem AZAFZAF

FOREWORD
SPA/RAC

The main purpose of the Action Plan for the conservation of bird species listed in the Annex II of the SPA/BD Protocol is to maintain and/or restore their population levels to a favourable conservation status and to ensure their long-term conservation. The Action Plan also aims to contribute to the sharing of knowledge and expertise between the Mediterranean countries and to co-ordinate efforts among them and other relevant initiatives and agreements. It inspired a synergic approach among the Mediterranean countries in the protection of these bird species and their habitats and encourages research to fill the many gaps in our knowledge concerning coastal and pelagic birds in the Mediterranean, particularly their distribution and movements, as well as their feeding, moulting and wintering areas at sea.

The Action Plan for the conservation of bird species was adopted in 2003 and has been assessed and updated twice during 2016-2017 and 2018-2022 to review and ensure the effective implementation of the Action Plan.

The Mediterranean Symposium on Ecology and Conservation of Marine and Coastal Bird Species provides a vital platform for sharing knowledge and promoting collaboration on bird conservation in the region.

The first edition was held in 2005 in Vilanova i la Geltrú, Spain, and the second took place a decade later, in 2015, in Hammamet, Tunisia. Both editions played a catalytic role in inspiring regional and national initiatives to enhance the protection of these vulnerable bird species. The third edition aimed to continue this important work.

The third Symposium took place in February 2024 in Djerba, Tunisia and aimed to review current knowledge on the 25 bird taxa listed in Annex II of the SPA/BD Protocol and to discuss the latest research findings and conservation efforts. Particular attention was given to ongoing conservation challenges, current projects across the Mediterranean, and endeavors to mitigate threats to these species' populations. The symposium offers Mediterranean ornithologists a unique opportunity to exchange information, share experiences, and foster collaboration.

The 3rd edition of the Mediterranean Symposium on Ecology and Conservation of Marine and Coastal Bird Species was co-organized by SPA/RAC and AAO/BirdLife in Tunisia, in partnership with Tour du Valat, ISPRA, and IUCN-Med.

Mahmoud Elyes Hamza

Director of the Specially Protected Areas Regional Activity Centre

FOREWORD
AAO/BIRDLIFE IN TUNISIA

Since the inception of the SPA/BD Protocol of the Barcelona Convention in 1995 — particularly following the adoption of the Action Plan for marine and coastal birds listed in Appendix II — Association "Les Amis des Oiseaux" (AAO/BirdLife in Tunisia) has been committed to the implementation and dissemination of these key instruments for the conservation of avian biodiversity in the Mediterranean.The Mediterranean Symposium on the Ecology and Conservation of marine and coastal bird species has always played a significant role in the promotion of effective networks of seabird researchers, conservation experts, protected area managers, and National Focal Points of the convention. It serves as a platform for the exchange of information and experiences, providing guidance on future research and conservation projects, as well as the ongoing development of the action plan.

While the initial endeavour was to close the knowledge gaps regarding the in Annex II listed species, the focus is increasingly shifting to concrete conservation and protection measures in the face of massive threats such as bycatch, plastic pollution, and climate change. National and sub-regional pilot projects often lead the way for regional initiatives.The regularity and scope of the symposium enable the monitoring of general developments in knowledge and conservation efforts, allowing recommendations for adapting the implementation of the action plan. Participants at the 3rd Mediterranean Symposium on the Ecology and Conservation of Marine and Coastal Bird Species adopted this approach and issued the 'Djerba Declaration' in February 2024.

As the BirdLife International Partner in Tunisia, we are particularly interested in Species Action Plans, such as the Regional Action Plan for the Audouin's Gull presented at the 3rd Symposium. We are also closely following efforts to harmonise different important biodiversity area categories and conservation approaches, and we support the convention's increased attention to coastal waterbirds in the Mediterranean.We feel particularly honoured to have successfully contributed to the organisation of the symposium for the second time thanks to the partnership of the SPA/RAC and the support of the National Focal Point of the Barcelona Convention and regional and national stakeholders. Presenting the proceedings of the 3rd symposium, we would like to thank all participants for their contributions as well as the SPA/RAC team and the members of the scientific and organisational committees.

Sami Rebah

President of the Association "Les Amis des Oiseaux"

CONTENT

THE THIRD MEDITERRENEAN SYMPOSIUM ON ECOLOGY AND CONSERVATION OF MARINE AND COASTAL BIRD SPECIES

Background

The Mediterranean Symposium on Ecology and Conservation of Marine and Coastal Bird Species is an important platform for sharing knowledge and promoting cooperation on bird conservation in the Mediterranean region. Its first two editions, held in 2005 and 2015, helped launch key initiatives to protect bird species at both national and regional levels. With its third edition, the symposium continued to serve as a driving force for conservation efforts across the region.

Symposium objectives

- Knowledge Sharing: Provide a platform for researchers and ornithology experts to share their latest findings, experiences, and exchange ideas.
- Addressing Challenges: Discuss current issues, challenges, and the state of knowledge regarding threats to marine and coastal bird populations.
- Conservation Initiatives: Explore Mediterranean strategies, action plans, and projects to mitigate these threats, ensuring a sustainable future for bird species.
- Research Gaps: Identify research gaps and areas for future study, enhancing our understanding of ecology and conservation of marine and coastal birds.
- Networking and Collaboration: Create opportunities for networking and building partnerships to facilitate the development and implementation of effective conservation strategies.

Organisers

The third edition of the Mediterranean Symposium on Ecology and Conservation of Marine and Coastal Bird Species was co-organised by SPA/RAC and AAO/BirdLife in Tunisia, in partnership with Tour du Valat, ISPRA, and IUCN-Med.

The Action Plan for the conservation of bird species listed in Annex II of the SPA/BD Protocol

In 1995, the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) adopted the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol). Annex II of this Protocol lists the endangered or threatened species found in the Mediterranean. Subsequently, the Parties to the Convention adopted a series of regional Action Plans for the

conservation of one single or groups of species. These include the Action Plan for the conservation of bird species listed in Annex II of the SPA/BD Protocol.

The main purpose of the Action Plan is to maintain and/or restore the population levels of bird species listed in the SPA/BD Protocol's Annex II to a favorable conservation status and to ensure their long-term conservation. The Action Plan also aims to contribute to the sharing of knowledge and expertise between the Mediterranean countries and coordinate efforts among the countries and other relevant initiatives and agreements. It also encourages a synergic approach among the Mediterranean countries in the protection of bird species and their habitats, and research to fill knowledge gaps. Since its adoption in 2003, the Action Plan was assessed and updated three times (2013, 2017 and 2023).

Course and content of the symposium

The third symposium on the ecology and conservation of marine and coastal bird species in the Mediterranean region took place from 13 to 15 February 2024 on the island of Djerba in Tunisia. The symposium was opened by the Minister for the Environment, who stressed the importance of these gathering, the Director of SPA/RAC, the representative of UNEP-MAP and the Governor of Mednine.

The meeting was attended by more than 80 participants from 16 countries. Over the course of the three-day programme, more than sixty papers were presented, forty-three of which were oral presentations. Two additional talks were held, one of which focused on the implementation of the Action Plan for conserving bird species listed in Annex II of the SPA/BD Protocol. The scientific sessions covered the following topics:

- Monitoring and Assessment of Marine and Coastal Birds across the Mediterranean
- Conservation of Mediterranean Seabirds Offshore: research, policy concerning marine protected areas
- Demography of Mediterranean Marine/Coastal Birds and the drivers acting on reproductive success and survival rates
- The Audouin's Gull and its International Single Species Action Plan
- Conservation of Coastal Birds in the Mediterranean

Poster presentations session, birdwatching excursions around the island and a gala dinner also provided many opportunities for networking.

Other highlights of the event included honoring Joan Mayol, Xavier Monbailliu and Mike Smart for their lifelong contribution to the study and conservation of seabirds

and waterbirds of the Mediterranean region, and drafting the 'Djerba Declaration', which summarizes key recommendations for the further development of marine and coastal bird conservation in the Mediterranean.

Recommendations

The following five key areas of recommendations have been formulated and are set out in more detail in the 'Djerba Declaration for the conservation of marine and coastal birds in the Mediterranean' below:

- Recommendation 1: Species Action Plans
- Recommendation 2: Conservation of Small Islands and the Control of Introduced Predators
- Recommendation 3: Bycatch Assessment and Mitigation
- Recommendation 4: Plastic Pollution
- Recommendation 5: Scientific Cooperation, Citizen Science, and the Role of local Authorities

Acknowledgements

The organizers of the Third Mediterranean Symposium on the Ecology and Conservation of Marine and Coastal Bird Species would like to express their sincere gratitude to all participants, the Scientific Committee, and partners for their valuable contributions to the success of the symposium. We sincerely thank the French Voluntary Contribution[1], the Global Environment Facility (GEF)[2] and the IUCN Centre for Mediterranean Cooperation (IUCN Med) for their financial contribution, and Institut de recherche pour la conservation des zones humides méditerranéennes (Tour du Valat) and Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA) for their technical support.

[1] Voluntary contribution made by the Ministry for Europe and Foreign Affairs of France pursuant to a Bilateral Agreement signed between UNEP and the Ministry on 15 July 2022 for the implementation of activities included in the UNEP/MAP Programme of Work. specifically for SPA/RAC supporting the implementation of deliverables under Activity 2.2.2 and 2.2.3

[2] GEF MedProgramme Child Project 3.1. "Management Support and Expansion of Marine Protected Areas in Libya"

DJERBA DECLARATION

3rd Mediterranean Symposium
on Ecology and Conservation
of Marine and Coastal Bird Species

Djerba Declaration

for the conservation of marine and coastal birds in the Mediterranean

Thanks to invitation of the Specially Protected Areas Regional Activities Center (SPA/RAC) of UNEP/MAP and Association "Les Amis des Oiseaux" (AAO/ BirdLife in Tunisia), scientists and experts actively involved in the conservation of Mediterranean coastal and marine birds have gathered in Djerba, Tunisia, on 13-15 February 2024 for the Third Mediterranean Symposium on Ecology and Conservation of Marine and Coastal Bird Species.

The participants agreed on the following conclusions and recommendations. First, improvements since the Second Symposium hold in 2015 in Hammamet, Tunisia, are acknowledged:

- All Contracting Parties to the Barcelona Convention have elaborated the legal protection of all coastal and marine birds species listed in Annex II (List of endangered and threatened species) of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol), even though the related application varies and few are benefiting from National Action Plans devoted to their conservation.
- A number of Contracting Parties have protected part of the breeding and/or feeding habitats of these species by the designation of protected areas that can enter the network of Specially Protected Areas and Biological Diversity in the Mediterranean or are on the way to do so, even if effective implementation of dedicated management plans are often lacking for these protected areas.
- Increasingly, conservation efforts are extended from coastal areas (colonies, wetlands) to the offshore environment, where some of the most threatened species also face severe threats such as bycatch, pollution, overfishing, effects of climate change, and the expected development of wind farms.

- A Quality Status Report (2023 MED QSR) has been conducted at SPA/RAC request for 11 indicator species belonging to 6 functional ecological groups of marine birds, together with the identification and assessment of the main pressures impacting the population dynamics of these species.
- The deep involvement of national and international NGOs and research institutions has led to major improvements in the knowledge on distribution, abundance and trends of breeding populations as well as non-breeding distribution and movements at sea, plus increased knowledge on their threats, even if much more is needed.
- The single species Action Plan for Audouin's Gull has been progressing. Many of the proposed conservation actions were implemented in several countries that were included in the original SAP.
- The increasing participation of the society through actions of "Citizen Science" are much appreciated improvements that can still be further developed.

This being deeply acknowledged, the participants would like to put forward the following recommendations:

Recommendation 1 – SPECIES ACTION PLANS

In order to strengthen the conservation of coastal and marine seabird species, SPA/RAC is requested to:

1. promote the elaboration of non-binding Action Plans (APs) at the Mediterranean scale for coastal and marine bird species listed under Annex II, and to
2. invite the Contracting Parties to elaborate and implement National Action Plans (NAPs) in line with the regional guidelines and the IMAP strategy (UNEP/MAP Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast). Training sessions on the implementation of NAPs could be proposed by SPA/RAC and its partners to concerned people in areas without experience in the elaboration of such documents.

Priority could be given to the elaboration of a rescue AP for the Osprey *Pandion haliaetus*, an endangered species in the Mediterranean, for which re-introduction procedures have been effectively developed that could be applied in most parts of the Mediterranean basin.

Also, attention should be urgently given to the recently described new taxon *levantinus* of the Little Tern *Sternula albifrons* breeding along the Egyptian and Libyan coastline. Its population seemingly is very small and its breeding sites are under strong pressure from human activities. SPA/RAC is called to support surveys

to gather more information on its distribution along the eastern Mediterranean coast and its genetic relationship with the little terns breeding elsewhere in the area. Depending on these relationships, *levantinus* may be a clear candidate to be added to the Annex II of the SPA/BD Protocol.

Species classified as threatened at global level by IUCN should also receive priority, and information should be gathered to allow a proper re-assessment of their status.

Lastly, it must be stressed that monitoring of long time series is of great informative value for the evaluation of population trends, as can be repeatable proxies (e.g. rafts of birds congregating at sea) when information on the number of breeding pairs is not available or realistically achievable. Population studies may also be valuable to assess trends for species that are difficult to count in their colonies, such as shearwaters and storm-petrels. Also, relatively widespread species are possibly more informative on pressures like disturbance, than ultra-rare species. This might suggest in future the opportunity to add species such as the Common Tern *Sterna hirundo* and Eurasian Curlew *Numenius arquata* to the Annex II of the SPA/BD Protocol.

Recommendation 2 – CONSERVATION IMPORTANCE OF SMALL ISLANDS AND LIMITATION OF INTRODUCED PREDATORS

Small, often uninhabited, islands and islets are of the greatest importance as breeding places for many of the most endangered species listed under Annex II of the SPA/BD Protocol. Many such islands remain unprotected and birds breeding there often are under pressure from disturbance by human activities (leisure, poaching) and predation by introduced species (mostly rats and cats).

Contracting Parties should be invited to improve the legal protection status and management of these important breeding sites. When introduced predators are present, the implementation of their eradication should be of the highest priority. In order to keep islands free from introduced predators (naturally predator free islands and islets, as well as those where introduced predators had been removed and that have an elevated risk of re-incursion), Contracting Parties should be invited to prepare and implement bio-security protocols for these important breeding sites.

Recommendation 3 – BY-CATCH ASSESSMENT AND MITIGATION

Seabirds are at risk of being caught by or entangled in various fishing gears. This cause of accidental mortality is more often diffuse although it can be locally/temporally high, and may be easily overlooked. Its impact on population demography is acknowledged to be high to very high for some species, particularly shearwaters.

Thanks to the joint effort of fisheries and conservation organisations, research institutions, governmental bodies and local authorities, fishermen and local communities, the situations when significant by-catch of seabirds occurs are increasingly understood, and ways to mitigate this problem are being developed. However, several potential knowledge gaps remain, and action to implement mitigation measures whenever necessary is urgently needed; most remains to be done.

Contracting Parties are requested to continue:

- Assessing incidental catches of coastal and marine birds,
- Identifying and testing mitigation techniques,
- Raising awareness on the topic and supporting policy advocacy.

A collaborative approach among all parties involved is essential.

For some fisheries, such as small-scale demersal longlines, a fraction of the captures involves the recovery of live birds: it is needed to invest in capacity building for fishermen to properly handle and release these birds in the best possible condition.

Recommendation 4 – PLASTIC POLLUTION

The Mediterranean Sea unfortunately is identified as one of the most plastic polluted water bodies on our planet. Plastic debris occurs under various forms which causes the death of many seabirds directly (entanglement) or impact their survival and/or productive capacity (e.g. internal wounds and repro-toxicity due to ingested micro-plastics).

Contracting Parties are strongly invited to maintain and develop their on-going efforts to reduce and prevent the introduction of plastic debris in the sea, whatever their origin (industrial waste, rubbish dumps, individual neglect, disused fishing gears, etc.).

Recommendation 5 – SCIENTIFIC COOPERATION, CITIZEN SCIENCE AND THE IMPORTANCE OF LOCAL AUTHORITIES' INVOLVEMENT

Recent improvements in the knowledge and understanding of the seabirds movements at sea, particularly shearwaters, have strongly benefited from cooperation with NGOs and research institutions from different countries. Such cooperation, including North-South collaboration, should be promoted whenever possible. Improved cooperation should also help the coordination of research projects, and direct them towards the most meaningful conservation outcomes.

Recent improvements in understanding population status have also benefited from increased involvement of amateur naturalists and the concerned public through «Citizen Science» programs. These programs, which greatly contribute to the acceptance of conservation measures, should be encouraged, and the resulting new information should be used to feed the awareness activities.

Being aware of the important role of local authorities throughout the Mediterranean in the local management of coastal and marine ecosystems and small islands, SPA/RAC is invited to extend technical guidance to local authorities about nature conservation, planning procedures and management plans of threatened ecosystems. Local authorities, however, often lack scientific and technical knowledge and advice on how to safeguard coastal and seabird habitats. Yet, they are eager to receive some vital information, and this, not only in English, but in their languages.

The organization of this 3rd Mediterranean Symposium on Ecology and Conservation of Marine and Coastal Bird Species has benefited from the technical assistance of IUCN Med, ISPRA (Italy) and Tour-du-Valat Biological Station (France), and financial support from the French Voluntary Contribution and the Global Environment Facility.

THE MEDBIRDS AWARDS

On the occasion of the 3rd Mediterranean Symposium on Ecology and Conservation of Marine and Coastal Bird Species, UNEP/MAP- SPA/RAC launched the 'MedBirds Awards' to honour lifelong contributions to the conservation of seabirds and shorebirds in the Mediterranean region.

This initiative acknowledges and rewards scientific achievements and celebrates collaborative networks that play a vital role in conserving the Mediterranean Sea and its biodiversity.

For this first edition of the MedBirds Awards, the jury honoured:

Michael Smart, United Kingdom - for his continuous dedication to Mediterranean waterbirds since the times of the Ramsar conference and for being at the intersections of countless connections between former, present and future ornithologists, especially in North Africa.

Xavier Monbailliu, France - for being the father of the Medmaravis association, which, since 1984, has promoted research and conservation of Mediterranean ecosystems and has brought together more than 500 marine biologists, ornithologists and conservationists from across the region.

Joan Mayol, Spain – who, as one of the lucky discoverers of the very first large colony of Audouin's Gull, has promoted the value of islands and the fight against alien species from his distinguished position in governmental roles.

The award ceremony was held in a hybrid format, with Xavier Monbailliu and Joan Mayol in attendance and Mike Smart joining via video link. The speeches of the jury and the honourees provided an opportunity to reflect on the recent history of seabird research and marine conservation in the Mediterranean, while also looking to the future. The award consists of a certificate and a bird sculpture made of driftwood by the Tunisian artist Ali Gharbi (www.facebook.com/gharbiclient).

PROGRAMME

Tuesday 13 February 2024

07:30 – 12:30 Excursions *(Ras Rmal and Djerbahood & Guellala coast and museum)*

12:30 – 14:00 Lunch

14:00 – 15:30 Official Opening

15:30 – 17:30 Session 1 of oral presentations: Monitoring and Assessment of Marine and Coastal Birds across the Mediterranean - Chair: **Abdulmaula HAMZA**

- Assessing seabird populations across the Mediterranean – SPA/RAC's MED QSR 2023 chapter on Marine Birds – Presented by: **Benjamin J. METZGER (Key speaker)**
- Current Status of Audouin's Gull *Ichthyaetus audouinii* and Mediterranean Storm Petrel *Hydrobates pelagicus melitensis* in Türkiye – Presented by: **Luc Ortaç ONMUS**
- National Assessment for Maritime and Coastal Bird Species of Lebanon – Presented by: **Fouad ITANI**
- Status of breeding seabirds on the Mediterranean coast of Egypt from 2012 till 2022 – Presented by: **Mohamed HABIB**
- Advancing Mediterranean Seabird Conservation: A Collaborative Approach and Integrated Monitoring Initiatives – Presented by: **Samar KILANI**
- Recent data on the status and distribution of breeding marine and coastal birds in Algeria – Presented by: **Riadh MOULAÏ**

17h30 – 18:00 Coffee break

18:00 – 18:30 SPA/RAC side event: The Mediterranean Action Plan for the conservation of bird species listed in the Annex II of the SPA/BD Protocol: What has been done so far? What still needs to be done? – Facilitated by **Lobna BEN NAKHLA**

Wednesday 14 February 2024

09:00 – 10:30 Session 2 of oral presentations: Conservation of Mediterranean Seabirds Offshore: research, policy concerning marine protected areas - Chair: **Jelena KRALJ**

- Conservation of Mediterranean Seabirds Offshore: where are we? – Presented by: **José Manuel ARCOS** (Key speaker)
- The pre-laying movements of shearwaters in the Mediterranean - Considerations for offshore protection throughout the breeding season – Presented by: **Marie Claire GATT**
- Drivers of sex-specific foraging behaviour during reproduction in marine top predators of the genus *Calonectris* across their global distribution – Presented by: **Marie Claire GATT**
- Tracking migration of adults and juveniles of a pelagic seabird endemic to the Mediterranean: the Yelkouan Shearwater *Puffinus yelkouan* – Presented by: **Loriane MENDEZ**
- The French National Action Plan for the Balearic Shearwater – Presented by: **Adrien LAMBRECHTS**

10:30 – 11:00 Coffee break

11:00 – 12:00 Session 2 continued

- Preliminary data of offshore seabird monitoring in the Northern Ionian Sea (Central Mediterranean Sea) – Presented by: **Nicola BACCETTI**
- Steps towards marine SPAs implementation in the Italian seas – Presented by: **Nicola BACCETTI**
- Self-reporting logbooks to collect seabird bycatch data: case study in the western Mediterranean Sea – Presented by: **José Manuel ARCOS**
- Filling the gap: improving knowledge of the impact of marine debris on Mediterranean seabirds by combining ingestion of marine debris with exposure to plasticisers – Presented by: **Matteo BAINI**

12:00 – 12:30 Poster session

12:30 – 13:30 Lunch

13:30 – 14:45 Session 3 of oral presentations: Demography of Mediterranean Marine/Coastal Birds and the drivers acting on reproductive success and survival rates - Chair: **Nicola BACCETTI**

- Marine birds in the Balearic Islands 38 years after the Alghero conference – Presented by: **Joan MAYOL**
- The Conservation status of the Balearic shearwater: an update – Presented by: **José Manuel ARCOS**

- Conservation status of the Mediterranean shag *Gulosus aristotelis desmarestii* in the Adriatic Sea during the non-breeding period: baseline population, trends, threats and knowledge gaps – Presented by: **Davide SCRIDEL**
- Foraging ranges and breeding success of Common Terns in the Adriatic Sea – Presented by: **Jelena KRALJ**
- Assessment of fishing gears interactions on bird species in the Alboran Sea (West coast of Algeria) – Presented by: **Ahmed INAL**

14:45 – 15:15 Coffee break & Poster session

15:15 – 16:45 Session 3 continued

- Bycatch monitoring in the Gulf of Gabes (GSA 14): impact of fisheries on seabirds – Presented by: **Samira ENAJJAR**
- Evaluation of toxicological effects of an oil spill on off the Cap Corse (France): chemical analysis and biomarkers on Puffinus yelkouan Population – Presented by: **Ilaria CALIANI**
- Prevalence and abundance of Nest Incorporated Debris of European Shags *Phalacrocorax aristotelis desmarestii* at Gara Island, Libya – Presented by: **Abdulmaula HAMZA**
- First assessment of marine litter in marine and coastal birds collected in Tunisia shoreline – Presented by: **Aida ABDENNADHER**
- Gulls, Terns, and Skuas of the Mediterranean coast of Türkiye: Species, their distributions and long-term population dynamics – Presented by: **Luc Ortaç ONMUS**
- As a sharing of experience: MedBycatch in Turkey – Presented by: **Denizcan DURGUN**

16:45 – 17:00 Break

17:00 – 18:00 MEDMARAVIS side event: MEDMARAVIS' revival: is a dedicated association possible/needed in the current scenario of seabirds' conservation in the Mediterranean? – Facilitated by: **Nicola BACCETTI**

Thursday 15 February 2024

09:00 – 10:30 Session 4 of oral presentations: The Audouin's Gull and its International Single Species Action Plan - Chair: **Marie Claire GATT**

- Review of the Implementation of the Species Action Plan for Audouin's Gull – Presented by: **Nuno OLIVEIRA** (Key speaker)
- Evaluation of Audouin's Gull Species Action Plan – Threats and conservation actions – Presented by: **Tânia NASCIMENTO**
- The Audouin's Gull in Catalonia: shifts from pristine dunes to rooftops and Harbours – Presented by: **Martí Franch RODRIGUEZ**
- New records of Audouin's Gull breeding colonies in Tunisia – Presented by: **Aida ABDENNADHER**

10:30 – 10:45 Coffee break

10:45 – 11:30 Session 4 continued

- Comparative analysis of the Audouin's gull *Larus audouinii* and the Yellow-legged Gull's *Larus michahellis* trophic ecology breeding in the Zembra Archipelago – Presented by: **Intissar THABET**
- Evolution and Distribution of wintering Audouin's Gull in Morocco (1983-2023) – Presented by: **Khadija BOURASS**
- Future collaboration for the monitoring of new breeding colonies of *L. audouinii* in Tunisia using IMAP Protocol – Presented by: **Mathieu THEVENET**

11:30 – 12:30 Poster session

12:30 – 13:30 Lunch

13:30 – 14:45 Session 5 of oral presentations: Conservation of Coastal Birds in the Mediterranean - Chair: **Laura DAMI**

- The Breeding Ecology of Kentish Plover in Tunisia – Presented by: **Hela BOUGHDIRI**
- Which wetlands should be protected in Tunisia to effectively secure wintering and stop over sites for the Kentish Plover *Charadrius a. alexandrinus* - Mid-winter counts 2002-2021 – Presented by: **Hichem AZAFZAF**
- Waders of the Mediterranean coast of Türkiye: Species, their distributions and long-term population dynamics – Presented by: **Bulut OKUMUSOGLU**
- Impact of breeding site management on the conservation of larids in southern France – Presented by: **Yves KAYSER**
- Overview on the population trend of the Greater Flamingo in North Africa and the breeding population in the Mediterranean Region – Presented by: **Laura DAMI**

14:45 – 15:15 Coffee break

15:15 – 17:00 Session 5 continued

- The birds of the island of Djerba: attempt at description and geographical Interpretation – Presented by: **Abdelfettah KASSAH**
- Osprey Conservation: A Comprehensive Plan for Safeguarding Ospreys and Marine Avifauna in Al Hoceima National Park – Presented by: **Houssine NIBANI**
- Breeding status of Eleonora's Falcon *Falco eleonorae* and irruptions of Razorbill *Alca torda* on the Mediterranean coast of Algeria – Presented by: **Abdelkrim SI BECHIR**
- Impact of fishing activities on seabirds in the coastal Mediterranean lagoons – Presented by: **Sahar MEHANNA**
- An update on the status of the Lesser Crested Tern colonies in Libya: field ringing campaign at Gara Island – Presented by: **Abdulmaula HAMZA**

16:00 – 17:00 Break

17:00 – 18:00 Symposium recommendations, MedBirds Award ceremony & closure

ORAL COMMUNICATIONS

FIRST ASSESSMENT OF MARINE LITTER IN MARINE AND COASTAL BIRDS COLLECTED ON THE TUNISIAN SHORELINE

Aida Abdennadher[1], Héla Jaziri[2], Emna Derouiche[2], Hamdi Ben Boubaker[2] and Sana Ben Ismail[2]

[1] Specially Protected Areas Regional Activity Centre (SPA/RAC), aida.abdennadher@spa-rac.org ; a.abdennadher@gmail.com
[2] National Institute of Marine Science and Technologies (INSTM)

Abstract

As part of SPA/RAC's Work Programme 2019-2021 and the EU's COMMON Project coordinated by the INSTM, we analysed litter contents in stomachs of marine and coastal birds, collected along the Tunisian coastline. The study included a sample of ten corpses of five different species and revealed the alarming prevalence of 60% of plastic debris. It is important to point out that the species involved use different foraging habitats. Both species of shearwaters (Calonectris diomedea and Puffinus yelkouan) actively forage on pelagic fish, mainly in offshore areas. The Great Crested Grebe (Podiceps cristatus) and Little Egret (Egretta garzetta) are mainly piscivorous species of littoral and coastal areas. In some cases, the state of the corpses prevented a proper collection of the debris due to the decomposition of the tractus. It is therefore likely that the quantities of plastic debris found were underestimated. The number of particles per bird appears to be greater in species that feed in the littoral/coastal zone, in particular in egrets, grebes and yellow-legged gulls. However, due to the small sample size, these results should be treated with caution. A study with a larger number of samples is needed to allow a more accurate and conclusive comparison of marine litter found in different species and their respective habitats.

Key-words: seabirds, marine litter, plastic, Tunisia

Introduction

Marine plastic pollution is an environmental contaminant of significant concern. Seabirds are particularly vulnerable to ingesting marine plastic as most of them feed close to the oceans' surface which is the zone where marine plastics occur at a high density (Cadée 2002). The prevalence of plastic ingestion varies following marine birds' foraging strategies (such as surface-feeders or deep-water diving feeders) even when feeding in the same area (Provencher *et al.* 2010). Seabirds are severely impacted, with 39% of 312 species ingesting marine debris (Gall and Thompson 2015). Ingestion of marine debris has been recorded in almost half of the world's seabird's species and in most oceanographic regions (Moore 2008).

To date, the only seabird species for which a published, standardized protocol has been adopted to assess plastic ingestion is the Northern Fulmar *Fulmarus glacialis* (Van Franeker and Law 2015; Provencher *et al.* 2019). For other species, a lack of consistency in sample collection and processing is still preventing meta-analyses and large-scale comparisons

The study at hand was conducted within the framework of SPA/RAC's Work Programme 2019-2021 and the EU's COMMON (Coastal Management and Monitoring Network for tackling marine litter in the Mediterranean Sea) project to contribute to evaluating the stomach contents of seabirds and aquatic birds stranded on the Tunisian coast for plastic debris.

Materials and methods

Corpses collection

The study was based on a methodology that involved establishing a network to monitor seabird strandings by engaging with and raising awareness among NGOs across the Tunisian coast. Corpses were collected with the help and assistance of local NGOs involved in marine biodiversity conservation along the Tunisian coast. Sampling was conducted through active beach surveys and incidental discoveries, with information subsequently communicated and transferred. Corpses were stored in a bag and transferred to the Marine Environment Laboratory at the National Institute of Marine Science and Technology of Tunisia (Salammbô).

Biometrics

From each individual we took the standard biometrics: weight, bill depth, head length, culmen length, tarsus length and wing length (right). Information on collection date, location and the name of the person who collected the bird. All information was annotated in the standardised dissection form (Van Franeker 2004).

Dissection and plastic debris extraction

Carcasses were opened along the sternum, and the gastrointestinal tract (GIT) was removed from the oesophagus to the cloaca for examination of ingested items. Ingested plastic content was extracted from each stomach following the protocol for monitoring plastic ingestion by Northern Fulmars (Van Franeker 2004). GIT was washed in a series of sieves with respective mesh sizes 5 mm, 1 mm and 0.3 mm diameter. The debris on the first two sieves were collected with tweezers and stored in Petri dishes (see figure 1). The debris on the 0.3 mm mesh were rinsed and collected in glass bottles for subsequent digestion (if necessary) and further microplastics analysis.

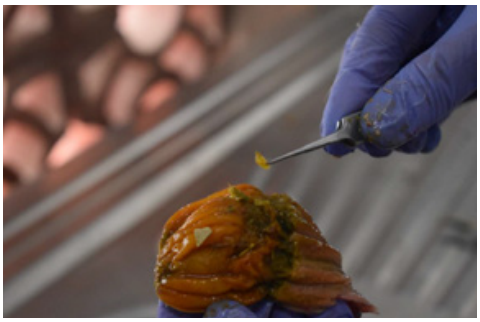
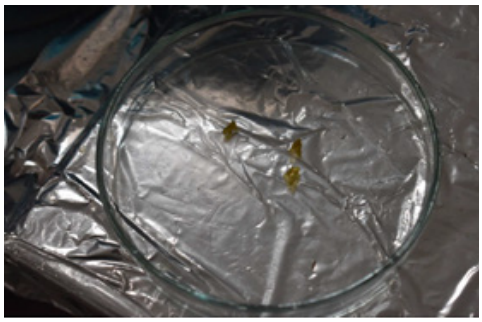



Figure 1. a) Collection of debris from the GIT; b) Storage of debris in Petri dish for microscopic analysis ©INSTM-COMMON Project / Hamdi Ben Boubaker

Plastic debris analysis

The presence of microplastics (MPs) was determined under a stereomicroscope (Olympus SZX7, 8x-56x) with attached digital camera and coupled to image analysis software Zen – ZEISS. All potential particle items were manually sorted out from the sample and categorized by colour, shape (fragment, fiber, pellet, film and foam) and size. Then, polymer identification for each item was carried out using a PerkinElmer Spectrum Two Fourier Transform Infrared (FT-IR) spectrometer.

Results

Collected species

Ten individuals from five species have been collected in the framework of this preliminary study (Tab. 1)

Table 1. List of the beached birds collected in the framework of this study

Species	Scientific name	Location	Number of individuals
Great Crested Grebe	*Podiceps cristatus*	Bizerte	1
Scopoli's Shearwater	*Calonectris diomedea*	Gulf of Gabès	3
Yelkouan Shearwater	*Puffinus yelkouan*	Gulf of Gabès	1
Yellow-legged Gull	*Larus michahellis*	Kuriat Island	4
Little Egret	*Egretta garzetta*	Ariana	1

Biometrics

For each individual, morphometric characteristics were measured. Details per individual are given in the table below (Tab. 2).

Table 2. Morphometric characteristics of the collected beached birds

Species	Culmen (cm)	Bill depth (cm)	Head length (cm)	Tarsus length (cm)	Wing lenght (cm)	Weight (gr)
Yellow-legged Gull	6.22	1.93	11.95	5.13	43.50	905
Yellow-legged Gull	6.14	2.11	12.47	3.90	43.00	685
Yellow-legged Gull	6.32	1.75	11.42	5.91	43.50	305
Yellow-legged Gull	7.53	2.02	12.39	6.75	45.33	850
Mean value	***6.55***	***1.95***	***12.06***	***5.42***	***43.83***	***686.25***
Great Crested Grebe	6.64	1.35	9.69	6.03	17.50	1,000
Scopoli's Shearwater	5.84	1.61	9.82	5.27	33.60	800
Scopoli's Shearwater	8.04	2.29	11.05	5.94	34.30	525
Scopoli's Shearwater	7.00	1.96	13.00	5.37	36.00	860
Mean value	***6.96***	***1.96***	***11.29***	***5.53***	***34.63***	***728.33***
Yelkouan Shearwater	4.50	16.50	8.90	4.58	22.30	410
Little Egret	10.02	2.07	15.00	10.73	28.00	300

Plastic analysis

Calculation of the prevalence revealed that 60% of the corpses collected contained plastic fragments in their digestive tract. The average number of these fragments was 1.8 per individual. The total weight of the fragments per bird ranged from 0.4 mg to 15.6 mg. Details are shown in the table below (Tab. 3).

Table 3. Plastic content in each analysed GIT

Species	Location	Frequency of occurrence	Number of fragments	Weight (mg)
Yellow-legged Gull	Kuriat	0	0	-
Yellow-legged Gull	Kuriat	1	2	0.4
Yellow-legged Gull	Kuriat	0	0	-
Yellow-legged Gull	Kuriat	1	3	5.2
Yelkouan Shearwater	Gulf of Gabès	0	0	
Scopoli's Shearwater	Gulf of Gabès	1	2	
Scopoli's Shearwater	Gulf of Gabès	0	0	
Scopoli's Shearwater	Gulf of Gabès	1	1	
Great crested Grebe	Bizerte	1	5	15.6
Little Egret	Ariana	1	5	2.1
Total		6		
%OF		60%	1.8	

The most recurrent polymers found were nylon and polypropylene. However, detailed results of the plastic analyses will be presented separately in a future publication.

Discussion and conclusion

For a sample of ten carcasses, including five different species, the prevalence of 60% plastic debris appears alarming. It is important to note that these species have different diets and trophic habits: the Yellow-legged Gull *Larus michahellis* feeds offshore, on fishing discards as well as on landfills (Abdennadher *et al.* 2010; Abdennadher *et al.* 2014). The two species of shearwaters are active pelagic foragers that feed only offshore (Phillips and Hamer 2008). The Great Crested Grebe and the Little Egret are coastal and littoral species, primarily piscivorous (Abdennadher *et al.* 2010). The state of decomposition of some of the collected carcasses prevented the effective collection of debris due to the decomposition and/or fragility of the digestive tract. It is therefore likely that the amount of plastic debris found are overall underestimated. The number of particles appears to be higher in species that forage in littoral and/or coastal areas, notably the Little Egret, the Great Crested Grebe, and the Yellow-legged Gull. However, given the small sample sizes, these results should be treated with caution when drawing conclusions. A study with a larger sample size is necessary to confirm these preliminary findings in relation to species and their respective foraging habitats.

The protocol for microplastic analysis used was based on the initial monitoring manuals for plastic in beached Northern Fulmars *Fulmarus-glacialis* under the OSPAR commission and has been refined to suit the case of stomach contents from seabirds. At the National Institute of Marine Science and Technologies (INSTM), we have improved the protocol for better results of digestion and sediment content release to increase the recovery rate of microplastic content. The improved protocol and its results will be the subject of a future scientific publication. The development of a specific protocol for plastic assessments in Mediterranean seabirds is highly recommended.

Acknowledgements

We would like to extend our thanks and gratitude to all NGOs participating in the study: Abysse Plongée, Notre Grand Bleu (NGB), Association de Sauvegarde des Zones Humides du Sud Tunisien (ASZHST), and Association Tunisea pour la Science Participative for their dedication, commitment, and volunteer support for this project. This study has also highlighted the importance of citizen science in data collection and support for scientific research.

References

Abdennadher, A., Ramírez, F., Romdhane, M.S., Jover, L. and Sanpera, C., 2014. Using a Three-Isotope Bayesian Mixing Model to Assess the Contribution of Refuse Dumps in the Diet of Yellow-legged Gull *Larus Michahellis*. Ardeola,

61(2), pp. 297-309. doi: 10.13157/arla.61.2.2014.297.

Abdennadher, A., Ramírez, F., Romdhane, M.S., Ruiz, X., Jover, L. and Sanpera, C., 2010. Biomonitoring of Coastal Areas in Tunisia: Stable Isotope and Trace Element Analysis in the Yellow-legged Gull. Marine Pollution Bulletin, 60(3), pp. 440-447. doi: 10.1016/J.MARPOLBUL.2009.10.003.

Abdennadher, A., Ramírez, F., Romdhane, M.S., Ruiz, X., Jover, L., Sanpera, C., 2010. Little Egret (*Egretta garzetta*) as a Bioindicator of Trace Element Pollution in Tunisian Aquatic Ecosystems. Environmental Monitoring and Assessment 2011, 175(1), pp. 677-684. doi: 10.1007/S10661-010-1560-Y.

Cadée, G.C., 2002. Seabirds and Floating Plastic Debris. Marine Pollution Bulletin, 44(11), pp. 1294-1295. doi: 10.1016/S0025-326X(02)00264-3.

Gall, S.C. and Thompson, R.C., 2015. The Impact of Debris on Marine Life. Marine Pollution Bulletin, 92(1–2), pp.170-179. doi: 10.1016/J.MARPOLBUL.2014.12.041.

Moore, C.J., 2008. Synthetic Polymers in the Marine Environment: A Rapidly Increasing, Long-Term Threat. Environmental Research, 108(2), pp. 131-139. doi: 10.1016/J.ENVRES.2008.07.025.

Phillips, R.A. and Hamer, K.C., 2008. Growth and Provisioning Strategies of Northern Fulmars *Fulmarus glacialis*. Ibis, 142(3), pp. 435-445. doi: 10.1111/j.1474-919X.2000.tb04440.x.

Provencher, J.F., Borrelle, S.B., Bond, A.L., Lavers, J.L., van Franeker, J.A., Kühn, S., Hammer, S., Avery-Gomm, S. and Mallory M.L., 2019. Recommended Best Practices for Plastic and Litter Ingestion Studies in Marine Birds: Collection, Processing, and Reporting. Facets, 4(1), pp. 111-130.

Provencher, J.F., Gaston, A.J., Mallory, M.L., O'hara, P. D. and Grant Gilchrist, H., 2010. Ingested Plastic in a Diving Seabird, the Thick-Billed Murre (*Uria lomvia*), in the Eastern Canadian Arctic. Marine Pollution Bulletin, 60(9), pp. 1406-1411.doi:10.1016/J.MARPOLBUL.2010.05.017.

Van Franeker, J.A., 2004. Save the North Sea Fulmar Manual Part 1: Collection and Dissection Procedures. Alterra-Rapport 672, 40 pp.

Van Franeker, J.A. and Law, K.L., 2015. Seabirds, Gyres and Global Trends in Plastic Pollution. Environmental Pollution, 203, pp. 89-96. doi:10.1016/j.envpol.2015.02.034.

WHICH WETLANDS SHOULD BE PROTECTED IN TUNISIA TO EFFECTIVELY SECURE WINTERING AND STOP OVER SITES FOR THE KENTISH PLOVER (CHARADRIUS A. ALEXANDRINUS) - MID-WINTER COUNTS 2002-2021

Hichem Azafzaf[1], Sami Rebah[1], Claudia Feltrup-Azafzaf[1], Moujib Gabous[1], Samar Kilani[1], Laura Dami[2] & Yves Kayser[2]

[1] Association "Les Amis des Oiseaux" (AAO/BirdLife in Tunisia), Ariana, Tunisia, azafzaf@gmail.com
[2] Institut de recherche pour la conservation des zones humides méditerranéennes Tour du Valat (TDV), Le Sambuc, France.

Abstract

This study analyses data collected during the winters from 2002 to 2021 in over 237 Tunisian wetlands. It shows the changes in annual abundance of the Kentish Plover (Charadrius a. alexandrinus) during these years, the spatial distribution and fluctuations of the species and gives a trend estimation for 20 years while using 20 covariates in an imputation model. These abiotic habitat variables are known to influence the presence and numbers of Kentish Plovers in Tunisian wetlands. Furthermore, this paper draws attention to the most important wetlands (wintering areas and stopover sites) in need of effective protection to sustainably secure at least 90% of the wintering population of the species in Tunisia.

Key-words: *Charadrius a. alexandrinus*, annual abundance, spatial distribution, trend, Tunisia

Introduction

Waders in Tunisia include 54 species of which 32 are regularly observed, the other 22 species, are only recorded occasionally or very rarely. Few, if any, detailed studies of the ecology of the Kentish Plover *Charadrius a. alexandrinus* (Fig. 1) in Tunisia are available. The species is common in Tunisia's wetlands, mostly on the coast and observed throughout the year. The phenological status of individuals sighted in the country may be that of a resident breeder, passage visitor or winter visitor (Isenmann *et al.* 2005; Azafzaf *et al.* 2015). The Kentish Plover is protected by the national law and is one of the 25 species considered in the Action Plan for the Conservation of Bird Species listed in Annex II to the SPA/BD Protocol (UNEP/MAP-RAC/SPA 2003; UNEP/MAP-SPA/RAC 2017) of the Barcelona Convention.

Materials and methods

The data and analysis used in this study are mainly based on the results of the International Waterbird Census (IWC) collected by volunteers of Association "Les Amis des Oiseaux" (AAO/BirdLife in Tunisia) during the winters 2002-2021 through direct observation of waterbirds and following the protocol established by Wetlands International (WI) for the IWC. During the twenty-year study period, almost 240 sites

Figure 1. Kentish Plovers *Charadrius a. alexandrinus*, adult, January 6, 2022, Sebkhet Kalaat El Andalous, Tunisia. © Hichem Azafzaf.

were visited at least once. (Azafzaf and Feltrup-Azafzaf 2004; Feltrup-Azafzaf and Azafzaf 2008; Azafzaf *et al.* 2020; Azafzaf *et al.* 2023), with count dates mainly between 1 and 31 January of each year (at a time when the spatial distribution of populations is relatively stable). In some years, however, there were no January counts at some sites, so the count data from the beginning of February was used.

The Ramsar Convention criterion 6 was used to identify sites of international importance, and for sites of national importance the threshold was calculated using the average of the wintering population in Tunisia over 10 years (2012-2021).

The classic method of analysing time series data is not easily applicable to series where observations are missing as some sites were not visited during the entire period. In this study, the data collected during 2002-2019 was used to calculate the trend, and we opted to use the input technique to fill in the gaps and obtain a series at regular intervals using the R package LORI.

Furthermore, we used 20 habitat covariates (Tab. 1), known to influence the presence and abundance of Kentish Plovers, in an imputation model.

Results

Annual abundance

Annual abundance of wintering Kentish Plovers in Tunisia have fluctuated between 2002 and 2021, with a minimum of 176 individuals observed at 3 sites in 2002 and a maximum of 13,861 individuals observed at 64 sites in 2011 (Fig. 2), with a national average of 5,470

individuals. Some major concentrations of the species were noted during these two decades: 11,000 individuals in January 2011, and 4,000 individuals observed in January 2007 both in the Kneïss Islands, 1,619 individuals in January 2009 in the Salines de Thyna IBA, 1,000 individuals in January 2021 in the Béjou plain. The increase in the national total in January 2011 to 13,861 individuals with a major concentration of 11,000 individuals in the Kneïss Islands remains unexplained.

Origin & spatial distribution

The origin of Kentish Plovers occurring in Tunisia during winter is unclear. Despite the huge number of Kentish Plovers ringed here since 1962 (more than 10,000 individuals) only one recovery is available from Algeria (Arnould and Lachaux 1974). For birds ringed outside Tunisia, only data from a bird hatched in May 2012 in Ukraine and controlled in October 2012 in the Gulf of Gabes (Hamza *et al.* 2014) were found. The many recaptures show only local or short-distance movements (Arnould and Lachaux 1974). This could indicate that a considerable part of the breeding population is resident, and the influx of foreign birds is limited (Delany *et al.* 2009). The Kentish Plovers are mainly recorded in the coastal zones of central and southern Tunisia, notably in the Gulf of Gabes, which is unique in the Mediterranean for its tidal range of up to two metres. Up to 11,000 individuals were observed in one locality wintering or on passage through this shallow tidal flat area. They are also observed on a regular basis, albeit in lesser numbers, in the oasis wetlands around Douz, Kebili and in freshwater habitats in north Tunisia (Maps 1 & 2).

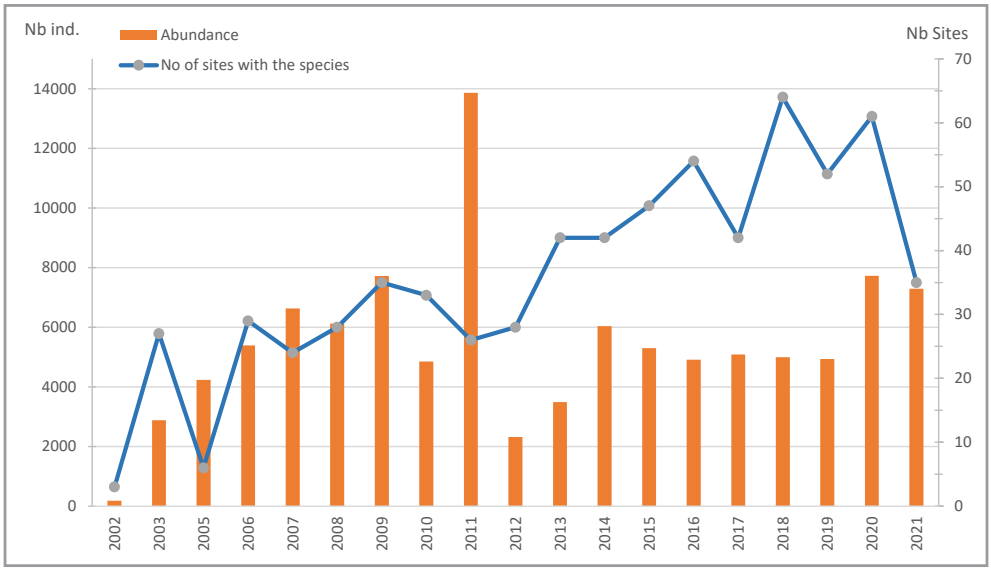
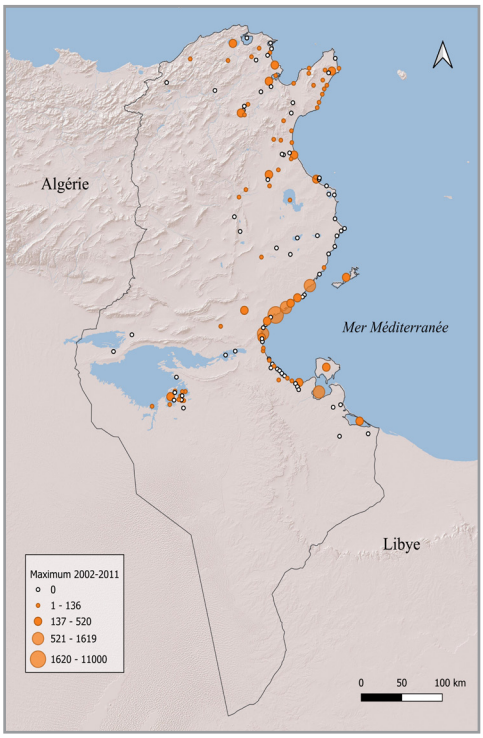
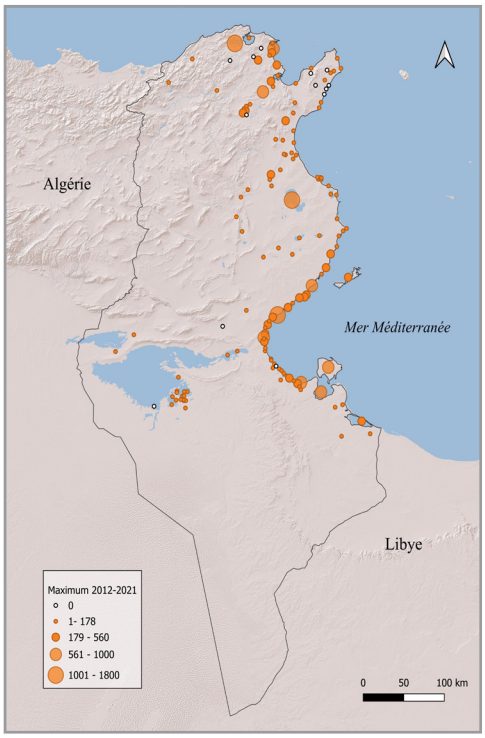


Figure 2. Annual abundance of the Kentish Plovers *Charadrius a. alexandrinus* in Tunisia during winters 2002-2021.



Map 1. Abundance and distribution of the Kentish Plover during the winters of 2002-2011



Map 2. Abundance and distribution of the Kentish Plover during the winters of 2012-2021

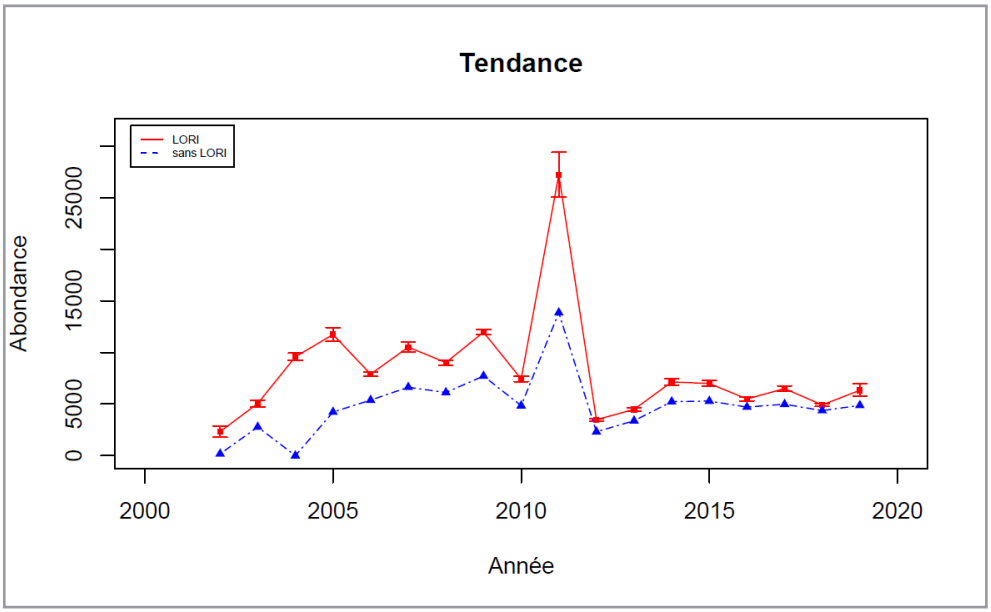


Figure 3. Trends of the Kentish Plover wintering population in Tunisia: estimated annual abundance by multiple imputation in LORI is shown in red, the annual abundance in blue.

Population trends

The result of the time series analysis in LORI is shown in Fig. 3 and suggests that the wintering population is underestimated and could probably be higher in some years. Furthermore, the trend is slightly negative when we compare the two periods 2002-2011 and 2012-2019, with a significant drop in 2012. This negative trend is linked to the loss and degradation of the Kentish Plover's key natural habitats and follows the Flyway trend analyses which is based on data from the African-Eurasian Waterbird Census from the period of 1967-2018 and shows a negative trend for the Kentish Plover population in West Europe & West Mediterranean (Wetlands International 2018).

Habitat Covariates

Five covariates seem to have effects on the occurrence of the wintering of the Kentish Plover in Tunisia (Fig. 4). Three covariates, the latitude, the distance to the coast and the typology of the wetland, especially if it is an artificial wetland (dam), have negative effects on the occurrence of the species. Two temporal covariates, the t_wint_SW (temperature anomaly in south-western Europe) and rainfall, seem to have positive effects on the occurrence of the species. However, the t_wint_SW should be treated with caution, given the lack of precise information on the origin of Kentish Plovers wintering in Tunisia.

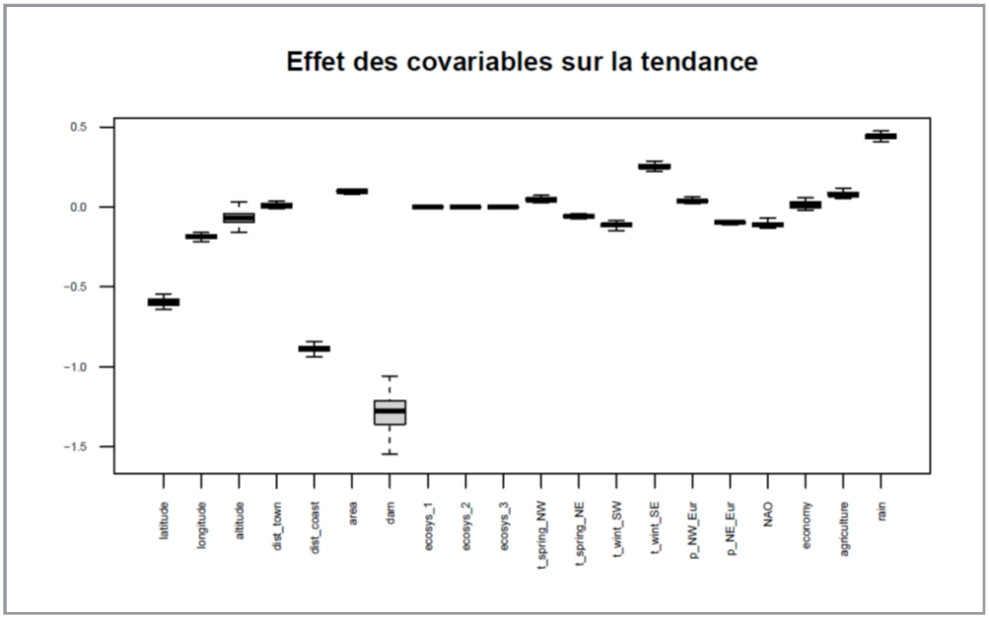


Figure 4. Covariates used in the statistical model LORI

Table 1. Description of the covariates used

Covariates	Name	Description
Spatial covariates	Latitude	Latitude coordinates on the centroids of the surveyed sites
	Longitude	Longitude coordinates on the centroids of the surveyed sites
	Alt	Mean of the altitude values located under the polygon of each site
	Dist_towns	Distance between sites and the nearest city
	Dist_coast	Distance between sites and the coastline
	Area	Maximum water extent, i.e. water area of each site ever detected as water between 1984 and 2018
	Ecosystems[1][1]	Raster of the Global Ecological Land Units (ELUs) describing ecosystemic units
	Dam	Information about whether the site is a dam
Temporal covariates	Spring NW anomalies	Departure from a reference value or long-term temperature average in the North-West of Europe, in the spring (April to July) of year n-1[2].[2]
	Spring NE anomalies	Same than previously but in the North-East part of Europe
	Winter SW anomalies	Departure from a reference value or long-term temperature average in the North-West of Europe, in the winter (August year n-1 to January year n), per year n
	Winter SE anomalies	Same as previous but in the South-East part of Europe
	p_NW_Europe	Average precipitation in North-West Europe in the spring, year n-1
	p_NE_Europe	Average precipitation in North-East Europe in the spring, year n-1
	NAO	Irregular fluctuation of atmospheric pressure over the North Atlantic Ocean that has a strong effect on winter weather in Europe
Spatio-temporal covariates	Agriculture	Percentage of farmland per year and per country. These lands include croplands used for perennial crops or permanent pasture areas, for temporal ones or set-aside lands.
		GDP Growth (Gross Domestic Product) per country and per year. The GDP growth rate is the most important indicator of economic health. When the economy is expanding, the GDP growth rate is positive. If it's growing, so will businesses, jobs and personal income. If the GDP growth rate turns negative, then the country's economy is in a recession.
	Rain	Amount of winter precipitation (August year n-1 to February year n) per site and per year n (1990 to 2017)[3][3]

1 Raster of the Global Ecological Units (ELUs) describing ecosystemic units, using three categories.
2 For example, April to July 1989 for a survey in winter 1990 that takes place from December 1989 to January 1990.
3 If a site surveyed in February during particular year, the amount of precipitation is calculated from August (year-1) to January (year n) for this site and this year. The same method is applied if the site is surveyed in December: we take into account the precipitation from August to December.

The most important sites to protect the Kentish Plover

The Kentish Plover was recorded at 142 sites during the monitoring period 2002-2021. Fig. 5 shows that 44 sites alone are home to 90% of the wintering population. These wetlands require effective protection, but currently only 14 sites have some level of formal protection. To meet Ramsar Convention criterion 6, a wetland must regularly support at least 1% of a waterbird species' or subspecies' population. For the *Charadrius a. alexandrinus* population, 1% equates to 666 individuals. During the study period, only the Kneiss Islands — an Important Bird Area (IBA) and Key Biodiversity Area (KBA), as well as a national nature reserve — met criterion 6. During the same period, 27 sites met the threshold of 88 individuals, representing 1% of the national population (see Tab. 2).

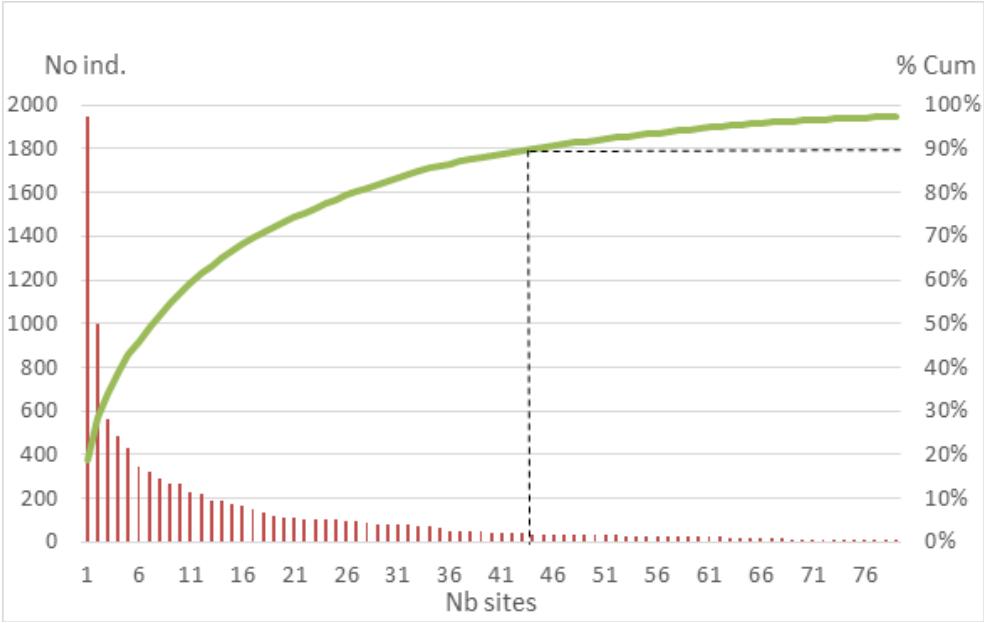


Figure 5. Average Kentish Plover numbers and cumulative percentages, 2002-2021.

Table 2. Sites of international & national importance for the conservation of the Kentish Plover in Tunisia

Kentish Plover	*Charadrius a. alexandrinus*																					
Years	**2002**	**2003**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**Min**	**Max**	**Avg**
Sites of international importance																						
Îles Kneïss		690	3,400	2,900	4,000	3,618	3,168	147	11,000	20	760	1,800	605	42	713	320	523	1,248	154	20	11,000	1,950
Sites of national importance																						
Plaine de Béjou																			1,000	1,000	1,000	1,000
Côte Port Zaboussa - Port Skhira																560				560	560	560
Port de Kalaat El Andalous											400			268		812		630	301	268	812	482
Salines de Thyna	150	254	420	519	192	641	1,619	407	548	232	228	948	98	200	249	471	837	48	51	48	1,619	427
El Grine				420	22	0	350	253		0		523	365	922	30	160	459	947	355	0	947	343
Oued Maltine				44	850	613	741	985	447	0	25	141	96	62	152	101	0	350	484	0	985	318
Îles de Jerba		15		520	82	0	39	294		150	35	145	135	834	377	574	499	363	568	0	834	289
Lagune de Boughrara				30	0	37	116	831		87	78	272	144	337	827	296	196	89	683	0	831	268
Côte Nakta												530							0	0	530	265
Parc National de l'Ichkeul	0	10	0	27	60	0	268	109		22	99	67	1,459	162	1,042	77	50	10	602	0	1,459	226
Plage de Chaffar											132		519				4	225		4	519	220
Sebkhet Dreïaa		0		0	360	26	22	256	876	145	82	296	74	101	20	230	543	150	50	0	876	190
Côte Melloulech - Sidi Mansour																	3	543	19	3	543	188
Sebkhet Ariana		80		200		282		370			124		22	260	1	64			300	1	370	170
Lac Collinaire Mabtouha											98							230		98	230	164
Sebkhet Sidi el Hani				22		0		5	7		15	0	2				12	34	1387	0	1,387	148
Îles Kerkennah	23	43	158	66	340	255	311	120	126	122	27	29	97	41	126	101		262	162	23	340	134
Oued Akarit et son Estuaire		475		0	0	5	2	126	26	18	36		23	60	811	79	10	150	70	0	811	118
Lagune El Bibene				17	300	24	27	29		538	54	17	28	383	0	135	6	13		0	538	112
Sidi Mansour				136			121		93	30	2	10		56	11	78	300	119	376	2	376	111
Côte El Nadhour - village Bou Said												27		5		89	31	473	0	0	473	104
Sebkhet Kourzia II											0		216	0	0		400		0	0	400	103
Oued Echaaba											326		86	132	29	5	0	190	40	0	326	101
Leymaoua Village															99					99	99	99
Sebkhet Dar Bel Ouar																			97	97	97	97
Plage de Mahres		0					148	37	67		8	73	258	6	145	86	43	0	176	0	258	81
Sebkhet Kalaat El Andalous						65		13		295			4					0	91	0	295	78

Discussion and conclusion

Time series analysis using LORI suggests that the number of Kentish Plovers wintering in Tunisia is underestimated, which is probably true given that this species rarely congregates and can be observed far from water or in small ephemera streams. The wintering population of the Kentish Plovers in Tunisia has a negative trend and requires special monitoring of the breeding and wintering population. Additional efforts and research should be made to understand the origin of the individuals observed in Tunisia and to confirm whether individuals from the West Europe & West Mediterranean/ West Africa population are wintering in Tunisia (Wetlands International 2025).

The origin of the 11,000 individuals, which is twice the national average, observed in 2011 in the Kneïss islands remains unknown, a similar observation, nearly 6,000 individuals in only one site, was made in 1995 at Merja Zerga wetland in Morocco (Dakki *et al.* 2001).

Acknowledgements

We would like to thank the AAO/BirdLife in Tunisia volunteers and staff, who have contributed to the rigorous collection of data on wintering waterbirds in Tunisia. We would also like to thank Tour du Valat and SPA/RAC for their contribution to strengthening the Mediterranean Waterbird Network.

References

Amari, M. and Azafzaf, H., 2001. Tunisia. In: L.D.C. Fishpool & M.I. Evans, eds – Important Bird Areas in Africa and associated islands: Priority sites for Conservation. Newbury and Cambridge, U.K.: Pisces Publications and BirdLife International (BirdLife Conservation Series No 11), pp. 953-973.

Arnould, M. and Lachaux, M., 1974. Baguage, Reprise et Contrôle en Tunisie, 1967-1971. Station de recherche ornithologiques de Rades. Institut de Recherches Scientifique et Techniques. Université de Tunis, Tunisie.

Azafzaf, H. and Feltrup-Azafzaf, C., 2004. Recensement hivernal des oiseaux d'eau en Tunisie - Janvier 2003. Rapport du Groupe Tunisien d'Ornithologie au sein de l'Association "Les Amis des Oiseaux", Ariana, 14 pp.

Azafzaf, H., Dlensi, H., Feltrup-Azafzaf, C. and Isenmann, P., 2015. Quelques Nouvelles Données sur L'Avifaune de Tunisie (2005-2014). Alauda, 83(1), 2015, pp. 7-28.

Azafzaf, H., Kilani, S. and Feltrup-Azafzaf, C., 2020. Le dénombrement international d'oiseaux d'eau (DIOE) en Tunisie: 2009-2018. Rapport de l'Association "Les Amis des Oiseaux" (AAO/BirdLife en Tunisie) et du Réseau Medwaterbirds, Tour du Valat (TDV), Tunis, pp. 12.

Azafzaf, H., Gabous, M. and Feltrup-Azafzaf, C., 2023. Le dénombrement international d'oiseaux d'eau (DIOE) en

Tunisie-Janvier 2023. Association "Les Amis des Oiseaux" (AAO/BirdLife en Tunisie), Ariana.

Dakki, M., Qninba, A., El Agbani, M., Benhoussa, A. and Beaubrun, P., 2001. Waders wintering in Morocco: national population estimates, trends and Site-assessments. Wader Study Group Bulletin, 96(2001).

Delany, S., Scott, D., Dodman, T. and Stroud, D. (eds.), 2009. An Atlas of Wader Populations in Africa and Western Eurasia. Wetlands International, Wageningen, The Netherlands.

Feltrup-Azafzaf, C. and Azafzaf, H., 2008. Recensement hivernal des oiseaux d'eau en Tunisie – Janvier 2008. Association "Les Amis des Oiseaux", Ariana.

Hamza, F., Hammouda, A., Chokri, M.A., Bechet, A. and Selmi, S., 2014. Distribution and abundance of Greater Flamingos *Phoenicopterus roseus* wintering in the central part of the Gulf of Gabès, Tunisia. Alauda 82 (2), pp. 135-142.

Isenmann, P., Gaultier, T., El Hili, A., Azafzaf, H., Dlensi, H. & Smart, M., 2005. Oiseaux de Tunisie - Birds of Tunisia. SEOF (eds.), Paris, 432 pp.

UNEP/MAP-RAC/SPA, 2003. Action Plan for the Conservation of bird species listed in Annex II of the Protocol concerning Specially Protected Areas (SPAs), and Biological Diversity in the Mediterranean. Ed. RAC/SPA, Tunis, 8 pp.

UNEP MAP-SPA/RAC, 2017. Draft updated Action Plan for the Conservation of Marine and Coastal Bird Species listed in Annex II of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean. By: Hichem Azafzaf and Joe Sultana. Ed: SPA/RAC, Tunis, 37 pp.

Wetlands International, 2025. IWC trend analysis for the AEWA Conservation Status Report, online dashboard.

BREEDING AND WINTERING POPULATION TRENDS OF THE GREATER FLAMINGO IN THE MEDITERRANEAN OVER A 30-YEAR PERIOD (1990-2021).

Laura Dami[1], Wed Abdou[2], Antoine Arnaud[1], Hichem Azafzaf [3], Arnaud Béchet [2], Nadjiba Bendjedda[4], Khalil Baddour[1], Mohamed Dakki[5], Ugoline Godeau[1], Khaled Etayeb [6]

[1] Tour du Valat, Institut de recherche pour la conservation des zones humides méditerranéennes, Le Sambuc, 13200 Arles, France, dami@tourduvalat.org
[2] Egyptian Environmental Affairs Agency, 30 Misr/Helwan Road, PO 11728, El Maadi Helwan, Egypt
[3] Association "Les Amis des Oiseaux" (AAO/BirdLife en Tunisie), 14, Rue Ibn El Heni, 2ème étage – Bureau N° 4, 2080 Ariana, Tunisia
[4] Direction Générale des Forêts, Ben Aknoun, Alger, Algeria
[5] Scientific Institute, Mohammed V University of Rabat, Av. Ibn Battota, 10106 Rabat-Agdal, Morocco
[6] Zoology Department, Faculty of Science, The University of Tripoli, Alfornaj, P.o.Box: 13227, Tripoli, Libya

Abstract

The Greater Flamingo (Phoenicopterus roseus) is listed in the appendices of several international conservation agreements including the Barcelona Convention. We combined 30 years of data from the International Waterbird Censuses (IWC) across North Africa, coordinated by the Mediterranean Waterbirds Network (MWN), with over 30 years of monitoring by the "The Network for the study and conservation of the Greater Flamingos in the Mediterranean and West Africa" to assess trends of the species in the Mediterranean basin. Wintering bird count data were analysed using a new statistical approach called LORI, while breeding data were summarized through descriptive analyses. The number of breeding pairs in the Camargue, as well as across the broader Mediterranean region, has generally increased over the past few decades. A similar trend has been observed for wintering flamingos in North Africa. In the last five years, both breeding and wintering populations appear to stabilize despite important fluctuations from year to year. Strengthening the link between breeding and wintering monitoring networks could provide critical insights into emerging trends and underlying causes of these changes.

Key-words: Greater Flamingo, Mediterranean region, trends, breeding populations

Introduction

The Greater Flamingo *Phoenicopterus roseus* is listed in the appendices of several international conservation agreements including the Bern Convention (1979), the Bonn Convention (1983), the EU Birds Directive (79/409/EEC), and the Barcelona Convention (1976). It exhibits a widespread distribution with an estimated population exceeding half a million individuals worldwide. This population is distributed across various regions, including West Africa (estimated

at 45,000–90,000 individuals), South Africa (around 50,000), East Africa (approximately 35,000), the Mediterranean (around 200,000), and the Middle East and Southeast Asia (around 200,000) (Béchet *et al.* 2017).

In the Mediterranean, flamingos are partial migrants, with individuals flying southward from European sites to winter in North African wetlands, while others remain in Europe, particularly in countries where winter is mild (Sanz-Aguilar *et al.* 2012). Mediterranean and West African flamingos constitute a single metapopulation because of substantial rates of natal and breeding dispersal among colonies of the region (Balkız *et al.* 2007; Diawara *et al.* 2007; Johnson and Cezilly 2007).

Despite this widespread population, the Greater Flamingo remains a fragile and vulnerable species, with few breeding sites in the Mediterranean (<20) and highly variable breeding success. The Greater flamingo does not tolerate any disturbance during incubation and until the chick leaves the nest, otherwise the adults will abandon the colony. Numerous cases of human or animal disturbance have been documented (Johnson and Cézilly 2007). Nesting sites remain threatened by urbanization and water management practices, such as the diversion of water for irrigation (Béchet 2017). If climate change would contribute, as some models predict, to a rise in the level of the Mediterranean Sea, this would expose some of these sites to submersion with unpredictable effects on the dynamics of this population (Verniest *et al.* 2023).

In the north of the Mediterranean, the Greater Flamingo has benefited from several conservation efforts which have consisted in building and securing breeding islands, either in France (Johnson 1982) or in Spain (Rendón-Martos *et al.* 1996). Even if this has resulted in increasing breeding frequency and productivity of the species in the last 40 years locally (Béchet *et al.* 2012), the effect on the overall trend of the species' population in the Mediterranean has remained undocumented.

Since 2002, coordinated monitoring of nesting colonies across the Mediterranean has been conducted through the Network for the study and conservation of the Greater Flamingo (Béchet *et al.* 2006). This initiative involves recording breeding pairs and chicks fledged at ten to 20 key sites to track trends in the breeding success of the species in the Mediterranean region. Flamingos have also been counted in North Africa during the International Waterbird Census (IWC). This monitoring program, which covers more than 140 countries, collects crucial data on waterbird populations in wetlands, helping to identify trends and inform national management policies and international agreements such as AEWA and Ramsar Convention (Delany 2005; van Roomen *et al.* 2011; Wetlands International 2014; Nagy and Langendoen 2020). Here, we present

trends in Greater Flamingo breeding numbers in the Mediterranean region over a 30-year period (1990-2021) together with wintering trends in North Africa over the same period.

Materials and methods

Breeding numbers in the Mediterranean and West Africa

Each year from 1990 to 2002, the Flamingo Specialist Group encouraged thorough efforts across the Mediterranean to identify all possible flamingo breeding sites. In 2002, the initiation of the Network for the study and conservation of the Greater Flamingo in the Mediterranean and West Africa, allowed to consolidate historical data and members of the network were committed to send breeding surveys of their site to Tour du Valat as the coordinator of the network. Once a breeding site was found, the number of breeding pairs and the number of chicks fledged were recorded using either estimate from the ground or count on pictures made from a plane or a drone depending on the sites. Counts of breeding pairs were generally made in May, when peak numbers (as suggested by field observations) were incubating and the crèches were counted ~15 days before the first chicks fledged when they are no longer vulnerable to predation (Béchet and Johnson 2008). Here, we make the assumption that no major breeding site were missed over the Mediterranean basin during the 30 years of the survey (1990-2021) so that no particular correction was necessary for computing trends.

Wintering numbers in the Mediterranean

The IWC in North Africa experienced low participation prior to 2012. In response, the Mediterranean Waterbird Network (MWN) was established to enhance both the quantity and quality of waterbird monitoring across the region. This collaborative network, involving the five North African countries, the Tour du Valat (serving as the network coordinator), and the Office Français de la Biodiversité (French Biodiversity Office), facilitated the development of training tools, secured funding to support fieldwork, and promoted research efforts across North Africa (Nagy *et al.* 2015; Mediterranean Waterbirds Network 2024).

Limited human and technical resources have for long constrained national networks to perform regular and comprehensive censuses, particularly in remote wetlands spanning thousands of kilometres (Dakki *et al.* 2001; Sayoud *et al.* 2017). As a result, the IWC database for North Africa contains significant gaps in data (62% of missing data), hampering simple assessment of species trends using conventional methods. To address this issue, a novel statistical approach was developed to yield reliable results despite the high rate of missing data. This method called the Low-Rank Interaction (LORI) model, is based on penalized Poisson models to impute and analyse incomplete monitoring data in a large-scale framework. Taking advantage

of the Lasso penalty, the LORI method has the capacity to integrate many environmental covariates, as well as time-space interactions. This brings improvement over standard approaches by incorporating more information, reducing autocorrelation, as well as estimating outliers, including for reasonably over-dispersed or zero-inflated count distributions (Dakki *et al.* 2021; Robin *et al.* 2019). This allows parameterization of (a) space and time factors, (b) the main effects of predictor covariates, as well as (c) space-time interactions. In a missing data imputation perspective, incorporating additional covariates provides an opportunity to improve the prediction of missing entries, as these could be good predictors of species counts (Amano *et al.* 2018). We used this method to analyze data from the IWC in North Africa to assess population trends of the Greater Flamingo between 1990 and 2021. We modelled the time-trend and spatial distribution of the Greater Flamingo in North Africa using 21 covariates. We performed multiple imputations (with the 'mi.lori' function of LORI package in R, Robin *et al.* 2019), to obtain 100 imputed values for each site and year as well as 100 estimates of covariance effects. Based on the outputs of the multiple imputation, we plotted the estimated population sizes over time using boxplots to represent the 100 posterior draws. These were accompanied by a Generalized Additive Model (GAM) smooth line (fitted with the ggplot2 package, Wickham 2016) to highlight overall temporal trends. Additionally, the estimated effects of covariates were also represented as boxplots, summarizing the distribution of the 100 draws for each effect.

Our choice of each covariate was governed by a priori hypothesis listed below (Tab. 1):

Table 1. List of hypotheses guiding covariate selection for the LORI model using winter counts data of greater flamingos

HYPOTHESES
* The field experience of a country's team of ornithologists, site accessibility, road infrastructure and/or the political situation and governance in the country could affect sampling and detection processes and, as a result, the abundance estimates on a national level (Amano *et al.* 2018). (i.e.: country's counts, distance from the nearest city).
* Gross Domestic Product growth rate per country and per year (i.e. performance of the economy) was used as a proxy for governance, which has been shown to be a major driver of waterbird conservation (Amano *et al.* 2018).
* Wetland surface area is a primary predictor of waterbird abundance, a proxy of which was provided by the maximum water extent extracted from the Global Surface Water dataset (De Goeij *et al.* 1992; Pekel *et al.* 2016).
* Site-specific flooding is a primary predictor of habitat availability and hence abundance of waterbirds. The sum of autumn/winter precipitation per site and per year (rainfall) was used as a proxy of yearly hydroperiod.

HYPOTHESES
* Agriculture is one of the major drivers impacting bird communities at a large scale: for example, through habitat loss and reclamation. Percentage of farmland per year and per country was used to index this impact (Gaston *et al.* 2003; Teyssèdre and Couvet 2007; Vickery *et al.* 2014).
* Altitude and distance from the coast covariates were used to compare low-altitude coastal lagoons and inland wetlands (e.g. chotts, sabkhas or reservoirs) and mountainous areas or plateaus. The combination of low altitude and proximity to the coast was used as a proxy for the threatened ecosystems of Mediterranean lagoons, a preferred habitat for several wading species (Dakki *et al.* 2001; Qninba *et al.* 2007; Ayache *et al.* 2009; Hüttich *et al.* 2012).
* Distance from the nearest urban agglomeration was used as a proxy both for wetland monitoring accessibility and potential impact of disturbance and/or pollution. Hence, this covariate could potentially negatively or positively impact the detection of waterbirds.
* As for any living organism, habitat is a primary influence on abundance and was thus indexed under 3 ecosystem macro groups ('Temperate & Boreal Forest', 'Shrubland & Grassland', 'Desert & Semi-Desert').
* Dams can positively or negatively affect waterbird abundance through habitat modification; some dams were created in the course of the time-series of counts we used, with a likely ecological impact on the waterbird community (El Agbani *et al.* 1996; Bergkamp *et al.* 2000; Dakki *et al.* 2011).
* Spring temperature and precipitation anomalies in breeding areas can affect reproduction and thus the abundance of birds subsequently migrating from northern Europe to North Africa (Forcey *et al.* 2011; Pavón Jordán *et al.* 2017).
* Winter temperature anomalies in wintering areas of southern Europe, especially lower-than-average temperatures, could influence migration numbers to North Africa, notably in the case of cold spells.
* The North Atlantic Oscillation (NAO) was used as a synthetic proxy for the yearly weather conditions affecting waterbirds in their wintering range and annual displacements between Europe and North Africa (Pavón Jordán *et al.* 2019).

Results

In the Camargue the main breeding colony in the Fangassier lagoon (Salin-de-Giraud) shows an increasing trend in the number of breeding pairs of greater flamingos from 1990 to 2000 and a stabilization afterward (Fig. 1). There is a notable peak in 2000 when flamingos used both their historical breeding site in the Fangassier lagoon and a nearby artificial island built for terns. In 2007 and 2014 there was complete failure of breeding and in 2015 flamingos moved to a new breeding site in the saltpans of Aigues-Mortes. The number of fledglings follows a similar trend to breeding pairs but has experienced a slight decline in recent years (Fig. 1).

At the Mediterranean level, the total number of breeding pairs and chicks gradually increased over the year, likely driven at least in the first decade by the increase in the number of breeding colonies used regularly (Fig. 2).

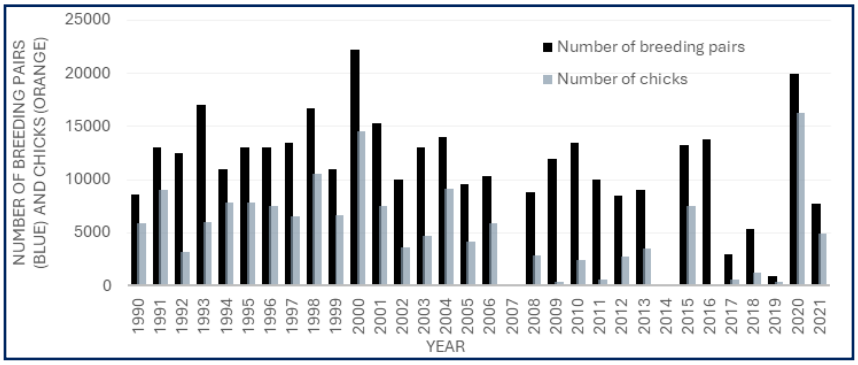


Figure 1. Number of breeding pairs and number of chicks of the Greater Flamingo in the Camargue, south of France, from 1990 to 2021.

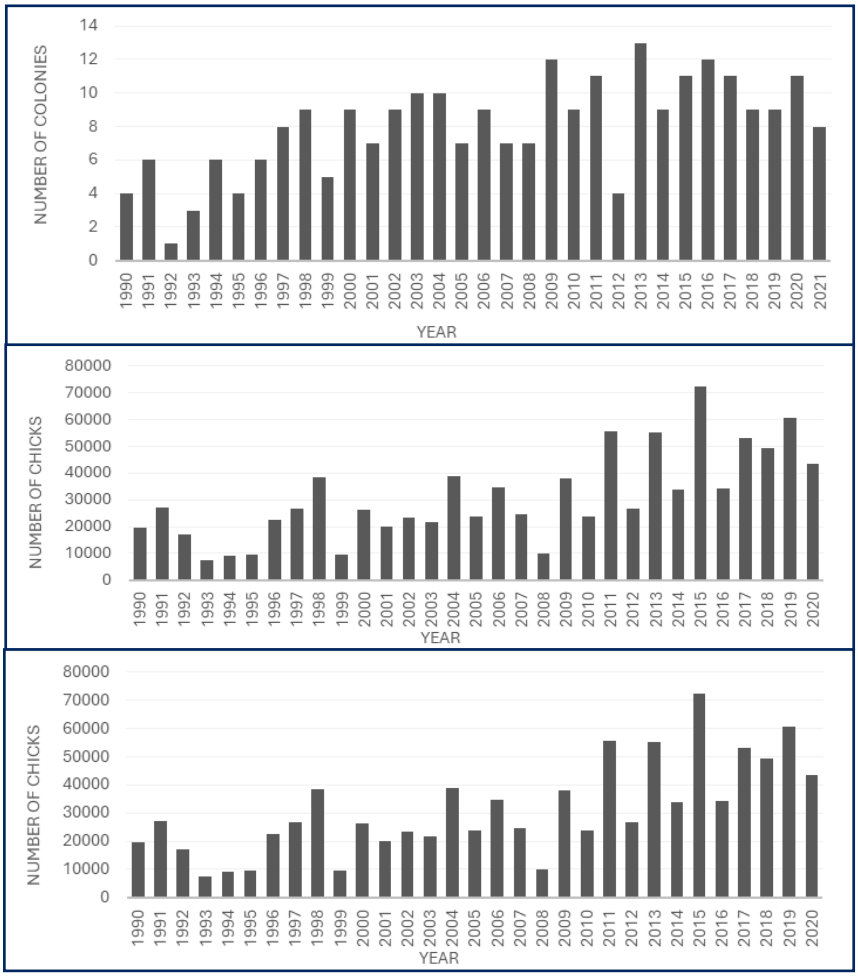


Figure 2. Number of Greater Flamingo colonies, breeding pairs, and fledglings in the Mediterranean region from 1990 to 2021.

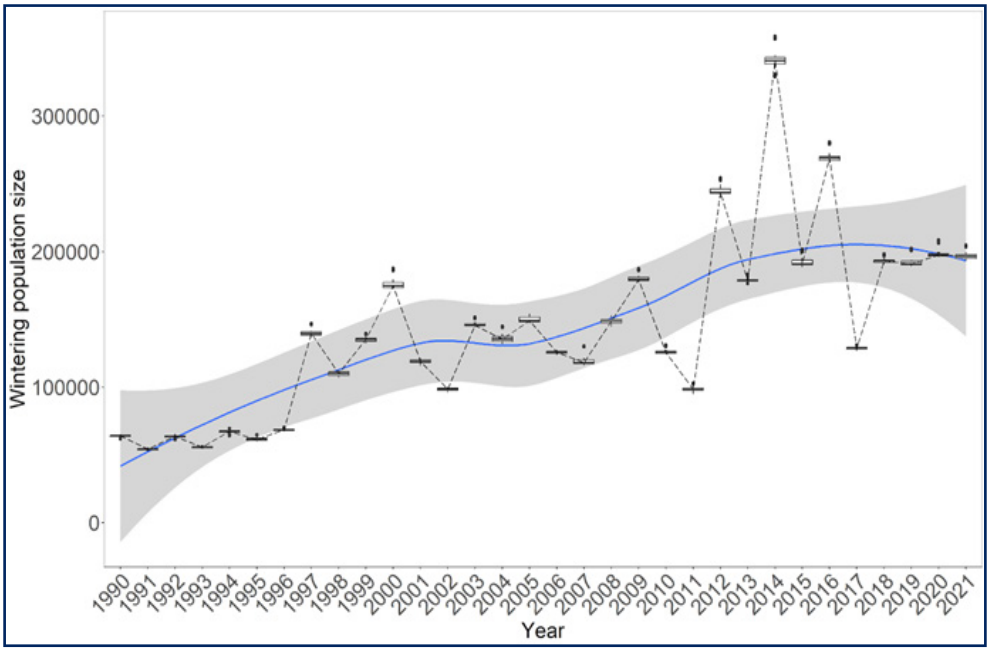


Figure 3. Winter population size of the Greater Flamingo in the Mediterranean (1990-2021). Boxplots based on 100 draws resulting from multiple imputations. The blue line is the smooth curve (with 95% Cis in grey) from a Generalized Additive Model fitting the observed data.

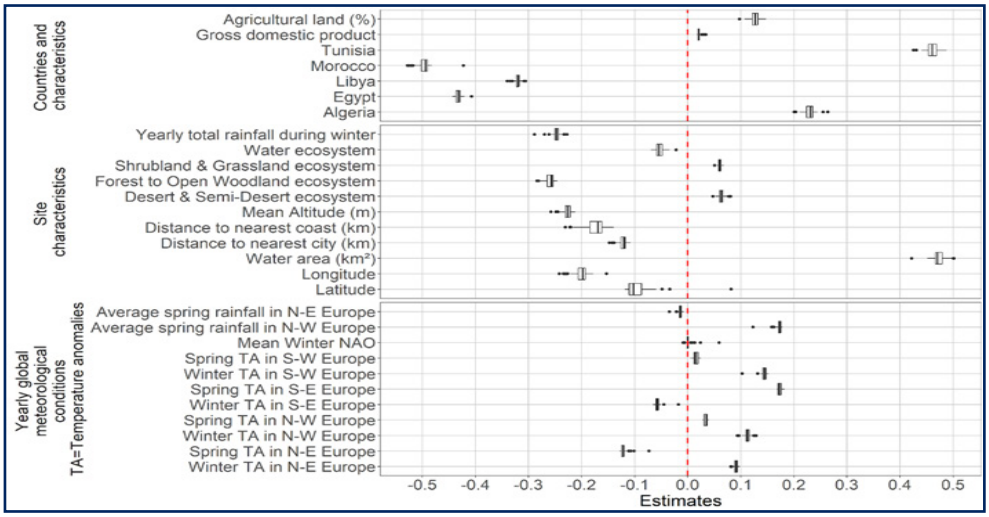


Figure 4. Effects of covariates on spatial and temporal variations in Greater Flamingo winter population size using IWC data as multi-imputed by the LORI method. Boxplots based on 100 draws resulting from multiple imputations.

Using the LORI method to impute count matrices for the Greater Flamingo's wintering numbers, we estimated the long-term trends for the wintering population of the species at the North African scale (Fig. 3).

This imputation-based statistical method also allowed the identification of covariates that may significantly influence species trends (Fig. 4).

IWC showed that Greater Flamingo populations in North Africa increased steadily until 2017, after which a slight decline was observed (Fig. 3). This imputation-based statistical method also allowed the identification of covariates that may significantly influence species trends (Fig. 4). These population trends are primarily influenced by the availability of water surface area and census data from Tunisia, with moderate contributions from Algeria's census data and the extent of agricultural land (Fig. 4).

Discussion and conclusion

Our results suggest that after 25 years of population growth there seems to be a stabilization of the population size of the Greater Flamingo across the Mediterranean, both in terms of wintering and breeding pair numbers. This apparent stabilization should be interpreted cautiously in light of site-specific variability. For example, in the Camargue, since 2015, the main flamingo colony has moved a few kilometres away from the traditional breeding site of the Fangassier. This relocation has resulted from changes in the Salin-de-Giraud saltpan ownership leading to more fluctuating hydrological conditions in spring. The result is a highly fluctuating number of breeding pairs and chicks fledged in the last 10 years.

Comparing figures from the two monitoring networks reveal both consistent and inconsistent patterns. The total number of greater flamingos wintering in North Africa is estimated between 100,000 and 200,000 individuals with a peak over 350,000 in 2014. These figures are coherent with an estimated 40,000 to 80,000 breeding pairs across the Mediterranean, corresponding to 80,000 to 160,000 breeding adult greater flamingos. Because flamingos have delayed recruitment and do not breed every year once having recruited, a significant proportion of flamingos do not participate to breeding every year so that the number of breeding pairs is expected to be lower than the number of wintering birds. Compiling wintering numbers in the north of the Mediterranean (from Portugal to Turkey) would be a useful perspective to better assess variation of reproduction effort of the whole Mediterranean population.

Pronounced peaks in the number of wintering birds appear in the trends (Fig. 3). These peaks could be related to successful breeding seasons in the previous year. Indeed, peaks observed in 2012, 2014, and 2016 correspond with high chick production during the

breeding seasons of 2011, 2013, and 2015. Given that approximately 34% of first-year chicks migrate to North Africa for their first winter (Sanz-Aguilar *et al.* 2012), these juveniles are added to the existing wintering population from previous years. Some negative peaks in North-African trends appear to coincide with years of poor reproductive success, such as 2011, 2017, and the period from 1993 to 1996.

However, winters following poor breeding years do not consistently show a marked decline in wintering numbers in North Africa. For example, the winters of 2000 and 2009, following notably poor breeding years, did not result in significant drops in the number of wintering individuals. This apparent inconsistency may be explained by additional factors influencing migration toward North Africa, such as European weather conditions, which might drive more individuals to migrate. More detailed analyses integrating all available data and covariates could help clarify these contrasting patterns.

Analyses of the wintering data in North Africa also highlight the strong influence of certain environmental covariates in explaining both spatial and temporal variations of population size. In particular, the extent of available water surfaces, the proportion of agricultural land, and spring rainfall in northwestern Mediterranean countries show a positive effect. Additionally, spring temperature anomalies in southwestern Europe and winter temperature anomalies in southeastern Europe appear to influence migratory decisions. These findings suggest that climatic conditions potentially unfavourable for breeding or wintering may influence flamingos to migrate to North Africa (and perhaps even affect the subsequent breeding season).

Finally, data from two countries, Tunisia and Algeria, have a particularly strong impact on the observed trends. This is largely due to the presence of key sites such as Lake Ichkeul in Tunisia (which in the past was a very important site for flamingos and other waterbirds), and emerging important habitats in Algeria, which have gained significance for the species over time.

Our results highlight the critical need for enhanced regional cooperation in monitoring and data interpretation. The Mediterranean Waterbird Network, which coordinates and compiles wintering data across the region, and the International Network for the study and conservation of the Greater Flamingo, which focuses on breeding data operate largely in parallel. However, cross-referencing their data sets would offer a more holistic understanding of population dynamics and would improve the detection of significant ecological events, such as breeding failures or shifts in migratory patterns.

Greater integration between these networks would strengthen the region's capacity to respond to emerging threats. In particular, shared data platforms, harmonized methodologies,

and joint reporting would enable more timely and targeted conservation actions. Moreover, consistent and comprehensive data submissions from all participating countries are vital to ensure accuracy and facilitate effective decision-making. Finally, the conservation of Mediterranean wetlands and the flamingos that depend on them is a shared international responsibility. No single colony operates in isolation; rather, each breeding and wintering site contributes to the resilience of the entire population. Regional cooperation is therefore not just beneficial — it is essential to sustaining flamingo populations in the face of climate variability, habitat change, and human pressures.

Acknowledgements

The analyses conducted through both networks would not have been possible without the invaluable contributions of the many volunteers across the participating countries, who dedicated their time to waterbird counts and the monitoring of Greater Flamingo breeding populations. We extend our gratitude to the partner organizations of both networks for their critical role in managing, sharing, and coordinating data. Their efforts are deeply appreciated. For the Mediterranean Waterbirds Network we deeply acknowledge: the Groupe de Recherche pour la Protection des Oiseaux au Maroc (GREPOM) – BirdLife Maroc (Morocco), the Association "Les Amis des Oiseaux" (AAO/BirdLife en Tunisie) (Tunisia), the Direction Générale des Forêts (Algeria), the Libyan Ornithological Society (LSB) (Libya) and the Ministry of Environment Egyptian Environmental Affairs Agency (EEAA) (Egypt). For the Network for the study and conservation of Greater Flamingo in the Mediterranean and West Africa we acknowledge Parc National du Banc d'Arguin (PNBA), Fuente de Piedra (Junta de Andalucia), Estacion biologica de Donana-CSIC, Parc Natural del delta de l'Ebre, Instituto Superiore per la Protzione e Ricerca Ambientale (ISPRA), Parco delta del Po, Parco Naturale Regionale Molentargius, Ege University, Doğa Derneği, Association "Les Amis des Oiseaux" (AAO/BirdLife en Tunisie), Laboratoire de recherche des zones humides de l'Université d'Annaba, Université de Guelma. We also wish to thank all co-authors and contributors to the ongoing work of these networks, with acknowledgment of the French Biodiversity Office.

Furthermore, this research and its subsequent analyses were made possible by the financial support of the French Ministry for Ecological Transition and Territorial Cohesion, the French Development Agency, and the French Biodiversity Office.

References

Amano, T., Székely, T., Sandel, B., Nagy, S., Mundkur, T., Langendoen, T., Blanco, D., Soykan, C.U. and Sutherland, W. J., 2018. Successful conservation of global waterbird populations depends on effective governance. Nature, 553(7687), pp. 199.

Ayache, F., Thompson, J.R., Flower, R.J., Boujarra, A., Rouatbi, F., Makina, H., 2009. Environmental characteristics, landscape history and pressures on three coastal lagoons in the Southern Mediterranean Region: Merja Zerga (Morocco), Ghar El Melh (Tunisia) and Lake Manzala (Egypt). Hydrobiologia 622, pp. 15-43.

Balkiz, Ö., Özesmi, U., Pradel, R., Germain, C., Siki, M., Amat, J.A., Rendón-Martos, M., Baccetti, N. and Béchet, A., 2007. Range of the Greater Flamingo, *Phoenicopterus roseus*, metapopulation in the Mediterranean: new insights from Turkey. Journal of Ornithology, 148 (3), pp.347-355. doi: 10.1007/s10336-007-0136-2. hal-02126351.

Béchet, A., 2017. Flight, navigation, dispersal, and migratory behavior. In: Flamingos: Behavior, Biology, and Relationship with Humans. Nova Science Publishers, Matthew J. Anderson (ed.), pp.97-106.

Béchet, A., Germain, C., Amat, J.A., Cañas, C., Rendon-Martos, M., Garrido, A., Baccetti, N., Dall'Antonia, P., Balkiz, Ö., Diawara, Y., Vidal i Esquerré, F., Johnson A., 2006. Metapopulation networks as tools for research and conservation: The Greater flamingo Phoenicopterus roseus in the Mediterranean and West-Africa. In: Boere G.C., Galbraith C.A., Stroud D.A., editors. Waterbirds around the World. Edinburgh, UK: The stationery office, 960 pp.

Béchet, A., Johnson, A.R., 2008. Anthropogenic and environmental determinants of Greater Flamingo *Phoenicopterus roseus* breeding numbers and productivity in the Camargue (Rhone delta, southern France). Ibis, 150, pp. 69-79.

Béchet, A., Rendón-Martos, M., Rendón, M.A., Amat, J.A., Johnson, A.R., Gauthier-Clerc, M., 2012. Global economy interacts with climate change to jeopardize species conservation: a case study in the Greater flamingo in the Mediterranean and West Africa. Environmental Conservation, 39, pp. 1-3.

Béchet, A., Thibault, M., Boutron, O., 2017. Les flamants roses en Camargue. Tour du Valat. Arles: Tour du Valat.

Bergkamp, G., McCartney, M., Dugan, P., McNeely, J. & Acreman, M., 2000. Dams, ecosystem functions and environmental restoration. Thematic review II, 1, pp. 1-187.

Dakki, M., Qninba, A., El Agbani, M.A., Benhoussa, A. & Beaubrun, P.C., 2001. Waders wintering in Morocco: national population estimates, trends, and site-assessments. Wader Study Group Bull., 96, pp. 47-59.

Dakki M., El Agbani M.A. & Qninba A. (Eds), 2011. Zones humides du Maroc inscrites jusqu'en 2005 sur la Liste de la Convention de Ramsar. Trav. Inst. Sci., Rabat, Sér. Générale, 7, 1-238.

Dakki, M., Robin, G., Suet, M., Qninba, A., El Agbani, M.A., Ouassou, A., El Hamoumi, R., Azafzaf, H., Rebah S., Feltrup-Azafzaf, C., Hamouda, N., Ibrahim, W.A.L., Asran, H.H., Elhady, A.A.,

Ibrahim, H., Etayeb, K., Bouras, E., Saied, A., Glidan, A., Habib, B.M., Sayoud, M.S., Bendjedda, N., Dami, L., Deschamps, C., Gaget, E., Mondain Monval, J.-Y., Defos du Rau, P., 2021. Imputation of incomplete large scale monitoring count data via penalized estimation. Methods Ecology and Evolution, 12(6), pp. 1031-1039. doi: 10.1111/2041-210X.13594

De Goeij, P.J., van der Have, T.M., Keijl, G.O., van Roomen, M.W.J. and Ruiters, P.S., 1992. The network of wetlands for waterbird migration in the eastern Mediterranean. In: Finlayson, M., Hollis, T. & Davis, T. (eds.). Managing Mediterranean wetlands and their birds: proceedings of an/WRB International Symposium, Grado, Italy, February 1991, pp. 70-72.

Delany, S., 2005. Guidelines for Participants in the International Waterbird Census (IWC). Wetlands International: Wageningen, The Netherlands.

Diawara, Y., Arnaud, A., Araujo, A., and Béchet, A., 2007. Nouvelles données sur la réproduction et l'hivernage des Flamants roses *Phoenicopterus rouseus* en Mauritanie et confirmation d'échanges avec les colonies méditerranéennes. Malimbus, 29, pp. 31-41.

El Agbani, M.A., Dakki, M., Beaubrun, P.C. and Thévenot, M., 1996. L'hivernage des anatidés (Anatidae) au Maroc (1990-94): Effectifs et sites d'importance Internationale et Nationale. Gibier Faune Sauvage, Game Wildl., 13, pp. 233-249.

Forcey, G.M., Thogmartin, W.E., Linz, G.M., Bleier, W.J. and McKann, P.C., 2011. Land use and climate influences on waterbirds in the Prairie Potholes. Journal of Biogeography, 38(9), pp. 1694-1707.

Gaston, K.J., Blackburn, T.M. and Goldewijk K.K., 2003. Habitat conversion and global avian biodiversity loss. Proceedings of the Royal Society of London, Series B. Biological Sciences, 270(1521), pp. 1293-1300.

Hüttich, C., Reschke, J., Keil, M., Dech, S., Weise, K., Beltrame, C., Fitoka, E., Paganini, M., 2012. Using the Landsat Archive for the Monitoring of Mediterranean Coastal Wetlands: Examples from the Glob-Wetland-II Project. http://www.earth-zine.org/2011/12/20/using-the-landsat-archive-for-the-monitoring-of-mediterranean-coastal-wetlands-examples-from-the-globwetland-ii-project/ (accessed 13.09.15).

Johnson, A.R., 1982. Construction of a breeding island for flamingos in the Camargue. In: Managing Wetlands and their Birds. Slimbridge, Glos., England: International Waterfowl Research Bureau, pp. 204-208.

Johnson, A.R. and Cézilly, F., 2007. The Greater flamingo. Mediterranean Waterbirds Network, 2024. https://www.medwaterbirds.net/page.php?id=35

Mediterranean Waterbirds Network, 2024. IWC Online Database. https://www.medwaterbirds.net/datacounts.php

Nagy, S., Flink, S. and Langendoen, T.,

2015. AEWA/MOP 6.14. 2015. Report on the conservation status of migratory waterbirds in the agreement area (MOP6), Sixth Edition, 134 pp.

Nagy, S. and Langendoen, T., 2020. Flyway trend analyses based on data from the African-Eurasian Waterbird Census from the period of 1967-2018. Online publication. Wetlands International, Wageningen, The Netherlands. http://iwc.wetlands.org/index.php/aewatrends8

Pavón Jordán, D., Santangeli, A. and Lehikoinen, A., 2017. Effects of flyway wide weather conditions and breeding habitat on the breeding abundance of migratory boreal waterbirds. Journal of avian biology, 48(7), pp. 988-996.

Pavón Jordán, D., Clausen, P., Dagys, M., Devos, K., Encarnaçao, V., Fox, A.D., Frost, T., Gaudard, C., Hornmann, M., Keller, V., Langendoen, T., Ławicki, Ł., Lewis, L.J., Lorentsen, S.-H., Luigujoe, L., Meissner, W., Molina, B., Musil, P., Musilova, Z., Nilsson, L., Paquet, J.-Y., Ridzon, J., Stipniece, A., Teufelbauer, N., Wahl, J., Zenatello, M. and Lehikoinen, A., 2019. Habitat and species mediated short and long term distributional changes in waterbird abundance linked to variation in European winter weather. Diversity and Distributions, 25(2), pp. 225-239.

Pekel, J.F., Cottam, A., Gorelick, N. and Belward, A.S., 2016. High-resolution mapping of global surface water and its long-term changes. Nature, 540(7633), pp. 418-422.

Qninba, A., Dakki, M., El Agbani, M.A. and Benhoussa, A., 2007. Rôle de la côte atlantique marocaine dans l'hivernage des Limicoles (Aves, Charadrii). Ostrich, 78(2), pp. 489-493.

Redon-Martos, M. and Johnson, A. R., 1996. Management of Nesting Sites for Greater Flamingos. Colonial Waterbirds, 19, pp. 167–183. https://doi.org/10.2307/1521961

Robin, G., Josse, J., Moulines, É. and Sardy, S., 2019. Low-rank model with covariates for count data with missing values. Journal of Multivariate Analysis, 173, pp. 416–434.

Sanz-Aguilar, A., Béchet, A., Germain, C., Johnson, A.R., Pradel, R., 2012. To leave or not to leave: survival tradeoffs between different migratory strategies in the Greater flamingo. Journal of Animal Ecology, 81, pp. 1171–1182. doi: doi:10.1111/j.1365-2656.2012.01997.x

Sayoud, M.S., Salhi, H., Chalabi, B., Allali, A., Dakki, M., Qninba, A., El Agbani, M.A., Azafzaf, H., Feltrup-Azafzaf, C., Dlensi, H., Hamouda, N., Abdel Latif Ibrahim, W., Asran, H., Abu Elnoor, A., Ibrahim, H., Etayeb, K., Bouras, E., Bashaimam, W., Berbash, A., Dechamps, C., Mondain-Monval J.-Y., Brochet, A.L., Véran, S. and Defos du Rau, P., 2017. The first coordinated trans-North African mid-winter waterbird census: The contribution of the International Waterbird Census to the conservation of waterbirds and wetlands at a biogeographical level. Biological Conservation, 206, pp. 11-20. https://doi.org/10.1016/j.biocon.2016.12.005

Teyssèdre, A. and Couvet, D., 2007. Expected impact of agriculture expansion on the world avifauna. Comptes Rendus Biologies, 330(3), pp. 247-254.

van Roomen, M., van Winden, E. and van Turnhout, C., 2011. Analyzing population trends at the flyway level for bird populations covered by the African Eurasian Waterbird Agreement: details of a methodology. SOVON-information report 2011/05, SOVON Dutch Centre for Field Ornithology, Nijmegen, the Netherlands, 22 pp.

Verniest, F., Le Viol, I., Julliard, R., Dami, L., Guelmami, A., Suet, M., Abdou, W., Azafzaf, H., Bendjedda, N., Bino, T., Borg, J.J., Božič, L., Dakki, M., El Hamoumi, R., Encarnação, V., Erciyas-Yavuz, K., Etayeb, K., Georgiev, V., Hamada, A., Hatzofe, O., Ieronymidou, C., Langendoen, T., Mikuska, T., Molina, B., Moniz, F., Moussy, C., Ouassou, A., Petkov, N., Portolou, D., Qaneer, T., Sayoud, S., Šćiban, M., Topić, G., Uzunova, D., Vine, G., Vizi, A., Xeka, E., Zenatello, M., Gaget, E., Galewski, T., 2023. Anticipating the effects of climate warming and natural habitat conversion on waterbird communities to address protection gaps. Biological Conservation, 279, 109939. https://doi.org/10.1016/j.biocon.2023.109939

Vickery, J.A., Ewing, S.R., Smith, K.W., Pain, D.J., Bairlein, F., Škorpilová, J. and Gregory, R.D., 2014. The decline of Afro Palaearctic migrants and an assessment of potential causes. Ibis, 156(1), pp. 1-22.

Wetlands International, 2014. IWC Online Database (accessed 3.09.16). http://iwc.wetlands.org.

Wickham, H., 2016. ggplot2: Elegant Graphics for Data Analysis. Springer-Verlag, New York, 260 pp.

BYCATCH MONITORING IN THE GULF OF GABES (GSA 14): IMPACT OF FISHERIES ON SEABIRDS

Samira Enajjar[1], Bechir Saidi[2], Anis Zarrouk[3] & Mohamed Nejmeddine Bradai[1]

[1] Carthage University, National Institute of Science and Technology of the Sea (INSTM), Marine Biodi versity Laboratory, Sfax 3018, Tunisia, enajjarsamira@yahoo.fr

[2] Kairouan University, Faculty of Sciences and Techniques of Sidi Bouzid, 9100, Sidi Bouzid,Tunisia
[3] Specially Protected Areas Regional Activity Centre (SPA/RAC)

Abstract

The bycatch of vulnerable species in fishing gear is a key threat for several taxonomic groups, including sea turtles, elasmobranchs, marine mammals as well as birds.

The present work was realized in the frame of the MedBycatch project (2019-2022), concerns a study of the impact of fisheries on seabirds in the Gulf of Gabes, Geographical Sub-Area (GSA) 14, Tunisia. For this, we performed 739 fishing days using direct observation and 1,678 questionnaires in the area. Monitoring concerned trawls, nets, benthic longline and seiners.

Thirty-six seabird individuals were recorded as bycatch, representing 0.6% of the total number of vulnerable specimens captured during observations. Their bycatch rate is 0.014 individuals by fishing days. Seabirds were bycaught by small scale vessels using nets and longlines. They have not been caught by trawl, despite their presence in fishing areas. The Greater Cormorant (Phalacrocorax carbo) and the Yellow-legged Gull (Larus michahellis) are the only species identified. Generally, specimens were removed dead.

Key-words: bycatch, seabirds, fisheries, Gulf of Gabes

Introduction

Seabirds provide many ecosystem services. They play a key role in nutrient cycling via the shaping of the plant community in their terrestrial and coastal breeding habitat. Their role as potential indicators of marine conditions is widely acknowledged. Many studies use aspects of seabird biology and ecology, especially productivity and population trends, to infer relationships, effects or correlate with aspects of the marine environment, particularly food availability. However, seabirds are among the most threatened birds in the world (BirdLife International 2018).

Incidental mortality in fishing gears (longline, gillnet, trawl fisheries, etc.) has been identified as one of the most significant threats to seabirds in terms of the number of species (about 100 species affected) and impact (mortality) (Dias *et al.* 2019). Understanding and quantifying the impacts of bycatch at the population level is a complex task. Seabird bycatch is influenced by fishing practices (the use of multiple gears by

the same vessels on the same fishing trips), fishing effort, species abundance, biological traits and feeding behavior (Genovart *et al.* 2016; Cortes *et al.* 2017).

In Tunisia, although, it is difficult to determine the exact number of marine avifauna populations that inhabiting or migrate to our country, certain species are known to be more abundant than others such as the Yellow-legged Gull, terns, the Yelkouan Shearwater (Gatt *et al.* 2019). By monitoring their populations and threats, conservationists can identify issues and take action before they become more severe. Data on bycatch induced seabird mortality in Tunisian water is largely unknown.

The aims of this study were to determine the impact of fishery on seabirds: which species are affected by bycatch, the rate of seabird bycatch by gears and fleet segment in the Gulf of Gabes (GSA 14) and to propose mitigating measures to reduce seabird mortality in the study area.

Materials and methods

The study was conducted in the framework of the MedBycatch project "Understanding Mediterranean multi-taxa bycatch of vulnerable species and testing mitigation - a collaborative approach". It is the result of the partnership between the Secretariat of the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS), the Secretariat of the General Fisheries Commission for the Mediterranean (GFCM), the Specially Protected Areas Regional Activity Centre (SPA/RAC), the International Union for Conservation of Nature - Centre for Mediterranean Cooperation (IUCN Med), BirdLife International Europe and Central Asia (BLI), the Mediterranean Association to Save the Sea Turtles (MEDASSET) and the World Wildlife Fund (WWF).

The project was conducted between 2019 and 2022 in the GFCM sub area GSA 14 (Gulf of Gabes) (Fig. 1). A standardized data collection and monitoring protocol for all vulnerable species encountered in the Mediterranean and the Black Sea were used (FAO 2019). This protocol includes four methodologies: on-board observations, questionnaires at landing sites, self-sampling activities and stranding data.

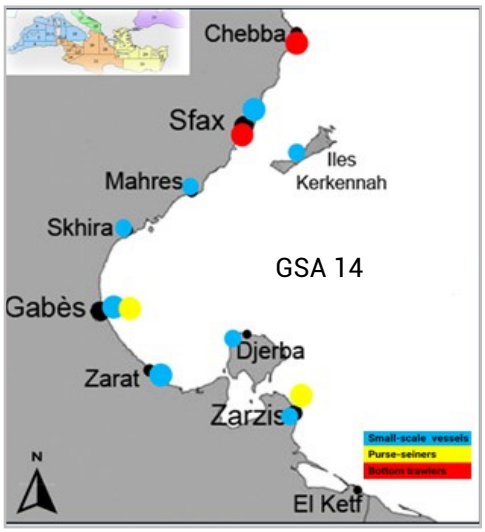


Figure 1. Study area showing the ports and the fleet segment considered

The work concerns three kind of gears: bottom trawls, nets (trammel, gillnet and

Table 1. Observation efforts by segment done during the MedBycatch project in the Gulf of Gabes.

Fleet segment	Observation efforts	
	Questionnaires	On board observations
Trawlers	260	146
Small scales fisheries	1,363	578
Purse Seiners	57	15
Total	1,680	739

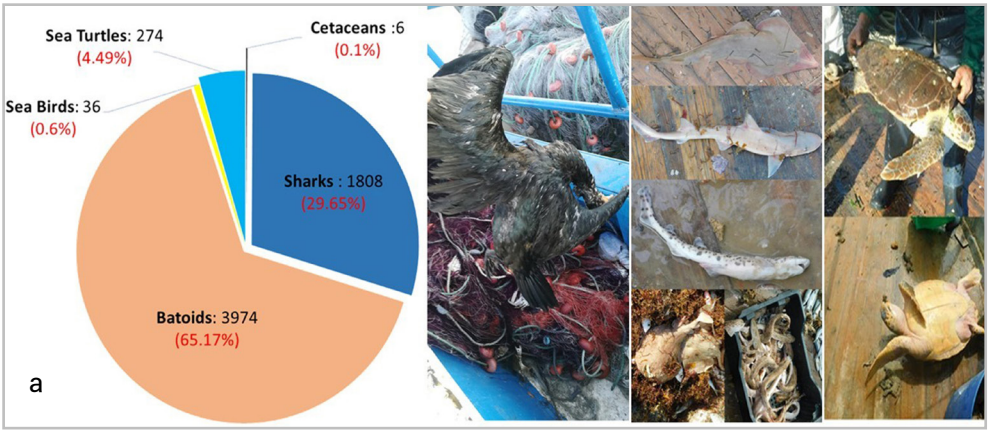


Figure 2..a) Total number (+%) of vulnerable specimens captured during the MedBycatch project in the GSA 14; b) Some vulnerable species accidentally captured in the GSA 14.

combined) and bottom longlines (Tab. 1). Species identification was completed according to the identification guide of vulnerable species incidentally caught in the Mediterranean fisheries developed during the project (Otero *et al.* 2019).

Results

During thirty months of observations (from March 2019 to June 2020 and from November 2020 to January 2022), observers carried out 1,680 questionnaires and 739 onboard observations in the GSA 14, totaling 5,055 fishing days for all fishing segments. The observation effort for each fleet is detailed in Table 1.

Among the species considered as vulnerable according to Annexes 1a and 1b of the bycatch protocol developed within the MedBycatch project framework, elasmobranchs (sharks and rays) are the group most frequently caught (considering the specimens number), accounting for 94.8% of catches. Sea turtles constitute the second taxon present in the catches with 4.49%. However, the captured specimens of seabirds and cetaceans don't exceed 0.6% and 0.1% respectively (Fig. 2).

A total of 36 specimens of seabirds were reported principally by small-scale vessels using trammel nets and

bottom longlines (Fig. 3 and 4). Twelve great cormorants *Phalacrocorax carbo* and only one yellow-legged gull *Larus michahellis* were identified. Usually, specimens were removed dead.

No seabirds were bycaught by bottom trawl, despite their presence in more than 80% of the fishing operations. At least seven species were identified around the trawlers. The most abundant species were the Yellow-legged Gull *Larus michahellis* and the Great Cormorant *Phalacrocorax carbo*.

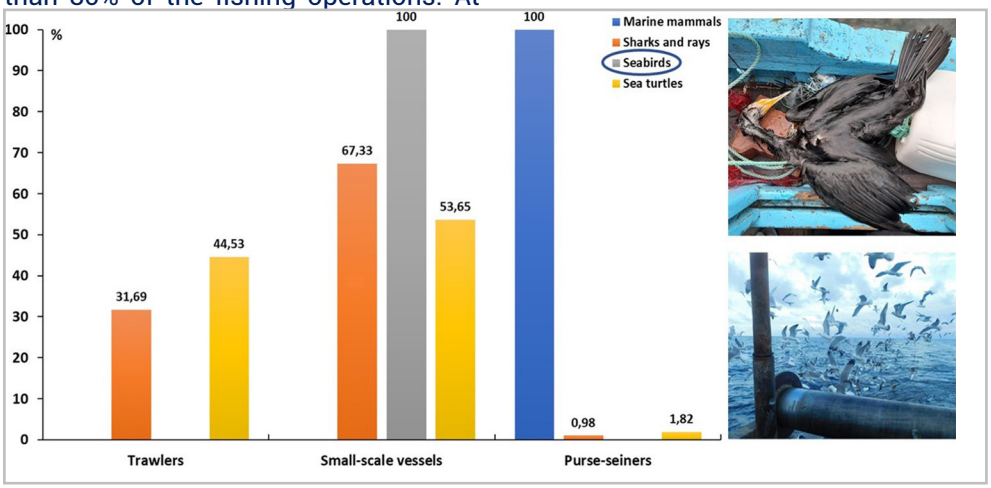


Figure 3. Percentage of vulnerable species incidentally caught by fishing fleet in the GSA 14.

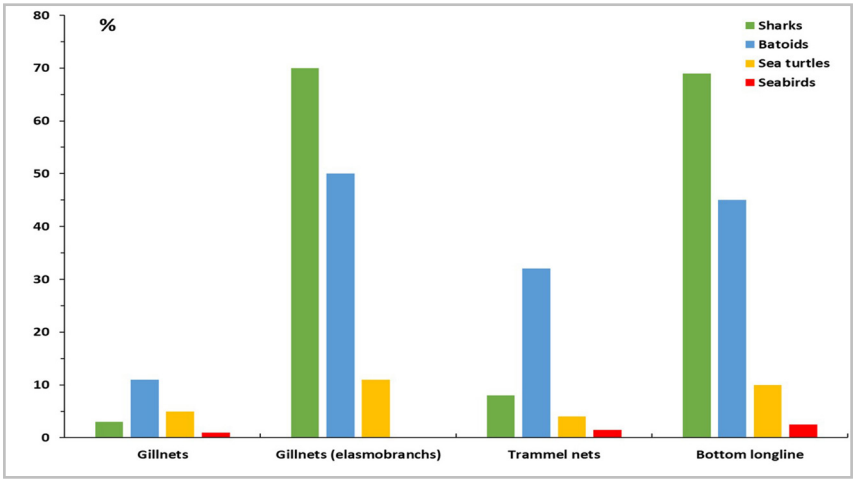


Figure 4. Percentage of fishing days with threatened vertebrates caught for each type of fishing gear in the GSA 14.

Small-scale vessels using multiple gears seem to affect all threatened vertebrates because of the overlap of their activity areas with the breeding and feeding grounds of endangered species (Fig. 5). Considering the fishing effort (fishing days), the bycatch rate of sharks, rays, sea turtles and seabirds are respectively: 0.54, 0.88, 0.07 and 0.014 individuals by fishing days.

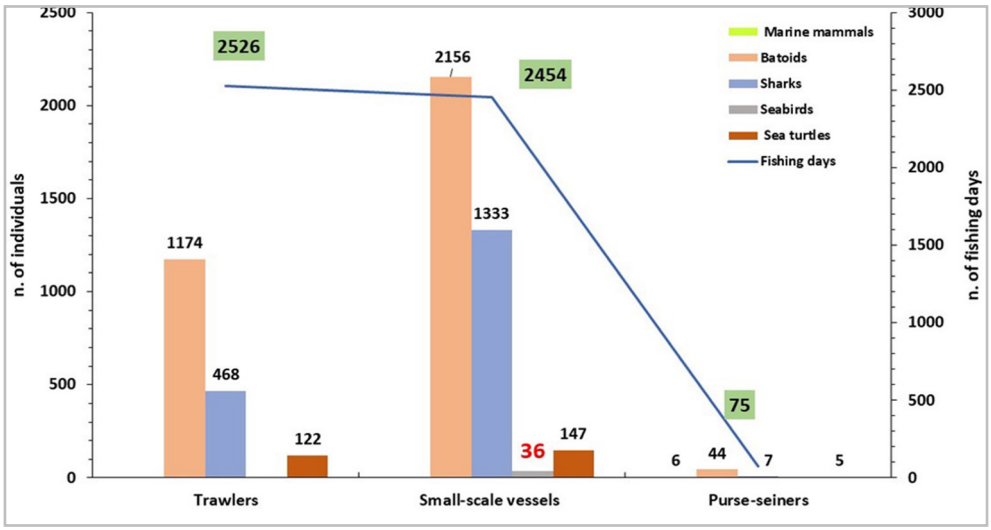


Figure 5. Relationship between number of fishing days and bycaught individuals

Discussion and conclusion

Tunisian waters are identified to be an important area for many seabird species (nesting and reproductive area) but also known to be an area of high threat essentially the human activities impact (Coll *et al.* 2012). Among them, fishing activity remains an understudied threat. Small-scale vessels using various kinds of gears appear to affect seabirds the most. Although, the rate of capture is low (0.014 individuals/fishing days), but the fishing effort in the Gulf of Gabes is huge, making the impact of bycatch worrying. According to the general directorate of fisheries and aquaculture, the GSA 14 shelters more than 6,000 boats totaling more than 900 thousand fishing days by year (DGPA 2022). Bradai *et al.* (2017) reported preliminary data on the bycatch of seabirds by longlines in the Gulf of Gabes. They indicated that the bycatch rate is low compared with other taxa. The capture rates are 0.01 and 0.04 individuals/1,000 hooks respectively in pelagic and bottom longlines. The Scopoli's Shearwater *Calonectris diomedea* was the only species identified.

As described in the Gulf of Gabes, bottom longlines, gillnets and trammel nets are also identified as a cause of mortality worldwide. Recent estimates suggest between 160,000 and 320,000

seabirds are killed annually by longlines (Anderson *et al.* 2011), about 400,000 by gillnets (Zydelis *et al.* 2013), tens of thousands by trawl fisheries (Da Rocha *et al.* 2021), and thousands by purse-seine fisheries (Carle *et al.* 2019). Overall, around one-third of all extant seabird species and hundreds of millions of individuals are at risk of bycatch (Dias *et al.* 2019). Likewise, in the European waters, gillnet fisheries are also responsible for the highest bycatch levels, with over 95,000 seabirds per year, followed by longline fisheries (Ramirez *et al.* 2024). It is clear therefore that monitoring seabirds-fisheries interactions and mortality is required on a global scale because of the highly migratory character of this near-apex predators travelling across trophic levels, space, and time.

Knowledge of fisheries impacts is essential for understanding the ecology and to build a conservation strategy for seabirds. It is essential to quantify changing mortality, which requires ongoing monitoring across all gear types and a wide geographic area. It is important to work on collecting data on the life stage of specimens bycaught. As they are long-lived organisms, bycatch affecting adult survival have a more severe impact on population dynamics (Parsons *et al.* 2008; Duarte *et al.* 2020). Deeper knowledge of the bycatch phenomena is necessary to choose the correct mitigation measure. These measures change with gears, areas, species, and seasons. Working in a multi-taxa approach is a key method to preserve the biodiversity of the marine megafauna.

Acknowledgments

The authors would like to thank the fishermen in the Gulf of Gabes (GSA 14) for their patience and cooperation. We would also like to acknowledge the hard work of all the MedBycatch team: observers, supervisors, coordinators and focal points of the project. Finally, the authors would like to express their sincere gratitude to the MAVA Foundation for funding this project.

References

Anderson, O.R.J., Small, C.J., Croxall, J.P., Dunn, E.K., Sullivan, B.J., Yates, O. and Black, A., 2011. Global seabird bycatch in longline fisheries. Endangered Species Research, 14, pp. 91–106.

BirdLife International, 2018. State of the World's birds: Taking the pulse of the planet. Cambridge, UK: BirdLife International, 80 pp.

Bradai, M.N., Saïdi, B., Enajjar, S. and Karaa, S., 2017. Pêcheries aux palangres de fond et de surface dans le Golfe de Gabès: Rapport final. MoU ACCOBAMS, N°07/2016/LB6410, 55 pp.

Carle, R.D., Felis, J.J., Vega, R., Beck, J., Adams, J., López, V., Hodum, P.J., González, A., Colodro, V. and Varela, T., 2019. Overlap of pink-footed shearwaters and central Chilean purse-seine fisheries: implications for bycatch risk. The Condor, 121, pp. 1-13.

Coll, M., Piroddi, C., Albouy, C., Ben Rais Lasram, F., Cheung, W.L., Christensen, V.,

Karpouzi, V.S., Guilhaumon, F., Mouillot, D., Paleczny, M., Palomares, L.M., Steenbeek, J., Trujillo, P., Reg, W. and Pauly, D., 2012. The Mediterranean Sea under siege: spatial overlap between marine biodiversity, cumulative threats and marine reserves. Global Ecology Biogeography, 21, pp. 465-480.

Cortes, V., Arcos, J. and Gonzàlez-Solís J., 2017. Seabirds and demersal longliners in the northwestern Mediterranean: Factors driving their interactions and bycatch rates. Marine Ecology Progress, Series 565, pp. 1–16.

Da Rocha, N., Oppel, S., Prince, S., Matjila, S., Shaanika, T.M., Naomab, C., Yates, O., Paterson, J.R.B., Shimooshili, K., Frans, E., Kashava, S. and Crawford, R., 2021. Reduction in seabird mortality in Namibian fisheries following the introduction of bycatch regulation. Biological Conservation, 253(108915).

Direction Générale de la Peche et de l'Aquaculture (DGPA), 2022. Statistical yearbook on fisheries and aquaculture. Ministry of Agriculture, Water Resources and Fisheries. 146pp.

Dias, M.P., Martin, R., Pearmain, E.J., Burfield, I.J., Small, C., Phillips, R.A., Yates, O., Lascelles, B., Borboroglu, P.G. and Croxall, J.P., 2019. Threats to seabirds: A global assessment. Biological Conservation, 237, pp.525–537.

Duarte, C.M., Agusti, S., Barbier, E., Britten, G.L., Castilla, J.C., Gattuso, J.P., Fulweiler, R.W., Hughes, T.P., Knowlton, N., Lovelock, C.E., Lotze, H.K., Predragovic, M., Poloczanska, E., Roberts, C., Worm, B., 2020. Rebuilding marine life. Nature, 580(7801), pp. 39–51.

FAO, 2019. Monitoring the incidental catch of vulnerable species in Mediterranean and Black Sea fisheries: Methodology for data collection. FAO Fisheries and Aquaculture Technical Paper No. 640. Rome, FAO, 106 pp. https://openknowledge.fao.org/server/api/core/bitstreams/08ddfe89-0260-4cd5-bd64-3d61150cf64b/content

Gatt, M.C., Lago, P., Austad, M., Bonnet-Lebrun, A.-S. and Metzger, B.J., 2019. Pre-laying movements of Yelkouan Shearwaters (Puffinus yelkouan) in the Central Mediterranean. Journal of Ornithology, 160, pp.625–632. https://doi.org/10.1007/s10336-019-01646-x

Genovart, M., Arcos, J.M., Alvarez, D., McMinn, M., Meier, R., Wynn, R.B., Guilford, T. and Oro, D., 2016. Demography of the critically endangered Balearic shearwater: The impact of fisheries and time to extinction. Journal of Applied Ecology, 53, pp. 1158–1168.

Otero, M., Serena, F., Gerovasileiou, V., Barone, M., Bo, M., Arcos, J.M., Vulcano, A., Xavier, J., 2019. Identification guide of vulnerable species incidentally caught in Mediterranean fisheries. UICN, Malaga, Espagne, 204 pp. https://www.rac-spa.org/sites/default/files/doc_bycatch/final_identification_guide_20_12.pdf

Parsons, M., Mitchell, I., Butler, A., Ratcliffe, N., Frederiksen, M., Foster, S. and Reid, J.B., 2008. Seabirds as indicators of the marine environment.

ICES Journal of Marine Scienece, 65(8), pp. 1520–1526.

Ramírez, D., Mitchell, I., Vulcano, A., Rouxel, Y., Marchowski, D., Almeida, A., Arcos, J.M., Cortes, V., Lange, G., Morkūnas, J., Oliveira, N., Paiva, V.H., 2024. Seabird bycatch in European waters. Animal Conservation, 16 pp. https://doi.org/10.1111/acv.12948.

Zydelis, R., Small, C. and French, G., 2013. The incidental catch of seabirds in gillnet fisheries: A global review. Biological Conservation, 162, pp. 76–88.

THE PRE-LAYING MOVEMENTS OF SHEARWATERS IN THE MEDITERRANEAN - CONSIDERATIONS FOR OFFSHORE PROTECTION THROUGHOUT THE BREEDING SEASON

Marie Claire Gatt[1], Paulo Lago[2], Anne-Sophie Bonnet-Lebrun[3], Martin Austad[4], Benjamin J. Metzger[4]

[1] Independent Researcher, Triq l-Immakulata Kunċizzjoni, Gżira, Malta. mcgatt57@gmail.com
[2] SEO/BirdLife-Marine Program, Delegació de Catalunya, 08026 Barcelona, Spain.
[3] Centre d'Études Biologiques de Chizé, CNRS - La Rochelle Université, Villiers-en-Bois, France.
[4] BirdLife Malta, 57/28 Triq Abate Rigord, Ta' Xbiex XBX 1120, Malta

Albatrosses and petrels often serve as emblematic species for the conservation of marine environments on which both they and we depend. Due to their pelagic nature, remote tracking technologies (e.g. GPS logging devices) are necessary to identify marine areas of importance for these species since direct observation is often difficult and doesn't allow us to determine the population of origin of aggregating birds. Therefore, tracking data from seabirds form an important component of marine protected area designation (Lascelles *et al.* 2012).

Marine protected area designation is often based on the movements of breeding birds, particularly on GPS tracking during incubation or chick-rearing. The pre-laying period has received comparatively less attention, despite being a crucial stage. In particular, the female pre-laying exodus determines the success of egg production within a season and, as a result, a population's reproductive output for the year (Mallory *et al.* 2008).

The Scopoli's Shearwater *Calonectris diomedea* is the most numerous shearwater in the Mediterranean basin. It is an Annex I species under the EU Birds Directive and is listed in Annex II of the SPA/BD Protocol of the Barcelona Convention. While the Scopoli's Shearwater is listed as least concern in the IUCN Red List, populations have been experiencing a decline (BirdLife International 2024). The Yelkouan Shearwater *Puffinus yelkouan* is also listed under Annex I of the EU Birds Directive and Annex II of the SPA/BD Protocol of the Barcelona Convention and is considered Vulnerable by the IUCN (BirdLife International 2024). They are highly emblematic species endemic to the Mediterranean, and the focus of several conservation and research projects across the Mediterranean. A number of marine protected areas have been designated for their protection, including marine Special Protected Areas in EU marine territory (Metzger *et al.* 2015).

From GPS tracking of birds from colonies in Malta, we demonstrate that the pre-laying exodus is characteristically different from foraging trips carried out concurrently by males and by females not developing an egg, but also from

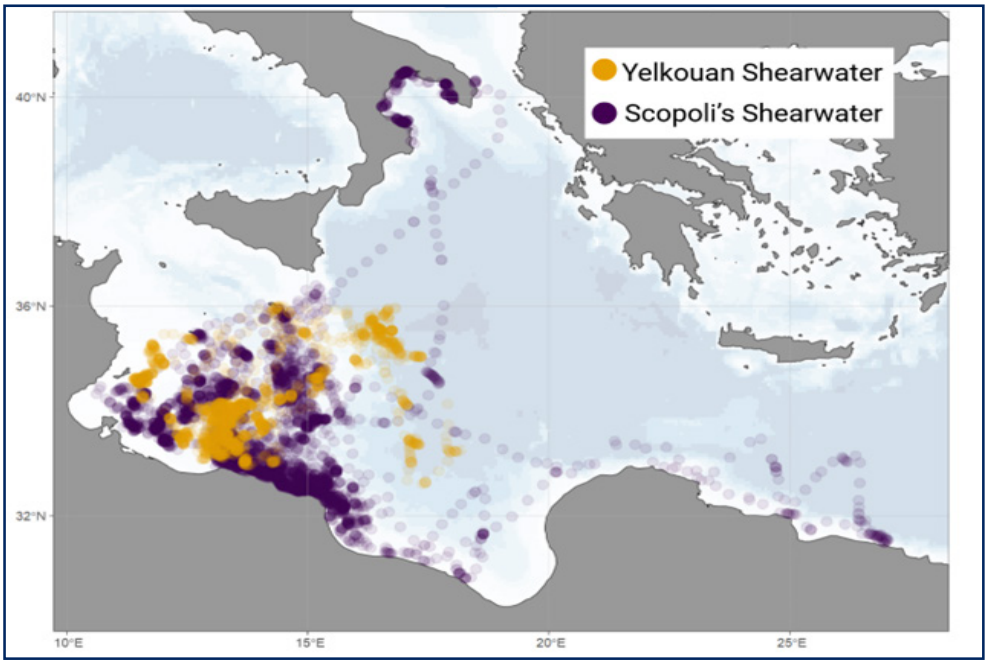


Figure 1. GPS locations of female Yelkouan Shearwaters (orange; *Puffinus yelkouan*) and Scopoli's Shearwaters (purple; *Calonectris diomedea*) during their respective pre-laying exodus.

foraging trips during the rest of the breeding season in terms of duration, distance, and area use. In particular, the waters off Tunisia and western Libya were identified as important foraging areas for both shearwaters during the pre-breeding period (Fig. 1).

The pre-breeding movements of Yelkouan Shearwaters *Puffinus yelkouan* from the Central Mediterranean have already been published (Gatt *et al.* 2019), uncovering that foraging movements during the pre-laying exodus differ in terms of distance, duration, and area use from those of females not developing an egg, males during the pre-laying period, and the foraging ranges of the species during chick-rearing period.

Aggregations of Yelkouan and Scopoli's Shearwaters in near-shore and/or shallow shelf areas may increase their overlap with artisanal fisheries, placing them at greater risk of mortality as bycatch (Hattab *et al.* 2013; Cortés *et al.* 2017). Within the Mediterranean, long foraging trips have a high probability of being undertaken in waters outside the jurisdiction of the country where the breeding colony is located. The pre-laying exodus may also take foraging females to areas other than those exploited during better known stages of the breeding season. Therefore, appropriate offshore protection of pelagic seabirds throughout the breeding season requires international and, especially, regional communication of results with fellow researchers and policy workers to identify conservation

priorities and actions.

This work is based on findings from Malta on pre-laying movements of Yelkouan Shearwaters published by Gatt *et al.* (2019), and pre-laying movements of Scopoli's Shearwaters (Gatt, Lago, Austad and Metzger, in prep.).

References

BirdLife International, 2024. IUCN Red List for birds. Downloaded from https://datazone.birdlife.org/species/search on 24/09/2024.

Cortés, V., Arcos, J.M. and González-Solís, J., 2017. Seabirds and demersal longliners in the northwestern Mediterranean: Factors driving their interactions and bycatch rates. Marine Ecology Progress Series, 565, pp. 1-16. https://doi.org/10.3354/meps12026

Gatt, M.C., Lago, P., Austad, M., Bonnet-Lebrun, A.-S. and Metzger, B.J., 2019. Pre-laying movements of Yelkouan Shearwaters (*Puffinus yelkouan*) in the Central Mediterranean. Journal of Ornithology, 160(3), pp. 625-632. https://doi.org/10.1007/s10336-019-01646-x

Hattab, T., Ben Rais Lasram, F., Albouy, C., Romdhane, M.S., Jarboui, O., Halouani, G., Cury, P. and Le Loc'h, F., 2013. An ecosystem model of an exploited southern Mediterranean shelf region (Gulf of Gabes, Tunisia) and a comparison with other Mediterranean ecosystem model properties. Journal of Marine Systems, 128, pp. 159-174. https://doi.org/10.1016/j.jmarsys.2013.04.017

Lascelles, B.G., Langham, G.M., Ronconi, R.A. and Reid, J.B., 2012. From hotspots to site protection: Identifying Marine Protected Areas for seabirds around the globe. Biological Conservation, 156, pp. 5-14. https://doi.org/10.1016/j.biocon.2011.12.008

Mallory, M.L., Forbes, M.R., Ankney, C.D. and Alisauskas, R.T., 2008. Nutrient dynamics and constraints on the pre-laying exodus of High Arctic Northern Fulmars. Aquatic Biology, 4, pp. 211-223. https://doi.org/10.3354/ab00113

Metzger, B.J., Oppel, S., Carroll, M., Meirinho, A., Dias, M.P., Barbara, N. and Lago P., 2015. Malta Marine IBA Inventory Report, BirdLife Malta, 37 pp.

STATUS OF BREEDING SEABIRDS ON THE MEDITERRANEAN COAST OF EGYPT FROM 2014 TO 2023

Mohamed Ibrahim Habib

Biodiversity Consultant, mrhydro35@hotmail.com

Abstract

I undertook direct counts to survey the seabirds on the Mediterranean coast of Egypt between 2014 and 2023 to assess the status of breeding seabirds. Two breeding populations of Slender-billed Gull (Chroicocephalus genei) contained 45,375 individuals. One population along the Mediterranean coast and another at Lake Qarun, over 350 km inland, representing 32% of the estimated regional breeding population of the Mediterranean population. Conversely, only fifteen empty nests were found at Egypt's only known breeding colony of Yellow-legged Gull (Larus michahellis). I counted ninety-two occupied nests of Gull-billed Tern (Gelochelidon nilotica), over 950 nests of Sandwich Tern (Sterna sandvicensis) and 670 breeding pairs of Common Tern (Sterna hirundo), both species are first-time breeding in Egypt.

The Mediterranean coast of Port Said till El Arish is an important nesting area for Levant Little Terns (Sternula albifrons levantinus), a new subspecies in the Middle East with over 3,930 breeding pairs, representing more than 6% of the current Black Sea and Mediterranean Little Tern breeding population.

Disturbance from landfilling and modification of the seashore by the gas industry, tourism resorts, and the building of new ports together with the collection of eggs and chicks are the main threats affecting breeding seabirds on the Mediterranean coast of Egypt. Signs should be posted forbidding all human intrusion in the breeding areas throughout the entire breeding period.

Key-words: seabirds, breeding, threats, monitoring, Egypt

Introduction

Seabirds globally face accelerating threats from anthropogenic pressures, driving widespread population declines. Coastal development degrades critical breeding and wintering habitats, while invasive predators exacerbate reproductive failures on land. At sea, unsustainable fishing practices cause bycatch mortality, compounded by declining fish stocks, pervasive pollution, marine debris, and disturbance from maritime traffic (Croxall *et al.* 2012). Despite these challenges, certain gull species exhibit contrasting trends, capitalizing on human-subsidized resources. Notably, populations of the Yellow-legged Gull *Larus michahellis* and the Slender-billed Gull *Chroicocephalus genei* have expanded significantly across Europe and the Mediterranean, with the latter

establishing colonies throughout the Black Sea and Mediterranean regions—hosting an estimated 140,000–205,000 individuals by 2000 (Thibault *et al.* 1996; Wetlands International 2014).

The Mediterranean Sea, a biodiversity hotspot supporting endemic and threatened species, is designated for special protection under the Barcelona Convention's SPA/BD Protocol (Annex II), which lists twenty-five endangered bird species (UNEP/MAP-SPA/RAC 2018). Nevertheless, regional monitoring remains fragmented, particularly along the southern Mediterranean rim. Egypt's coastline, a potential stronghold for seabirds, suffers from critical knowledge gaps regarding breeding populations and trends. No comprehensive assessment of breeding seabirds, especially gulls, has been conducted here (Habib 2020), hindering conservation prioritization.

This study therefore aims to document the distribution, abundance, and breeding status of seabirds along Egypt's Mediterranean coast from 2014 to 2023, providing the first baseline assessment to inform national and regional conservation strategies.

Materials and methods

Surveys were conducted annually during the breeding season (April–August) along the Egyptian Mediterranean coast from 2014 to 2023. The study area spanned key coastal governorates historically known to support seabird colonies: El Arish (North Sinai), Port Said, Damietta, Alexandria, and El Fayum (including Lake Qarun). Survey sites were selected using a targeted approach based on:

1. Historical records of seabird colonies from scientific literature and local reports.
2. Preliminary reconnaissance (2014) to identify active and potential breeding habitats (e.g. coastal islands, salt pans, sandy spits, lagoons,).
3. Accessibility constraints, prioritizing sites reachable by road or foot.

Sites were revisited annually to monitor colony persistence and detect new settlements. Sites were accessed by vehicle and on foot. Each colony received 2–4 visits per breeding season to account for phenological variation (nest initiation, chick rearing). Breeding pairs were quantified using Apparently Occupied Nests (AON) as the standard unit (Bibby *et al.* 2007). AON included nests with adults in incubation posture, eggs or chicks and fresh nest material with recent adult attendance. Unoccupied but structurally intact nests were recorded separately but excluded from population estimates

Counts and behavioural monitoring (e.g., incubation, chick provisioning) were conducted from distanced vantage points using 10×42 binoculars and 20–60× spotting scopes. Observation periods were limited to 5–15 minutes per site to minimize disturbance. Muddy substrates and unstable dunes often

prevented close approach. Observations were thus made from secure, elevated positions (e.g., dunes, cliffs) ≥50 m from colonies.

Results

Surveys along Egypt's Mediterranean coast (2014–2023) documented six breeding seabird species, revealing significant colonies and range expansions. Population estimates are summarized in Table 1, with detailed species accounts below.

Slender-billed Gull *Chroicocephalus genei* (Fig. 1). Two major colonies were identified:

- Port Fouad (El Nasser Salinas): Thousands of nests with chicks observed in (Habib M.I. 2016a), with adults foraging in Lake Manzala.

- Suez Canal and Lake Qarun (El Qaren El Zahaby Island): Active breeding confirmed since 2014.

The combined Egyptian population was estimated at 15,125 pairs (45,375 individuals), representing 7.4–10.8% of the Mediterranean-Black Sea population. (140,000–205,000 pairs) (Wetlands International 2014).

Figure 1. Slender-billed Gull *Chroicocephalus genei* brooding eggs, El Nasser Salinas, Egypt. © Mohamed Ibrahim Habib

Yellow-legged Gull *Larus michahellis* (Fig. 2)

The first confirmed Egyptian breeding occurred at El Malaha, Port Fouad (east of Port Said). Surveys documented fifteen empty nests and one occupied nest (Habib 2017), indicating a small but established colony. No other breeding sites were detected during the study period.

Figure 2. Adult Yellow-legged Gull *Larus michahellis*. © Mohamed Ibrahim Habib

Gull-billed Tern *Gelochelidon nilotica*

Three breeding colonies were recorded:

- Lake Qarun (El Qaren El Zahaby Island): First confirmed breeding in NE Africa (2 pairs, 2014),

- El Nasser Salinas: twelve occupied nests (Habib 2015),

- Abu Simbel: eighty occupied nests (Habib 2017).

Lake Qarun's colony is protected by a seasonal fishing ban.

Figure 3. Gull-billed Tern *Gelochelidon nilotica* brooding eggs.© Mohamed Ibrahim Habib

Sandwich Tern *Thalasseus sandvicensis* (Fig. 4)

A new colony was established at El Nasser Salinas, Port Fouad: >950 nests counted in 2017 (first Egyptian breeding record). This represents 15.8% of the Mediterranean population (~6,000 pairs) (Wetlands International 2014), potentially linked to Suez Canal expansion and hunting bans.

Figure 4. Sandwich Tern *Thalasseus sandvicensis* parent brooding a chick. © Mohamed Ibrahim Habib

Common Tern *Sterna hirundo* (Fig. 5)

Two colonies exceeded historical records:

- Drainage Lake (Lake Manzala): 270 nests (Habib 2014a),
- El Nasser Salinas: 400 pairs (Habib 2017).

Both sites significantly surpassed the only previously recorded colony at El Malaha, which hosted only five pairs in 1990 (Habib 2016b).

Figure 5. Common Tern *Sterna hirundo* brooding eggs. © Mohamed Ibrahim Habib

The Levant Little Tern *Sternula albifrons levantinus* (Fig. 6)

Newly discovered subspecies in 2008 and published in April 2023 (Kiat 2023). In total I estimated there were 2,591 nests at Port Said, 439 nests at El Arish, and nine hundred nests at Port Fouad, giving a total of 3,930 (Habib 2014b; Habib 2016c). The terns preferred to nest on the mainland rather than on islands. Eason *et al.* (2012) found 439 Levant Little Tern nests in the northern Sinai. Port Said is an important nesting area for Levant Little Terns in the Middle East, representing more than 6% of the current Black Sea and Mediterranean breeding population, estimated at 63,500–113,000 birds (Wetlands International 2014; Meininger and Atta 1994).

Table 1. Summary of breeding seabird populations along Egypt's Mediterranean coast (2014–2023)

Species	Key Breeding Sites	Peak Population Estimate	Year	Regional Significance
Slender-billed Gull	Port Fouad, Lake Qarun	15,125 pairs	2017	7.4–10.8% of region
Yellow-legged Gull	El Malaha, Port Fouad	16 nests (1 occupied)	2017	First Egyptian record after declining
Gull-billed Tern	Lake Qarun, Abu Simbel	80 nests (Abu Simbel)	2017	First NE Africa record
Sandwich Tern	Port Fouad	>950 nests	2017	15.8% of Mediterranean population
Common Tern	Drainage Lake, Port Fouad	400 pairs (Port Fouad)	2017	>80 times the historical max
Levant Little Tern (ssp. levantinus)	Port Said, El Arish	3,930 nests (total)	2014–2016	>6% of regional population

Figure 6. The Levant Little Tern *Sternula albifrons* brooding chicks. © Mohamed Ibrahim Habib

Discussion and conclusion

We found 3,930 Levant Little Tern nests at three spots in Egypt. The nests were at:

- Port Said: 2,591 nests.
- El Arish: 439 nests
- Port Fouad: 900 nests

These birds strongly prefer to nest on the mainland shore rather than on islands. The large group at Port Said (2,591 nests) is very important. It makes up over 6% of the entire Little Tern population living around the Mediterranean and Black Seas (Wetlands International 2014).

This study provides the first comprehensive assessment of breeding seabirds along Egypt's Mediterranean coast (2014–2023), revealing regionally significant colonies and novel ecological insights. Key findings include:

- Egypt is a regional stronghold of

major colonies of Slender-billed Gull (15,125 pairs) and Sandwich Tern (>950 nests), representing >7% and >15% of their respective Mediterranean-Black Sea populations.

o Range expansions with the first confirmed Egyptian breeding records for Yellow-legged Gull and Sandwich Tern, alongside the establishment of Gull-billed Tern colonies in NE Africa.

o Subspecies significance with the confirmation of substantial populations of the newly described Levant Little Tern subspecies *Sternula albifrons levantinus* (Kiat 2023), with 3,930 nests recorded.

Threats to breeding seabirds

The identified colonies face escalating anthropogenic pressures:

o Direct Disturbance: Breeding sites, particularly near Port Said, experience high levels of disruption from fishermen accessing nesting islets, truck traffic on coastal roads, and illegal collection of tern chicks during critical nesting periods (this study; Habib 2018b).

o Habitat Loss & Degradation: Coastal development, including the construction of the Corniche road and new resorts, is rapidly encroaching on beach and salt pan habitats, increasing tourism pressure and fragmenting breeding areas.

o Infrastructure Impacts: Large-scale projects like the Suez Canal bypass and Eastern Port expansion likely caused the consolidation of Slender-billed Gulls into El Nasser Salinas (Habib 2018a) and may have facilitated the Sandwich Tern colonization, but future phases pose inundation or disturbance risks.

o Industrial Activity: Operations related to the offshore gas industry present potential threats through habitat alteration, pollution, and increased maritime traffic (cf. Croxall *et al.* 2012 for global seabird impacts).

o Limited Protection: Most colonies currently lack formal protected status or targeted management plans, leaving them highly vulnerable.

Conservation Recommendations

Urgent, targeted actions are required to safeguard these populations:

o Designate key breeding sites (El Nasser Salinas, Port Said tern colonies, El Qaren El Zahaby Island) as Specially Protected Areas under the Barcelona Convention SPA/BD Protocol, enforcing strict access controls during the breeding season (April-August).

o Mitigate Disturbance:

- Install prominent signage detailing colony significance and restricting access,
- Enforce bans on chick collection and regulate fishing activity near colonies,
- Establish buffer zones (≥200m) around colonies, monitored by rangers.

o Integrate Biodiversity into

Development Mandate Environmental Impact Assessments (EIAs) for all coastal infrastructure and industrial projects (e.g., resort expansions, gas operations, port developments), explicitly evaluating impacts on seabird colonies and mandating mitigation (e.g., seasonal work restrictions).

o Long-term Monitoring Implement standardized annual surveys to track population trends and assess conservation intervention effectiveness.

o Levant Little Tern Priority: Given its recent taxonomic recognition and mainland nesting preference (increasing vulnerability), develop a species-specific action plan for *S. a. levantinus* focusing on habitat protection from development and recreational pressure.

The Significance of new discoveries of this study fundamentally alters our understanding of seabird distribution in the southeastern Mediterranean.

Egypt's Emerging Role: The scale of Slender-billed Gull, Sandwich Tern, and Levant Little Tern colonies establishes Egypt's coast as a critical, previously underappreciated seabird breeding hub within the Mediterranean basin. Colonization Dynamics: The recent establishment and growth of Gull-billed Tern colonies and the first breeding of Sandwich and Yellow-legged Gulls suggest potential range shifts or expansions, possibly driven by habitat creation (e.g., Salinas), reduced persecution, or climate influences. The consolidation of Slender-billed Gulls highlights how large infrastructure projects can drastically alter local distribution.

Conservation Imperative: The discovery of these significant populations, particularly the endemic Levant Little Tern subspecies, places a heightened responsibility on Egyptian authorities to implement effective conservation. Protecting these sites contributes directly to regional biodiversity targets under the Barcelona Convention.

The Egyptian Mediterranean coast supports seabird populations of regional and global importance. Without immediate, science-based conservation interventions addressing the identified threats, these valuable colonies face significant risk of decline. The protection of these sites is not only a national priority but also a significant contribution to Mediterranean seabird conservation.

References

Bibby, C.J., Burgess, N.D., Hill, D.A. and Mustoe, S.H.A., 2007. Bird census techniques (2nd ed.). Academic Press, 302 pp.

Croxall, J., Butchart, S.H.M., Lascelles, B., Stattersfield, A., Sullivan, B., Symes, A. and Taylor, P., 2012. Seabird conservation status, threats and priority actions: A global assessment. Bird Conservation International, 22, pp. 1-34.

Eason, P., Rabea, B. & Attum, O., 2012. Island shape, size, and isolation affect nest-site selection by Little Terns.

Journal of Field Ornithology, 83, pp. 372-380.

Habib, M.I., 2014a. Common Tern *Sterna hirundo* breeding at Port Said, Mediterranean coast of Egypt, May 2013. Dutch Birding, 36(1), pp. 25-26.

Habib, M.I., 2014b. Little Tern *Sterna albifrons* nesting, Port Said. Egypt In: Bulletin of the Mediterranean Waterbirds Network, 2.

Habib, M.I., 2015. Gull-billed Terns breeding at Qarun Lake, Egypt, in 2013–14. Dutch Birding, 37, pp. 178-180.

Habib, M.I., 2016a. The Slender-billed Gull *Larus genei* breeding in Egypt in 2014. In: P. Yesou, J. Sultana, J. Walmsley and H. Azafzaf (Eds.), Proceedings of the 2nd Symposium on the Conservation of Marine and Coastal Birds in the Mediterranean, RAC/SPA and Medmaravis, 2015, pp. 63-66.

Habib, M.I., 2016b. Common Tern (*Sterna hirundo*) breeding colony discovered at Port Fouad, Port Said, Mediterranean coast of Egypt, May 2016 [Poster]. Bird Numbers 2016, Halle University, Germany.

Habib, M.I., 2016c. A survey of Little Tern *Sternula albifrons* colonies at Port Said, Egypt, in 2015 with notes on behaviour. Sandgrouse, 38, pp. 118-123.

Habib, M.I., 2017. New breeding colony of Yellow-legged Gull at Port Fouad, Egypt, in May 2016. Dutch Birding, 39, pp. 86-87.

Habib, M.I., 2018a. Slender-billed Gulls *Larus genei* breeding at El Nasser Salinas, northern Egypt, June 2017. Sandgrouse, 40, pp. 28-35.

Habib, M.I., 2018b. Sandwich Terns breeding at Port Fouad, Egypt, in June 2017. Dutch Birding, 40, pp. 168-171.

Habib, M.I., 2020. Status of breeding seabirds on the Mediterranean coast of Egypt from 2012 to 2018. Sandgrouse, 42, 78-83 pp. .

Kiat, Y., Habib, M.I., van Swelm, N.D., Alkaabi, A., Senfeld, T. and Collinson, J.M., 2023. A new subspecies of Little Tern from the Levant and its distinction from 'European Little Tern' and Saunders's Tern. British Birds, 116, pp. 210–221.

Meininger, P.L. and Atta, G.A.M., 1994. Ornithological studies in Egyptian wetlands 1989/90. Foundation for Ornithological Research in Egypt, 402 pp.

Thibault, J.C., Zotier, R., Guyot, L. and Bretagnolle, V., 1996. Recent trends in breeding marine birds of the Mediterranean region with special reference to Corsica. Colonial Waterbirds, 19, pp. 31-40.

UNEP/MAP-SPA/RAC, 2018. SAP/RAC: SPA-BD Protocol - Annex II: List of endangered or threatened species.

Wetlands International, 2014. Waterbird population estimates. https://wpe.wetlands.org [Retrieved March 14, 2014].

NATIONAL ASSESSMENT FOR MARITIME AND COASTAL BIRD SPECIES OF LEBANON

Fouad Itani

Association of Bird Conservation in Lebanon (ABCL), Beirut, Lebanon, fouaditani@birdsoflebanon.com

Abstract

The Association of Bird Conservation in Lebanon (ABCL), with support from the Global Greengrants Fund, has undertaken a pivotal project titled the «National Assessment for Maritime and Coastal Bird Species of Lebanon.» This initiative is essential for safeguarding Lebanon's unique avian biodiversity found along the country's 240 km Mediterranean coastline. This region, recognized for its ecological importance, faces growing pressures from human activities and environmental changes that threaten the well-being of coastal bird species. Among the most pressing ecological threats are pollution from industrial and agricultural sources, illegal hunting practices, climate change impacts, and widespread habitat destruction. These challenges jeopardize not only the survival of key bird species but also the health of the ecosystems and communities that depend on them.

The project's field surveys, employing point counts, transects, boat counts, and vantage point observations, recorded 18 of the 25 bird species listed under Annex II of the Barcelona Convention's Protocol on Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD). Notable discoveries include recent records like the European Shag (Phalacrocorax aristotelis), documented for the first time in Lebanon in 2023. The study underscores the urgent need for continuous monitoring, community engagement, and conservation actions to mitigate these threats and ensure the long-term survival of Lebanon's avian species.

Key-words: Barcelona Convention, threatened bird species, Mediterranean, seabirds, Lebanon

Introduction

Lebanon's coastal region provides critical habitat for a variety of seabird species, many of which are protected under the Barcelona Convention's Annex II. These species contribute to the overall health and balance of the Mediterranean ecosystem, playing vital roles in maintaining ecological functions such as nutrient cycling and pest control. However, increasing human activity, such as unregulated development, industrial pollution, and overfishing, has put significant strain on these populations. Furthermore, illegal hunting during migration seasons poses a direct threat

to many species, some of which are already endangered or have dwindling populations (Itani & Indary 2024).

To address these concerns, ABCL launched the «National Assessment for Maritime and Coastal Bird Species of Lebanon» to evaluate the status of seabird populations along the Lebanese coast. The project's primary goals are to establish baseline data on species population and distribution, identify key ecological threats, and promote local community involvement in bird conservation efforts.

Materials and methods

Field surveys were conducted in selected coastal and marine zones based on their ecological significance and the diversity of bird species they support. The surveys were carried out during both the breeding and wintering seasons, ensuring comprehensive data collection on the birds' migratory, breeding, and foraging behaviors. Key methods employed included:

- Point counts: to monitor bird populations at fixed locations.
- Boat counts: to observe seabird species in offshore environments (Fig. 4).
- Transects: used for systematic observation across selected coastal zones.
- Vantage point observations: utilized to observe seabird movements over time from elevated positions.

Figure 1. The Vulnerable Audouin's Gull *Ichthyaetus audouinii*, is a former breeder and a rare passage migrant to Lebanon (Ramadan-Jaradi *et al.* 2020). ©Fouad Itani

Figure 2: European Shag *Gulosus aristotelis* recorded for the first time in Lebanon, in Tripoli. ©Fouad Itani

Figure 3. The Mediterranean Gull *Ichthyaetus melanocephalus* is a scarce and irregular passage migrant and winter visitor to Lebanese coastal areas (Ramadan-Jaradi *et al.* 2020). ©Fouad Itani

These methods were complemented by literature reviews to provide a broader understanding of historical data on seabird populations. Local communities, including fishermen, birdwatchers, and nature reserve managers, were also involved in the data collection process, contributing valuable insights into seabird behaviors and threats in their regions.

Results

The project recorded 18 of the 25 species listed in Annex II of the Barcelona Convention's Protocol. Significant species observed include the Gull-Billed Tern *Gelochelidon nilotica*, Scopoli's Shearwater *Calonectris diomedea* (Fig. 10), and Mediterranean Gull *Larus melanocephalus* (Fig 3).

A major discovery was the documentation of the European Shag *Phalacrocorax aristotelis* (Fig. 2), which was observed for the first time in Lebanon in late 2023, near Tripoli (Sawan & Namnoum 2024). This finding adds to the known species diversity of the region and marks an important milestone in the country's ornithological records.

We were able to identify key threats, analyze the chronology and phenology status of various species, and assess their conservation status, providing crucial data that allowed us to thoroughly update the 10-year Annotated Checklist (Ramadan-Jaradi *et al.* 2020).

However, the surveys also highlighted concerning trends. Six species, such as the Balearic Shearwater and Osprey, were not observed during our study that is supported by the Global Greengrants Fund, which may indicate their limited distribution or declining presence in the region. Furthermore, the project identified an emerging threat: the illegal hunting of seabirds by local fishermen (Ramadan-Jaradi 2023). This practice, likely exacerbated by Lebanon's ongoing economic crisis, poses a severe risk to already vulnerable bird populations.

Discussion and conclusion

The findings of this project reveal

Figure 4. Applying the Boat Count Method offshore Tripoli. ©ABCL

Figure 5. The Palm Islands, offshore Tripoli is home to the only breeding gull in the country the Yellow-legged Gull *Larus michahellis*. ©Fouad Itani

the dynamic and complex nature of Lebanon's seabird populations. While some species appear to be stable, others show signs of decline or are absent from their historical habitats. These changes are likely influenced by a combination of environmental factors, including habitat degradation, pollution, and climate change.

The inclusion of local stakeholders in the project, particularly fishermen and conservationists, has been instrumental in gathering accurate data and promoting sustainable conservation practices. Workshops and eco-tourism initiatives have proven effective in raising awareness about the importance of seabirds and their habitats. Community engagement will be crucial for the project's long-term success, as it fosters a sense of shared responsibility for Lebanon's natural heritage.

Moving forward, the project recommends several key actions:

- Strengthening legal frameworks and enforcement to regulate hunting and fishing practices.
- Implementing stricter pollution controls and promoting habitat restoration efforts in degraded coastal areas.
- Establishing new Marine Protected Areas (MPAs) and Important Bird Areas (IBAs) to provide safe havens for migratory and resident seabirds.
- Developing bird identification guides and monitoring protocols to empower local communities and conservation groups to contribute to seabird conservation efforts.

In conclusion, this assessment provides a critical foundation for future seabird conservation work in Lebanon. With continued monitoring and community involvement, it is possible to mitigate the threats facing these species and ensure the long-term preservation of Lebanon's rich avian biodiversity.

Figure 6. Sandwich tern *Thalasseus sandvicensis* is a fairly common passage migrant and winter visitor to Lebanon. ©Fouad Itani.

Acknowledgments

This project was made possible through the generous support of the Global Greengrants Fund and the dedication of local communities and conservation experts. Special thanks go to Professor of Ornithology, Dr. Ghassan Ramadan-Jaradi, for his unwavering support and invaluable contributions to this project.

References

Itani, F., 2023. Best Practices for Safeguarding Native Birds from Avian invasive Species and Sustained Monitoring in Tyre Coast Nature Reserve. Final Report to the Tyre Coast Nature Reserve (TCNR).

Itani, F. and Indary, S., 2024. National Assessment for Maritime and Coastal Bird Species of Lebanon. Final Report to the Global Greengrants Fund (GGF).

Ramadan-Jaradi, G., Itani, F., Hogg, J., Serhal, A. and Ramadan-Jaradi, M., 2020. Updated checklist of the birds of Lebanon, with notes on four new breeding species in spring 2020. Sandgrouse, 42, pp. 186-238.

Ramadan-Jaradi, G., 2023. Data on the abundance and distribution ranges of seabirds and their habitats as a contribution to the implementation of IMAP. Final Report to the National Council for Scientific Research in Lebanon (CNRSL).

Sawan, M. and Namnoum, C., 2024. First records of European Shag *Gulosus aristotelis* and other recent bird observations in Lebanon, 2023-2024. Sandgrouse, 46(1), pp. 99-102.

Figure 7. Yellow-legged Gull caught by the man-made fire at Palm Island Nature Reserve. ©Fouad Itani

Figure 8. Disturbance next to breeding grounds can push avian species away (Itani, 2023). ©Fouad Itani

Figure 9. The Common Myna an invasive species threatening other avian species (Itani, 2023). ©Fouad Itani

Figure 10. Scopoli's Shearwater *Calonectris diomedea* recorded offshore during passage. ©Fouad Itani

ADVANCING MEDITERRANEAN SEABIRD CONSERVATION: A COLLABORATIVE APPROACH AND INTEGRATED MONITORING INITIATIVES

Samar Kilani[1], Yassine Ramzi Sghaier[1], Lobna Ben Nakhla[1]

[1] Specially Protected Areas Regional Activity Centre (SPA/RAC), Boulevard du Leader Yasser Arafat - B.P. 337 - 1080 - Tunis Cedex – Tunisie, skilani.samar@gmail.com

Abstract:

In 2008, the Barcelona Convention adopted the Ecosystem Approach as a strategic framework for preserving the Mediterranean's marine and coastal ecosystems, with the goal of achieving Good Environmental Status (GES). This approach defines 11 Ecological Objectives (EOs), providing a roadmap for operational objectives and GES targets (Barcelona Convention 2008). The regional implementation of the Ecosystem Approach is supported by the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria (IMAP), which utilizes regionally agreed common indicators for all Ecological Objectives, enabling comprehensive quantitative analyses of the Mediterranean's environment.

This study focuses on the IMAP Common Indicators related to seabirds, examining monitoring scales, assessment criteria, baseline, and threshold values for CI3 (species distributional range), CI4 (species abundance), and CI5 (species demographic characteristics). Through collaborative efforts, the SPA/RAC has assisted Mediterranean countries harmonize national monitoring programs for seabirds, supported by EU-funded projects such as IMAP-MPA and EcAp MED III. Harmonized seabird monitoring was carried out in 2023 in Egypt, Morocco, Lebanon, Libya, and Tunisia, with an emphasis on 11 IMAP indicator species.

This initiative fosters a holistic understanding of the complex relationship between environmental pressures and their impacts on seabird populations, reinforcing conservation and management efforts. Both historical and new data contribute to enhancing regional data management practices.

Key-words: seabird conservation, Ecosystem Approach, IMAP, Barcelona Convention, Mediterranean

Introduction

Seabirds play a crucial role in the Mediterranean's marine biodiversity, acting as indicators of ecosystem health. Many species in this region are facing multiple pressures from both land and sea. Recognizing their ecological significance, the Barcelona Convention incorporated seabirds into its biodiversity targets under Ecological Objective 1 (EO1). The Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and

Related Assessment Criteria (IMAP) facilitates data collection on seabird populations through three Common Indicators: species distributional range (CI3), species abundance (CI4), and species demographic characteristics (CI5). This manuscript highlights the regional seabird monitoring efforts and their implications for the conservation of Mediterranean seabird populations.

Materials and methods

The Ecosystem Approach (EcAp) adopted by the Barcelona Convention is aimed at achieving Good Environmental Status (GES) through regular monitoring and assessments. In the context of seabird conservation, IMAP identifies 11 key seabird species from 25 species listed in Annex II of the SPA/BD Protocol. These species represent six functional ecological groups and are employed as indicator species for the IMAP Common Indicators CI3, CI4, and CI5.

During the biennium of 2022-2023, and within the framework of the EU-funded projects IMAP-MPA and EcAp MED III, as well as the UNEP/MAP work plan, the national IMAP was implemented in seven Contracting Parties across more than 30 sites. These sites were divided into Marine Protected Areas (MPAs) and «under pressure» sites, in alignment with the principles outlined in the IMAP framework. At least one of the sites selected in each country had to be an MPA, while two sites had to be under human pressure. This site selection ensures that monitoring captures the impact of both protected and degraded environments on seabird populations (UNEP/MAP 2016). The 11 IMAP indicator species were central to these monitoring efforts (SPA/RAC 2023). Contracting Parties (CPs) developed their national monitoring plans based on the national IMAP programs and in coherence with the Monitoring Protocols for IMAP Common Indicators related to Biodiversity and Non-Indigenous Species.

Guidelines for monitoring seabirds in the Mediterranean were followed, incorporating both land-based and ship-based approaches. For land-based monitoring, linear transects were used during the wintering bird season. Ship-based surveys, involving offshore counts and scanning transects, complemented the land-based observations. For the breeding season, the Point Count method (Blondel 1981) was used to monitor the potential breeding species of the Common Indicators (UNEP/MAP 2016).

Data was collected following Data Dictionaries and Data Standards for the Common Indicators 3, 4, and 5 related to Marine Birds. The formatted sets of data were submitted to the IMAP Info System, available at this link.

The species were selected based on criteria such as wide Mediterranean distribution, conservation concern, and representation of different functional ecological groups, as detailed in the assessment elements document (UNEP/MAP 2022).

Results

Harmonized monitoring provided critical insights into the status of the 11 indicator species across the South Mediterranean countries. In Bosnia and Herzegovina, monitoring was conducted at six sites (four land and two offshore), resulting in the observation of one species, the Mediterranean Shag *Gulosus aristotelis desmarestii*, with a total count of 293 individuals. Morocco targeted six species from the IMAP indicator list, including Osprey *Pandion haliaetus* and Audouin's Gull *Ichthyaetus audouinii*, across three main sites. In Tunisia, the focus was on five indicator species during the nesting period at five significant sites. Lebanon monitored five species across three main sites, including both MPAs and areas under pressure. Egypt reported a total of 15 species from Annex II, with five included in the IMAP list, monitored across five main sites, including Salloum MPA. Lastly, in Libya, monitoring efforts were conducted at four sites, including two Marine Protected Areas (MPAs). While the wintering bird census reported a total of 18,018 individuals across all species, the breeding season highlighted significant observations for the Lesser Crested Tern *Thalasseus bengalensis* and Mediterranean Shag *Gulosus aristotelis*, particularly in the Gulf of Sirt and Ain Alghazala MPA. Collectively, these monitoring efforts highlight the diverse seabird populations in the Mediterranean and underscore the necessity for continued collaboration in conservation efforts, particularly in light of reported threats such as illegal hunting, the impact of invasive species, and pollution, all of which pose significant risks to seabird populations and their habitats.

Discussion and conclusion

The seabirds' monitoring underscore the importance of comprehensive and integrated monitoring programs. While progress has been made in tracking distribution and abundance, demographic data remain limited, hindering a fully quantitative GES assessment. Specifically in Bosnia and Herzegovina, this work not only marks the first application of the IMAP but also represents a pilot study in ornithology, leading to the establishment of the national IMAP for seabirds. Overall, this work serves as a foundation that should be continued, with further assessments and monitoring efforts extending the experience to other species and across the Ecological Objectives. Moving forward, expanding monitoring networks and addressing data gaps will be essential to ensuring the sustainability of seabird populations in the Mediterranean.

Acknowledgments

The authors would like to thank the European Union's IMAP-MPA and EcAp MED III projects for their financial support, as well as the national teams in Egypt, Morocco, Lebanon, Libya, and Tunisia for their dedication to seabird monitoring. Special thanks to the Italian Ministry for Ecological Transition

(MITE) for supporting the work carried out in Bosnia and Herzegovina, and to the national teams for their valuable contributions.

References

Barcelona Convention, 2008. Ecosystem Approach Roadmap. UNEP/MAP, Athens, 25 pp.

SPA/RAC, 2023. Seabird Monitoring in the Mediterranean. Tunis, 45 pp.

Smith, J., 2015. Marine Conservation in the Mediterranean. Marine Policy, 23(2), pp. 12-35.

UNEP/MAP, 2016. Implementation of the Ecosystem Approach in the Mediterranean: progress report. UNEP(DEPI)/MED WG.431/Inf.7, 18 pp. Available at: https://www.rac-spa.org/sites/default/files/ecap/ig22_inf7.pdf

UNEP/MAP, 2022. Monitoring and Assessment Scales, Assessment Criteria, Thresholds and Baseline Values for the IMAP Common Indicators 3, 4, and 5 related to seabirds. UNEP/MED WG.520/4, 72 pp.

UNEP/MAP, 2023. Mediterranean Quality Status Report. UNEP/MAP, Athens, 80 pp. Available at: Biodiversity & Fisheries | MEDQSR (info-rac.org)

FORAGING RANGES AND BREEDING SUCCESS OF COMMON TERNS IN THE ADRIATIC SEA

Jelena Kralj[1], Željko Pavlinec[2], Luka Jurinović[3], Sanja Barišić[1], Davor Ćiković[1],Vesna Tutiš[1]

[1] Institute of Ornithology, Croatian Academy of Sciences and Arts, Zagreb, Croatia, jkralj@hazu.hr
[2]Aquarium Pula, Pula, Croatia
[3]Croatian Veterinary Institute, Poultry Center, Zagreb, Croatia

Abstract

Along the Croatian Adriatic coast, the Common Tern (Sterna hirundo) breeds on small, sparsely vegetated rocky islets or artificial structures. From 2021 to 2023 we monitored breeding success at four colonies in the Northern and Central Adriatic and in 2023 we tracked nine birds from two colonies using solar-powered GPS loggers. The median value of daily maximum distance from the colony was 13.98 km (IQR 12.42-16.90) during the incubation and 13.59 km (IQR 12.01-16.29) during the chick-rearing period. The median value of daily colony attendance measured as the proportion of GPS locations within a 200 m buffer of the colony was 0.50 during the incubation and 0.38 during the chick-rearing period. The clutch size was between 2.1 and 2.8 eggs per colony per year, with common replacement clutches. Breeding success was low in all colonies in all years (<0.5 chicks/nest). Disturbance by fishermen and tourists was identified as the main threat. Still, large foraging ranges in comparison to other studied populations indicate that availability and predictability of food may also affect the breeding success.

Key-words: foraging distance, colony attendance, tracking data

Along the Croatian Adriatic coast, the Common Tern *Sterna hirundo* breeds on small, sparsely vegetated rocky islets or artificial structures, usually in small colonies of 5-40 pairs. They choose islands without the Yellow-legged Gull *Larus michahellis* colonies. We monitored breeding success at four colonies in the Northern and Central Adriatic from 2021 to 2023 through regular visits and camera traps (in one colony for two years). In 2023 we used solar-powered GPS loggers (GPS-Bluetooth Nano, Interrex, 3.2 g and GPS UHF Nano tag, Milsar, 3.9 g) with remote download to study foraging ranges of adult breeding terns from two colonies in the North (bay of Pula, Istria, 44.575° N 13.802° E) and Central Adriatic (is. Školjić near island of Pašman, 43.977° N 15.356° E). We tagged 16 terns and successfully tracked nine birds (four males and five females) with a total of 197 tracking days (see Kralj *et al.* 2024). Tracking data were resampled to one-hour intervals (± 5 minutes). Tracking data were analysed using R (version 4.3.2, R Core Team 2023) packages

"fossil" (Vavrek 2011) and "amt" (Signer *et al.* 2019).

Terns were mainly foraging along the coast or in the channel between the islands and the mainland, but three individuals in the North Adriatic also foraged in the open sea more than 60 km from the coast. The median value of daily maximum distance from the colony was 13.98 km (IQR 12.42-16.90) during the incubation and 13.59 km (IQR 12.01-16.29) during the chick-rearing period. The absolute maximum distance from the colony was 69.4 km for North Adriatic and 50.2 km for Central Adriatic terns. Adriatic terns foraged at greater distances from colonies than Common Terns from freshwater sites in Croatia and the German Wadden Sea (Militão *et al.* 2023; Kralj *et al.* 2024). The birds most actively foraged during the late afternoon. Along the east Adriatic coast, diurnal winds increase in the mid-day and calm down towards the evening, therefore this foraging dynamic could be the result of birds avoiding foraging among waves. Although freshwater lakes were within foraging range, no tracked terns were recorded foraging at freshwater sites. Tracking studies with a finer temporal scale and detailed spatial and temporal data on wind and tide dynamics are needed to understand the environmental factors that affect the foraging dynamics of Common Terns in the Adriatic Sea.

The median value of daily colony attendance (proportion of GPS locations within a 200 m buffer of the colony) was 0.50 during the incubation and 0.38 during the chick-rearing period, which was significantly lower than in the freshwater populations (0.80 and 0.68, respectively; Kralj *et al.* 2024). Daily nest attendance during the incubation was higher for females (males 0.40, females 0.53).

The clutch size was between 2.1 and 2.8 eggs per colony per year. Replacement clutches were common, with no significant difference in the number of eggs between first and replacement clutches. Breeding success was low in all colonies in all years (<0.5 chicks/nest). Slightly larger breeding success was observed on more remote islands. Disturbance by fishermen and tourists was identified as the main threat. However, large foraging ranges in comparison to other studied populations (Militão *et al.* 2023; Kralj *et al.* 2024), indicate that the availability and predictability of food may also affect the breeding success. The effect of seawater warming and increasing fishing pressure in the Adriatic Sea on seabirds have to be further studied. The study of numerous and widespread seabird species might provide valuable information on pressures such as disturbance or food shortage to seabirds in general, so it is worth considering the possible future introduction of more common species, such as the Common Tern, in the Barcelona protocol.

References:

Kralj, J., Pavlinec, Ž., Jurinović, L., Barišić, S., Martinović, M., Meštrović, L., Bjelić Laušić, M., Ćiković, D., Tutiš, V., Lončar, V., Galov, A., 2024. River and sea: foraging range of freshwater and marine Common Terns. Journal of Ornithology, 166(43), pp. 121-130. https://doi.org/10.1007/s10336-024-02196-7

Militão, T., Kürten, N., Bouwhuis, S., 2023. Sex-specific foraging behaviour in a long-lived seabird. Marine Biology, 170(132), 17 pp. https://doi.org/10.1007/s00227-023-04280-7

R Core Team, 2023. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/

Signer, J., Fieberg, J., Avgar, T., 2019. Animal movement tools (amt): R package for managing tracking data and conducting habitat selection analyses. Ecology and Evolution, 9(2), pp. 880-890. https://doi.org/10.1002/ece3.4823

Vavrek,M.,2011.Fossil:Palaeoecological and Palaeogeographical Analysis Tools. PalaeontologiaElectronica,14(1T),16pp.

THE FRENCH NATIONAL ACTION PLAN FOR THE BALEARIC SHEARWATER

Adrien Lambrechts

Office Français de la Biodiversité (OFB), Délégation de façade atlantique, 1, rue Eugène Varlin 44000 Nantes, France, adrien.lambrechts@ofb.gouv.fr

The Balearic Shearwater *Puffinus mauretanicus*, a species endemic to the Balearic Islands, is considered the most endangered seabird in Europe. The global population size of this species is low and declining. Its conservation status is ranked «critically endangered» in Europe since 2004, and the species is protected in France. It is also listed in the Annex II (threatened species) of the SPA/BD Protocol of the Barcelona Convention. France has a major responsibility in its conservation during the non-breeding period (presence in French Atlantic territorial waters), and to a lesser extent during the breeding period (presence in the Mediterranean Sea).

To face the population decline, SEO / BirdLife-Spain has coordinated the first international action plan for the Balearic Shearwater in 2011, in which France was urged to take this endangered species into account. In 2020, after two years of preparation and public engagement, and following its validation by a national steering committee, the French government approved its own National Action Plan (NAP) for five years (2021-2025) in support of this species.

This NAP primarily aims to reduce the pressures exerted on the species, such as interactions with fisheries, nautical sports and leisure activities, and potential interactions with existing and planned offshore wind farms, in order to improve Balearic Shearwater conservation status.

This National Action Plan for the Balearic Shearwater should define a medium- to long-term strategy aiming to:

- Organise coherent monitoring of sub-populations of the species;
- Implement coordinated actions favourable to the restoration of the species and its habitat;
- Facilitate the integration of the protection of this species in human activities and public policies;
- Inform and raise awareness among the stakeholders concerned and the general public.

This Plan is the first strategic national document whose objective is to act with all partners having potential levers for improving the unfavourable status of this species.

The two first years of this NAP implementation lead to a number of significant achievements:

- Setting a coordinated monitoring plan including surveys from the shore, at sea standardized surveys, GPS bio-logging programme on birds caught at sea, collect of tissue to characterize trophic ecology and contamination level;
- Starting an ambitious programme to characterize interactions with fisheries and assess by-catch risk, including surveys with fishermen and on-board observation on longline, gillnet and purse seine fleets;
- Initiating a global public and stakeholder awareness programme to reduce disturbance of the species at sea by leisure activities, including the distribution of leaflets, the publication of papers, or awareness raising through at-sea interventions.

The main actions of this National Action Plan are developed, with a focus on actions related to fisheries and by-catch issues, including those implemented in the Mediterranean waters (Golfe du Lion): surveys of fishermen, on-board observations, by-catch risk assessment.

English version of the French National Action Plan: https://oiseaux-marins.org/upload/gedit/1/projets_pna_puffin_des_baleares/rapports/20230613_french_nap_balearic_shearwater_en_web.pdf

Website to follow up with the implementation of the plan: https://oiseaux-marins.org/accueil/projets/pna-puffin

PRELIMINARY DATA OF OFFSHORE SEABIRD MONITORING IN THE GULF OF TARANTO (NORTHERN IONIAN SEA)

Cristiano Liuzzi[1], Stefano Bellomo[2], Maurizio Ingrosso[3], Francesca Cornelia Santacesaria[2,3], Carmelo Fanizza[2], Giulia Cipriano[3], Roberto Carlucci[3]

[1] Centro Studi de Romita APS, 70014 Conversano (Bari), Italy, cristiano.liuzzi@gmail.com
[2] Jonian Dolphin Conservation, 74123 Taranto, Italy
[3] Department of Biosciences, Biotechnologies and Environment, University of Bari Aldo Moro, 70125 Bari, Italy

Abstract

In order to identify significant conservation areas and comprehend medium- and long-term patterns that support habitat management, standardised bird monitoring is essential. While certain bird species are internationally monitored through multi-year databases like the International Waterbird Census, marine species, particularly those with uncertain conservation statuses, are often overlooked, especially in the Mediterranean Sea.

This study presents preliminary data from standardized monitoring conducted off the coasts of Apulia and Basilicata in the Gulf of Taranto, Northern Ionian Sea between January 2022 and December 2023. Using the European Seabirds at Sea (ESAS) guidelines, linear transects were performed, recording bird sightings within a 90° angle and 300 m from the boat. Bird counts were conducted in time intervals (poskey) lasting 5 minutes, at a constant speed of 7 knots, with tracking performed using the OruxMaps application.

A total of 1,030 poskey were completed, covering 1,105.2 km and 85.8 hours of navigation, resulting in 19 seabird species observed, totalling 10,853 individuals.

Phenology and seasonal patterns were examined for three species: Scopoli's Shearwater (Calonectris diomedea), Yelkouan Shearwater (Puffinus yelkouan), and Mediterranean Gull (Larus melanocephalus).

Key-words: Scopoli's Shearwater, Yelkouan Shearwater, Mediterranean Gull, pelagic birds, offshore monitoring

Introduction

The marine environment is home to many bird species that have an unfavourable conservation status, and others that are threatened with extinction. The standardized monitoring of birds is essential to identify areas of important conservation interest and obtain medium and long-term trends that provide precious indications for appropriate habitat management (e.g. establishment of new Special Protection Areas following the Directive 147/2009/CE; Marine Protected Areas, etc.).

Using multi-year databases, certain bird

species are simultaneously monitored on a global scale (Wetland International 2020); this method allows to evaluate the health status of bird populations and to improve and inform consequent conservation strategies. On the other hand, census programs frequently fail to adequately target species that live in offshore marine environments. Those species often have an unknown or unfavourable conservation status, particularly in the Mediterranean Sea. Large-scale offshore studies are very few in Italian waters (LIPU 2009). An exception is the Gulf of Taranto in the Northern Ionian Sea (Central-eastern Mediterranean), where standardized surveys on pelagic birds started in 2017 (Liuzzi *et al.* 2022).

This work aims to present the preliminary results of data collected during standardized monitoring activities carried out between January 2022 and December 2023. Inter-specific and seasonal differences in the number of individuals observed were explored for the occurring species. In particular, the study was focused on Scopoli's Shearwater *Calonecteris diomedea*, Yelkouan Shearwater *Puffinus yelkouan*, and Mediterranean Gull *Larus melanocephalus*, three species of conservation concern which occur in large numbers in the study area. Particularly, about these target species, the literature reports that: Scopoli's Shearwater is a regular visitor in the Gulf of Taranto from late winter to late autumn, with only occasional sightings during winter months (Brichetti and Fracasso 2018); the Yelkouan Shearwater is present year-round in the study area, however no breeding sites have been documented; the Mediterranean Gull is regularly observed in the Gulf of Taranto, especially from autumn to early spring, with winter groups often numbering in the thousands (Zenatello *et al.* 2020).

Materials and methods

The study area extends from Santa Maria di Leuca to Punta Alice (Fig. 1), covering an area of about 14,000 km². It shows a complex geomorphology with a narrow continental shelf and steep slope, cut by several channels in the western sector and descending terraces in the eastern one. At the centre of the gulf lies the submarine Taranto Valley canyon system. The characteristics of its geomorphology result in a complex distribution of water masses and the occurrence of upwelling phenomenon with high seasonal variability (Bakun and Agostini 2001; Civitarese *et al.* 2010).

Data were collected during standardized monitoring off the coasts of Apulia and Basilicata in the Gulf of Taranto (Central Mediterranean Sea), carried out from January 2022 to December 2023.

The European Seabirds at Sea method (ESAS) has been used in order to obtain qualitative and quantitative data on the occurrence of seabird taxa, with particular regard to pelagic species, recording the species identity and number of individuals observed. For instance, this methodology has been implemented with the aim to

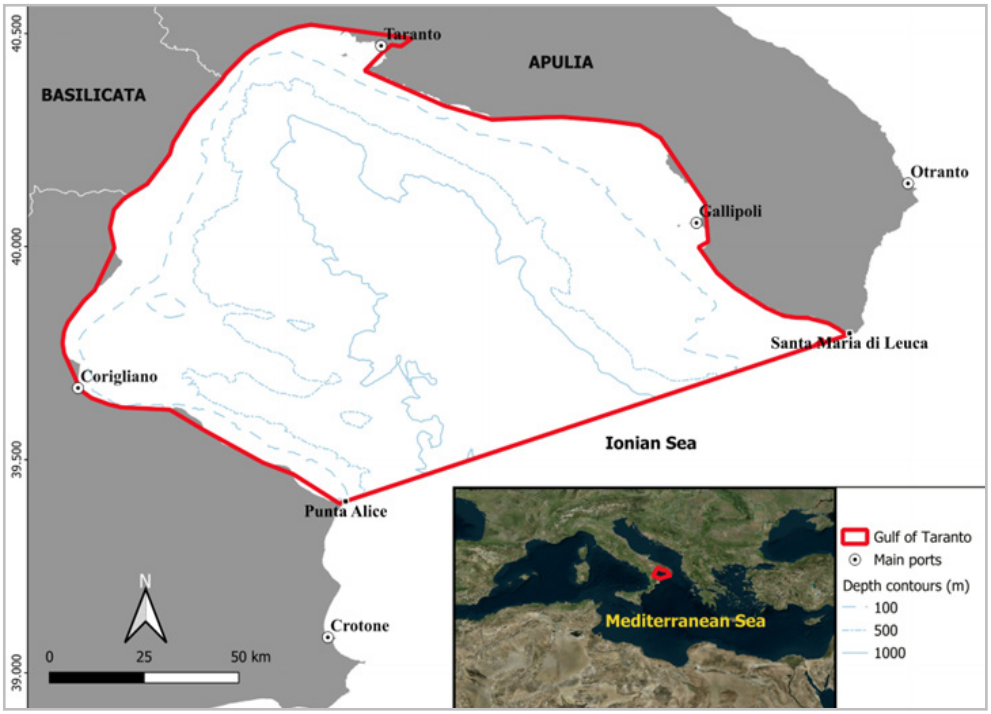


Figure 1. Map of Gulf of Taranto (red polygon). The most important ports are reported.

facilitate data standardization and future comparison with other geographical areas.

The methodology has already been used in Italy by LIPU and was preparatory to the identification of Marine Important Bird Areas (IBAs) and Special Protection Areas (SPAs) in the marine environment (LIPU 2009).

Linear transects were made in the sea, making linear journeys (Tasker *et al.* 1984), on board of a 12 m catamaran. All bird observations made were recorded, but only individuals in flight or sitting on the surface of the water, within 300 m perpendicular distance from the vessel, were considered in the transect.

The counting of the birds in the transect was carried out in time intervals (poskey) lasting 5 minutes, with a constant speed of the boat of 7 knots. The bird sighting was implemented with the naked eye, and it was aided with binoculars (7x32 and 8x42) for species recognition. All transects were traced using the OruxMaps application. The codes used for annotating the parameters collected were the standard indicated for the ESAS (Tasker *et al.* 1984).

For the focus species (Scopoli's Shearwater, Yelkouan Shearwater, Mediterranean Gull), additional information, namely behaviour and association with cetaceans, boats, etc., was collected and encoded based on what is proposed by Camphuysen and Garthe (2004). Seasons were defined as follows: winter (December–February), spring (March–May), summer (June–August), and autumn (September–November).

Results

The transects were carried out monthly between January 2022 and December 2023, for a total of 23 sampling sessions, 1,030 poskeys and 1,105.2 km travelled in about 86 h of navigation.

Altogether 19 species of seabirds were sighted: 1 Anatidae, 1 Podicipedidae, 2 Procellariidae, 1 Phalacrocoracidae, 12 Laridae, 1 Stercorariidae, and 1 Alcidae, for a total of 10,853 individuals (Tab. 1).

The three focus species were chosen to characterize the study area: the Scopoli's Shearwater, the Yelkouan Shearwater, and the Mediterranean Gull. For these species, the phenology and seasonal variations were analysed. Figures 2 and 3 respectively show the monthly percentage of positive poskeys and the number of individuals recorded for these species in each season.

Scopoli's Shearwater was recorded from March to October. No observations were made during winter. Spring was the season with the highest percentage of positive poskeys and the greatest number of individuals for this species. The species has not been observed in association with cetaceans and only rarely with tuna (1.5% of individuals) and active fishing vessels (0.4%).

The Yelkouan Shearwater was observed in all seasons. Winter showed the highest percentage of positive poskeys, while spring recorded the highest number of individuals, when large groups (>100 individuals) were observed, both feeding and resting. Association with fishing activities were rare, occurring in only 0,2% of observation.

The Mediterranean Gull was also recorded throughout the year; however, winter was clearly the most significant season, confirming the importance of the area as a wintering ground, as also documented along the coasts (Zenatello *et al.* 2020). During winter, this species exhibited both the highest percentage of positive poskeys and the highest number of individuals. The species associated with fishing vessels in 10.7% of observations.

Among other species, the regular presence of the Little Gull *Hydrocoloeus minutus* during winter and spring stands out, with groups of hundreds of individuals (over 700) observed both feeding and resting. These are the first available data on the actual wintering population present in the Gulf of Taranto, as winter monitoring conducted from the coast does not allow for a complete census of this species (Serra *et al.* 1997; Baccetti *et al.* 2002; Zenatello *et al.* 2014; Zenatello *et al.* 2020).

The Yellow-legged Gull *Larus michahellis* is the dominant species (Tab. 1), especially in summer, following the breeding season.

Audouin's Gull *Larus audouinii* was mainly observed during spring migration, with single individuals.

The Black-legged Kittiwake *Rissa tridactyla*, although considered a regular wintering species, is often not reported in IWC censuses due to its pelagic habits. This study provided evidence of its presence in the Gulf of Taranto.

Table 1. Species occurring during surveys. Species name (scientific and common), number of individuals, and percentage of poskeys are reported.

Species	Common name	Winter		Spring		Summer		Autumn	
		n. ind.	% poskey	n. ind.	% poskey	n. ind.	% poskey	n. ind.	% poskey
Anas crecca	Common Teal	0	0.00	0	0.00	0	0.00	2	0.40
Podiceps cristatus	Great Crested Grebe	0	0.00	4	0.30	0	0.00	0	0.00
Calonectris diomedea	Scopoli's Sheaewater	0	0.00	450	14.16	27	6.98	47	7.94
Puffinus yelkouan	Yelkouan Shearwater	49	9.09	956	3.61	103	7.44	4	1.19
Phalacrocorax carbo	Great Cormorant	4	0.87	11	0.90	0	0.00	9	0.79
Hydrocoloeus minutus	Little Gull	1167	3.46	1429	4.52	0	0.00	0	0.00
Rissa tridactyla	Black-legged Kittiwake	15	3.90	1	0.30	0	0.00	0	0.00
Larus genei	Slender-billed Gull	0	0.00	22	0.60	0	0.00	0	0.00
Larus ridibundus	Black-headed Gull	1094	30.30	13	0.90	28	3.26	430	32.14
Larus melanocephalus	Mediterranean Gull	355	15.58	102	7.23	25	5.12	87	15.08
Larus audouinii	Audouin's Gull	2	0.87	27	5.42	2	0.93	4	1.59
Larus fuscus	Lesser Black-backed Gull	2	0.87	2	0.60	0	0.00	2	0.79
Larus michahellis	Yellow-legged Gull	669	36.80	867	24.10	1347	45.12	1317	34.52
Larus cachinnans	Caspian Gull	0	0.00	1	0.30	0	0.00	0	0.00
Chlidonias niger	Black Tern	0	0.00	0	0.00	124	6.51	0	0.00
Sterna hirundo	Common Tern	0	0.00	2	0.30	0	0.00	0	0.00
Thalasseus sandvi-censis	Sandwich Tern	19	5.19	17	1.51	2	0.93	3	1.19
Stercorarius parasiticus	Arctic Jaeger	1	0.43	0	0.00	2	0.93	0	0.00
Alca torda	Razorbill	6	1.30	1	0.30	0	0.00	0	0.00

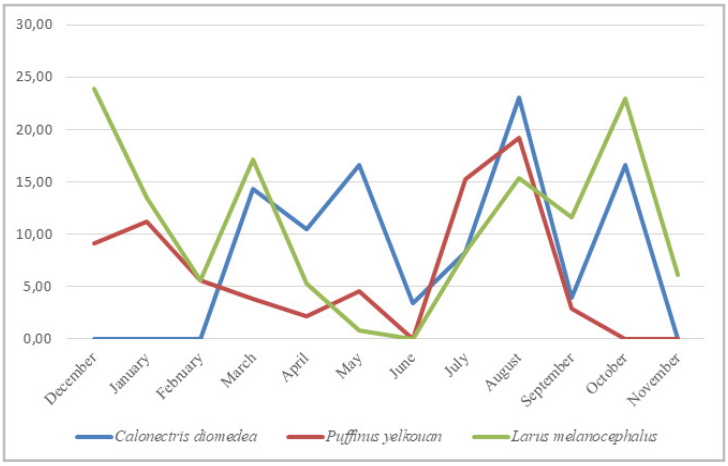


Figure 2. Percentage of poskeys for the three investigated species during the year.

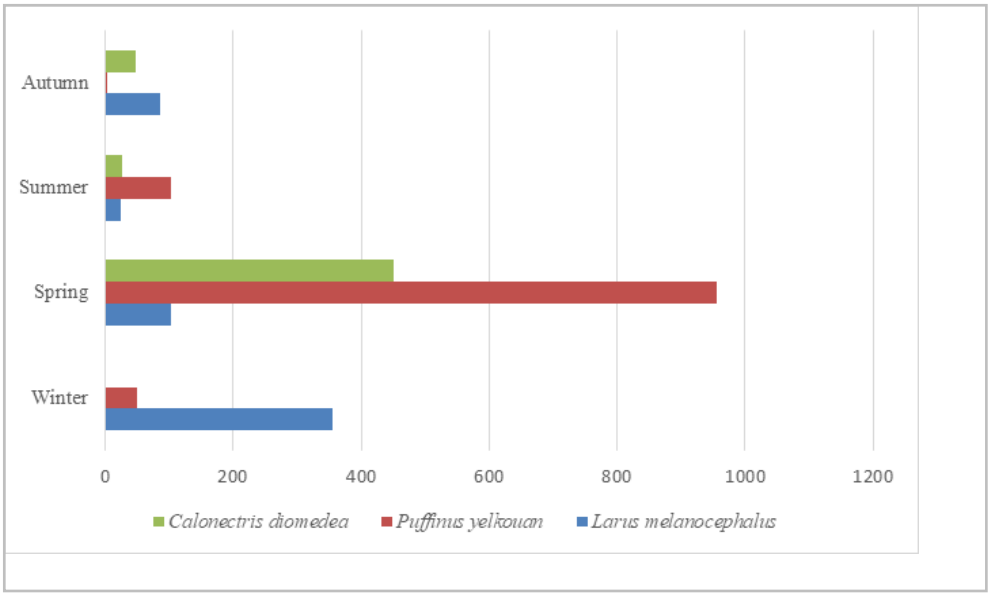


Figure 3. Number of observed individuals of the three investigated species during each season: winter (from December to February), spring (from March to May), autumn (from June to August), summer (from September to November).

Discussion and conclusion

The information collected during this preliminary study indicates that some species of high conservation interest regularly use the Gulf of Taranto waters as a foraging area. This is not only the case for individuals on passage, but the timing of observations strongly suggest that the area is a key foraging ground to breeding and wintering populations of some species.

Particularly, the area is regularly used by the Yelkouan Shearwater, as a foraging site, with the species frequently observed feeding and/or actively searching for prey, often in association with the Scopoli's Shearwater and the Yellow-legged Gull, especially in the presence of tuna. During spring, large flocks (over 100 individuals) were often observed. This is the first standardized data collected in the Gulf of Taranto, also for this species.

Scopoli's Shearwater regularly uses the area for both feeding and resting. While large flocks of up to 120 individuals, as observed in May, may occasionally be seen, most sightings involve single individuals in flight. Interestingly, despite the frequent presence of fishing vessels in the area, interactions between this species and fishing activities appear negligible. This contrasts with the Yellow-legged Gull, which was the only species consistently observed in association with fishing vessels.

During the wintering period, the Mediterranean Gull also regularly uses the offshore waters of the Gulf of Taranto, supporting observations from

the Apulian coast, where thousands of individuals often gather, particularly during adverse weather conditions (Liuzzi *et al.* 2013). Offshore, sightings mainly involved single birds or small groups, with the notable exception of a flock of 220 individuals engaged in feeding activity in January 2022, in association with hundreds of other Laridae, including Yellow-legged Gull, Black-headed Gull, and Little Gull.

The confirmation of the regular presence of large groups (often monospecific) of the Little Gull, between January and April, is a further element of importance. Due to its frequently predominantly pelagic lifestyle, this species is challenging to observe from land and is greatly underestimated during IWC monitoring. The information obtained on this species, although still partial, provides the first reliable estimates on the real presence of the wintering contingent in Apulia and throughout the entire Gulf of Taranto. Moreover, the area could represent one of the most important in the Central Mediterranean, although it is not recognized as such in the literature (Erard 1960; Erard 1963; Olsen and Larson 2003).

The Yellow-legged Gull which resulted the dominant species is the only regularly breeding seabird species in the study area, with a population of 500-600 pairs on the Cheradi Archipelago.

The invasion of the Razorbill *Alca torda* in the central Mediterranean in the winter of 2022-2023 (Balestrieri *et al.* 2023) allowed the observation of some individuals also in the study area. These sightings are exceptional, as previous reports date back to the late 19th century (de Romita 1900; Liuzzi *et al.* 2013).

Further studies are needed to obtain data at a spatial resolution high enough to support the eligibility of the area as a Marine Important Bird Area and eventual designation as a Special Protection Area for marine birds in the study arear. This would be pertinent in light ofnew policy developments and increasing number of requests for offshore wind farms installations.

The continuation of the monitoring activities will also provide precise indications on numerous other important aspects, such as phenology, density, seasonal abundance of the different species, the use of the area, and inter and intra-specific interactions.

References

Baccetti, N., Dall'Antonia, P., Magagnoli, P., Melega, L., Serra, L., Soldatini, C., Zenatello, M., 2002. Risultati dei censimenti degli uccelli acquatici svernanti in Italia: distribuzione, stima e trend delle popolazioni nel 1991-2000. Biologia e Conservazione della Fauna, 111, pp. 1-240.

Balestrieri, R., Vento, R., Viviano, A., Mori, E., Gili, C., Monti, F., 2023. Razorbills *Alca torda* in Italian Seas: A Massive Irruption of Historical Relevance and Role of Social Network Monitoring. Animals 13(4), 656, 12 pp.

Bakun, A., Agostini, V.N., 2001. Seasonal patterns of wind-induced upwelling/ downwelling in the Mediterranean Sea. Scientia Marina, 65(3), pp. 243–257.

Brichetti, P. and Fracasso, G., 2018. The Birds of Italy. Volume 1. Anatidae-Alcidae. Edizioni Belvedere, Latina, historia naturae (6), 512 pp.

Camphuysen, C.J. and Garthe, S., 2004. Recording foraging seabirds at sea: standardised recording and coding of foraging behaviour and multi-species foraging associations. Atlantic Seabirds, 6(1), 32 pp.

Civitarese, G., Gacic, M., Lipizer, M., Eusebi Borzelli, G.L., 2010. On the impact of the Bimodal Oscillating System (BiOS) on the biogeochemistry and biology of the Adriatic and Ionian Seas (Eastern Mediterranean). Biogeosciences, 7, pp. 3987–3997.

de Romita, V., 1900. Materiali per una fauna barese". In: La Sorsa S. (ed.), La Terra di Bari sotto l'aspetto storico, economico e naturale. Vol. III, Vecchi, Trani, pp. 245-338.

Erard, C., 1960. Sur l'aire de reproduction, les zones d'hivernage et les migrations de la Mouette pigmée *Larus minutus*, Pallas. Alauda, 28(1), pp. 196-228.

Erard, C., 1963. Compléments à l'étude des migrations de la *Larus minutus,* Pallas. Alauda, 31(4), pp. 285-293.

LIPU, 2009. Dalla terra al mare. Studio preliminare per l'individuazione delle IBA (Important Bird Areas) in ambiente marino. LIPU-BirdLife Italia, Parma, 98 pp.

Liuzzi, C., Mastropasqua, F., Todisco, S., 2013. Avifauna pugliese...130 anni dopo. Ed. Favia, Bari, pp. 322.

Liuzzi, C., Bellomo, S., Santacesaria, F.C., Fanizza, C., Crugliano, R., Pollazzon, V., Cipriano, G., Carlucci, R., 2022. Seabird monitoring data in the Gulf of Taranto (Northern Ionian Sea, Central-eastern Mediterranean Sea). IEEE International Workshop on Metrology for the Sea; Learning to Measure Sea Health Parameters (MetroSea), Milazzo, Italy, 2022, pp. 12-16, doi: 10.1109/ MetroSea55331.2022.9950800.

Olsen, K.M., Larson, H., 2003. Gulls of Europe, Asia and North America. Helm, London, 406 pp.

Serra, L., Magnani, A., Dall'Antonia, P., Baccetti, N., 1997. Risultati dei censimenti degli uccelli acquatici svernanti in Italia, 1991-1995. Istituto Nazionale per la Fauna Selvatica, Biologia e Conservazione della Fauna, 101, 307 pp.

Tasker, M.L., Jones, P.H., Dixon, T., Blake, B.F., 1984. Counting Seabirds at Sea from ships: a review of methods employed and suggestion for a standardized approach. The Auk, 101, pp. 567-577.

Wetlands International, 2020. Waterbird Population Estimates. wpe.wetlands.org

Zenatello, M., Baccetti, N., Borghesi, F., 2014. Risultati dei censimenti degli uccelli acquatici svernanti in Italia. Distribuzione, stima e trend delle popolazioni nel 2001-2010. ISPRA, Serie

Rapporti 206/2014, 321 pp.

Zenatello, M., Liuzzi, C., Mastropasqua, F., Luchetta, A., La Gioia, G., 2020. Gli uccelli acquatici svernanti in Puglia, 2007-2019. Regione Puglia, Salentina srl (ed.), pp. 276.

IMPACT OF FISHING ACTIVITIES ON SEABIRDS IN THE COASTAL MEDITERRANEAN LAGOONS, EGYPT

Sahar Fahmy Mehanna

National Institute of Oceanography and Fisheries NIOF, Fisheries Division, Egypt, sahar_mehanna@yahoo.com

Abstract

Human activities including fishing, oil spills and the expanding ocean economy as well as climate change are threatening seabird populations. Because marine birds regularly follow fishing boats to feed, studying the fishing boats' routes could assist to protect threatened seabirds. Competition with fisheries and incidental capture in fishing gear are the major current threats for seabirds at sea. Fishing is a traditional activity in Egypt and is composed of both industrial and artisanal fleets with about 85% of the later consisting of small vessels less than 12 m length. The Egyptian Mediterranean coastal area exhibits six lakes or lagoons situated along the coast of the Nile delta (Northern delta lakes: Manzalah, Burullus, Edku and Mariut) and to the east of the Suez Canal (Port-Fouad and Bardawil). All of them, with the exception of Lake Mariut, are directly connected to the sea. The lakes and wetlands in the coastal region of the delta are an important ecosystem for waterbirds, as they represent the wintering areas for thousands of migratory birds such as gulls, flamingos, terns, and cormorants. Gillnets, trammel nets, traps, and lines with hooks are usually used in the coastal lagoons and lakes, however, to date their by-catch in respect to birds has not been assessed before. Overall search on the impact of the Egyptian fishing fleet on seabird populations is very rare, and we need to fill the gap in knowledge about these impacts. Assessing the bycatch issues in the coastal waters as well as understanding the feeding habits and foraging grounds of these birds could help informing on better protection strategies from the hazards they may face at sea. More efforts should be made to protect important seabird habitat and to ensure that seabirds are taken into account when managing fish stocks.

Key-words: coastal lagoons, bycatch, seabirds, threatened species, small-scale fisheries

Introduction

Fisheries and fishing activities have severe effects on aquatic ecosystems, eliminating a massive biomass of target and non-target species from the world's oceans (Lewison *et al.* 2012; Halpern *et al.* 2019; Votier *et al.* 2023). Aquatic birds are among the other aquatic groups that are highly influenced by incidental mortality or bycatch while at the same time they are facing a number of threats from fisheries comprising

direct competition for the same resources, entanglement in lost fishing gear, biodiversity loss and community structure alterations, depletion of sub-surface predator populations that would otherwise facilitate access to prey, and light-induced vessel attacks (Montevecchi 2023). Seabirds' mortality due to fishing activities has major effects on marine ecosystems because seabirds play a key role as predators and scavengers (Einoder 2009), and their contribution to nutrient cycling both in marine ecosystems and into terrestrial environments where they nest and roost (Otero *et al.* 2018). Recent studies have confirmed the seabirds' decline at a greater rate, leading to an increasing proportion of threatened species (Croxall *et al.* 2012; Dias *et al.* 2019). In the most recent assessment of the International Union for the Conservation of Nature (IUCN 2019), 31% of seabird species were listed as globally threatened (Critically Endangered (CE), Endangered (EN) or Vulnerable (VU)), and another 11% as Near Threatened (NT) on the Red List of IUCN.It was concluded that the three main threats were invasive species at breeding sites, bycatch during fishing operations, and overfishing (Dias *et al.* 2019; Carneiro *et al.* 2020; Beal *et al.* 2021).

Fishing intensity has increased in the last decade, and new technologies and fishing techniques have been developed and deployed. Consequently, seabirds are attracted to fishing vessels to feed on discards, wastes from processing, unwanted catch and bait used (Jiménez *et al.* 2019). So, birds come close to fishing gear, putting them at risk of being caught on hooks or entangled in longlines, injured in collision with trawl cables, or trapped in gillnets (Anderson *et al.* 2011; Žydelis *et al.* 2013; Phillips and Wood 2020).

Egypt occupies a unique geographical location as a bridge between the continents of Europe, Asia, and Africa and therefore millions of birds pass through it. Egyptian lakes, lagoons, and wetlands in the coastal region of the delta represent an important ecosystem for migratory waterbirds, as they represent the winter home for thousands of migratory birds such as gulls, flamingos, terns, and cormorants. Gillnets, trammel nets, traps, hooks, and lines are usually used in the coastal lagoons and lakes and their by-catch in respect to seabirds was never assessed before.

Searches about the impact of the Egyptian fishing fleet on seabird populations are very rare and we need to fill the gap in knowledge about these impacts. The Egyptian Mediterranean coast exhibits six lakes or lagoons which are situated along the Nile delta coast (Northern Delta lakes: Manzalah, Burullus, Edku and Mariut) and to the east of the Suez Canal (Port Fouad and Bardawil). All of them, with the exception of Lake Mariut, are directly connected to the sea (Fig. 1). The Northern Delta lakes provide a rich and vital habitat for estuarine and marine fish and their

regeneration and have always been major areas of fish production in Egypt, where more than 75% of Egyptian lakes' production was harvested from. Additionally, they are internationally important sites for wintering waterbirds, providing valuable habitat for several hundred thousand birds. This work is trying to shine light on the impact of fishing activities on seabirds in the Egyptian northern lakes.

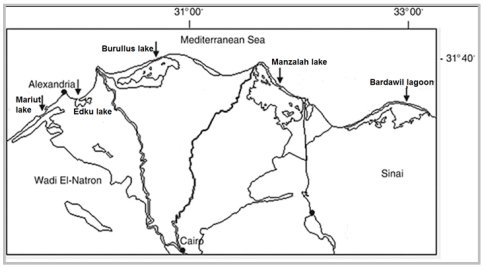


Figure 1. Egyptian Mediterranean coast with the six coastal lakes and lagoons

Study area

The northern lakes and lagoons of Egypt, including Bardawil, Manzalah, Burullus, Edku and Mariut are important strategic stops for wintering migratory birds, and home for breeding birds (Meininger *et al.* 1986). The two largest natural lakes in Egypt, Manzalah and Burullus, were the subject of this study.

Manzalah lake (31°15'60.00» N 32°11'60.00» E) is considered one of the most important regions of inland fishery in Egypt (Fig. 2). It is the largest and one of highly important natural lakes in Egypt where it produces about 35.6% of the total production from the Egyptian lakes and 47.5% of the total production from the Delta lakes. It is connected to the Mediterranean Sea

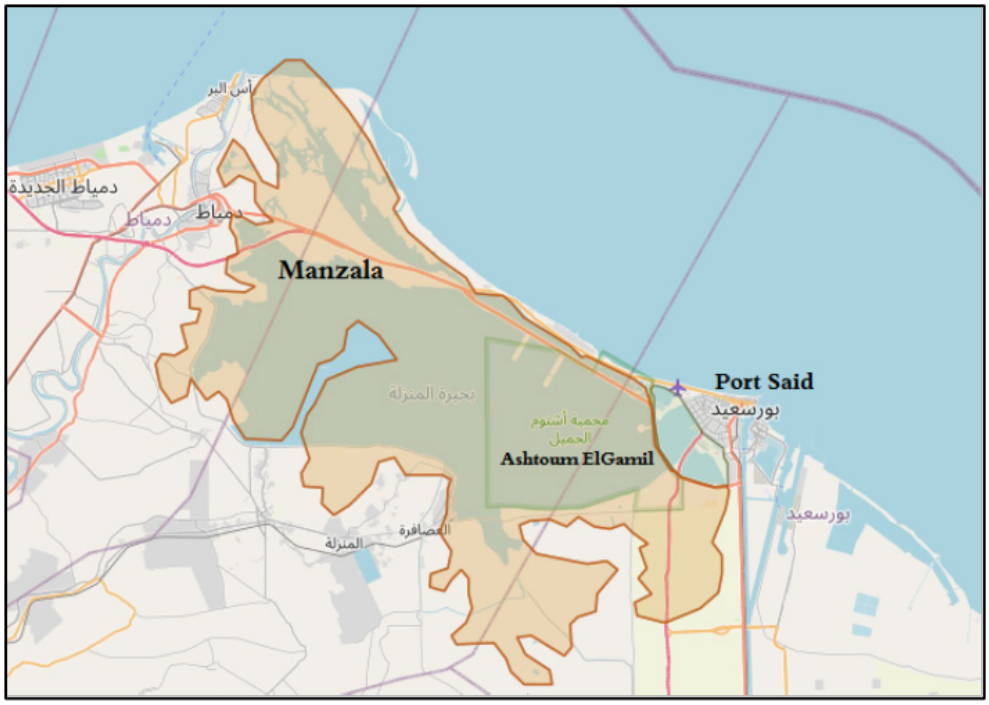


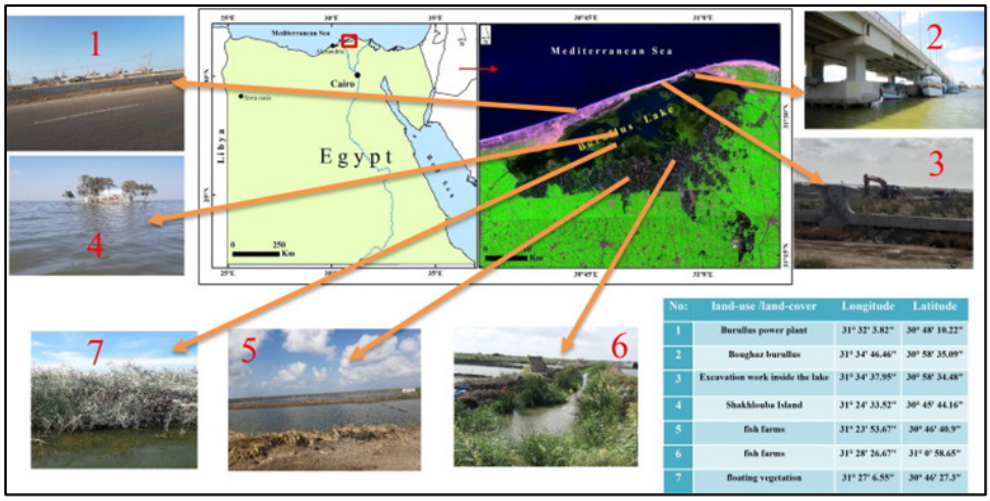
Figure 2. Manzalah lake with Ashtoum El-Gamil protected area

allowing for water exchange which helps to have a diverse economically valuable fish species (GAFRD 2020). Lake Manzalah is environmentally unprotected under national legislation, except for the Ashtoum El-Gamil site in the northeastern part of the lake, which is recognized as a natural protectorate (Fig. 2). Ashtoum El-Gamil PA is one of the most interesting wetland protectorates because it is one of the important natural areas visited specifically by people who are interested in bird-watching activities. It represents an international flyway of waterbird migration from Europe and Asia to Africa along the Mediterranean Sea (Meininger and Atta 1994; EEAA 2012). It is declared a protected area by Prime Minister's decree No. 459/1988 with an area of about thirty km2; which was modified with the decree No. 2780/1998 to extend its area to about 180 km2 (EEAA 2012). Large fish farms and mudflats are found along the eastern shore and in the southeastern part of the lake.

Lake Burullus (Fig. 3), the second-largest natural lake, is located between the two Nile River branches (Damietta and Rosetta), between latitudes 31° 25′ and 31° 35′ N and longitudes 30° 31′ and 31° 05′ E. It is considered as the most productive lake in Egypt now (GAFRD 2020). Burullus lake or wetland is separated from the Mediterranean Sea by a 65 Km long sand bar, the middle section of the bar is narrow and is cut by an inlet (Bughaz) that connects the sea and the lake. The Lake is a registered Ramsar site and is identified as an Important Bird Area (IBA) by BirdLife International (2024a). It was declared a nature reserve under Law 102/1983 in May 1998. The lake has about fifty islets; the largest (Kawm El-Akhdar) is about 9 km2. These small islets provide habitat for rich diversity of plants and animals including birds. Also, the expanding fish farms in the southern part of the lake provides a feeding area for birds.

Materials and methods

All available data about seabirds in Egypt was collected through two activities: the first from literature including all published and non-published resources; secondly data was collected as a side activity through the fish sampling program from September 2022 to September 2023. Bimonthly field trips were carried out to both Manzalah and Burullus lakes and transects walked along 4–5 km of the coastline were performed to collect information related to dead or injured birds. Interviewing the local fishermen and fish farm owners were also undertaken during each trip to collect data about the impacts of seabirds on their fishing and the impacts of their fishing activities on seabirds. The local fish markets in Port Said were visited during the autumn and winter seasons and bird sellers and hunters in the area were interviewed. The managers of MPAs in both Manzalah and Burullus lakes were also interviewed during the study period as well as birds' lovers societies and bird watchers in the winter season.



No:	land-use /land-cover	Longitude	Latitude
1	Burullus power plant	31° 32' 3.82"	30° 48' 10.22"
2	Boughaz burullus	31° 34' 46.46"	30° 58' 35.09"
3	Excavation work inside the lake	31° 34' 37.95"	30° 58' 34.48"
4	Shakhlouba Island	31° 24' 33.52"	30° 45' 44.16"
5	fish farms	31° 23' 53.67"	30° 46' 40.9"
6	fish farms	31° 28' 26.67"	31° 0' 58.65"
7	floating vegetation	31° 27' 6.55"	30° 46' 27.3"

Figure 3. Burullus wetland with different habitats

Results and discussion

Ashtoum El-Gamil is considered one of the wetland reserves for birds and is home to 174 bird species, out of the 255 recorded in lake Manzalah. Manzalah has three main habitats: reed-swamps, saltmarshes, and sandy areas. It is one of the most important breeding areas in the entire western Palearctic region. The most common species found are grebes, cormorants, herons, gulls, ducks, coots, waders, rails, terns, pelicans, and flamingos. The reserve annually hosts about 224,000 birds, and monitoring efforts have identified five species being close to endangered, and with one already classified as endangered.

Waterbirds, mainly ducks and coots, are trapped and hunted in the coastal lakes of the Nile Delta, especially Manzalah lake and most of the catches are sold at local markets in Port Said and Damietta cities. The hunting and consumption of waterbirds as food are known activities since ancient times (Meininger and Mullie 1981a; Meininger and Mullie 1981b; Mullie and Meininger 1983) and still happen to date, but the quantities are decreasing greatly every year. It is worth mentioning that the Egyptian legislation allows to hunt some waterbird species during the winter months but unfortunately this activity is undertaken without any control and monitoring, so many illegal hunting activities are observed, and some live captured waterbirds like pelicans and flamingos are sold abroad in very high prices.

Burullus is one of Egypt's most important wetlands for wintering waterbirds, including Anas penelope, Anas clypeata, Aythya nyroca, Aythya ferina, Fulica atra and Tringa totanus. Burullus is one of the most important wintering grounds for Aythya nyroca in the eastern Mediterranean. Burullus is also an important breeding site for several waterbird species. About

thirty-five species of birds are known to breed, of which the most prominent are *Tachybaptus ruficollis*, *Ixobrychus minutus*, *Phalacrocorax carbo*, *Porphyrio porphyrio*, *Sterna albifrons*, *Charadrius alexandrinus*, *Vanellus spinosus*, *Glareola pratincola*, *Caprimulgus aegyptius*, *Ceryle rudis*, *Centropus senegalensis* and *Acrocephalus stentoreus*. The endemic delta subspecies of *Calandrella rufescens* (Calandrella rufescens nicolli) probably has its largest population in the vicinity of Burullus (BirdLife international 2024a). Burullus protected area has a wide range of habitat types: sandbars with a variety of sand formations, the water body is ranging from brackish to saltwater, islets of various size and sediments, inter-tidal mudflats and salt marshes, reed swamps, canals, and drains in farmlands. All these different habitats make the lake and its islets a very important area for wintering and breeding of international important migratory waterbirds of which more than fifty-two different species were recorded in autumn and winter 2022. Cormorants, gulls, and ducks are the common migratory species groups while terns, egrets, herons, kingfishers, and sand martins are the common resident birds in the lake.

Fishing activities

The fishing fleet in Manzalah and Burullus lakes is a small-scale fleet fluctuating between 5,900 and 7,500 boats in lake Manzalah and between 5,619 and 8,770 fishing boats in Burullus lake. The number of fishermen in lake Manzalah fluctuates between 19,000 and 28,700 fishermen and in lake Burullus it varies from 18,663 to 26,310 fishermen. There are many types of fishing gear used in the lakes, the most common ones being entangling nets (gill and trammel nets). Fishing with these nets is mostly carried out in boats of the third class «Canoe – like faloukas without sails» with a crew size of two to three men. Trawl nets or frame nets are also used, these are dragged nets locally known as Al-Kerba, and one of the illegal and destructive fishing methods used. Also, traps including wire basket traps (Gawabi), Spiral traps (Tahaweet), Hosha and barriers, lines and Clarias traps are widely used in all northern Delta lakes in Egypt. In addition to these common gear types, a number of fishing methods were recorded in the lakes like cast net or Torraha, encircling fishing gear or El-Tara, Laffa and Lokkafa.

Threats facing the aquatic birds in northern lakes

Seabirds are facing a number of challenges in the northern coastal lakes such as habitat loss, severe pollution, overwhelming flow of drainage water, fishing activities and by-catch, overfishing and food scarcity, excessive and illegal hunting, and other illegal behaviour of the different users in the lakes. Likely future constraints relate to impacts of new development projects, including the International Highway that runs along the sand bars, new fishing ports, future sea-side resorts, deepening of the lakes and removing the vegetation

coverage and some islets. Additional threats are the expected impacts of future climate change including the rise of sea-level and temperature. Until now, there is no precise data about the biodiversity and the different species of birds inhabiting and visiting the protectorates. In addition, the bycatch issue is a very important threat seabirds and the whole marine ecosystems are facing, and it should be addressed to protect both. In the Nile Delta's lakes and lagoons, thousands of waterbirds mainly ducks, gulls, and terns are being trapped or shot. Although the actual numbers of birds killed are relatively low and need to be confirmed, hunting is still one of the main threats that has a negative effect in coastal lagoons in Egypt. Another important threat that the seabird and waterbird areas in Egypt face comes from large scale land reclamation projects, which - if not stopped in time - will destroy entire coastal ecosystems. Up to now at least 50% of the coastal wetlands in the Nile Delta have already been reclaimed (Mehanna *et al.* 2022; Mehanna *et al.* 2023), while there are plans for reclamation of other large areas. In 1972 the total area of reclaimed saltmarsh in the Nile Delta was already estimated at about 4,000 km2 (Meininger and Mullie 1981a; Meininger and Mullie 1981b).

Relatively little information is available about the impact of chemical and organic pollution of Egyptian coastal waters. Wastes from large industries, for instance near Alexandria and Port Said, and human sewage are discharged on a large scale and without purification in the coastal lakes and Mediterranean Sea. This likely has a negative impact on the environment and consequently on the seabird and waterbird populations.

Fishing impacts on seabirds

The impacts of fishing activities on seabirds could be classified into direct and indirect impacts. Monofilament gillnets, trawl nets and other types of nets are responsible for the largest amount of by-catches of birds and mammals, followed by lines with hooks, especially the baited ones. Birds may also become entangled in lost fishing gear (lines and nets) and are being disturbed by fishing activities. It is worth mentioning that the small-scale fisheries show less impact comparing with the large scale and industrial fishing. In the Egyptian coastal lagoons, the impacts of fishing activities on seabirds and waterbirds could be neglected as there is no mortality caused by direct entanglement of birds, but fishermen impacted the birds directly by collecting their eggs, and by hunting the adults and indirectly by competing for food through the overfishing and declining the fish stocks. Fishermen in the lakes of Manzala and Burullus are engaged in hunting as a secondary occupation during winter and some of them are hunting full-time during winter. Also, the owners of the fish farms around the two lakes fight seabirds to prevent them from feeding on fish fry in their farms, so some incidental mortality may be caused. The disturbance in the

coastal lakes and lagoons caused by the huge number of small fishing boats and human settlements lead to the elimination of big colony breeders like herons. Additionally, the coastal lakes suffer from uncontrolled and untreated sewage water influx which leads to severe pollution. Such anthropogenic activity has short- and long-term impacts on wildlife and biodiversity richness.

Conclusion

In conclusion, to develop and implement a strategic plan to conserve seabird populations in the Egyptian coastal lakes and lagoons, the following issues require immediate attention:

- the absence of accurate information,
- absence of institutional effective conservation,
- shortage of funds to support seabird research and conservation,
- lack of regional expertise,
- and lack of awareness of the importance of seabird conservation.

For improved seabird protection, it is essential to strengthen the capacity for the seabirds conservation, to improve the protection of seabird breeding areas and to develop a conservation action plan for the seabirds breeding in the area, which should include research and monitoring, legislation and awareness. Also, understanding the feeding habits and foraging grounds of these birds could help to inform on better protection strategies from the hazards they may face at sea. More efforts should be paid to ensure fish stocks are managed to take seabirds into account and to protect important seabird habitats.

References

Anderson, O.R., Small, C.J., Croxall, J.P., Dunn, E.K., Sullivan, B.J., Yates, O. and Black, A. D., 2011. Global seabird bycatch in longline fisheries Endangered Species Research, 14, pp. 91-106.

Beal, M., Oppel, S., Handley, J., Pearmain, E.J., Morera-Pujol, V., Carneiro, A.P.B., Davies, T.E., Phillips, R.A., Taylor, P.R., Miller, M.G.R., Franco, A.M.A., Catry, I., Patricio, A.R., Regalla, A., Staniland, I., Boyd, C., Catry, P. and Dias, M.P., 2021. track2KBA: An R package for identifying important sites for biodiversity from tracking data. Methods in Ecology and Evolution, 12(12), pp. 2372-2378.

BirdLife International, 2024a. Important Bird Area factsheet: Lake Burullus (Egypt). Downloaded from https://datazone.birdlife.org/site/factsheet/lake-burullus-iba-egypt on 02/10/2024.

Carneiro, A.P.B., Pearmain, E.J., Oppel, S., Clay, T.A., Phillips, R.A., Bonnet-Lebrun, A.S., Wanless, R.M., Abraham, E., Richard, Y., Rice, J., Handley, J., Davies, T.E., Dilley, B.J., Ryan, P.G., Small, C., Arata, J., Arnould, J.P.Y., Bell, E., Bugoni, L., Campioni, L., Catry, P., Cleeland, J., Deppe, L., Elliott, G., Freeman, A., González-Solís, J., Granadeiro, J.P., Grémillet, D., Landers, T.J., Makhado, A., Nel, D., Nicholls, D.G., Rexer-Huber, K., Robertson, C.J.R., Sagar, P. M., Scofield, P., Stahl, J.-C., Stanworth,

A., Stevens, K.L., Trathan, P.N., Thompson, D.R., Torres, L., Walker, K., Waugh, S. M., Weimerskirch, H. und Dias, M.P., 2020. A framework for mapping the distribution of seabirds by integrating tracking, demography and phenology. Journal of Applied Ecology, 57, pp. 514–525.

Croxall, J. P., Butchart, S.H., Lascelles, B., Stattersfield, A.J., Sullivan, B., Symes, A. and Taylor, P., 2012. Seabird conservation status, threats and priority actions: a global assessment. Bird Conservation International, 22(1), pp. 1–34.

Dias, M.P., Martin, R., Pearmain, E.J., Burfield, I.J., Small, C., Phillips, R.A. and Croxall J.P., 2019. Threats to seabirds: a global assessment. Biological Conservation, 237, pp. 525–537.

Egyptian Environmental Affairs Agency (EEAA), 2012. Natural Protected Areas in Egypt. Report prepared by the nature conservation sector, Ministry of State for Environmental Affairs press, Egypt.

Einoder, L.D., 2009. A review of the use of seabirds as indicators in fisheries and ecosystem management. Fisheries Research, 95(1), pp. 6-13.

General Authority for Fish Resources Development (GAFRD), 2020. Annual statistical report of General Authority for Fish Resources Development (GAFRD), 2020 - Fish statistics yearbooks. Ministry of Agriculture and Land Reclamation, Cairo.

Halpern, B.S., Frazier, M., Afflerbach, J., Lowndes, J.S., Micheli, F., O'Hara, C., Scarborough, C. and Selkoe, K.A., 2019. Recent pace of change in human impact on the world's ocean. Scientific Reports, 9, 8 pp. https://doi.org/10.1038/s41598-019-47201-9

International Union For Conservation Of Nature (IUCN), 2019. The IUCN Red List of threatened Species. Version 2019-2. Accessed at https://www.iucnredlist.org on 20 September 2020

Jiménez, S., Domingo, A., Forselledo R., Sullivan, B.J. and Yates, O., 2019. Mitigating bycatch of threatened seabirds: the effectiveness of branch line weighting in pelagic longline fisheries. Animal Conservation, 22(4), pp. 376-385.

Lewison, R., Oro, D., Godley, B.J., Underhill, L., Bearhop, S., Wilson R.P. and Yorio, P., 2012. Research priorities for seabirds: improving conservation and management in the 21st century. Endangered Species Research, 17, pp. 93-121.

Mehanna, S.F., Fattouh, Sh., Mehassab, A. and Koleib, Z., 2022. Comparative study of fish production from Lake Manzalah before and during the cleansing and development operations based on surplus production modeling approach. Egyptian Journal of Aquatic Biology & Fisheries, 26(5), pp. 613-624.

Mehanna, S.F., Hassan, N.H., Koleib Z.M. and El-Bokhty, E.B., 2023. Fish production, fishing gears, economic and social impacts of the purification and development project on Lake Manzalah fisheries, Egypt. Egyptian Journal of Aquatic Biology & Fisheries, 27(6), pp. 85-100.

Meininger, P.L. and Atta, G.A.M. (1994). Ornithological studies in Egyptian wetlands 1989/ 1990. FORE Report 94-01/WIWO Report 40. Vlissingen/Zeist, the Netherlands.

Meininger, P.L. and Mullie, W.C., 1981a. The significance of Egyptian wetlands for wintering waterbirds. Holy Land Conservation Fund, New York, 123 pp.

Meininger, P.L. and Mullie, W.C., 1981b. Egyptian wetlands as threatened wintering areas for waterbirds. Sandgrouse, 3, pp. 62-77.

Meininger, P.L., Sorenson, U.G. and Atta G.A.M., 1986. Breeding birds of the lakes in the Nile Delta, Egypt. Sandgrouse, 7, pp. 1-20.

Montevecchi, W.A., Lamarre, J., Rouxel, Y., Montevecchi, M.W., Blackmore, R.J., Bourne, C. and Spiegel, C.S., 2023. High-contrast banners designed to deter seabirds from gillnets reduce target fish catch. Marine Ornithology, 51(1), pp. 115-123. http://doi.org/10.5038/2074-1235.51.1.1518

Mullie, W.C. and Meininger, P.L., 1983. Waterbird trapping and hunting in Lake Manzala, Egypt, with and outline of its economic significance. Biological Conservation 27(1), pp. 23-43.

Otero, X.L., La Peña-Lastra, D., Pérez-Alberti, A., Ferreira, T.O. and Huerta-Diaz, M.A., 2018. Seabird colonies as important global drivers in the nitrogen and phosphorus cycles. Nature Communications, 9(246), 8 pp.

Phillips, A.R. and Wood, A., 2020. Variation in live-capture rates of albatrosses and petrels in fisheries, post-release survival and implications for management. Biological Conservation, 247(108641), 8 pp.

Votier, S.C., Sherley, R.B., Scales, K.L., Camphuysen, K. and Phillips, R.A., 2023. An overview of the impacts of fishing on seabirds, including identifying future research directions. ICES Journal of Marine Science, 80(9), pp. 2380–2392. https://doi.org/10.1093/icesjms/fsad173.

Žydelis, R., Small, C. and French, G., 2013. The incidental catch of seabirds in gillnet fisheries: a global review. Biological Conservation, 162, pp. 76–88.

ASSESSING SEABIRD POPULATIONS ACROSS THE MEDITERRANEAN - SPA/RAC'S 2023-MED-QSR CHAPTER ON MARINE BIRDS

Benjamin J. Metzger[1], Dilek Sahin[2], Yassine Ramzi Sghaier[3], Lobna Ben Nakhla[3], Samar Kilani[3]

[1] Independent consultant: 26/1 Triq L-Immakulata Kuncizzjoni, Gzira, GZR 1141, Malta, ben.lanius@gmail.com
[2] Institute of Environmental Sciences, Bogazici University. Hisar Campus, Bebek 34342, Istanbul, Türkiye
[3] Regional Activity Centre for Specially Protected Areas, Bd du Leader Yesser Arafet, Tunis, Tunisia

Abstract

The Ecosystem Approach Group under the Barcelona Convention recently finalised its 2023 Mediterranean Quality Status Report, (2023 MED QSR; UNEP/MAP 2023). The report presents the assessment of the state of the natural marine environment in the region and whether it reaches Good Environmental Status (GES).

Seabirds sensu lato are a crucial component of the region's marine biodiversity and ecosystem which is assessed within the report under the Ecological Objective Biodiversity. Many of the relevant seabird taxa are endemic or near endemic to the Mediterranean, are situated on top of marine food webs, and ecologically connect marine and coastal environments across the region. Facing multiple pressures at land and at sea, seabirds from different functional ecological groups in the area serve as sentinels of the health of the Mediterranean ecosystem.

From the comprehensive list of 25 marine and coastal bird species listed in Annex II of the SPA/BD Protocol of the Barcelona Convention, the focus was directed to a list of 11 indicator species. These taxa, falling under the broad category of 6 functional ecological groups, were employed for the 2023 MED QSR assessment. The integrated assessment of GES for each of these seabird taxa is based on three Common Indicators: Distributional Range CI3, Abundance CI4, and Demography CI5.

The assessments rely on national monitoring datasets, provided by the Contracting Parties (CPs) to the Barcelona Convention, augmented with data from BirdLife International's Seabird Tracking Database, Wetlands International's International Waterbird Census (IWC), as well as published scientific articles and reports.

The results indicate that for many seabird populations of the assessed species GES might be reached when taking a modern baseline approach. This is the only reliable approach to set baselines owing to the lack of both information on a pristine state in the Mediterranean and accurate historic data across the region. The heterogeneity of the data currently prevents a truly quantitative integrated GES assessment across the entire region. Furthermore, some endemic

taxa of conservation concern appear to fail to reach GES targets at least in some of the Common Indicators. Closing data gaps, harmonising data collection and monitoring programs, and further implementing suitable conservation actions within the Marine Protected Areas (MPA) network, are important steps towards successfully assessing GES and reaching set targets across the region in the near future.

Key-words: Mediterranean Quality Status Report, Barcelona Convention, Good Environmental Status, Ecosystem Approach, Biodiversity.

Introduction

Seabirds are a fundamental part of the biodiversity found in our oceans and seas. The seabird community inhabiting the Mediterranean Basin exhibits a relatively high degree of endemism with various endemic or near-endemic taxa at a species or subspecies level. In the region, seabird species sensu lato occupy a variety of niches, thus forming part of several differentiated functional ecological groups. Therefore, selected seabird taxa from these different functional ecological groups can act as indicators, serving as sentinels for the environmental health of different parts of the unique Mediterranean ecosystem.

At the same time, seabirds in the Mediterranean are facing a long list of anthropogenic threats and many populations are currently characterised by an unfavourable conservation status (BirdLife International 2024).

In order to create the policy framework to protect them and to improve their conservation status, most seabird species occurring regularly in the Mediterranean region are listed under national, regional and international conservation agreements and policies.

The most overarching of these frameworks, the Barcelona Convention, currently lists twenty-five seabird species under Annex II of the Protocol Concerning Specially Protected Areas and Biological Diversity (SPA/BD) in the Mediterranean. To assess the biological diversity in the region, the Contracting Parties to the Barcelona Convention (Decision IG.17/6) adopted the Ecosystem Approach Roadmap. Following this adoption, the first Mediterranean Quality Status Report was published in 2017 as an initial step towards providing a regional assessment based on the MAP Ecological Objectives and the Integrated Monitoring and Assessment Programme of the Mediterranean. Sea and Coast and Related Assessment Criteria (IMAP) indicators. The 2017 MED QSR used available national data to assess the regional status of the seabirds among others, presented the knowledge gaps and provided recommendations on how to close these gaps (UNEP/MAP 2017).

Six years after the initial report, the Specially Protected Areas Regional Activity Centre (SPA/RAC) carried out the next round of this most overarching assessment in the region, and the

Ecosystem Approach Group under the Barcelona Convention finalised its 2023 Mediterranean Quality Status Report (UNEP/MAP 2023). Following again the Ecosystem Approach, the aim for the seabird chapter of the report was to produce a Quality Status Report regarding seabirds s.l. inhabiting the region that is fully based on quantitative monitoring and assessment. As a result, the seabird chapter presents the state of marine birds in the region, including a detailed analysis, whether GES is reached.

The vision for the 2023 MED QSR was an integrated DPSIR-based assessment of God Environmental Status (GES), developed on consolidated and quality-assured monitoring datasets, reported and processed through an effective IMAP Info System that is interoperable with national and other regional monitoring and reporting networks (COP21 Decision 24/04, Tirana).

Materials and methods

The Ecosystem Approach (EcAp) was utilized for the assessment. It is defined as a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Regular monitoring and assessments are integral part of the Ecosystem Approach to inform on the status of the marine environment and on the success of conservation initiatives. Within the overall assessment elements of the Ecosystem Approach, the region's seabirds s.l. form part of the Ecological Objective EO1: Biodiversity. Within EO1, the following three IMAP Common Indicators (CI) were used for the assessment of seabird populations in the Mediterranean: CI3: Species Distributional Range, CI4: Species Population Abundance, and CI5: Population Demographic Characteristics.

Assessment elements for seabird monitoring had been developed under the IMAP-MPA project to provide guidance for monitoring programmes (UNEP/MAP-SPA/RAC 2022). Detailed assessment elements, scales of monitoring and assessments, assessment criteria as well as ways forward to define and trial baseline and threshold values have been proposed for IMAP's three common indicators CI3 to CI5. These assessment elements were developed with the aim to also link them to another monitoring and assessment programme that is relevant for the part of the region, the Marine Strategy Framework Directive (EU MSFD), to achieve harmonisation and to reduce redundancies.

For each of these IMAP Common Indicators, the objective, the definition and the target of Good Environmental Status were laid out. Furthermore, the scales of monitoring and assessment, the assessment criteria, as well as the baseline and threshold values were defined.

Out of the 25 bird species of seabirds s.l. listed in Annex II of the SPA/BD Protocol of the Barcelona Convention

Table 1. UNEP/MAP's eleven indicator species, each listed in one of six functional ecological groups.

Functional Ecological Group	Species
Coastal top predators	**Osprey Pandion** *haliaetus*
Intertidal benthic feeders	**Kentish Plover** *Charadrius alexandrinus*
Inshore benthic feeders	**Meditereanean Shag** *Gulosus aristotelis desmarestii*
Offshore surface feeders	**Audouin's Gull** *Ichthyaetus audouinii*
Inshore surface feeders	**Slender-billed Gull** *Croicocephalus genei* **Lesser Crested Tern** *Thalasseus bengalensis emigratus* **Sandwich Tern** *Thalasseus sandvicensis*
Offshore surface & pelagic feeders	**Mediterranean Storm-petrel** *Hydrobates pelagicus melitensis* **Scopoli's Shearwater** *Calonectris diomedea* **Yelkouan Shearwater** *Puffinus yelkouan* **Balearic Shearwater** *Puffinus mauretanicus*

11 indicator species from 6 functional ecological groups had been selected with the support of the Online Working Group on Mediterranean marine birds (UNEP/MED WG.521/Inf.7, Decision IG.22/7; Tab.1).

Selection criteria for the indicator species had been (a) an ideally wide distribution across the Mediterranean, (b) suitability for a regional assessment of GES, (c) conservation concern in the Mediterranean, (d) good representation for the various functional ecological groups.

To provide the Contracting Parties with a platform onto where to directly upload their monitoring and assessment data, SPA/RAC developed the online IMAP Info System (https://www.info-rac.org/). However, at the time of the assessment, this online database had not yet been populated with data concerning Mediterranean seabirds. Thus, for the Common Indicators CI3, CI4, and CI5 of the Ecological Objective Biodiversity (EO1) regarding seabirds, the assessment for the 2023 MED QSR is mainly based on national monitoring datasets that had been submitted to SPA/RAC by the CPs' focal points.

Datasets for some of the Common Indicators on some of the 11 indicator species were received from a list of CPs. These datasets provided by the CPs' focal points were complemented with data from additional sources where available. The following additional data sources were utilised:

a) Wetlands International - International Winter Census (IWC) data: Datasets of IWC midwinter counts collected during the current assessment cycle were provided by Wetlands International for all CPs. Observations of all indicator species that were picked up regularly during coastal counts were included in the assessment within a buffer area around the region.

b) Birdlife International - Seabird Tracking Database: Datasets of tracked individuals of indicator species in the region were provided by BirdLife International repository. More than 20 datasets for the at-sea distribution of tracked individuals from five species of three functional groups (offshore surface feeders, offshore surface and pelagic feeders, inshore benthic feeders) were received and included in the assessment.

c) Assessments from experts: Additional information was received from experts working on specific indicator species in the region.

d) 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 were carried out using quantitative monitoring data collected by each CP during the current assessment cycle. Only where data collected by the CPs was regarded not sufficient (based on data quality or quantity, 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, GES was assessed separately, using the methodologies described in "Monitoring and Assessment Scales, Assessment Criteria, Thresholds and Baseline Values for the IMAP Common Indicators 3, 4 and 5 related to seabirds" (UNEP/MED WG.521/Inf.7). It was the intention to integrate the separate GES from CIs, species and CPs across the region, in a second step.

Whether GES is reached is presented in a simplified traffic-light system approach. Data from complete assessments or from sub-samples that are deemed representative are evaluated against modern baselines using defined threshold values.

In addition to the assessment of Common Indicators within EO1 Biodiversity, we carried out a DPSIR (Drivers, Pressures, States, Impacts, Responses) analysis from literature, with the aim to identify the main drivers and pressures that are active on seabirds in the Mediterranean region.

Results

The detailed results of the GES assessment by Common Indicator, Contracting Party, species and – were relevant – by the species life cycle stage, are presented in the chapter of marine birds of the original Mediterranean Quality Status Report 2023 (UNEP/MAP 2023). When taking a modern baseline approach, several species reach GES for CI3: Species Distributional Range and CI4: Species Population

Table 2. The top-5 drivers and associated pressures on seabird populations in the Mediterranean region.

	Drivers	Pressures
I.	Increase in human population, demands, and activities in the region, urbanisation and industrialisation, non-sustainable development	Direct habitat loss, increase in disturbance, noise and light pollution, direct persecution, climate change with increase in SST, extreme weather events, sea-level rise
II.	Changes in fishing fleet sizes and activities, including discard treatment, gear type and scale	Incidental bycatch, entanglement in (ghost) fishing gear, reduction of food availability up to depletion of food sources
III.	Increase in transport (humans, animals and goods, ballast water)	Introduction of invasive alien species, habitat loss, increase in disturbance, noise and light pollution
IV.	Increase in landfills and organic waste	Increase and population maintenance of problematic native and non-native species
V.	Increase in single use plastic and other persistent human-induced substances	Exposure to micro- and macro-plastics, heavy metals, organo-pollutants, incl. petrochemicals, ingestion and bioaccumulation (additionally in case of macro-plastics: entanglement)

Abundance across the territories of many Contracting Parties. However, specifically endemic taxa of higher conservation concern, in many cases appear to fail to reach GES targets.

The data collation by CI, CP and species revealed frequent gaps in the data availability for the assessment cycle at hand. In particular the Common Indicator CI5, Demographic Characteristics, is currently widely lacking quantitative datasets in most indicator species for integrated assessments across the region.

The DIPSR analyses identified the most relevant drivers and their associated pressures acting on Mediterranean seabird populations (Tab. 2).

Discussion and conclusion

The initial aim for the 2023 Mediterranean Quality Status Report chapter on marine birds was to present a fully integrated GES assessment on seabird populations in the region. The plan was to integrate the results of the assessments of monitoring data spatially within sub-regions and across the region, within and between the relevant Common Indicators as well as across the indicator species within each functional ecological group. Ultimately, the goal was to reach overarching conclusions of the status of Mediterranean seabird populations under the Ecological Objective Biodiversity. However, the multiple gaps in comparable monitoring datasets across the CPs, CIs and indicator species prevent a truly quantitative and fully integrated GES assessment of marine bird populations across the entire region.

In general, no historic data were available to define baselines of the relevant Common Indicators required

for the assessment of CI3 and CI4. Utilising pristine state conditions on the other hand to define baselines appears too speculative. Therefore, a Modern Baseline Approach was taken for the assessment at hand. However, it has to be noted that baselines are likely to have shifted to significantly lower levels in modern times as compared to historical or pristine state baselines.

For CI5, Population Demographic Characteristics, baselines for reproductive success and survival rates can be defined from population viability models. However, CI5 remains the least monitored Common Indicator across the region. Therefore, it is recommended that future monitoring and assessments focus stronger on CI5.

The DPSIR analysis highlights the major pressures Mediterranean seabird populations face as well as the underlying anthropogenic drivers of these pressures. However, it also reveals how the Common Indicators assessed for seabirds are potentially impacted by CIs of other Ecological Objectives within the Ecosystem Approach, such as EO2 Non-indigenous species CI6 impacting and Invasive Alien Species; EO3 (CI7-CI11, CI 12): Harvest of commercially exploited fish and shellfish; EO9 Pollution (CI17-CI20): Marine pollutants accumulating along food chains; EO10 Marine litter (CI24): Increased exposure to micro- & macro-plastic pollution. Ecological Objective EO11: Energy currently puts its focus on noise pollution impacting marine mammals. Here we suggest that light pollution impacting CIs in some of the seabirds could be added.

It can be concluded that the monitoring and assessment of Mediterranean seabirds has come a long way since the initial Quality Status Report in 2017. Currently, it is mainly the lack of baselines and multiple gaps in datasets that prevent a truly quantitative, integrated GES assessment of seabird populations across the region. Expanding and harmonising monitoring programs is key to improve the availability and comparability of datasets for future assessments of seabird populations in the Mediterranean. Creating links between different Ecological Objectives will further help to assess how different pressures act on seabirds in the region. Taking these steps will help the CPs to populate the IMAP Info-System with valuable data for the next assessment cycle and make sure that the 2029 MED QSR will be a fully integrated, truly quantitative GES assessment across the Mediterranean region.

Finally, it is important to strengthen the MPA network for Mediterranean seabirds and to further implement conservation actions within the MPA network to make sure that especially the seabird populations with conservation concern will be assessed as reaching GES in the future.

Acknowledgements

We are grateful to the individuals and organisations who contributed

additional data to the marine birds' chapter of the 2023 MED QSR, namely: Bethany Clark, BirdLife International (Seabird Tracking Database); Martin Austad, Paulo Lago, BirdLife Malta; Hannah Greetham, Ewan Wakefield, University of Durham; Petra Quillfeldt, Justus Liebig University Giessen; Marco Cianchetti-Benedetti, Ornis Italica; Raül Ramos Garcia, Jacob Gonzalez-Solis, Universitat de Barcelona; Andreu Rotger, Museo delle Scienze, Trento (MUSE); Ana Sanz Aguilar, IMEDEA (CSIC-UIB); David Gremillet, CEFE-CNRS; Jacopo G. Cecere; Giorgia Gaibani; Simona Imperio; Federico De Pascalis; Diego Rubolini; ISPRA; LIPU; Letizia Campioni, MARE ISPA-IU; Tom Langendoen, Wetlands International; Flavio Monti; Jose Manuel Arcos, SEO; Nicola Baccetti; Abdulmaula Hamza; Danae Portolou, Hellenic Ornithological Society.

References

BirdLife International, 2024. IUCN Red List for birds. Downloaded from http://www.birdlife.org on 25/09/2024.

UNEP/MAP, 2017. Mediterranean Quality Status Report. Downloaded from https://www.unep.org/unepmap/resources/quality-status-report-mediterranean-med-qsr-2017 on 25/09/2024.

UNEP/MAP, 2023. Mediterranean Quality Status Report. Downloaded from https://www.unep.org/resources/annual-report/mediterranean-quality-status-report-2023-med-qsron 25/09/2024.

UNEP/MAP-SPA/RAC, 2022. 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).43p+Annex. Available on: Monitoring and Assessment Scales, Assessment Criteria, Thresholds and Baseline Values for the IMAP Common Indicators 3, 4 and 5 related to sea birds

RECENT DATA ON THE STATUS AND DISTRIBUTION OF BREEDING MARINE AND COASTAL BIRDS IN ALGERIA

Riadh Moulaï[1], Mohammed Hamimeche[1], Soufyane Kahlessenane[1], Sihem Bakour[1], Mouloud Benabdi[1,2]

[1] Laboratoire Zoologie Appliquée et d'Ecophysiologie Animale, Faculté des Sciences de la Nature et de la Vie, Université de Bejaia, Algérie, moulai741@hotmail.com

[2] Bureau d'études– ETS Abyss Environnemental Services, 18, Lot les Rosiers Ouled Fayet, 16094, Alger, Algérie

Abstract

This paper presents the results of a monitoring study for the breeding seabird species of the Algerian coast and islands between 2002 and 2023. The attention is given to eight marine and coastal bird breeding species [Yellow-legged Gull (Larus michahellis), Audouin's Gull (Ichthyaetus audouinii), Common Tern (Sterna hirundo), Little Tern (Sternula albifrons), Kentish Plover (Charadrius alexandrinus), Little Ringed Plover (Charadrius dubius), Scopoli's Shearwater (Calonectris diomedea), Mediterranean Shag (Gulosus aristotelis desmarestii)], and two island-dwelling birds of prey [Eleonora's Falcon (Falco eleonorae) and Osprey (Pandion haliaetus)]. However, data on Algerian marine and coastal birds remain limited and are not updated for all coastal areas. The present study paper offers additional and comprehensive data for the species indicated above (except for the Mediterranean Shag, Scopoli's Shearwater, Audouin's Gull, and Osprey which remain particularly poorly understood) in Oranie's coast and islands, as well as in the Béjaia, Jijel and Annaba regions. Our findings indicate the Yellow-legged Gull as the most abundant and widespread species nationwide, while Audouin's Gull appears to be the rarest seabird in Algeria. The updated data on the status and distribution of species, based on a literature review and census will be used to suggest areas in Algeria that should be protected as important seabird areas.

Key-words: marine birds, coastal birds, Algeria, status, distribution, threats

Introduction

Despite having a coastline of almost 2,000 km, Algeria has a limited number of islands and islets (potential nesting sites). There are almost seventy sites that are island environments. More than half of these islands remain unexplored from a scientific point of view.

Ornithologists interested in Algeria have paid little attention to seabirds. Studies carried out before 1977 were based on sporadic observations. It was not until 1978 that more precise information became available, with the publication of Jacob and Courbet's (1980) study on breeding seabirds on the Algerian coast.

Following this period, research into

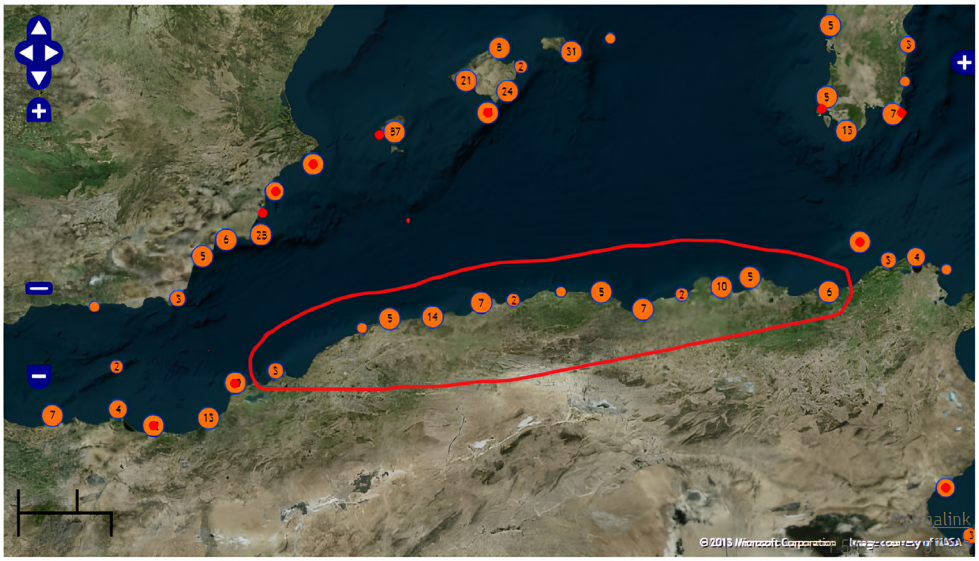


Figure.1: Location of the Algerian coast and its main island environments (the numbers in the circles indicate the number of islands per coastal sector) http://initiative-pim.org/

seabirds became less comprehensive and was once again limited to sporadic or highly localized observations. Against this backdrop, we set out to update the data on breeding seabirds and coastal birds that breed along the Algerian coastline. This was done based on a recent bibliographical synthesis and personal census data.

Our work aims to shed light on the status, numbers and, above all, distribution of seabirds in Algeria. We will list and discuss the main threats and conservation issues concerning species with high heritage values.

Materials and methods

There are almost seventy islands and islets in Algeria (Fig. 1). The vast majority of these are small, covering no more than one hectare, and are located close to the mainland. In fact, most are less than one kilometre from the coast. The largest of our islands are located on the west coast. Rachgoun Island covers twenty-five hectares, while the Habibas Archipelago covers forty hectares. The Algerian coastline stretches for over 2,000 kilometres and is characterized by a succession of cliffs, rocky areas, and mixed sandy and pebbly beaches. It should be noted that the rocky areas seem to be dominant. There are also numerous coves, small wadi mouths, and coastal wetlands.

The method used to count breeding birds in the surveyed coastal areas depends on the breeding habitat and ecology of the species in question. For instance, a census of coastal birds is carried out between the beginning of March and the end of May. Searching for nests mainly applies to species that nest in dune vegetation, on sand or pebble beaches, or on the edges of bodies of water, close to the mouths of wadis. These nests

are relatively visible, and the habitats were systematically surveyed in order to identify potential nesting sites. Most seabird species nest on islands and on the rocky coastline. Breeding pairs of seabirds were counted between March and May, from 2002 to 2023. Site visits and census methods were intricately linked to the accessibility of the colonies and the conditions at sea. For hard-to-reach colonies, for example, the number of breeders was estimated from a boat using a pair of binoculars. For colonies that were more easily accessible, we counted individual nests, marking them on the first pass to avoid counting them again on subsequent passes. This method is mainly used for gulls and shags. Shearwaters are searched for at night. Nest counts of colonial island raptors, such as Eleonora's Falcon, are carried out between mid-September and mid-October. The following references were used to identify counting dates and census methods:

- Yellow-legged Gull, Audouin's Gull, Common Tern, and Little Terns: Moulaï *et al.* 2006; Ghermaoui *et al.* 2013; Telailia 2014; Moulaï *et al.* 2023.
- Mediterranean Shag: Moulaï *et al.* 2023.
- Scopoli's Shearwater: Durand 2011; Taibi *et al.* 2014; Telailia 2014.
- Kentish Plover and Little ringed Plover: Michelot and Laurent 1993; Kebbi *et al.* 2018.
- For the Eleanora's Falcon: Peyre *et al.* 2018; Bakour and Moulaï 2019.
- Osprey: Telailia 2014; Moulaï *et al.* 2023.

Results

The main outcome of this study is the following annotated list of breeding seabirds, coastal birds, and island-dwelling birds of prey.

Kentish Plover *Anarhynchus alexandrinus*

It breeds on virtually all sandy and pebble beaches in Algeria, with an average of one pair between 500 m and 1 km of beach (Michelot and Laurent 1993; Kebbi *et al.* 2018).

Little ringed Plover *Charadrius dubius*

Common breeding bird on beaches near wadi mouths and coastal wetlands. Often nests in sympatry with the Kentish Plover (Michelot & Laurent 1993; Kebbi *et al.* 2018).

Common Tern *Sterna hirundo*

A single colony was recorded on the islet of Laouinet, located to the east of the town of El Kala at the eastmost point of the Algerian coastline. In May 2005, fewer than ten pairs were counted (Telailia 2014).

Little Tern *Sternula albifrons*

A single colony was recorded at the Sidi Salem beach in Annaba, which is located at the extreme east of the Algerian coastline. Reproduction is irregular from year to year (Metallaoui and Houhamdi 2014; Baaloudj *et al.* 2018). This is the only colony of this species known to exist in Algeria.

Eleonora's Falcon *Falco eleonorae*

There are currently nine colonies in Algeria. Four of these are found on the east coast and have a total of 239 breeding pairs, while the remaining five are situated on the west coast and have a total of 206 pairs. The largest colonies are located at Cap Kef Amor, to the east, with one hundred pairs, and at the Habibas islands, to the west, with 114 pairs (Peyre *et al.* 2018; Bakour and Moulaï 2019).

Osprey *Pandion haliaetus*

Only two pairs have been recorded along the entire Algerian coast. One pair breed on the cliffs between Annaba and Skikda in the eastern sector (Telailia 2014) and another pair breeds on the Habibas islands (Mouret 2008; Durand 2011). This pair was absent during the May 2023 survey (Moulaï *et al.* 2023).

Mediterranean Shag *Gulosus aristotelis desmarestii*

There are small numbers of breeders in various places along the Algerian coast, with one to three pairs on cliffs and islets. The largest gathering of breeding pairs was observed on the Habibas islands in May 2023, with eleven pairs present (Moulaï *et al.* 2023).

Scopoli's Shearwater *Calonectris diomedea*

The species is breeding in small numbers on three islands in the eastern part of the Algerian coast with a total of at least fifty breeding pairs (Telailia 2014). However, the largest colonies are in the western part, with more than five hundred pairs on the Habibas islands and one hundred pairs on Rachgoun Island. On the Habibas islands, breeding success seems to be threatened following predation by black rats (Durand 2011; Taibi *et al.* 2014; Telailia 2014).

Yellow-legged Gull *Larus michahellis*

It is the most widespread seabird in Algeria. Its breeding numbers have increased from 2,500 pairs in 1978 to several thousand pairs today. Most of Algeria's coastal towns have been colonized. The largest colonies can be found on Rachgoun Island, with more than 5,000 pairs, and the Habibas Islands, with 3,500 pairs (Moulaï *et al.* 2006; Ghermaoui *et al.* 2013; Moulaï *et al.* 2023).

Audouin's Gull *Ichthyaetus audouinii*

Unfortunately, only one colony remains in Algeria, on the Habibas islands. Previously, eight colonies were found in 1978 (Jacob and Courbet 1980). In May 2023 we counted only seventy-five pairs (Moulaï *et al.* 2023). Breeding numbers on the Habibas islands fluctuate widely. For example, the number of breeding pairs fell from 538 pairs in 2006 to zero in 2008. Nine pairs were recorded in 2011 (Mouret 2008; Durand 2011) and seventy-five pairs were counted in 2023 (Moulaï *et al.* 2023).

The three small colonies at the Habibas islands appear to be under threat from the Yellow-legged Gull. Mapping of the two species' nests shows that Audouin's gulls are confined to the margins of the

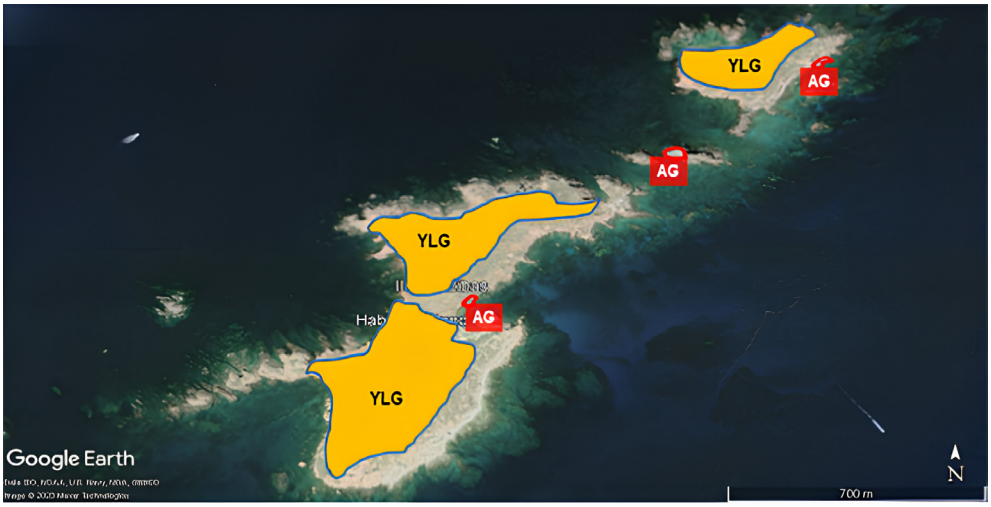


Figure 2. The position of Audouin's Gull (AG) colonies compared to Yellow-legged Gull (YLG) colonies on the Habibas Archipelago.

Yellow-legged Gull colonies (Fig. 2). The latter species, which nests earlier, leaves little free space for the Audouin's Gull (Moulaï *et al.* 2023).

Discussion and conclusion

We note that the most important colonies of seabirds with high heritage values are found at the two extremes of the Algerian coast. These include the following species: Audouin's Gull *Ichthyaetus audouinii*, Scopoli's Shearwater *Calonectris diomedea*, Mediterranean Shag *Gulosus aristotelis desmarestii*, Eleonora's Falcon *Falco eleonorae* and Osprey *Pandion haliaetus*. The central coast between Jijel and Mostaganem remains poor in terms of seabird nesting sites, with only colonies of Yellow-legged Gull and a few scattered pairs of Mediterranean Shag.

In conclusion, we propose two important areas for breeding seabirds (Important Area for the Seabirds-IASB) along the Algerian coastline (Fig. 3):

- IASB 1: located in the west between the city of Oran and Honaine, including the islands of Plane, Ronde, Habibas, Rachgoun and Mokeum, with the nesting of five species of high heritage value.

- IASB 2: located between Cap de Fer (Annaba) and the town of Collo, including the islands of Cap de Fer, Kef Amor, Sirigina and Rahbet Teffah, with the nesting of three species of high heritage value.

References

Baaloudj A., Bouzid A., Nedjah R., Samraoui F., Samraoui B., 2018. Distribution and breeding of the Slender-billed Gull *Chroicocephalus genei,* Common Tern *Sterna hirundo* and Little Tern *Sternula albifrons* in Algeria. Revue d'Écologie (La Terre et La Vie), 73(3), pp. 385-395.

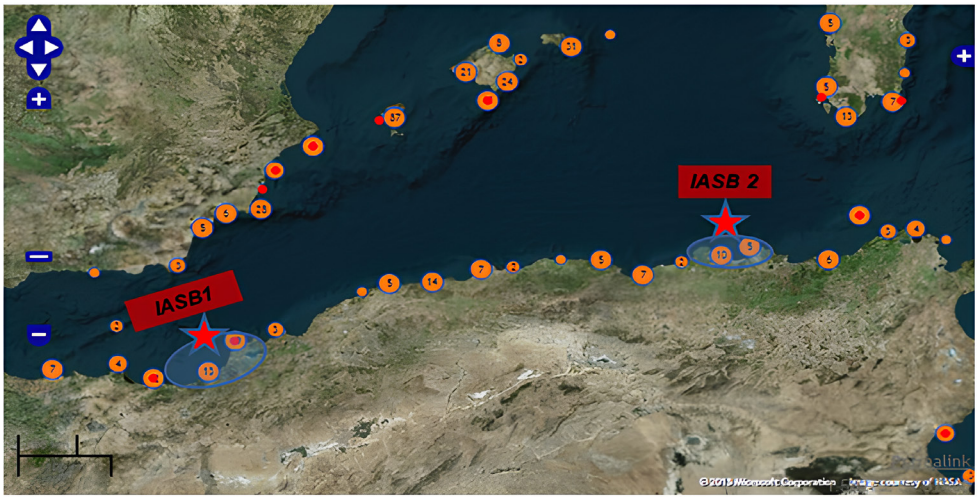


Figure 3. Geographical location of the two coastal stretches proposed as ISBA on the Algerian coast.

Bakour, S. and Moulaï, R., 2019. Dietary analysis across breeding seasons of Eleonora's Falcon *Falco eleonorae* on the western coast of Algeria. Ostrich, 90(1), pp. 63-72.

Durand, J.P., 2011. Suivi ornithologique des populations d'oiseaux marins des îles Habibas Algérie (PIM), 13p.

Ghermaoui, M., Abdellaoui, K., and Moulaï, R., 2013. Première observation d'une nidification mixte du Héron garde-bœuf, Bubulcus ibis et de l'Aigrette garzette, *Egretta garzetta* en milieu insulaire sur l'île de Rachgoun en Algérie. Alauda 81(4), pp. 311-312.

Jacob, J. P. and Courbet, B., 1980. Oiseaux de mer nicheurs sur la côte en Algérie. Le Gerfaut, 70, pp. 385-401.

Kebbi, M., Bougaham, A. F. and Moulaï, R., 2018. Biologie de reproduction du Petit gravelot, *Charadrius dubius* et du Gravelot à collier interrompu, *Charadrius alexandrinus* dans des colonies sympatriques. Alauda 86(3), pp. 179-190.

Metallaoui, S., Houhamdi, M., 2014. Premières données sur la reproduction de la Sterne naine *Sterna albifrons* en Algérie: description de la colonie. Bulletin du réseau « Oiseaux d'eau Méditerranée, 2, pp. 11-18.

Michelot, J.-L. and Laurent, L., 1993. Observations estivales d'oiseaux marins sur les plages algériennes et marocaines. Le Bièvre, 13, pp. 109-117.

Moulaï, R., Sadoul, N. and Doumandji, S., 2006. Effectifs et biologie de la reproduction du Goéland leucophée Larus michahellis dans la région de Béjaia (Algérie). Alauda, 74(2), pp. 225-234.

Moulaï, R., Bakour, S., Kahlessenane, S., Hamimeche, M., Benabdi, M., 2023. Rapport Mission îles Habibas – Etude de classement pour la mise en conformité de la réserve naturelle des îles Habibas.

Projet Pebla. Deutsche Gesellschaft für Internationale Zusammenarbeit-Algérie (GIZ-Algérie) and Abyss Environmental Services.

Mouret, V., 2008. Mission de terrain Réserve Naturelle des îles Habibas. Petites îles de Méditerranée (PIM), 28 pp.

PIM, 2025. Initiative pour les Petites îles de Méditerranée et de Micronésie. https://initiative-pim.org/

Peyre, O., Telailia, S., Benhartiga, S. and Beddek, M., 2018. Le faucon d'Eléonore *Falco eleonorae* en Algérie: statut, effectifs et répartition mondiale. Alauda 86(2), 2018, pp. 109-116.

Taibi, A., Ghermaoui, M. and Oubaziz, B., 2014. First study of the reproduction of Cory's shearwater *Calonectris diomedea* (Procellariidae, Aves) at the Rachgoun Island (Beni Saf, Algeria) Advances in Environmental Biology 8(10), pp. 15-20.

Telailia, A., 2014. Etude des oiseaux marins et côtiers du Nord Est Algérien: écologie et biologie de la reproduction et impact de l'environnement sur les espèces nicheuses. Thèse doctorat en sciences agronomiques, 141 pp.

OSPREY CONSERVATION: A COMPREHENSIVE PLAN FOR SAFEGUARDING OSPREYS, SEAGRASSES, AND MARINE AVIFAUNA IN AL-HOCEIMA NATIONAL PARK (MOROCCO)

Houssine Nibani

Association AGIR, Al-Hoceima, Morocco, agirnibani@gmail.com

Abstract

The Osprey (Pandion haliaetus), a diurnal raptor species belonging to the order Accipitriformes and the family Pandionidae, is the sole living representative of its genus. The species has an extremely large range and BirdLife International evaluated it as Least Concern (LC) (BirdLife International 2021). In Morocco, the population is located along the Mediterranean coastline in Al-Hoceima National Park (PNAH), where human activities, especially illegal fishing, significantly threaten the species. Recent conservation efforts led by the NGO AGIR and the National Water and Forests Agency, in partnership with international and local actors, have focused on restoring the population using various strategies, including Nature Conservation Standards and Nature based Solutions (NbS). Additionally, efforts have expanded to include Slender Seagrass (Cymodocea nodosa), a species vital for the maintenance of marine biodiversity and as an indicator of the health of coastal ecosystems. These frameworks ensure alignment with conservation targets, including the Osprey as an umbrella species and Slender Seagrass(Cymodocea nodosa) as a key bioindicator, to safeguard the broader ecosystem. The Osprey Action Plan (2023-2028) (Nibani 2022) seeks to increase breeding pairs and mitigate threats through multi-stakeholder collaboration and habitat protection.

Key-words: *Pandion haliaetus*, *Cymodocea nodosa*, monitoring, Al-Hoceima National Park, Smart MPA

Introduction

The Moroccan population of the Osprey (Pandion haliaetus) is part of a larger Western Mediterranean metapopulation, estimated to consist of around 80 pairs. Additionally, pairs are found in the Balearic Islands, with fewer than 100 breeding pairs distributed across Corsica (32 pairs), the Balearic Islands (16–18 pairs), Algeria (approximately 15–17 pairs), and Morocco (approximately 14–18 pairs) (Monti 2012).

In the Al-Hoceima National Park, the Osprey *Pandion haliaetus*, commonly known as the Fish Hawk, is not only an important species for maintaining the balance of marine ecosystems but also serves as an umbrella species for broader conservation efforts in Al-Hoceima National Park (PNAH) (Kaïkaï 2025). By focusing on the conservation

of the Osprey, AGIR and its partners aim to protect a variety of other species and ecosystems that are integral to the Mediterranean coastal environment. Alongside the Osprey, *Cymodocea nodosa*, a seagrass species with significant ecological functions, has been integrated into the conservation plan. This species contributes to nutrient cycling, provides habitats for marine fauna, and plays a crucial role in carbon sequestration (Duarte & Chiscano, 1999).

Osprey conservation has been guided by the Nature based Solutions (NbS) framework (IUCN 2020), which sets clear criteria and indicators for achieving lasting biodiversity conservation. At the same time, *Cymodocea nodosa* monitoring ensures the preservation of key marine habitats that support the life cycle of multiple species, including fish stocks essential for the Osprey's diet.

The Osprey population in PNAH faces threats from habitat degradation, illegal fishing, and competition with other species like the Yellow-legged Gull *Larus michahellis* (Monti *et al.* 2013). To address these threats, AGIR has employed Standards for Conservation (Conservation Measures Partnership 2020) aligned with the eight conservation targets identified in the NbS framework (IUCN 2020). These targets include the Osprey as the focal species, while supporting the restoration of *Cymodocea nodosa* beds and the entire marine and coastal ecosystem.

In addition to local initiatives, the integration of Smart Marine Protected Area (MPA) technologies has provided innovative tools to monitor and manage threats in real time, ensuring that the conservation efforts are adaptive and sustainable.

Materials and methods

Data Collection and Monitoring

Monitoring the Osprey population in Al-Hoceima National Park has been a continuous effort since the early 2000s, adhering to the Nature Conservation Standard (Conservation Measures Partnership 2020), which encompasses eight critical conservation targets. Among these targets, the Osprey serves as an umbrella species, symbolizing broader ecosystem health, including the monitoring of vital habitats like the *Cymodocea nodosa* seagrass beds.

The primary methods employed for data collection include ground surveys, nest monitoring, and the use of rings to track individual birds. Furthermore, divers and remote underwater drones have been utilized to assess the health and coverage of *Cymodocea nodosa*, which is essential for supporting the park's biodiversity by providing breeding grounds for key fish species in the Osprey's diet.

By integrating these methodologies, conservationists can not only track the Osprey population but also evaluate the overall health of the marine and coastal habitats within the park. Changes in the density and distribution

of *Cymodocea nodosa* are closely monitored to assess environmental shifts and human impacts, including pollution and coastal development.

To enhance conservation efforts, real-time data from Smart MPA systems has been incorporated. This data makes it possible to track Osprey movements, identifying critical feeding areas, monitoring *Cymodocea nodosa* beds, and detecting illegal fishing activities.

This comprehensive approach contributes to a robust management strategy aligned with global NbS criteria, ensuring the achievement of both species-specific and ecosystem-wide conservation objectives, Osprey conservation through Nature-based Solutions (NbS) and *Cymodocea nodosa* restoration.

NbS, as established by IUCN in 2020, have played a crucial role in the success of conservation efforts aimed at protecting the Osprey within Al-Hoceima National Park (PNAH). These solutions are designed to address both immediate conservation needs and long-term ecological resilience. The framework adopted by AGIR adheres to NbS criteria (IUCN 2020), which include ecological sustainability, social inclusivity, and long-term impact.

A key component of these efforts is the restoration of *Cymodocea nodosa* seagrass beds, which stabilize sediments, reduce coastal erosion, and enhance marine biodiversity critical factors for the Osprey's habitat. On the other hand, to protect Ospreys, initiatives have been implemented to combat dynamite fishing, a practice that threatens their nesting habitats located on cliffs. These actions include raising awareness among local fishermen, who play an active role in monitoring illegal activities. Their involvement is crucial for the success of conservation measures, as they help report infractions and protect nesting areas.

Additionally, No-Take Zones have been established to ensure the safety of marine habitats and support the Osprey population. These zones not only preserve essential marine resources for the Ospreys' survival but also promote the recovery of marine ecosystems in the region.

The eight conservation targets identified under the Nature Conservation Standards are integrated into this comprehensive strategy for the Al-Hoceima National Park, ensuring a lasting impact on Ospreys and their habitats:

1. Osprey Population (focal species)
2. Seabird Species (e.g., Audouin's gulls *Larus audouinii*)
3. Marine Ecosystem Health (including *Cymodocea nodosa* monitoring)
4. Fish Stocks (primary food source for Ospreys)
5. Invasive Species Control (e.g., Yellow-legged Gull)

6. Coastal Habitat Restoration (including seagrass beds)

7. Sustainable Fisheries Management

8. Community Involvement and Awareness

These targets are underpinned by a set of indicators that measure progress toward biodiversity restoration, ecological resilience, and social engagement. For example, the health of *Cymodocea nodosa* beds is monitored to assess the success of habitat restoration efforts. NbS approaches, such as *Cymodocea nodosa* replanting, habitat protection, and species management, are implemented to address each target.

Alignment with Nature Conservation Standards and NbS Indicators

• The Nature Conservation Standards (Conservation Measures Partnership 2020) provide a comprehensive framework for assessing the effectiveness of conservation interventions. These standards include:

• Target Identification: Establishing Ospreys and *Cymodocea nodosa* as focal species to ensure protection across multiple ecosystem levels.

• Criteria Development: Adhering to NbS criteria such as ecological coherence, long-term viability, and social inclusiveness.

• Monitoring and Evaluation: Using real-time data from Smart MPA technologies to track progress, detect threats, and measure success against set indicators. For instance, NbS indicators such as improved habitat connectivity, species population growth, and reduced human-wildlife conflicts are tracked continuously through the Ziphius Platform.

Results

Osprey Population and Conservation Target Monitoring

Notably, the Osprey population has seen significant growth, increasing from 5 breeding pairs in 2012 to 16 pairs in 2023 as a minimum confirmed via photographic evidence, reflecting the positive impacts of conservation efforts in the park. This impressive increase underscores the effectiveness of ongoing monitoring and protective measures.

In recent years, the Osprey population in PNAH has shown signs of stabilization. The application of NbS, from predator control to habitat restoration, has positively impacted the breeding success of the Ospreys, with an estimated 16 breeding pairs currently recorded.

The eight conservation targets, as outlined in the Nature Conservation Standards (Conservation Measures Partnership 2020), are continuously monitored through Smart MPA systems.

Key results include:

• Fish Stock Recovery: Targeted measures to reduce overfishing have led to a noticeable recovery in key fish species, such as mullets and sardines,

which rely on *Cymodocea nodosa* beds as nurseries.

• Invasive Species Management: The Yellow-legged Gull population, a significant competitor for nesting sites, has been reduced by 20% through targeted interventions.

• Coastal Habitat Restoration, including the restoration of cliffs and beach ecosystems, has provided additional nesting opportunities for Ospreys and seabirds like Audouin's gulls. Similarly, *Cymodocea nodosa* beds have been restored, increasing habitat complexity and biodiversity.

• The area of the *Cymodocea nodosa* seagrass bed at Boumehdi increased from 184,254 m² in 2019 to 371,697 m² in the current study. This suggests some improvement or a capacity for resilience of this seagrass bed, due to guarding against shallow-water trawling in this area.

Discussion and conclusion

The Osprey National Action Plan (2023–2028) (Nibani 2022) sets a clear path towards restoring the Osprey population and protecting marine biodiversity in Al-Hoceima National Park.

The integration of the Nature Conservation Standards and the alignment of conservation targets with NbS has created a holistic framework that addresses both species-specific needs and broader ecosystem resilience.

By using the Osprey and *Cymodocea nodosa* as key species for conservation efforts, AGIR has successfully implemented conservation measures that benefit a wide range of other species and habitats within the park.

This Osprey population serves as an umbrella for other species, whose conservation status has also improved due to integrated management efforts. *Cymodocea nodosa* restoration has been critical in this success, as the seagrass beds support fish species that are a primary food source for the Osprey.

The actual use of Smart MPA technologies ensures that the conservation targets are met while allowing for adaptive management based on real-time data. On the other hand, the alignment with the IUCN Global Standard for Nature based Solutions provides a model for integrating biodiversity conservation with sustainable development, offering insights for managers of other protected areas within the Mediterranean and beyond.

In conclusion, the Osprey and *Cymodocea nodosa* conservation efforts in PNAH exemplify the benefits of a Nature-based Solutions approach, which enhances the ecological integrity of protected areas while engaging local communities in conservation actions. These efforts serve as a replicable model for other marine and coastal conservation projects globally.

References

BirdLife International, 2021. Species factsheet: Osprey *Pandion haliaetus*. Downloaded from https://datazone.birdlife.org/species/factsheet/osprey-pandion-haliaetus

BirdLife International 2018. *Pandion haliaetus*. The IUCN Red List of Threatened Species.

Conservation Measures Partnership (CMP) 2020. Open Standards for the Practice of Conservation, Version 4.0. Washington, DC, CMP. https://www.conservationmeasures.org

Duarte, C.M. and Chiscano, C.L., 1999. Seagrass biomass and production: A reassessment. Aquatic Botany, 65(1-4), pp. 159-174. https://doi.org/10.1016/S0304-3770(99)00038-8

Fernández-Torquemada, Y. and Sánchez-Lizaso, J.L., 2011. Responses of *Cymodocea nodosa* to hypersaline stress: A microcosm approach. Marine Environmental Research, 72(4), pp. 206-213. https://doi.org/10.1016/j.marenvres.2011.08.002

González, L.M., Arroyo, B. and Margalida, A., 2006. Conservation status of Ospreys in Southern Europe. Bird Conservation International, 16(1), pp. 41-56.

IUCN, 2020. Global Standard for Nature-based Solutions. A user-friendly framework for the verification, design and scaling up of NbS. First edition. Gland, Switzerland: IUCN, 30 pp.

Kaïkaï, T., 2025. Caractérisation des herbiers marins au niveau du Parc National d'Al Hoceima. Diplôme de Master des Sciences et Techniques, Faculté des Sciences et Techniques d'Al Hoceima, Maroc.

Monti, F., Nibani, H., Dominici, J.M., Rguibi Idrissi, H., Thévenet, M., Beaubrun, P. C., and Duriez, O., 2013. The vulnerable Osprey breeding population of the Al Hoceima National Park, Morocco: present status and threats. Ostrich, 84(3), pp. 199-204.

Monti, F., 2012. The Osprey, *Pandion haliaetus*. State of knowledge and conservation of the breeding population of the Mediterranean basin. Initiative PIM, 26 pp.

Nibani, H., 2022. Plan d'Action National du Balbuzard pêcheur, ANEF & AGIR, Expertise France. Royaume du Maroc. https://agirmed.files.wordpress.com/2024/02/plan-d-action-national-du-balbuzard-pecheurs-maroc-.pdf

GUEST CONTRIBUTION

outside the oral presentations and posters during the symposium

CONTRIBUTION TO THE IMPLEMENTATION OF THE NATIONAL IMAP-BASED MONITORING PROGRAMMES RELATED TO SEABIRDS IN LEBANON

Ghassan Ramadan-Jaradi

National Council for Scientific Research-Lebanon (CNRS-L), grjaradi@hotmail.com , Ghassan.Jaradi@gmail.com

Abstract

The Barcelona Convention adopted in 2008 the Ecosystem Approach (EcAp Process) to achieve and maintain Good Environmental Status (GES) of the Mediterranean Sea and Coast.

A major component of the ecosystem approach implementation is the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria (IMAP), that includes regionally agreed common indicators. For Lebanon we monitored the three seabird common indicators consisting of species distribution ranges (CI1), species abundances (CI2) and species demographic characteristics (CI3). The study was conducted between October 2022 and May 2023 in three sensitive areas: Tripoli, Beirut, and Tyre. It resulted in updating the phenological status of two species of gulls: the Armenian Gull (Larus armenicus) and Audouin's Gull (Larus audouinii). The project proposed ten species out of twenty-five that are listed in Annex II of the SPA/BD Protocol of the Barcelona Convention, but we monitored five of them since the others are either vagrants, rare species or never recorded in Lebanon. The five monitored species are two gulls, the Slender-billed Gull (Chroicocephhalus genei) and the Audouin's Gull (former breeder), one tern, the Sandwich Tern (Thalasseus sandvicensis), and two shearwaters, the Scopoli's Shearwater (Calonectris diomedea) and Yelkouan Shearwater (Puffinus yelkouan). All five monitored species are passage migrants and winter visitors. Presently, none of them is confirmed as breeding in the country. Instead, the Yellow-legged Gull (Larus michahellis) and the Little-ringed Plover (Charadrius dubius), which are not listed in the Annex II, do breed in Lebanon, whereas the Audouin's Gull appeared to be a possible breeder. The abundance of each species/habitat is also given as baseline data for future monitoring.

Key-words: seabirds, coastal birds, indicators, monitoring, Lebanon

Introduction

To protect marine and coastal ecosystems of the Mediterranean, the Barcelona Convention adopted the Ecosystem Approach (EcAp Process) in 2008, under the vision of «A healthy

Mediterranean with marine and coastal ecosystems that are productive and biologically diverse for the benefit of present and future generations», Implementation of this process was facilitated by an Integrated Monitoring and Assessment Programme (IMAP) that includes a list of 11 Ecological Objectives, addressing all key elements of the Mediterranean marine and coastal environment as well as regionally agreed common indicators for all Ecological Objectives and aims to enable quantitative, integrated analysis of the state of the marine and coastal environment of the Mediterranean (Barcelona Convention 2017). This way of protecting ecosystems has led us to focus, through the SPA/RAC activity "Contribution to the implementation of the national IMAP-based monitoring programmes related to seabirds" (Ramadan-Jaradi 2023), on the IMAP Common Indicators (CI) related to seabirds, means their distributional range (CI3), species abundance (CI4), and species demographic characteristics (CI5), and develop scales of monitoring and assessments, criteria, baseline, and threshold values. Because monitoring all seabird species in the region for GES assessment appears neither feasible nor necessary, we have focused on representative species from a range of functional groups, which can showcase the relationship between environmental pressures and their main impacts on the marine environment. To apply this on the ground, we worked under the authority of the Conseil National de la Recherche Scientifique CNRS-L, and we performed the tasks between October 2022 and June 2023. These tasks contributed to the implementation of the national IMAP-based monitoring programme for seabirds. We also submitted quality-assured/controlled data sets deriving from the field surveys, including historical data sets that were not reported until now.

The study targeted the twenty-five species of sea and coastal birds listed in Annex II of the SPA/BD Protocol but at the same time focused on a narrower list of ten different indicator species of shearwaters, gulls, terns, the Mediterranean Shag *Gulosus aristotelis desmarestii*, and the Osprey *Pandion haliaetus* to create a baseline for future assessments.

Five of these ten species were omitted

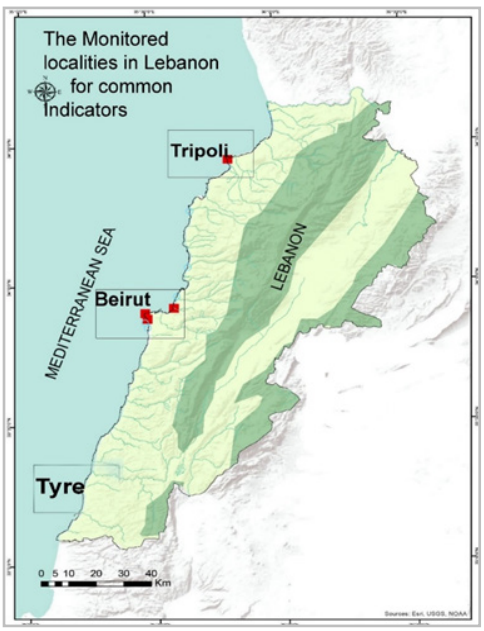


Figure 1. Location of the monitored areas in Lebanon (for plots, see text).

from the list due to either their vagrancy, rarity, or inexistence in Lebanon. Even though, the eyes remained open for all species recorded during the field visits to the three sensitive areas of Lebanon: Tripoli, Beirut, and Tyre (Fig.1).

Materials and methods

Within the EU funded EcAp-Med II Project coordinated by SPA/RAC to implement the first phase of IMAP (2016-2019), the author of this paper has developed the national monitoring programme for marine biodiversity in Lebanon (Ramadan-Jaradi 2017a). He also trained a team of birdwatchers on seabird identification (Ramadan-Jaradi 2017c) and on seabirds and coastal birds counting thanks to financial support from SPA/RAC and IUCN respectively (Ramadan-Jaradi 2020a). It was found that seabirds have received relatively little attention in the Lebanese Sea area, particularly regarding the study of their distribution patterns on the coast and at sea (Ramadan-Jaradi 2017b). The most extensive coverage of the region regarding marine top predators has been conducted by Ramadan-Jaradi & Ramadan-Jaradi, (2001) who had conducted several coastal and seabirds' surveys since 1995, culminating in 2019-2020 with those supported by IUCN (Ramadan-Jaradi 2020), using point counts and transects methodologies. However, seabirds have been only marginal to research work, and little information is available for the target groups of this study. On the other hand, a handful of sporadic seabirds surveys have been conducted in recent years (2020-2022), providing some relevant information for the region and records of new species for the country.

For the present paper, the monitoring of indicators was applied on Palm Islands Nature Reserve (PINR), Tyre Coast Nature Reserve (TCNR) and Beirut coastal areas. It was carried out according to the methodology of Linear Transects during the wintering season, often between 07:30 AM and 12:00 PM (occasionally until 4:00 PM).

The surveys were conducted by scanning 90° ahead from either the port or starboard side of the moving boat. Observations were limited to a transect band 300 m wide by 1,000 m long, or a 300 m three-segment transect from the boat's beam (noting that the largest island in the Palm Islands Nature Reserve (SPAMI) is only 400 m long).

All data gathered is documented with photos, references and GPS positions that served to analyze the results of the monitored Common Indicators (Ramadan-Jaradi 2017a). During the breeding season, which runs from April to late May, the method of Point Count (Blondel *et al.* 1981) was used to monitor the potential breeding species of the Common Indicators. It consists of staying at a point in the middle of a circle of 300 m diameter, where the observer records all species and populations of birds seen within the circle's area or flying overhead.

As for the effort of observation during the monitoring in 2022-2023, it was as follows:

- three validation visits to PINR in spring and three in winter: during each visit, four plots (Mina Harbor, Tripoli Dump, Archipelagos, and PINR) are monitored.
- three validation visits to Beirut Coast in spring and three in winter: During each visit five plots are monitored (Raouche1, Raouche2, Beirut Waterfront, Quarantina, and Rear of City Mall),
- three validation visits to TCNR in spring and three in winter: During each visit four plots (Tyre Waterfront, TCNR-N, TCNR-S or Ras El Ain and Abbasyeh MPA) are monitored.

Results

The present study targeted all the twenty-five species of the Annex II of the Protocol SPA/BD and proposed ten species to be monitored. It appeared that only five of the ten proposed species could be considered and selected, because the other five species are either species that have not yet been proven to appear in Lebanon, or that are vagrants or rare.

It is worth mentioning that our study did not show any species of those listed in Annex II of the Protocol SPA/BD as nesting in Lebanon. Rather, the only seabird species that nests in Lebanon is the Yellow-legged Gull *Larus michahellis*, which breeds on the SPAMI PINR, and, for the first time since many years, on the Ballane Island (part of the Tripoli/Mina Archipelagos).

Among the waders (coastal birds), the only breeding species is the Little ringed plover *Charadrius dubius* which nests on sandy and earthen areas of the shore and back shore of the country. Both the Yellow-legged Gull and the Little Ringed Plover are not on the list of birds cited in the Annex II of the SPA/BD Protocol. Only after one year from the end of our study, the White-crowned Kingfisher was recorded.

The following table (Tab. 1) shows the stations of each area, number of visits, number of species in winter and spring and the number of individuals in winter and spring. Normally, areas of political tension are avoided. In the table below, it is worth noting that the Mina archipelagos have a high number of individuals.

In a second table (Tab. 2), we present the final 5 species adopted and monitored for the seabird common indicators in Lebanon. In this table, the phenological status (PS) conforms with the present status at the level of the three areas of the study, from Tyre to Tripoli through Beirut. We also updated the conservation status (CS) of the former breeder Audouin's Gull from least concern (LC) to vulnerable (VU) and from "occasional" to "regular possible breeder". In addition, we present in Tab. 2 the number of individuals recorded in each of the three monitored areas in winter and in spring. The frequency of appearance of the individuals is

Table 1. Distribution of species and populations and the number of visits to the monitoring plots (stations).

Monitoring areas	Sites visited	Winter visits No.	Spring visits No.	No. of recorded species out of the 25 of Annex II in winter	No. of individuals recorded	No. of recorded species out of the 25 of Annex II in spring	No. of individuals Recorded
TYRE	1.Tyre Waterfront	3	3	9	309	13	195
	2. TCNR North	3	3	9	60	13	295
	3. TCNR S (Ras El Ain)	3	3	10	229	5	19
	4. Abbasyeh	3	3	10	399	8	397
Beirut	5. Beirut Waterfront	3	3	7	36	15	193
	6. Raouche 1km offshore	3	3	7	146	8	215
	7. Raouche 2km offshore	3	3	9	53	5	76
	8. Quarantina	3	3	9	151	8	94
	9. Back of City Mall	3	3	7	33	17	352
Tripoli	10. Mina Harbor	3	3	11	138	14	167
	11. Tripoli Dump	3	3	11	92	4	40
	12. Mina Archipelagos	3	3	9	241	12	703
	13. PINR (last three islands)	3	3	14	329	15	319

given for the same three areas (species frequency is the likelihood of finding a species in a given area).

Since all birds have received the same effort of observation (in terms of number of visits, areas, time given to each of the species and plot) the number of individuals and frequency of species can be compared. They are lowest for the Audouin's Gull which was observed two times: on the second of April 2023, one individual, and on the 15th of April 2023, three individuals. This species was recorded as breeding in Palm Islands by Stenhouse (1904) but there has been no evidence of it since then.

Table 2. List of monitored species in Lebanon where W denotes winter and S spring (for more details see text above).

Species monitored in Lebanon	C. Status	P. Status	Tripoli # ind./ Sp./W	Tripoli # ind./Sp./S	Beirut # ind./ Sp./W	Beirut # ind./ Sp./S	Tyre # ind./ Sp./W	Tyre # ind./ Sp./S	Total ind. Frequency
1. Audouin's Gull	LC to VU	FB, pm, wv	4	15	2	10	6	4	41
Larus audouinii			3	4	1	4	2	2	F 2.67
# of individuals			19		12		10		41
2. Slender-billed Gull	LC	pm, WV	92	19	24	34	65	30	274
Chroicocephhalus genei			10	5	4	4	9	4	F 6
# of individuals			111		68		95		274
3. Sandwich Tern	LC	PM, WV	45	28	42	56	48	14	233
Thalasseus sandvicensis			10	5	7	7	9	3	F 7
# of individuals			73		98		62		233
4. Scopoli's Shearwater *Calonectris diomedea*	LC	PM, WV	19	94	53	78	0	31	275
			4	6	4	5	0	5	F 4
# of individuals			113		131		31		275
5. Yelkouan Shearwater *Puffinus yelkouan*	VU	PM, WV	43	158	38	189	54	53	535
			6	6	6	10	5	5	F 6.33
# of individuals			201		227		107		535

After the completion of the study, subject to the present paper, we visited Palm Islands on 29 May 2023 in company with a Birdwatcher and Ichthyologist. It was surprising when many Yellow-legged Gulls were protesting our presence by flying overhead and making loud noises. We then observed one Audouin's Gull chasing a Yellow-legged Gull on two 5 minutes intervals of time. This suggests that the status of the Audouin's Gull should be verified and reconsidered through additional visits and longer stays to observe this species on PINR.

The Audouin's Gull appeared as per the table below in almost equal numbers in Tyre (10 individuals) and Beirut (12 individuals) but in a relatively higher number (19 individuals) in Tripoli, which is the previous breeding site for this species.

The Slender-billed Gull was considered in the near past as irregular rare passage migrant and scarce winter visitor (Ramadan-Jaradi *et al.* 2008). Our field studies on shores and offshore showed, as expressed in table 2, that the species is an uncommon passage migrant and a common winter visitor. However, monitoring should continue to rule out chance. We believe that the Slender-billed Gull was overlooked, especially as it mixes with flocks of Common Black-headed Gulls in winter and up to early March. This species appeared to be more common in Tripoli and Tyre than in Beirut.

The Sandwich Tern was recorded as an extremely rare passage migrant and winter visitor from early August to mid-April on the coasts and Palm Islands (Ramadan-Jaradi & Ramadan-Jaradi 1999; 2001). Recently, a published paper (Ramadan-Jaradi *et al.* 2020b) regarded the Sandwich Tern as a scarce passage migrant but a fairly common winter visitor species. Our field studies on the shores and in offshore areas showed that the species is an uncommon passage migrant in the study area, whereas it is still a common winterer (Tab. 2).

The Scopoli's Shearwater is considered common on passage from March to mid-June and from early August to late September. The species is recorded irregularly in large flocks offshore and near Palm Islands in January and February (Ramadan-Jaradi *et al.* 2020b). The present study showed that the species is a common taxon in winter and spring, more common in Beirut and Tripoli and uncommon in Tyre and never seen on the coast.

The Yelkouan Shearwater is a common species on passage, usually in small numbers from early August to early September (200 ind. reported off Tripoli in late September) and in March and April. Few winter records of single birds or smaller flocks (up to fifty-five ind.) are known. The species often mixes with Common Black-headed Gull Larus ridibundus while resting on surface water during winter (November-February) (Ramadan-Jaradi *et al.* 2008). At local level, the Yelkouan Shearwater is a common bird in winter and on

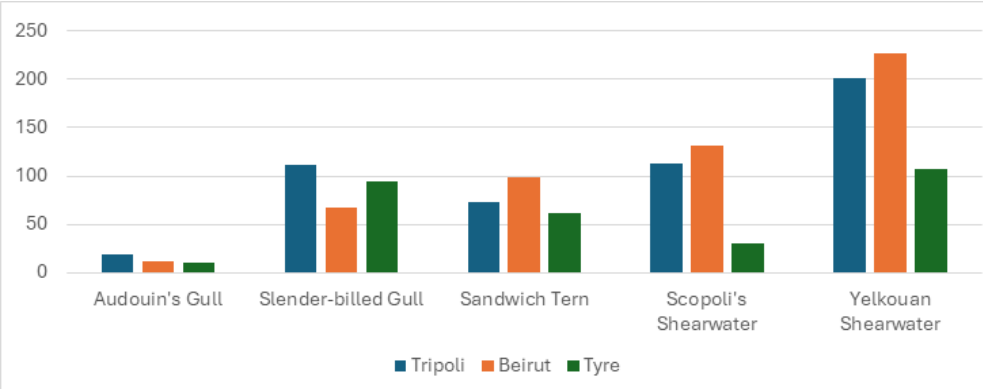


Figure 2. Abundance of five species in three study areas from north to south Lebanon: Tripoli, Beirut, and Tyre.

passage as per the results from this study. It is also the most common of all "common indicator species" that were studies. Furthermore, this species appears much more common in Beirut and Tripoli than in Tyre and is always seen in open water.

Unexpectedly, it seems that the two species of shearwater, which do not approach the land and at the same time are far from sight in the sea where they hunt and rest on the water in the large of the sea, are the two species that are the most present and numerous among seabirds. Thanks to the trips with boats attractive to marine birds we were able to see groups of seabirds resting on the surface of seawater. In addition, we observed and photographed about a dozen of killed Yelkouan Shearwaters in a fisherman's boat in the Mina Harbor. This might be related to the economic crisis in the country before which fishermen were never seen hunting seabirds.

Discussion and conclusion

It was concluded during the monitoring activities that in several study stations the application of the Transect method on terrestrial areas was not convenient due to:

1) the small size of the area: the Palm Island, for example, the largest island of the three islands forming the Nature Reserve (SPAMI), has a length of only about 400 meters,

2) the inaccessibility of some lands along the coast, intercepting the transect.

To solve this issue, we adopted circular transects following the perimeter of the island and observing the island and its surrounding sea whilst respecting the definition of the linear transect in the methodology described above. Elsewhere, we performed 900 meters transect (segmented into three portions) to avoid barriers, provided the habitat before and after the barriers is almost the same. This is the case in the Tyre Coast Nature Reserve (SPAMI) where the northern and the southern parts are divided into two sections by the Palestinian Camp of Rachidya.

Otherwise, the transects were generally fine outside the SPAMIs, and it was highly rewarding to travel along them by boat, regardless of whether the transect was perpendicular or parallel to the shore. The lack of statistical testing of monitors' knowledge may suggest providing them with a programme to help them compare the richness, means, frequencies, abundance, densities, diversity index, and evenness of populations.

Except for the Yellow-legged Gull and the Little Ringed-Plover, and despite the absence of other breeding seabirds in Lebanon, the Point Count method proved to be highly efficient in detecting birds that visit dumps or landfills. The Vantage Point was excellent for the census of the birds from the birdwatching tower of the flat Palm Island (Rabbit Island).

In our study, at least, population trends can be obtained, even for non-breeding species, but certainly not before the second year of monitoring. We expect to reach clear results about the trends of species after monitoring for five to ten years.

Acknowledgments

The author gratefully acknowledges the National Council for Scientific Research-Lebanon (CNRS-L) and its Secretary General Dr. Tamara Elzein for selecting him to conduct the project on which this paper is based. This project and subsequently this paper also benefited from the wise proofreading and relevant comments of Dr. Milad Fakhry.

References

Blondel, J., Ferry, C., and Frochot, B., 1981. Point counts with unlimited distance. Studies in Avian Biology, 6, pp. 414-420.

Ramadan-Jaradi, G. and Ramadan-Jaradi, M., 1999. An updated checklist of the birds of Lebanon. Sandgrouse, 21(2), pp. 132-170

Ramadan-Jaradi, G. and Ramadan-Jaradi M., 2001. The avifauna of Palm Islands Nature Reserve in Lebanon 1893-2000. Lebanese Science Journal, 2(1), pp. 17-35.

Ramadan-Jaradi, G., Bara, T. and Ramadan-Jaradi, M., 2008. Revised checklist of the birds of Lebanon 1999-2007. Sandgrouse 30(1), pp. 22-69.

Ramadan-Jaradi, G., 2017a. National Monitoring Programme for Biodiversity in Lebanon – EO1 – Seabirds. Developed for RAC/SPA-MOE- Ecap and MedMPA net II Lebanon. Final Report, pp. 1-61.

Ramadan-Jaradi, G., 2017b. Status and Distribution of Migrating and breeding seabirds in north Lebanon. Lebanese Science Journal, 18(2), pp. 156-165.

Ramadan-Jaradi G., 2017c. Training on the identification of the marine birds with focusing on threatened and endangered species. Supported by RAC-SPA, 2017. Final Report, pp. 1-36.

Ramadan-Jaradi, G., 2020a. Facts on the marine and coastal birds of Lebanon. Amman, Jordan: IUCN ROWA, Beirut, Lebanon: Ministry of Environment, pp.1-

89.

Ramadan-Jaradi, G., Itani, F., Hogg, J., Serhal, A., and Ramadan-Jaradi, M., 2020b. Updated checklist of the birds of Lebanon, with notes on four new breeding species in spring 2020. Sandgrouse, 42, pp. 186-238.

Ramadan-Jaradi, G., 2021. Study of coastal and marine birds of Lebanon: an atlas of distribution. Amman, Jordan: IUCN ROWA and Beirut, Lebanon: Ministry of Environment, pp. 1-54.

Ramadan-Jaradi, G., 2023. Contribution to the implementation of the national IMAP-based monitoring programmes related to seabirds. CNRS-IMAP-MPA. Final Report, 40 pp.

Stenhouse, J.H., 1904. The birds of Nakhl island on the coast of Syria. Ibis (VIII) 4, pp. 29-32.

UNEP-MAP, 2017. Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and related Assessment Criteria. Funded by the EU. Final Report, 50 pp. https://www.medqsr.org/integrated-monitoring-and-assessment-programme-mediterranean-sea-and-coast/ Retrieved on 7 September 2024.

POSTER COMMUNICATIONS

With the aim of making the posters exhibited during the symposium accessible to a wider audience, and since only a few articles were received in this regard, the organisers decided to include both the articles received and the abstracts of all other posters in the proceedings, each with a link to the relevant poster.

SEABIRDS MONITORING IN THE EGYPTIAN MEDITERRANEAN COAST IN THE FRAME OF THE IMAP – MPA PROJECT IN EGYPT

Mohamed S. Abdelwarith

Environmental Researcher, Egyptian Environmental Affairs Agency (EEAA), Mohamed7j@hotmail.com

Abstract

Because of Egypt's unique, strategic geographical position along migration routes of Palearctic birds wintering in Africa, many Palearctic species migrate through Egypt in internationally significant numbers. Many of these species are included in the SPA/ BD sea bird's annex.

Of the Mediterranean coastal wetlands, the most important are the six major coastal lagoons: Bardawil, Malaha, Manzala, Burullus, Idku, and Maryut. The remainder of the Egyptian Mediterranean coast is of rather limited importance for birds. Two of these important wetlands for seabirds have been declared Ramsar Sites along the Egyptian Mediterranean coast.

The programme of monitoring of seabirds in the Egypt Mediterranean coasts has been implemented in the framework of the EU-funded project "Towards achieving the Good Environmental Status of the Mediterranean Sea and Coast through an ecologically representative and efficiently managed and monitored network of Marine Protected Areas" (referred to as IMAP-MPA project). The IMAP monitoring requirements focus on, based on agreed common indicators, parameters that are indicative of the state of the environment, the prevailing anthropogenic pressures and their impacts, and the progress towards a good environmental status (ecological objectives and targets).

The bird monitoring programme was implemented during the winter periods of the IMAP- MPA project along the Egyptian Mediterranean coast. Fourteen species listed in the SPA/ BD seabirds annex have been recorded.

The poster presented at the symposium is available here

ASSESSING THE IMPACT OF PLASTIC POLLUTION ON SEABIRDS IN TUNISIA: A COMPREHENSIVE APPROACH INTEGRATING ADOPT-A-BEACH INITIATIVES AND A REGIONAL DATABASE

Wassim Amdrous, Mehdi Aissi, Ibrahim Ben Amer, Mariam Feki, Mouna Abaab

WWF North Africa, Bis rue El Moez -E Menzah 1- 1004 Tunis, Tunisia, wamdrous@wwfna.org

Abstract

Plastic pollution is a growing threat to marine ecosystems worldwide, with seabirds being particularly vulnerable to its lethal effects. This study is to evaluate the impact of plastic pollution on seabird populations in the Mediterranean, employing an integrated approach that combines Adopt-a-Beach initiatives with the establishment of a comprehensive database on plastic pollution. The Adopt-a-Beach program is an initiative that engages local communities, citizen scientists, and environmental organizations in beach cleaning activities along the Mediterranean coastline. Through systematic data collection, including the type and quantity of recovered plastics, spatial distribution, and temporal variations, we aim to quantify the extent of plastic pollution on selected beaches. Concurrently, the program is developed in Tunisia to raise public awareness on plastic pollution and marine organisms (inc. seabirds) and promoting community involvement in mitigating this environmental challenge. In tandem with Adopt-a-Beach efforts, a database will be established to consolidate information on plastic pollution along the Tunisian coastline. This database will provide a comprehensive overview of plastic pollution trends over time. Geographic Information System (GIS) tools will be used to map and identify hotspots with high plastic concentrations, offering insights for conservation actions.

In 2023, an extensive assessment of over 80 beaches in Tunisia resulted in the identification and classification of the top 10 main pollutants. The findings underscored a significant presence of microplastics, including abandoned fishing nets and other fishing gear. Given that these areas are commonly utilized by seabirds, studying a possible correlation between plastic pollution levels and the status of seabird populations is imperative. This correlation will be analysed through necropsy examinations, dietary analysis, and behavioural observations. The integration of field data with the regional perspective provided by the database aims to determine the interaction between plastic pollution and the health of seabirds, contributing to a more comprehensive understanding of the ecological challenges at hand.

The outcomes of this two years long (since 2022 and continuing) research will not only enhance our understanding of the specific impacts of plastic pollution

on seabirds in Tunisia but will also contribute to the development of potential conservation strategies. The integrated approach, merging citizen science through Adopt-a-Beach initiatives with a comprehensive regional database, holds promise for promoting sustained engagement in mitigating plastic pollution and safeguarding the ecological health of the Mediterranean Sea.

The poster presented at the symposium is available here

THE USE OF STABLE ISOTOPES IN THE STUDY OF THE AVIFAUNA OF THE GALITE ARCHIPELAGO IN TUNISIA

Hsan Ben Jemaa[1,2], Said Nouira[1], François Fourel[3], Ilham BENTALEB[2]

[1] University of Tunis El-Manar, Faculty of Sciences in Tunisia, Campus Universitaire El-Manar, 2092 El Manar-Tunis, Tunisia, hsan.benjemaa@fst.utm.tn
[2] University of Montpellier, UMR 5554-ISEM CNRS, IRD, EPHE, Montpellier, France, Pl. Eugène Bataillon, 34090 Montpellier, France
[3] UMR CNRS 5023 LEHNA Université Claude Bernard Lyon 1, VILLEURBANNE Cedex-France

Abstract

The Mediterranean basin is considered a biodiversity hotspot, characterized by a diverse range of landscapes, marine areas, and organisms. Among its islands is the Tunisian archipelago of «La Galite.» Still difficult to access, this archipelago showcases incredible richness and biodiversity, serving as a major migratory route and nesting site for numerous seabirds. Many of these bird species are endemic to the Mediterranean, such as the Eleonora's falcon (Falco eleonorae), an obligate migratory species. The breeding habitat of Eleonora's falcons encompasses the islands of the Mediterranean, extending as far as the Canary Islands in the Atlantic.

Studying the diets and migratory circuits of species is essential for developing effective conservation and sustainable development plans within island ecosystems. Our research will commence with a thorough investigation into the feeding habits of Eleanora's falcons during the breeding season within the Galite archipelago. Subsequently, we will delineate the wintering habitats of these falcons and the geographical origins of their prey.

The diet analysis of the Eleanora's Falcon was conducted by examining the stable isotopic signatures of carbon (δ13C) and nitrogen (δ15N) in the feathers of 19 falcons and their prey (7 specimens) (the remiges p8 and p9), along with insect fragments retrieved from regurgitated pellets. A Bayesian stable isotope mixing model from the «Simmr» package in the R programming language was employed to elucidate the dietary patterns of the falcons. Additionally, to determine the geographical origins of both adult falcons and their prey, the isotopic signatures of deuterium (δ2H) were utilized. Geospatial assignments were performed using the «Isorix» package in R. Feather sampling from Eleonora's falcons and their prey was exclusively carried out on Fauchelle Island during the final three weeks of September. Seven prey species were identified through the morphological characters of the feathers described in the literature and knowledge of migratory bird species flying above the breeding grounds of the falcons: Common Nightingale (Luscinia megarhynchos - Lu.m), European Greenfinch (Chloris chloris - Ch.ch), Spotted Flycatcher (Muscicapa

striata - Mu.s), Common Quail (Coturnix coturnix - Co.c), Eurasian Hoopoe (Upupa epops - Up.u), Common Whitethroat (Sylvia communis - Sy.c) and European Storm-petrel (Hydrobates pelagicus - Hy.p).

The contribution of passerines to the diet of falcons was significantly higher than that of insects. This contribution was very high compared to those found in other breeding colonies. The diet of all the falcons was dominated by the whitethroat, the nightingale and the hoopoe.

Eleonora's falcons' prey on species originating from various regions, ranging from the Mediterranean to the southern Scandinavian countries. The results of attributing the geographical origins of the falcons' prey validate the effectiveness of the utilized method, which involves hydrogen isotope analysis. Concerning the attribution of the original sites of adult Eleonora's falcons using our prediction maps, the results indicate relatively low P values for the theoretical wintering sites in Madagascar and the Southeast region of the African continent. This suggests that the remiges p8 and p9 of adult falcons have molted on Galite Island.

The poster presented at the symposium is available here

BREEDING SEABIRDS ON THE SMALL ISLANDS OF THE EDOUGH PENINSULA (ALGERIA)

Neila Ahlem Benloucif[1], Tarek Hamel[1], Amir Boulemtafes[2], Saliha Trea[1]

[1] Biology Department, faculty of Sciences, University Badji Mokhtar Annaba, Algeria, benloucifneila@yahoo.fr
[2] Department of Biology, faculty of natural and life sciences, University 8 mai 1945 Guelma, Algeria.

Abstract:

This study focuses on breeding seabirds on the small islands of the recently established Marine Protected Area (MPA) on the Edough Peninsula, comprising 15 identified sites with active seabird colonies. This community includes over 10,000 breeding pairs belonging to various species (Gulosus aristotelis, Falco eleonorae, Larus michahellis, Chroicocephalus ridibundus, Columba livia, Calonectris diomedea). The Yellow-legged Gull (Larus michahellis) dominates the community in terms of both number and distribution. A particular observation made is the apparent preference of the island of Sainte-Piastre, the island furthest away from the mainland, by breeding yellow-legged gulls, for which the population number keeps increasing year after year. Recent trends emerge, with a significant and rapidly multiplying population of Rock Doves (Columba livia) and the decline of the European Shag (Gulosus aristotelis) to a critical level. Recommendations are provided for the conservation and management of this seabird community.

Key-words: Breeding seabirds; Islands; Yellow-legged Gull; Seabird community, Edough peninsula.

Introduction

Insular ecosystems harbor unique biodiversity, particularly that of marine birds, which play a crucial role in these fragile environments (Spatz *et al.* 2021). The small islands of eastern Algeria hold significant ecological importance in the Mediterranean region, playing a pivotal role in the preservation of marine, terrestrial, and avian biodiversity.

Despite their modest size, these islands host colonies of marine birds, contributing essential components to the regional ecological balance. However, the lack of dedicated research on these islands creates a notable gap in our understanding of their ecological richness and potential impact.

It is imperative to undertake comprehensive studies to document and protect these unique ecosystems, especially concerning the interactions among seabirds, fauna, flora, and their insular environment. The primary objective of this preliminary

research is to assess avian diversity on the islands within the framework of a thesis aimed to study the impact of these birds on the vegetation of the small islands in this region.

Materials and Methods

Islands' Location

We conducted a preliminary geolocation of small islands, identifying 15 islands that met the criteria for the presence of seabird communities. Our focus was on five specific islands: El Louh, Ste Piastre, Gargamiz, Serigina, and Cap Kal'aa. The first three belong to the Edough Peninsula, designated as a Marine Protected Area (MPA) (Annaba department). The latter two are located further west along the coast of Skikda (Fig. 1).

Study Period

During the spring season of 2023, we monitored the gull population on the islands in the East of the Edough Peninsula. Despite the main focus on gulls, other species of seabirds were also recorded. Field excursions, conducted between late May and early June, covered various island environments.

Bird identification was carried out on-site using the ornithology guide of Svensson *et al.* (2010). Direct observations in the field included counting individuals and assessing nests on the island.

These observations were crucial for documenting the variety of species present. Observation tools such as ornithological binoculars and telescopes were used.

Figure1. Geographic location of the five studied islands in North Algeria (Hamel *et al.* 2022).

Results

The following Table 1 summarizes the main environmental and biological characteristics of five island sites, including area (in m²), distance to the mainland and elevation (in meters), the number of birds observed (N), and the number of nests recorded. These variables were selected to assess the influence of abiotic factors on the spatial distribution of individuals and nesting success of the Yellow-legged Gull *Larus michahellis*.

Table 1. Yellow-legged Gull density in the studied islands.

Name	Area (m^2)	Distance to the continent (m)	Height (m)	Number of birds observed (N)	Number of nests
El Louh	3,211.14	10	3	350	5
Ste Piastre	1,200.02	2260	15	1,200	40
Gargamiz	72,010.02	40	29	20	0
Serigina	36,136.26	616.16	15	1,060	25
Cap Kal'aa	896.47	27,342.1	20	640	30

Table 2 shows the number of nests recorded at the five studied islands. The data analysis reveals a heterogeneous distribution of breeding species across the sites, with a clear predominance of Larus michahellis, which is present at almost all locations.

Table 2. Colony size (number of nests) of the different species on the studied islands

Bird species	El Louh	Ste Piastre	Gargamiz	Serigina	Cap Kal'aa
Gulosus aristotelis	0	2	0	0	0
Falco eleonorae	0	20	0	8	10
Larus michahellis	5	40	0	25	30
Chroicocephalus ridibundus	0	0	0	4	0
Columba livia	0	0	0	0	0
Calonectris diomedea	0	2	0	0	0

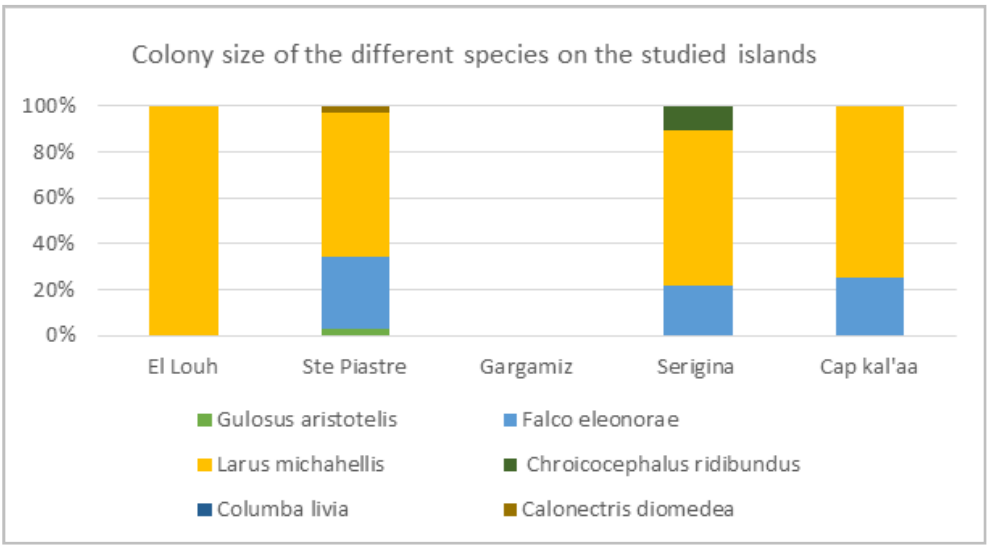


Figure 2. Colony size of the different species on the studied islands

Discussion and conclusions

In the five studied sites, a significant disparity in population density is observed, highlighting a marked difference among them. The population of yellow-legged gulls stands out distinctly due to its high level compared to other present species (Fig. 2).

It is noteworthy that the islands farther from the continent seem to serve as breeding sites, while those adjacent to the continent are primarily resting places. This observation could be attributed to the absence of disruptive factors on the islands farther from the continent. The small islands are uninhabited by humans, which may explain the choice of these sites by yellow-legged gulls for breeding, thereby benefiting from a conducive tranquillity for nesting (Tab.1).

The thesis research lays the foundation for a more in-depth exploration of seabird biodiversity and their impacts on insular ecosystems in the Mediterranean region, particularly in Edough peninsula. The main objective is to examine the impact of seabirds, particularly yellow-legged gulls, on island vegetation. This approach aims to understand how the high density of yellow-legged gulls can influence biodiversity and development of vegetation on these islands, contributing to a better comprehension of insular ecosystems (García *et al.* 2002). The islands are sites conducive to the development of seabird species the gulls particularly find the tranquillity necessary for nesting.

.

References

García, L.V., Marañón, T., Ojeda, F., Clemente, L. and Redondo, R., 2002. Seagull influence on soil properties, chenopod shrub distribution, and leaf nutrient status in semi-arid Mediterranean islands. Oikos, 98(1), pp. 75-86.

Hamel, T., Hidalgo Triana, N., Meddad-Hamza, A., Boulemtafes, A., Souilah, N., de Bélair, G. and Salvo Tierra, A.E., 2022. Analysis of taxonomic distinctness and priority conservation areas as a basis for heritage enhancement of floristic diversity: the case of the 'hotspot'of the islands of Numidia (North-Eastern Algeria). Mediterranean Botany, 43, pp. 1-24.

Svensson, L., Mullarney, K. and Zetterström, D., 2010. Collins Bird Guide: The Most Complete Guide to the Birds of Britain and Europe (2nd ed.). Harper Collins Publishers LCC, London, United Kingdom, 416 pp.

Spatz, D.R. and Holmes, N.D., 2021. Islands: Fragile showcases of biodiversity. In: The UNESCO Courier, pp 23-25. https://courier.unesco.org/en/articles/islands-fragile-showcases-biodiversity.

The poster presented at the symposium is available here

MONITORING MARINE BIRD POPULATIONS IN LIBYAN COASTAL AREAS: INSIGHTS FOR ASSESSING GOOD ENVIRONMENTAL STATUS IN MPAS AND HIGH-PRESSURE AREAS

Ali Berbash[1], Naser Essa[3], Salih Deryaq[1], Mahmoud Abouhajer[3], Nora Elbabaa[1], Sroro Elshebli[1], Samar Kilani[2], Yassine Ramzi Sghaier[2]

[1] Ministry of environment, Tripoli, Libya. Al-Ghiran street - Janzour, Tripoli, Libya, aberbash83@yahoo.com
[2] Specially Protected Areas Regional Activity Centre (SPA/RAC). Boulevard du Leader Yasser Arafat - B.P. 337 - 1080 - Tunis Cedex, Tunisie
[3] Libyan Society of Bird (LSB)

Abstract

Implemented within the framework of the national Integrated Monitoring and Assessment Programme (IMAP), marine bird monitoring aligns with the overarching goal of achieving Good Environmental Status (GES) for the Mediterranean Sea and its coastal regions. The focus lies on IMAP Common Indicators related to Seabirds, specifically CI3 (Species distributional range), CI4 (Population abundance of selected species), and CI5 (Population demographic characteristics).

This study presents data collected during monitoring activities at four selected sites along the Libyan coast. Two of these locations, Tripoli coast and Gulf of Sirte (Gara island), face human pressure, while the other two, Farwah Lagoon in the west and Ain Al-Ghazaleh marine protected area in the east of Libya, are designated as marine protected areas (MPAs).

Using both techniques, point observations by spot scope and/or binoculars and drone footage, the team conducted the work on two phases. The first phase aimed at counting the total number of individuals following the International Waterbird Census (IWC) standardized monitoring and in cooperation with the Libyan team of wintering water bird census. During the second phase, focus was made on medium colony census to survey the targeted sites during the nesting season. The study continued from the beginning of January 2022 to the end of May 2022.

Although the bird survey took note of all the seabird species, the study focussed on the 10 IMAP indicator species of which only Mediterranean Shag (Phalacrocorax aristotelis desmarestii), Audouin's Gull (Larus audouinii), Slender-billed Gull (Chroicocephalus genei), Lesser crested Tern (Thalasseus bengalensis), Sandwich Tern (Thalasseus sandvicensis) and Yelkouan Shearwater (Puffinus yelkouan) were recorded in Libya.

During the wintering season, for a total of four observation points, 38 species of seabirds have been sighted for a total of 18,018 individuals. Breeding season monitoring in the Gulf of Sirte Gara Island spotted 24 nests and 600 individuals of

Lesser Crested Tern. Colonies of nesting Mediterranean shags were spotted in both Gulf of Sirte (Gara island) with 68 nests and 216 shags, and in Ain Alghazala MPA 66 nests and 170 shags.

Illegal hunting is still considered the main threat to birds in Libya, and the absence of some protection measures in important sites for bird migration and nesting sites has had an impact on the decrease in bird numbers.

The poster presented at the symposium is available here

INVENTORY OF SEABIRDS IN THE GOURAYA NATIONAL PARK AND LAKE MÉZAÏA, BEJAIA, ALGERIA

Samia Berkane, Moussa Heddad and Farid Achour

People's Democratic Republic of Algeria, Ministry of Agriculture and Rural Development, General Directorate of Forests, Gouraya National Park, Bejaia, Algeria, samia_berkane@hotmail.fr

Abstract:

An inventory study was carried out between September 2022 and August 2023 in order to collect more information on the seabirds of the Gouraya National Park and Lake Mézaïa.

This study not only enabled us to get a better picture of the avian importance of these sites but also to gather more data on the appearance of their activities and behaviours. By combining the results of this inventory with previous studies, a total of twelve species recorded in the coastal zone of the Gouraya National Park and Lake Mézaïa, these birds belong to six different families: Sulidae, Phalacrocoracidae, Procellariidae, Phaethontidae, Laridae and Sternidae.

The inventory was carried out on two sites and showed the existence of species protected by Algerian law such as the Northern Gannet (Sula bassana), Audouin's Gull (Ichthyaetus audouinii), Mediterranean Shag (Gulosus aristotelis desmarestii), and Great Cormorant (Phalacrocorax carbo).

The study sites are favourable places for birds which play a role in the ecological balance and are also true indicators of the good health of these ecosystems.

Key-words: Gouraya National Park, Lake Mézaïa, seabirds, inventory, Bejaia

Introduction

The ecosystems of the Gouraya National Park are a characterization of the biological heritage existing in the park by unit. Ecosystems are more or less homogeneous in terms of their main physical and biological properties. The Gouraya National Park (GNP) is represented in three different ecosystems, in this case marine ecosystem, terrestrial ecosystem and lake ecosystem (Fig. 1). These ecosystems are favourable places for avifauna, the geology and the environment are favourable, in particular the coastline of the park which includes Pisans Island, the continental shelf. The updating of the seabird inventory of the Gouraya National Park was the subject of the present study of seabirds.

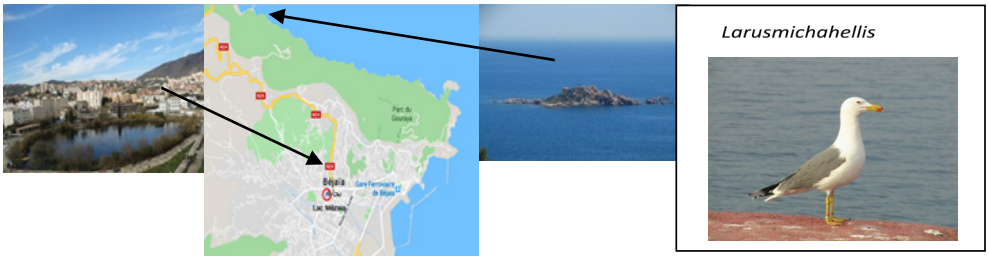


Figure 1. The geographical location and ecosystem types of the study area as well as the most frequently observed bird species, the Yellow-legged Gull *Larus michahellis* (© Management Plan of the Gouraya National Park, 2019)

Materials and methods

The inventory of seabirds is carried out in the Gouraya National Park and Lake Mézaïa. The park is located on the east coast of Algeria and is part of the coastal chain of Northern Algeria, which extends over an area of 2,080 ha. It opens onto the Mediterranean Sea over a length of 11.5 km of ledges and cliffs falling steeply into the sea. The area includes Pisans Island, and the lake located in the city centre of Bejaia, between 52° 83 East longitude and 36°45 North latitude, which extends over an area of 3 ha. The lake is at 2 km distance from the sea and forms an ecological corridor. The present inventory is carried out during the years 2022 and 2023

Various avian counting methods have been developed:

- Direct observations on sites in the morning and identification through bird songs and calls at established counting points,
- Search for signs of presence,
- Kilometric index of abundance (IKA)– (Blondel *et al.* 1970)
- Point Index of Abundance (IPA) method (Blondel *et al.* 1970)
- Counting colonial birds and seabirds
- Counting migrants

We counted vocal individualizations for marine and waterbirds according to a protocol combining two methods, either the simultaneous counting of species, or scanning the perimeter for one species. Observations and identification of birds were performed using a pair of binoculars, a spotting scope, bird identification guides, a camera, a notepad with a pen and recordings (songs and calls) of the target bird species.

Results and discussion

Seabird diversity of the Gouraya National Park and Lake Mézaïa

The results of the seabird inventory carried out in the coastal area of the Gouraya National Park and at Lake Mézaïa allowed us to identify twelve seabird species (Tab. 1), among a total of 142 bird species known to occur in the Gouraya National Park that were recorded by the Ornithology Cell of the Gouraya National Park (Berkane *et al.* 2017; 2020; 2021; 2022; 2025).

The seabird species recorded belong to several families. A total of six seabird families were detected: Laridae, Phalacrocoracidae, Procellariidae, Sternidae, Sulidae and Phaethontidae (Tab. 1). The results revealed the dominance of the Laridae family.

Table 1. Presence and absence of seabird species during the inventory in the Gouraya National Park and at Lake Mézaïa (Bureau d'études techniques Environnement-Ecologie-Ecosystèmes B.E.T.E3, 2015).

Families	Species	Gouraya National Park	Lake Mézaïa
Laridae	- Yellow-legged Gull	+	+
	- Black-backed Gull	+	+
	- Audouin's Gull	+	+
	- Black-headed Gull	+	
Phalacrocoracidae	- Great Cormorant	+	+
	- Mediterranean Shag	+	
Procellariidae	- Cory's Shearwater	+	
	- Yelkouan Shearwater	+	
Sternidae	- Sandwich Tern	+	+
	- Common Tern	+	+
Phaethontidae	- Black Tern		+
Sulidae	- Northern Gannet	+	

Protection status of recorded species

The Executive Decree No. 12-235 of May 24, 2012, established the list of in Algeria protected non-domestic animal species. Gouraya National Park and Lake Mézaïa are home to protected species such as the Great Cormorant, the Mediterranean Shag, and the Northern Gannet. The Yellow-legged Gull is the only sedentary nesting species on Pisans Island in the Gouraya National Park (Moulaï 2006).

Conclusion

The updated inventory confirms significant richness and diversity in seabird species on the coast of the Gouraya National Park and at Lake Mézaia. Through this study we identified and counted twelve seabird species belonging to six different families among the 142 bird species recorded in the Gouraya National Park.

These species of seabirds feed on small fish or zooplankton and therefore play a

role in the ecological balance and they are reliable indicators of ecosystem health.

The conservation of the diversity of birds in Gouraya National Park inevitably involves safeguarding the habitats of these birds. Different measures can improve the status and presence of birds in the Gouraya National Park as to preserve and restore the natural habitats of the protected area.

References

Blondel, J., Ferry, C. and Frochot, B., 1970. The method of point abundance indices (P.I.A.) or bird surveys by «listening stations». Alauda, 38, pp. 55-71.

Bureau d'études techniques Environnement-Ecologie-Ecosystèmes - B.E.T.E3, 2015. Ecological study of birds in Gouraya National Park (Bejaia). Technical Studies Office (Environment, Ecology, Ecosystems), 77 pp.

Executive Decree No. 12-235 of May 24, 2012, establishing the list of protected non-domestic animal species. Official Journal of Algeria No. 35 of June 10, 2012.

Moulaï, R., 2006. Bio-ecology of the terrestrial and marine avifauna of Gouraya National Park (Bejaia), particular case of the yellow-legged Gull, State doctoral theses in Agricultural Sciences, INA EL HARRACH, Algiers, 154 pp.

Ornithology Cell of Gouraya National Park with scientific support from Mr. Riadh Moulaï, professor ornithologist, University of Bejaia, 2010, 2014, 2016, 2017 2018, 2019, 2021, 2022, 2023.

The poster presented at the symposium is available here

FACTORS AFFECTING THE OFFSHORE DISTRIBUTION OF YELKOUAN SHEARWATERS IN THE NORTHWESTERN ADRIATIC SEA: INSIGHT FROM MACHINE LEARNING

Silvia Bonizzoni[1,2], Blair D. Sterba-Boatwright[3], Sarah Piwetz[1], Giovanni Bearzi[1,2,4]

[1] Dolphin Biology and Conservation, Cordenons, Italy, silvia.bonizzoni@gmail.com
[2] OceanCare, Wädenswil, Switzerland
[3] Texas A&M University, Corpus Christi TX, USA
[4] ISMAR Institute of Marine Sciences, CNR National Research Council, Venice, Italy

Abstract

The Yelkouan Shearwater (Puffinus yelkouan) is endemic to the Mediterranean and Black Seas and is classified as Vulnerable in the IUCN Red List. Most information on its distribution and habitat use comes from telemetry tracking of single individuals and land-based studies at nesting sites, whereas few studies have been based on direct visual observations conducted offshore. Information on the species' distribution and habitat use in the eastern Mediterranean is scant. Land-based studies suggest that the northern Adriatic Sea represents an important area for moulting, feeding and passage during the interbreeding period; however, the species' distribution at sea is unknown. Based on visual surveys conducted from small boats between April and October 2018–2022 (total effort: 169 days and 23,836 km), we provide information on 1) the occurrence of Yelkouan Shearwaters within a study area of 3,000 km2 off the region of Veneto, Italy, in the northwestern Adriatic Sea; and 2) the geographic, bathymetric and oceanographic variables likely to drive the species' offshore distribution in this area. Yelkouan Shearwaters were observed in all months during the study period (except in April, when effort was lower). They were encountered on 66 days, for a total of 238 sightings including 916 individuals, in waters 9–33 m deep, between 2 and 24 km from the coast. Individual counts ranged between 1 and 100 (mean 3.85, SD 8.33, mode 1), with 95% of the encounters having less than 10 individuals. When the birds were spotted, behaviour was recorded as «flying» (75%) or «sitting on water» (25%). An Explainable Boosting Machine model—a machine learning technique based on generalized additive models, specifically designed to produce interpretable models for high dimensional datasets—selected chlorophyll a as the most important variable to explain the species' occurrence, followed by distance from the coast, and bottom depth. The model indicated a higher occurrence in waters with chlorophyll a less than ~2.3 mg/m3, farther than ~15 km from the coast, and deeper than ~22 m. The effects of sea surface temperature, salinity, and day of the year were less clear. This study provides insight into the offshore distribution of Yelkouan Shearwaters, within one of the Mediterranean areas most exposed to cumulative human threats.

The poster presented at the symposium is available here

SEABIRD BYCATCH IN PORTUGUESE MAINLAND WATERS: FISHERIES, SEASON AND SPECIES OF CONCERN IN THE CASE STUDIES IN ALGARVE AND AVEIRO-NAZARÉ REGIONS

Flávia Carvalho[1], Magda Frade[2], Ana Almeida[1], Elisabete Silva[1], Ana Marçalo[2], Nuno Oliveira[1], Jorge Gonçalves[2] and Joana Andrade[1]

[1] Sociedade Portuguesa para o Estudo das Aves, Av. Almirante Gago Coutinho, 46A 1700-031 Lisboa, Portugal, flavia.carvalho@spea.pt
[2] Centro de Ciências do Mar, Universidade do Algarve, Campus Gambelas, Ed. 7, 1º piso, 8005-139, Faro

Abstract

Bycatch resulting from fishing activity is one of the most serious threats to marine megafauna (i.e., seabirds, cetaceans and sea turtles). Particularly with regard to seabirds, around the world, annually hundreds of thousands of individuals of various species are bycaught in different fishing gears. This phenomenon has different intensity and depends on the type of fishing, area and time of year. Even knowing this problem, for Portuguese continental waters there are no estimates of the bycatch rate and average removal values for specific species.

In Portugal, for the Eastern Algarve and for the Special Protection Area (SPA) Aveiro-Nazaré, within the scope of the LIFE Ilhas Barreira (2019-2023) and LIFE PanPuffinus (2020-2025) projects respectively, efforts have been made to obtain more data regarding this serious threat. In both areas, using in person questionnaires to fishermen, it was possible to fill in information gaps for these areas. In 2.5 years, for the Algarve, 888 questionnaires were carried out in seven fishing ports (Quarteira, Olhão, Culatra, Fuseta, Tavira, Cabanas de Tavira and Monte Gordo) to vessels operating trammel/gillnets and purse seine. 109 captured seabirds were reported, among the most affected was the Northern Gannet (Morus bassanus), the Great Cormorant (Phalacrocorax carbo) and gulls (Larus spp.). Most catches were recorded in winter and autumn (bycatch rate = 0.006 and 0.005 birds/fishing days, respectively) and in purse seine (bycatch rate = 0.007 birds/fishing days). In the SPA, in 2 years, 311 questionnaires were carried out in three fishing ports (Nazaré, Figueira da Foz and Aveiro) on vessels operating different fishing gears. 1,112 seabird captures were reported, among the most affected were the northern gannet, the Common Murre/Razorbill (Uria aalge/Alca torda), gulls and the Balearic Shearwater (Puffinus mauretanicus). Most catches were also recorded in winter and autumn (bycatch rate = 0.21 and 0.09 birds/fishing days, respectively) and in trammel nets (bycatch rate = 0.17 birds/fishing days). Between these two areas, the northern region seems to be more concerning, where higher rates of seabird bycatch were found. All this work includes building a relationship of trust and sharing with the fishermen over

time, this is one of the most important points for good monitoring and mitigation of bycatch, ensuring the conservation of these sensitive species.

The poster presented at the symposium is available here

TEMPORAL DYNAMICS OF THE POPULATION AND NESTING OF THE LITTLE EGRET (EGRETTA GARZETTA) ON THE KURIAT ISLANDS (2018-2023)

Malek Chaarana[1], Seif Eddine Triki[1], Amjed Khiareddine[1], Hamdi Hamzaoui[1], Ahmed Zaddem[2]

[1] Association Notre Grand Bleu (NGB), malekcharana@gmail.com
[2] Agence de Protection et d'Aménagement du Littoral (APAL)

Abstract

The Kuriat Archipelago is a high-valued ecosystem area, nationally and internationally. This archipelago is characterized by its rich biodiversity, culture and heritage. It is home to endangered and / or protected species such as the loggerhead turtle, the Posidonia Seagrass and marine birds. In 2020, a total of 99 species of marine and terrestrial birds were recorded on the Kuriat Islands. Through continuous monitoring, the number of species increased to 110, encompassing migratory and endemic species. Among the endemic and nesting species of the Kuriat Islands, the Little Egret (Egretta garzetta) stands out. The winter bird census involves regular visits with techniques such as fixed listening points, ensuring reliable results by recording the present species and their behaviors. It was observed that between 2020 and 2023 on these islands, there were variations in the number of Little Egret individuals, with a winter average of 98 individuals.

The nesting monitoring of the Little Egret primarily focuses on small wooded areas, especially among thorny bushes, providing protection against predators. Two historically favorable nesting zones, specifically located on Petite Kuriat, are targeted during this surveillance. In 2018, the first nesting signal of the species was recorded with the discovery of 16 nests on little Kuriat, highlighting the gradual establishment of the Little Egret in the site. In 2020, the population reached 448 individuals, accompanied by 125 recorded nests, marking a significant expansion. Subsequent monitoring in 2021 reveals the presence of 186 nests. In 2022, the number of nests continued to increase, reaching 230, and new colonies were observed in the northwest zone. In 2023, although the population remains present with 108 nests, the complete absence of a colony could be attributed to weather conditions, climate change, and/or early mass tourism activity this year. Furthermore, the possibility of diseases affecting the Little Egret population on the island cannot be ignored. These results underscore the importance of closely monitoring ecological dynamics for effective conservation of this species on the small Kuriat Island.

The poster presented at the symposium is available here

SEA AND COASTAL BIRDS OF THE GALITE ARCHIPELAGO – TUNISIA

Sahbi Dorai[1], Sabri Jaziri[1], Hassan Zaghdoudi[2], Ibrahim Maalaoui[2], Ridha Ouni[1]

[1] Mediterranean Action Nature Association (MAN), Tunisia, doraisahbi@hotmail.fr
[2] Coastal Protection and Planning Agency (APAL), Tunisia

Abstract

Global changes exert a significant influence on population dynamics, particularly disrupting the timing of migration and migratory routes of avifauna in general. Our study focuses on a comprehensive analysis of available literature on the La Galite archipelago since 1876, as well as on the missions conducted by the co-management teams of Mediterranean Action Nature Association (MAN) and Coastal Protection and Planning Agency (APAL) between 2021 and 2023. The objective is to establish an inventory of avifauna species, with a particular emphasis on nesting seabird species of conservation interest in the archipelago. In total, 107 bird species were identified over the past three decades, including six species of seabirds belonging to four distinct families. Five of these taxa are listed in Annex II of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean of the Barcelona Convention. Among these taxa, some are considered threatened or vulnerable: Scopoli's Shearwater (Calonectris diomedea) (LC), Yelkouan Shearwater (Puffinus yelkouan) (VU), Mediterranean Storm Petrel (Hydrobates pelagicus melitensis) (LC), Mediterranean Shag (Gulosus aristotelis desmarestii) (LC), and Audouin's Gull (Ichthyaetus audouinii) (VU). The results highlight the importance of these observations in guiding future scientific monitoring of vulnerable species in the archipelago, thereby contributing to more effective conservation of these populations.

Key-words: Galite Archipelago, Tunisia, seabirds, vulnerable species, co-management

Introduction

Nestled within the Galite Archipelago, a vital hub of biodiversity, our study unfolds against the backdrop of significant global changes affecting the complex dynamics of avian populations. Notably, these changes have led to shifts in the timing and routes of avifauna migration. Our research aims to conduct a detailed exploration, merging insights from a thorough analysis of historical records dating back to 1876 with empirical data gathered during field missions carried out between 2021 and 2023 by the co-management teams of Mediterranean Action Nature Association (MAN) and Coastal Protection and Planning Agency (APAL).

As stewards of this delicate ecosystem, our primary goal is to compile a comprehensive taxonomic inventory of avifauna species. We specifically focus

on the seabird community, giving particular attention to species that use the archipelago as a crucial nesting habitat, a pivotal point for conservation efforts. By combining historical knowledge with contemporary field data, our research seeks to unravel the intricate dynamics of avian life, providing a scientific narrative that addresses the challenges posed by global changes, and establishes a robust foundation for strategically informed conservation initiatives.

Materials and methods

Study site

The Galite Archipelago (Lat: 37°32′ N; Long: 8°56′ E) is situated off the northern coast of Tunisia, 40 km northwest of Sidi Mechrig and 64 km northeast of Tabarka (Fig. 1).

Covering a total area of 808 hectares, it comprises the main island of Galite (752 ha), stretching 5.3 km in length and approximately 3 km in width. Galiton to the West: Galiton (29.9 ha) and La Fauchelle (13.6 ha), and the islets known as Les Chiens or Galiton to the East (12.5 ha), including Gallina, Pollastro (a simple rocky outcrop), and Gallo. These islets are characterized by mountainous terrain, with a maximum altitude of 391 m, dominated by slopes and steep cliffs.

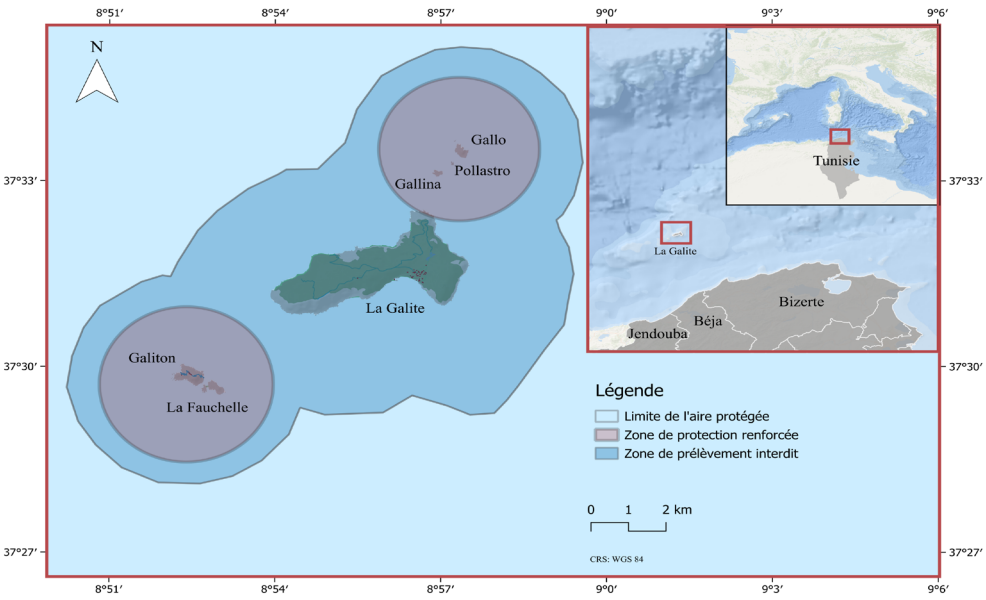


Figure 1. Location and scape map of the Galite archipelago

Methods

Our study focuses on a comprehensive analysis of available literature on the archipelago since 1876 (Gaultier 1977; D'Albetris 1978; Isenmann *et al.* 2005), coupled with field missions conducted between 1995 and 2023. These missions were carried out within three distinct frameworks over the years.

1995-2000: Active team participation in the implementation of the Life TCY 97/TN/055 project (Conservation and Rehabilitation of Fragile Island Ecosystems).

2006-2013: Within the Small Islands of the Mediterranean initiative, coordinated by the Coastal Conservancy, over thirty missions enhanced understanding and protected small Mediterranean islands' fauna and flora (Tranchant and Vidal 2006; Benhaj *et al.* 2006; Oro de Rivas and Martinez Abrain 2007; Maamouri and Ouni 2007; Bazin *et al.* 2011; Ouni 2013).

2018-2023: Since 2018, our APAL/MAN team has actively co-managed the Marine Protected Area of the Galite Archipelago, funded by the MedFund (APAL and MAN 2023).

During these periods, the bird census of the archipelago was conducted through direct observation using binoculars and telescopes (Fig.2).

Figure 2. Field methods for species detection and inventory

Results and discussion

In total, 107 bird species have been identified over the past three decades, including six species of seabirds belonging to four distinct families (Fig.3):

- Procellariidae: Scopoli's Shearwater *Calonectris diomedea* and Yelkouan Shearwater *Puffinus yelkouan*
- Hydrobatidae: Mediterranean Storm Petrel *Hydrobates pelagicus melitensis*
- Phalacrocoracidae: Mediterranean Shag G*ulosus aristotelis desmarestii*
- Laridae: Audouin's Gull *Ichthyaetus audouinii* and Yellow-legged *Gull Larus michahellis*

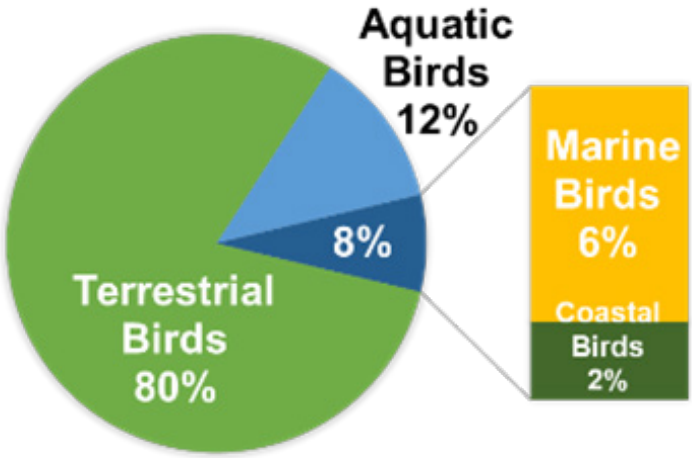


Figure 3. Composition of bird species in Galite archipelago

Five specially protected species of the archipelago are listed in Annex II of the Protocol concerning specially protected areas and biological diversity in the Mediterranean under the Barcelona Convention. They are considered of least concern or vulnerable: Scopoli's Shearwater *Calonectris diomedea* (LC), Yelkouan Shearwater *Puffinus yelkouan* (VU), Mediterranean *Storm Petrel Hydrobates pelagicus melitensis* (LC), Mediterranean Shag *Gulosus aristotelis desmarestii* (LC), and Audouin's Gull *Ichthyaetus audouinii* (VU) (UICN 2025).

Scopoli's shearwaters dominate, with 3,005 breeding pairs, representing over 2% compared to the largest known colony with 141,780 breeding pairs, which is located on Zembra Island in Tunisia (Defos Du Rau *et al.* 2015). This reinforces the ecological importance of the archipelago at the national scale.

Audouin's gulls, a globally vulnerable species, find refuge with around 100 breeding pairs, thus constituting the largest known colony in Tunisia and emphasizing the need for comprehensive conservation measures.

We confirmed the presence of Yelkouan Shearwaters and Mediterranean Storm Petrels, in the archipelago, but with no evidence of breeding so far. Targeted monitoring is needed to fill these gaps.

The overall distribution of the seabird species with location of breeding sites are illustrated in Figure 4.

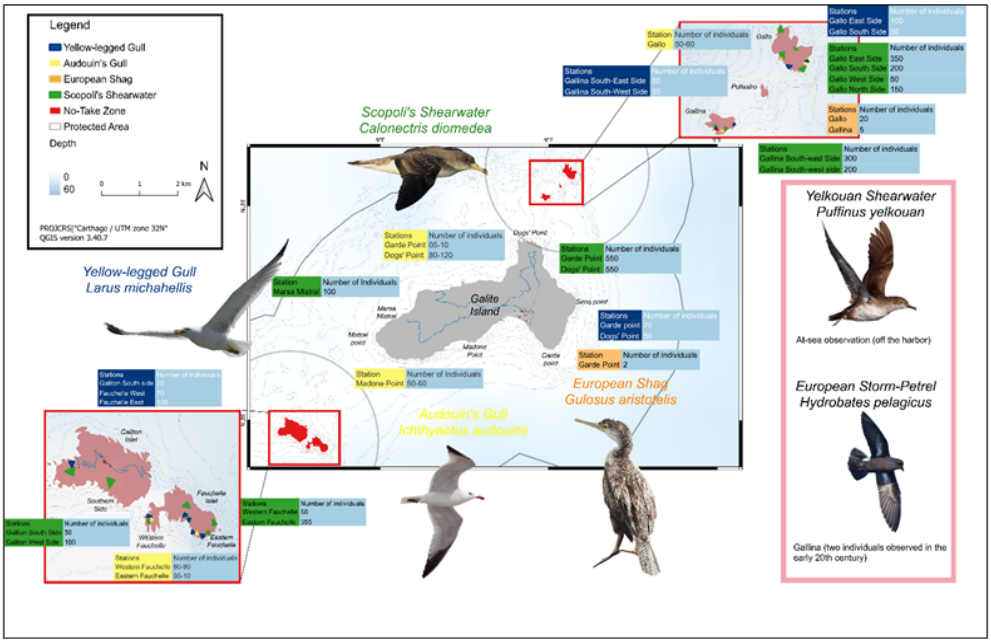


Figure 4. Distribution and nesting areas in the Galite archipelago of the five specially protected species.

Conclusion

The Galite Archipelago hosts a diverse marine and coastal avifauna, and our results highlight the importance of these observations in guiding future scientific monitoring of vulnerable species in the archipelago, thereby contributing to a more effective conservation of these populations.

Moving forward, these conservation efforts must focus on protecting crucial nesting habitats, ensuring the survival of globally rare and endangered species, in particular seabirds.

References

Bazin, N., Zarrouk, A., Zaghdoudi, H., Thevenet, M., Agarbi, S., Jawadi, W. and Rihani, W., 2011. Archipel de la Galite « Mise en place d'un suivi – Oiseaux marins ». Initiative PIM, Tunisia, 15 pp.

Benhaj, S., Bernard, F., Delaugerre, M., Muracciole, M., Tranchant, Y. and Vidal, P., 2006. Archipel De La Galite Notes ornithologiques « Faune et Flore ». Initiative PIM, Tunisia, 38 pp. Available at: www.initiative-pim.org].

D'Albetris, E.A., 1978. Crociera del Violante: comandato dal capitano-armatore Enrico D'Albertis durante l'anno 1876. Parte narrativa del capitano Enrico D'Albertis ; Resoconti zoologici. Annali del Museo civico di storia naturale di Genova , 11, pp. 11-324.

Defos Du Rau, P., Bourgeois, K., Ruffino, L., Dromzee, S., Ouni, R., Abiadh, A., Esteve, R., Durand, J.-P., Anselme, L., Faggio, G., Vahya, J.M., Peters, P., Rguibi, H., Renda, M., Miladi, B., Hamrouni, H., Alilech, S., Ben Dhafer, A., Nefla, A., Jaouadi, W., Agrebi, S. and Renou, S., 2015. The Mediterranean Cory's Shearwater is still threatened by fishery bycatch despite much higher population size estimate. Journal of Ornithology, 156(4), pp. 877-892. DOI 10.1007/s10336-015-1187-4. Pp 877-892.

Gaultier, T., 1977. L'île de la Galite et ses îlots. Aperçu faunistiques et remarques sur quelques espèces particulièrement rares et menacées. Rapport de mission, Tunisia, 19 pp.

Isenmann, P., Gaultier, T., El Hili, A., Azafzaf, H., Dlensi, H. and Smart, M., 2005. Oiseaux de Tunisie - Birds of Tunisia. Société d'Etudes Ornithologiques de France, Paris, 432 pp.

Maamouri, M. and Ouni, R., 2007. Inventaire ornithologique de l'Archipel de la Galite. Rapport de mission PIM. Association "Les Amis des Oiseaux", Tunis, pp. 63-70.

Oro de Rivas, D. and Martinez Abrain, A., 2007. Notes Ornithologiques sur l'exspédition Galite, 2007. Rapport de mission PIM. IMEDEA (CSIC-UIB), Valencia, pp. 53-62.

Ouni R., 2013. Note naturaliste de l'archipel de la Galite et les îles Fratelli, Tunisie. Etude de la population du Faucon Eléonore. Initiative PIM, Tunisia, 14 pp. Available at: www.initiative-pim.org.

APAL and MAN, 2023. Rapport d'activité de la cogestion de la Galite. Rapport d'activités annuelle 2022. Projet co-gestion de la future AMCP de l'archipel de la Galite., Agence de Protection et d'Aménagement du Littoral (APAL)- Association Méditerranée Action Nature (MAN)- MedFund, Décembre 2023. Edition MAN-APAL, 49 pp.

Tranchant, Y. and Vidal, P., 2006. Observations Ornithologiques sur l'Archipel de la Galite. Rapport de mission PIM. Conservatoire: Etudes des Ecosystèmes de Provence/Alpes du Sud, Marseille, pp. 39-52.

IUCN, 2025. The IUCN Red List of Threatened Species. Version 2025-1. https://www.iucnredlist.org

The poster presented at the symposium is available here

MONITORING AND OBSERVATION OF SEABIRDS: A STUDY OF LARUS MICHAHELLIS IN THE AL HOCEIMA REGION OF THE MOROCCAN MEDITERRANEAN SEA

Aymane Khaili[1], Faycal Lissaoui[2], Ilham Touiss[3], Haiat Essalmani[1]

[1] Research team on the biotechnological valorization of micro-organisms, genomics and bioinfor matics. Department of Biology, Faculty of Sciences and Technology; Abdelmalek Essaadi University, Tangier, Morocco, khailiaymane2@gmail.com
[2] Department of Biology, Faculty of Sciences; Ibn Tofail University, Kenitra, Morocco
[3] Laboratory of Life and Health Sciences, Faculty of Medicine and Pharmacy, University Abdelmalek Essaadi, Tangier, Morocco.

Abstract

Seabirds play a fundamental role in marine ecosystems as predators, nutrient recyclers, and key indicators of ocean health. To better understand the ecological dynamics to which they are exposed and the pressures they face, it is imperative to monitor and study them closely. In this context, our study aims to observe seabirds during a trawler trip on 18 December 2020, in the Al Hoceima region of the Moroccan Mediterranean. We recorded the sighting of a particular species of Yellow-legged Gull (Larus michahellis), marked by colored rings on the tarsus, using accelerated photography, their movement and behavior were also tracked, as were the geographical coordinates of the observation. In addition, we conducted surveys of trawler fishermen concerning seabird bycatch from 1 to 19 February 2021. Finally, we raised awareness among fishermen of the ecological importance of these seabirds. Consequently, our research has documented marked seabird individuals and compared our sighting data with previous records, particularly from Spain and Portugal. The results show a total distance migrated of 957 km recorded in 4 sightings after 5 months, as well as a significant correlation between sightings of this species and fishing activity. According to the questionnaire, no seabird by-catch was recorded. These observations contribute significantly to the understanding of seabird movements and migrations in the region, while assessing the impact of human activities in order to contribute to the conservation of seabirds.

The poster presented at the symposium is available here

COMPOSITION AND DISTRIBUTION OF PELAGIC AND COASTAL BIRD POPULATIONS IN TUNISIA

Faouz Kilani[1], Ridha Ouni[1], Hannibal Hamrouni[1], Aymen Nefla[2], Foued Hamza[3], Mohamed Ali Chokri[3], Habib Dlensi[4], Badreddine Jemaa[1], Hamed Mallat[5], Ahmed Ben Hmida[6], Hassen Zaghdoudi[6], Houssem Ben Othmen[1], Oussema Fersi[7], Maram Aziza[1], Bayrem Miladi[2], Slim Alilech[1], Omar El Golli[8], Faycel Ghzaiel[4], Amira Ben Othmen[9], Khouloud Hamzi[9], Ahmed Ghdira[10], Sahbi Doraii[7], Emjed Khayreddine[10], Naoufel Hamouda[11], Naceur Ghliss[11], Sami Ben Haj[7], Kamel Ejad[2], Wael Ben Aba[1]

[1] Association Tunisienne de la Vie Sauvage (ATVS), faouz.kilani@gmail.com
[2] Association pour la Sauvegarde du Patrimoine Ecologique et Naturel du Cap-Bon (ASPEN)
[3] Faculté des Sciences de Gabes (FSG)
[4] Association de la Continuité des Générations (ACG)
[5] Faculté des Sciences de Sfax (FSS)
[6] Agence de Protection et d'Aménagement du Littoral (APAL)
[7] Méditerranée Action Nature (MAN)
[8] Institut Supérieur des Technologies de l'Environnement de l'Urbanisme et du Batiment. (ISTEUB)
[9] Association Jlij pour l'Environnement Marin (AJEM)
[10] Notre Grand Bleu (NGB)
[11] Association Sauvegarde des Zones Humides du Sud Tunisien (ASZHST)

Abstract

As part of the Torda Initiative conducted in 2022 and 2023, an exhaustive survey of avian fauna in the sea and along the coast covering the entire Tunisian territory from the Northwest to the extreme Southeast revealed various data on the population of marine and coastal birds and their spatial distribution. Consequently, significant sites for the conservation of these birds have been identified with the aim of supporting their protection and conservation status.

The poster presented at the symposium is available here

WHEN MOROCCO'S MEDITERRANEAN MPAS BECOME THE MAIN CONSERVATION TOOL FOR SEABIRDS

Mustapha MARRAHA

Moroccan Mammal Study and Protection Group Association, marraha_mustapha@yahoo.fr

Abstract

The objective of the study is to evaluate the management effectiveness of the different categories of MPAs implemented in the Moroccan Mediterranean Sea and its impact on the conservation of marine biodiversity with a focus on marine and coastal birds. The methodology used is based on the evaluation of a certain number of criteria and key elements. The criteria for evaluating these MPAs vary depending on the categories of each MPA, its specific objectives and conservation priorities. The approach adopted to inform these evaluation criteria boils down to a detailed analysis of documents related to these indicators, but also to discussions with national stakeholders concerned by the ecology of marine birds, by the integrated management of coastline and its artificialization and by MPA managers. All of the general criteria often used to assess the effectiveness and impact of marine protected areas listed below are relevant:

1) Establishment and expansion of the MPA Network.

2) Zoning and Spatial Planning of each of the MPAs with varying levels of protection.

3) The degree of integration and governance of MPAs.

4) The degree of collaboration of populations and partners.

5) Degree of artificialization of the coastline surrounding the MPA.

6) Capacity Building.

7) Application of the Regulations.

8) Monitoring and control.

9) Scientific Research and Monitoring.

10) Technological Innovation.

11) Sustainable Tourism to minimize negative impacts.

12) Education and Awareness.

13) Degree of integration of adaptation strategies to Climate Change.

This attempt at evaluation, although it remains largely perfectible, made it possible to

classify MPAs according to their degree of effectiveness and hence their significant contribution to the conservation of marine biodiversity and the preservation of crucial habitats for marine and coastal birds.

The poster presented at the symposium is available here

MASSIVE WRECK OF ATLANTIC PUFFINS AND OTHER SEABIRDS IN PORTUGAL MAINLAND DURING THE WINTER OF 2022- 2023

Nuno Oliveira[1], Inês C. Varanda[2], Michael P. Harris[3], Ana Almeida[1], Hany Alonso[1], Alexandre Bouça[2], Marisa Ferreira[4,5], Maren Georg[1], João P. Lopes[2], Marina Sequeira[2], Francisca Hilário[4,5], & Joana Andrade[1]

[1] Portuguese Society for the Study of Birds (SPEA), Lisboa, Portugal, nuno.oliveira@spea.tn
[2] Instituto da Conservação da Natureza e das Florestas (ICNF), Lisboa, Portugal
[3] UK Centre for Ecology & Hydrology, Penicuik, UK
[4] Portuguese Wildlife Society (SPVS), Figueira da Foz, Portugal
[5] CRAM-ECOMARE - Centro de Reabilitação de Animais Marinhos do ECOMARE, Ílhavo, Portugal

Abstract

In the winter of 2022-23, a large number of dead and live seabirds, particularly Atlantic puffins (Fratercula arctica), washed up along the mainland coast of Portugal. These massive mortality events can be associated with different causes (e.g., extreme weather conditions, food shortages, pollution or bycatch) and, when occurring frequently or at a large spatial scale, can have a significant impact on seabird populations. The documentation of these events is challenging, considering their unpredictability and magnitude. Nevertheless, it is crucial work for a better understanding of marine threats and their impact on seabird conservation. In mid-January 2023, through a collaborative effort from ICNF, SPEA, DGAV, CRAM and many local NGOs and volunteers, there was a campaign in the Peniche region over several weeks to count and collect dead and live stranded seabirds, and to take them to a wildlife recovery centre. We also collected information of stranded seabirds through an ongoing SPEA citizen science project and encouraged the public and local NGOs to report dead or live stranded seabirds found elsewhere along the Portuguese coastline. In this study based on the information collected, we characterise this seabird wreck, including the species and numbers affected, its extent, and provide information on possible causes. From early December to early March, we recorded 2151 stranded seabirds of 20 species, 80% of which were Atlantic puffins (n=1723) and 8% (n=165) were Razorbills (Alca torda). The peak of this seabird wreck was the 2nd fortnight of January 2023, when nearly 90% of all stranded birds were reported, and it was spatially concentrated in the area around Peniche, where 81% of birds were washed ashore. Most puffins were adult birds (78% of 311 birds, aged > 3 years), 14% were immature (2-3 years) and only 8% were first winter birds. Six ringed puffins were adult birds from UK breeding colonies, including two birds > 23 years old. The majority of the puffins (98% of 229 birds) were not moulting their flight feathers and were in condition to fly. A total of 227 puffins were rescued alive and transported to a wildlife recovery centre (CRAM) but the survival rate was low (21% did not survive transportation and 71% died at

CRAM). Necropsies of the birds were inconclusive regarding the cause of death, but most birds were emaciated, showing gastrointestinal vacuity and atrophy of internal organs. Eight puffins were tested for H5N1, with negative results.

The poster presented at the symposium is available here

INVESTIGATION IN THE EXCEPTIONAL PRESENCE OF THE RAZORBILL ALONG THE TUNISIAN COAST

Ridha Ouni[1], Aymen Nefla[2], Hannibal Hamrouni[1], Faouz Kilani[1], Hamza Foued[3], Mohamedali Chokri[3], Habib Dlensi[4], Badreddine Jemaa[1], Hamed Mallat[5], Ahmed Ben Hmida[6], Hassen Zaghdoudi[6], Housem Ben Othmen[1], Lousema Fers[7], Maram Aziza[1], Bayrem Miladil[2], Slim Alilech[1], Mohamed Omar El Golli[8], Faycel Ghzaiel[9], Amira Ben Othmen[9], Khouloud Hamzi[9], Ahmed Ghdira Ahmed[10], Sahbi Dorai[10], Amjed Khyareddine[10], Naoufel Hamouda[11], Naceur Ghliss[11], Sami Ben Haj[7], Kamel Ejed[2], Wael Ben Aba[1]

[1] Association Tunisienne de la Vie Sauvage (ATVS), elanion2003@yahoo.fr
[2] Association pour la Sauvegarde du Patrimoine Ecologique et Naturel du Cap-Bon (ASPEN)
[3] Faculté des Sciences de Gabés (FSG)
[4] Association de la Continuité des Générations (ACG)
[5] Faculté des Sciences de Sfax (FSS)
[6] Agence de protection et d'Aménagement des littorals (APAL)
[7] Association « Méditerranée Action Nature » (MAN)
[8] Instiut Supérieur des Technologies de l'Environnement de l'Urbanisme et du Batiment. (ISTEUB)
[9] Association « Jlij pour l'Environnement Marin » (AJEM)
[10] Association « Notre Grand Bleu » (NGB)
[11] Association « Sauvegarde des Zones Humides du Sud Tunisien » (ASZHST)

Abstract

The Tunisian coastline is known for its pelagic avifauna diversity, which occupy various marine ecosystems throughout the year. In addition to the eight pelagic bird species regularly encountered during breeding and wintering seasons, we exceptionally recorded an occasional species, the Razorbill (Alca torda). This accidental occurrence was due to stormy weather conditions in the Atlantic which have pushed back a significant number of Razorbill specimens into the Mediterranean basin, including our Tunisian coasts. In order to understand this phenomenon and explain this recent remarkable irruption, monitoring across the entire Tunisian coastline and offshore and specifically on fishing ports and beaches, was carried out during November and December 2023. Throughout our campaign (45 days with 60 participants and specialists) we documented a total of 89 individuals observed, including 32 individuals washed up on the beaches.

The poster presented at the symposium is available here

RESEARCH ON BIRDS AND BIODIVERSITY IN AYVALIK ISLANDS PROJECT, TÜRKIYE

Lider Sinav[1], Kadri Kaya[2], Öznur Kahraman[2], Esra Başak[3]

[1] Hacettepe University, Faculty of Science, Department of Biology, Ankara, Türkiye, lidersnv@gmail.com
[2] BBOM Ayvalık Education Cooperative, Balıkesir, Türkiye
[3] Proje Evi Cooperative, Balıkesir, Türkiye

Abstract

As part of the project entitled "Research on Birds and Biodiversity in Ayvalık Islands", 96 bird species were recorded, which is higher than the number reported in previous studies. A total of 1,516 bird observation records were entered into the observation.org database. These observations were completed in a total of 125 hours for both land and sea observations, covering a sea area of 794 kilometers with boat transects. Land-based observations were conducted on five islands, while sea-based observations were carried out around fifteen islands in the Ayvalık Archipelago. Potential nesting sites for the Yelkouan Shearwater (Procellariiformes-Procellariidae), the Scopoli's Shearwater (Procellariiformes-Procellariidae), and the Storm Petrel (Procellariiformes-Hydrobatidae) were examined. The breeding of the Eagle Owl (Strigiformes-Strigidae)was confirmed on the islands, marking the first recorded observation of the species in the area. A significant sighting of 275 Scopoli's Shearwaters moving together was documented. Breeding population data were collected for species such as the Audouin's Gull (Charadriiformes-Laridae), the European Shag (Suliformes-Phalacrocoracidae), and the Yellow-legged Gull (Charadriiformes-Laridae). The islands were found to provide safe stopover sites for migratory birds.

Key-words: Ayvalık Islands, Yelkouan Shearwater, Scopoli's Shearwater, Storm Petrel, Audouin's Gull.

Introduction

Ayvalık Islands Nature Park is a Key Biodiversity Area (KBA) (Doğa Derneği 2006); an archipelago consisting of 25 islands in Northern Aegean Türkiye, where the project "Research on Birds and Biodiversity in Ayvalık Islands Project" is currently being conducted. The main goal of the project is to carry out field research on five target bird species to fill the knowledge gaps regarding their current population and breeding status. The research hypotheses arise from the surrounding environment of the protected area which is covered by marine zones to a large extent of the total 179.5 km2; therefore, the marine ecosystems in the nature park ecologically represent some of the most important ones.

Materials and methods

The study was conducted from September 2023 to August 2024 in the Ayvalık Islands KBA, which consists of 25 islands. The largest islands were selected for land-based surveys, with target species being the Yelkouan Shearwater *Puffinus yelkouan*, the Scopoli's Shearwater *Calonectris diomedea*, the Storm Petrel *Hydrobates pelagicus*, the Audouin's Gull *Ichthyaetus audouinii*, and the Eleonora's Falcon *Falco eleonorae*.

The land-based observations were carried out on Çıplak Island (39.289258, 26.592986), İlyosta Island (39.326983, 26.536197), Büyük Maden Island (39.384678, 26.585933), Kız Island (39.407615, 26.708703), and Büyük Karaada (39.377540, 26.706271). During the September-October 2023 period, one day of observation was conducted on each island, documenting all bird species seen during the autumn migration. In April-May 2024 (early breeding season), two days of land observations were conducted on each island, and in June-July 2024 (late breeding season), two more days were dedicated to land observations (Boyla *et al.* 2019). These observations were carried out to detect all breeding bird species, with breeding codes and abundances recorded.

Figure 1. Ayvalık Islands, location of species records (dots) and marine survey route (yellow line) © Lider Sinav

Additionally, in April-May and June-July 2024, sea-based transect observations were carried out around the islands by boat. For the Storm Petrel, two baiting trials were conducted in June and August 2024 using a mixture of fish oil, chips, and bread, with the expectation that the species would be attracted to the scent. During the sea-based observations, rocky areas that could potentially serve as nesting sites for the Yelkouan Shearwater, the Scopoli's Shearwater, and the Storm Petrel were identified. On August 15, 2024, a night observation was conducted at this potential nesting site (39.381065, 26.568303) (Fig. 1)

Results

During fieldwork in spring, summer, and autumn, 96 bird species were recorded on the islands (excluding the pine forest and olive groves on Cunda Island). Previous studies have reported lower species numbers.

A total of 1,516 bird observation records were created, all entered into the observation.org database. The data provide high-resolution location information compared to previous general location records.

Land-based bird observations were conducted on six islands, and sea-based observations were carried out around fifteen islands. This represents one of the most extensive efforts in the area for bird research.

A potential nesting site for Yelkouan Shearwater, Scopoli's Shearwater, and Storm Petrel was found on one island. Night observations were conducted to check for nesting activity, but no signs of nesting were detected. No prior detailed studies on potential nesting sites for these species were found.

The Eleonora's Falcon was found feeding and migrating around the islands. The Eagle Owl *Bubo bubo* breeding was confirmed on the islands for the first time. There were no previous records of this species breeding in the area. A significant observation of around 275 Scopoli's Shearwaters moving together was made, highlighting the importance of the marine area for this species. The observation was also documented on video. The Yellow-legged Gull *Larus michahellis* was found to be the dominant breeding seabird on most islands, especially those further from the mainland. The Stone-curlew *Burhinus oedicnemus* was found breeding on an island with annual herbaceous vegetation. Although its presence was known, this was the first confirmation of its breeding status and numbers on the islands.

The islands provide safe stopover areas for migratory birds. Several species, including the Night Heron *Nycticorax nycticorax*, were recorded for the first time on the islands during migration. New records of the Audouin's Gull were made, confirming that the species, though rare, continues to use the area.

Detailed population data for breeding species like the European Shag *Phalacrocorax aristotelis* and the Yellow-legged Gull were collected. These data will be useful for future population size estimates.

Conclusions

The Ayvalık Islands are a challenging geography for bird observation due to their distance from the mainland. This study aimed to overcome these challenges and document the birdlife on the islands. The findings shed light on the avian biodiversity of the islands and will guide future conservation efforts. New species have been found in the area, and detailed data has been collected on others. The islands' isolation from the mainland and their lack of human development make them a haven for a wide variety of species. Future research should focus on identifying new species beyond the 96 recorded, further investigating nesting and stopover sites, and ensuring the long-term protection of the islands as safe havens for migratory birds.

Acknowledgments

The Turquoise Coast Environment Fund - Türkiye, Conservation Collective, and Support Foundation for Civil Society supported this project spanning from September 2023 to August 2024. We would like to extend our sincere thanks to all the individuals and institutions that supported us as volunteers.

References

Boyla, K.A., Sinav, L., and Dizdaroğlu, D.E., 2019. Türkiye üreyen kuş atlası. WWF-Türkiye, Doğal Hayatı Koruma Vakfı, İstanbul, pp. 20-23.

Doğa Derneği, 2006. Önemli Doğa Alanları. https://dogadernegi.org/onemli-doga-alanlari/. Accessed on 20 June 2025.

The poster presented at the symposium is available here

NEW BREEDING SITES OF LITTLE TERN STERNULA ALBIFRONS AND KENTISH PLOVER CHARADRIUS ALEXANDRINUS IN CIRENAICA, LIBYA

Jaber Yahia

Faculty of Science, Omar AL- Mukhtar University, El-Bayda, Libya, jaber.yahia@gmail.com

Abstract

A total of 23 coastal wetlands and islets of Cirenaica, Libya, were irregularly visited during the last four years during the breeding season. Kentish Plovers were present in 14 of them, Little Terns in 10, while 10 sites hosted both species and 9 none of them. The maximum number of pairs per site was 20 individuals for the Kentish Plover at Gsibaia and 16 individuals for the Little Tern at Ain Al Wahsh in Bumbah Gulf. Breeding of either species was previously unknown in 19 sites overall, according to the main reference text of Isenmann et al. (2016).

The poster presented at the symposium is available here

SEBKHET ENNJILA AS A WETLAND FOR MARINE AND COASTAL BIRDS: VULNERABILITY AND MONITORING GAPS

Rafik Zarrad & Hechmi Missaoui

National Institute of Marine Sciences and Technologies (INSTM, -Tunisia, rafik.zarrad@instm.rnrt.tn

Abstract

The paleolagoon "Ennjila" is located in the Central East of Tunisia. This wetland attracts periodically a variety of marine and coastal bird species with large abundances (eg. Greater Flamingo, shearwaters, gulls, etc.). However, the ecosystem is scarcely monitored, nor is the extent of the sebkhet, which is affected by precipitation. The analysis of the precipitations showed a great fluctuation influencing the annual and seasonal water surface patterns. These results were confirmed through remote sensing. The temporal analysis of atmospheric temperature showed a clear warming trend in the last twenty years with an average of 0.13°C per year. We report evidences that this sebkhet is under the pressure of human activities (pollution) and climate change. These factors can increase the vulnerability of wintering, foraging and breeding bird populations.

Key-words: Ennjila, seabirds, Mahdia coasts, vulnerability

Introduction

The Sebkhet Ennjila is one of the Mediterranean's characteristic wetlands in the Tunisian Sahel semi-arid area. It is located in the Central East of Tunisia (Fig. 1), close to the village El Alya at 19 km distance from Mahdia. In the past, it was connected to the Mediterranean Sea by what is called the "Roman Canal".

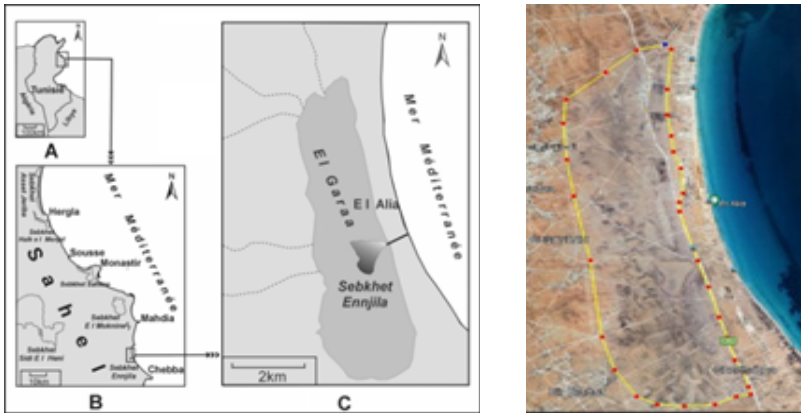


Figure 1. Geographical location of the Sebkhet Ennjila (A, B and C from Brahim, 2015, D from https://firms.modaps.eosdis.nasa.gov/map).

It is separated from the sea by a rocky beach-ridge around 600 meters wide. This Sebkhet is relatively small with a surface of 60 hectares. However, it is surrounded periodically by a great flooded area locally named locally named "Garaa" and can reach 2000 hectares (Figs 1C and 1D). This wetland periodically attracts various species of marine and coastal birds, which are important in terms of their abundance (eg. Greater Flamingo, shearwaters, gulls, etc.). However, this wetland is scarcely monitored regarding ecosystem and avifauna.

Materials & methods

Observed meteorological data (precipitations and atmospheric temperature) were obtained on a monthly basis from Mahdia's nearest wheather station (19 km distance) through the platform Meteomanz.com. Forecast meteorological data based on global models were obtained from the same platform. The temperature anomalies were calculated as a difference with the average of the total period data. Satellite images were extracted from the Google earth map pro: Satellite images 2003-2023. Complementary in situ observations were conducted in January 2024. Other information was gathered from the local community about the evolution of the presence/abundance of seabirds.

Results

The analysis of the precipitations showed a great fluctuation (Fig. 2) that influences the annual and seasonal water surface variations (Fig. 3). The annual mean ± SD is 395 ± 325 mm. The values fluctuate between 100 mm in the year 2022 to 1600 mm in 2003. Higher precipitations, 600 mm and 900 mm were recorded in the years 2016 and 2020, respectively. The Sebkhet Ennjila dries in summer and autumn. However, many droughts were recorded in winter and spring (Fig. 3).

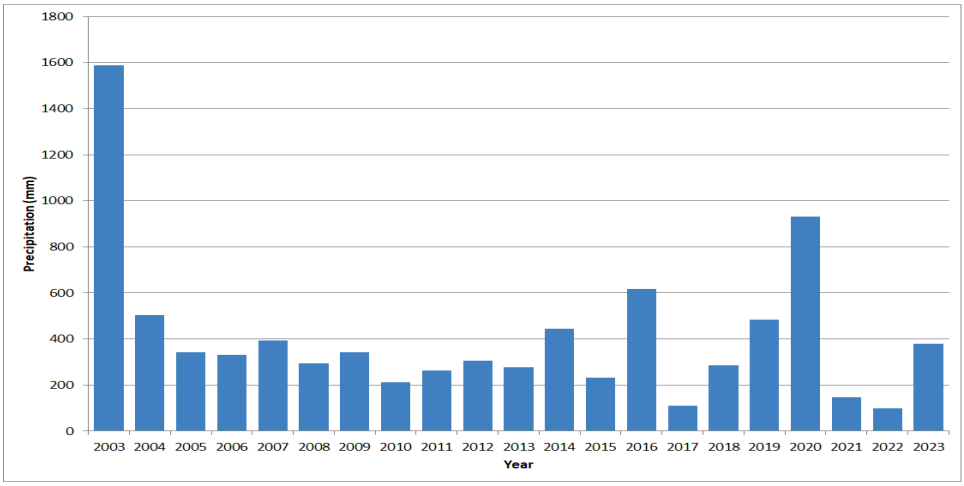


Figure 2. Annual precipitations of Mahdia (2003-2023).

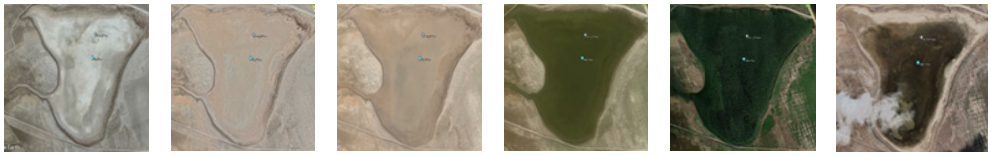


Figure 3. Chronological satellite images of Sebkhet Ennjila in winter-spring period (Sources: Google Earth Pro).

The temporal analysis of atmospheric temperature showed a clear warming trend (Fig. 4) in the last ten years with 0.27°C.year-1. The quasi-totality of positive anomalies was recorded between 2014 and 2023 (Fig. 5).

The local community had reported that the Greater Flamingo was present in early winter (December 2023). Some weeks later, in January 2024, this species was not found due to the presence of poachers.

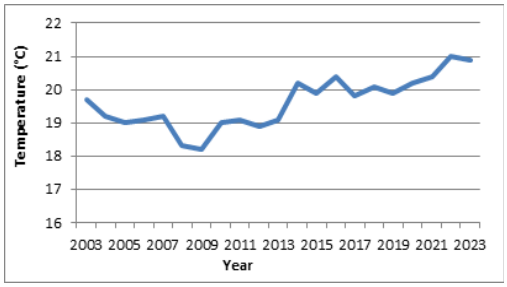


Figure 4. Annual variation of atmospheric temperature of Mahdia (2003-2023).

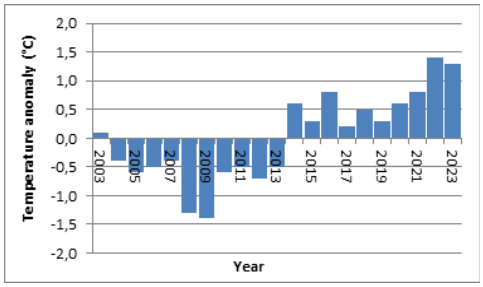


Figure 5. Annual anomalies of atmospheric temperature of Mahdia (2003-2023).

Discussion and conclusion

The Tunisian coastlines include several hypersaline environments of varying sizes and physical and ecological characteristics. In particular, extensive salt lakes where the water is intermittent are characteristic of the Tunisian Sahel semi-arid, almost natural ecosystem that contributes to the maintenance of biological diversity (Qiu *et al.* 2024). We reported the variation in climate as well as a case of poaching in the area. These factors may increase the vulnerability of wintering, feeding and breeding bird populations.

The wetlands in the Mediterranean basin are characterised as both a biodiversity and a climate change hotspot (Giorgi 2006). Climate change has already increased mean temperatures (Salimi *et al.* 2021) and has also led to a rise in the frequency of severe drought events (Mariotti *et al.* 2008). In addition, the increase in land cover change and land-use intensity over the last 50 years is deteriorating wetlands (Cuttelod *et al.* 2009). The Sebkhet Ennjila is no exception of this situation. Indeed, the present work showed an increase in the temperature during the lasted twenty years. However, this wetland is scarcely monitored regarding ecosystem and

ornithology. In the future, a scientific program may help in gathering protocoled data on the ecosystem, flora and fauna with a focus on marine and coastal birds. In addition, some immediate measures need to be applied to protect marine and coastal birds in the Sebkhet Ennjila from poaching and pollution.

References

Cuttelod, A., Garcia, N., Malak, D.A., Temple, H.J. and Katariya, V., 2009. The Mediterranean: a biodiversity hotspot under threat. Gland, Switzerland: J.-C. Vié, C. Hilton-Taylor, S.N. Stuart (Eds.), Wildlife in a changing world: an analysis of the 2008 IUCN Red List of Threatened Species, IUCN, 16 pp.

Giorgi, F., 2006. Climate change hot-spots. Geophysical Research Letters, 33(8), pp. 1-4.

Mariotti, A., Zeng, N., Yoon, J.-H., Artale, V., Navarra, A., Alpert, P., Li, L.Z.X., 2008. Mediterranean water cycle changes: transition to drier 21st century conditions in observations and CMIP3 simulations. Environmental Research Letters, 3(4), 1-8 pp.

Qiu, J., Yixin, Z., Jianwu, M., 2024. Wetland habitats supporting waterbird diversity: Conservation perspective on biodiversity-ecosystem functioning relationship. Journal of Environmental Management, 357(120663). https://doi.org/10.1016/j.jenvman.2024.120663.

Salimi, S., Almuktar, S.A.A.A.N, Scholz, M., 2021. Impact of climate change on wetland ecosystems: A critical review of experimental wetlands. Journal of Environmental Management, 286, pp.1-15.

The poster presented at the symposium is available here

LIST OF PARTICIPANTS

Abdelwarith, Mohamed Said
Egyptian Environmental Affairs Agency, Egypt

Abdennadher, Aida
Specially Protected Areas Regional Activity Centre (SPA/RAC), Tunisia

Aissa, Hedi
Association "Les Amis des Oiseaux" (AAO/BirdLife in Tunisia), Tunisia

Amdrous, Wassim
WWF North Africa, Tunisia

Arcos, José Manuel
SEO/BirdLife, Spain

Azafzaf, Hichem
Association "Les Amis des Oiseaux" (AAO/BirdLife in Tunisia), Tunisia

Baccetti, Nicola
Italian Institute for Environmental Protection and Research (ISPRA), Italy

Badreddine, Ali
Tyre Coast Nature Reserve, Lebanon

Baini, Matteo
University of Siena, Italy

Behi, Baha
iGD, Tunisia

Ben Aba, Wael
Association Tunisienne de la Vie Sauvage (ATVS), Tunisia

Ben Aouicha, Souad
Specially Protected Areas Regional Activity Centre (SPA/RAC), Tunisia

Ben Brahim, Rabii
The Dreamer, Tunisia

Ben Jemaa, Hsan
Faculté des Sciences de Tunis (FST), Tunisia

Ben Marzouk, Houssem Eddine
IGD Communication, Tunisia

Ben M'Barek, Nabiha
ATPNE, Tunisia

Ben Nakhla, Lobna
Specially Protected Areas Regional Activity Centre (SPA/RAC), Tunisia

Ben Osman, Imen
WWF North Africa, Tunisia

Ben Othmen, Houssem
Association Tunisienne de la Vie Sauvage (ATVS), Tunisia

Benloucif, Neila Ahlem
UBMA university, Algeria

Berbash, Ali
Ministry of Environmental, Libya

Berkane, Samia
Parc National du Gouraya, Bejaia, Algerie, Algeria

Borghesi, Fabrizio
Municipality of Ravenna, Italy

Boughdiri, Hela
University of Debrecen, Hungary

Bourass, Khadija
GREPOM/BirdLife Morroco, Morocco

Caliani, Ilaria
University of Siena, Italy

Chaarana, Malek
Notre Grand Bleu (NGB), Tunisia

Chebili, Hedi
Minsitère de l'Environnement, Direction Générale de l'Envoronnement et de la Qualité de Vie (DGEQV), Tunisia

Cherkaoui, Sidi Imad
Université Ibn Tofail, Morocco

Chtir, Chourouk
Association de Sauvegarde des Zones Humides du Sud Tunisien (ASZHST), Tunisia

Dami, Laura
Tour du Valat, research Institute for the conservation of Mediterranean wetlands (TDV), France

Dell'Omo, Giacomo
Ornis Italica, Italy

Dell'Omo, Eleonora
Ornis Italica, Italy

Dorai, Sahbi
Méditerranée Action Nature (MAN), Tunisia

Durgun, Denizcan
Doğa Derneği - BirdLife in Turkey, Turkey

Enajjar, Samira
INSTM, Tunisia

Feltrup-Azafzaf, Claudia
Association "Les Amis des Oiseaux" (AAO/BirdLife in Tunisia), Tunisia

Gabous, Moujib
Association "Les Amis des Oiseaux" (AAO/BirdLife in Tunisia), Tunisia

Gagliardi, Alessandra
Istituto Oikos ETS, Italy

Gaidi, Wassim
Specially Protected Areas Regional Activity Centre (SPA/RAC), Tunisia

Gatt, Marie Claire
Independent, Malta

Habib, Mohamed
Red Sea Association for environment and water sports, Egypt

Hamza, Abdulmaula
University of Tripoli/ Department of Biology, Libya

Hamza, Mahmoud Elyes
Specially Protected Areas Regional Activity Centre (SPA/RAC), Tunisia

Hamzi, Khouloud
Association Jlij pour l'Environnement Marin Djerba, Tunisia

Itani, Fouad
Association for Bird Conservation in Lebanon, Lebanon

Kassah, Abdelfettah
Former Professor in Sfax University, Tunisia., Tunisia

Kayser, Yves
Tour du Valat, research Institute for the conservation of Mediterranean wetlands (TDV), France

Kefi, Imtinen
Specially Protected Areas Regional Activity Centre (SPA/RAC), Tunisia

Khaili, Aymane
ABDELMALEK ESAADI UNIVERSITY, Morocco

Khammassi, Manel
Faculty of Sciences of Tunis, Tunisia

Kilani, Faouz
Association Tunisienne de la Vie Sauvage (ATVS), Tunisia

Kilani, Samar
Specially Protected Areas Regional Activity Centre (SPA/RAC), Tunisia

Kralj, Jelena
Institute of ornithology, Croatian Academy of Sciences and Arts, Croatia

Lambrechts, Adrien
Office Français de la Biodiversité, France

Limam, Atef
Specially Protected Areas Regional Activity Centre (SPA/RAC), Tunisia

Maamouri, Faouzi
Tunisia

Maaoui, Dorra
Specially Protected Areas Regional Activity Centre (SPA/RAC), Tunisia

Marraha, Mustapha
Association "Group of study and protection of the Moroccan Mammals", Morocco

Mayol Serra, Joan
Initiative PIM, Spain

Mehanna, Sahar
National Institute of Oceanography and Fisheries (NIOF), Egypt

Mendez, Loriane
CIESM (Mediterranean Science Commission), Monaco

Metzger, Benjamin
Independent, Malta

Monbailliu, Xavier
Monbailliu & Associates, France

Moslah, Syrine
Association Tunisienne de la Vie Sauvage (ATVS), Tunisia

Moulaï, Riadh
Université de Béjaia, Algeria, Algeria

Nascimento, Tânia
SPEA, Portugal

Nibani, Houssine
AGIR, Morocco

Okumusoglu, Bulut
Faculty of Sciences, Department of Biology, Institute of Sciences, Natural History Museum research and Application Center, Turkey

Oliveira, Nuno
SPEA _ Portuguese Society for the Study of Birds, Portugal

Onmus, Luc Ortaç
Ege University, Türkiye

Ouni, Ridha
Association Tunisienne de la Vie Sauvage (ATVS), Tunisia

Ramadan-Jaradi, Ghassan
Lebanese University, Beirut, Lebanon

Saied, Almokhtar
Ministry of Environment, Libya

Sinav, Lider
Hacettepe University, Turkey

Sposimo, Paolo
NEMO Ltd, Italy

Stavros, Antoniadis
Coordinating Unit for the Mediterranean Action Plan United Nations Environment Programme Barcelona Convention Secretariat, Greece

Thabet, Intissar
INAT, Tunisia

Thevenet, Matthieu,
Initiative PIM, France

Yahya, Jaber
Faculty of Science, Omar AL- Mukhtar University, Libya

Yahyaoui, Asma
WWF North Africa, Tunisia

Yésou, Pierre
Independent, France

Zarrad, Rafik
National Institute Of Marine Sciences and Technologies-INSTM, Tunisia

COMMITTEES

Scientific Committee

Josep Arcos
Sociedad Espanola de Ornitologia (SEO/BirdLife), Spain

Martin Austad
BirdLife Malta, Malta

Hichem Azafzaf
Association "Les Amis des Oiseaux" (AAO/BirdLife in Tunisia), Tunisia

Nicola Baccetti
Italian Institute for Environmental Protection and Research (ISPRA), Italy

Jocelyn Champagnon
Tour du Valat, research Institute for the conservation of Mediterranean wetlands (TDV), France

Imed Cherkaoui
Groupe de Recherche pour la Protection des Oiseaux au Maroc (GREPOM) / Université Ibn Tofail, Morocco

Helena Clavero
IUCN Centre for Mediterranean Cooperation (IUCN-Med), Spain

Marie Claire Gatt
Independent, Malta

Abdulmaula Hamza
Tripoli University, Libya

Jelena Kralj
Institute of Ornithology (Croatian Academy of Sciences and Arts), Croatia

Joan Mayol
Initiative pour les Petites îles de Méditerranée (PIM), Spain

Benjamin J. Metzger
Independent, Malta

Xavier Monbailliu
MEDMARAVIS, France

Nuno Oliveira
Portuguese Society for the Study of Birds (SPEA, BirdLife's partner in Portugal), Portugal

Luc Ortaç Onmus
Natural History Museum, Research and Application Centre, Faculty of Sciences, Department of Biology, Türkiye

Ghassan Ramadan-Jaradi
Lebanese University, Beirut, Lebanon

Abdelkrim Si Bachir
University Batna 2, Algeria

Pierre Yésou
Seabird conservation expert, France

Organizing Committee

Specially Protected Areas Regional Activity Centre (SPA/RAC), Tunisia

- Souad Ben Aouicha
- Lobna Ben Nakhla
- Wassim Gaidi
- Dorra Maaoui

Association "Les Amis des Oiseaux" (AAO/BirdLife in Tunisia), Tunisia

- Claudia Feltrup-Azafzaf
- Moujib Gabous

Istituto Superiore per la Protezione e la Ricerca Ambientale (ISPRA), Italy

- Nicola Baccetti

IUCN Centre for Mediterranean Cooperation (IUCN Med), Spain

- Helena Clavero

INDEX

Specially Protected Areas Regional Activity Centre
Boulevard du Leader Yasser Arafat
B.P.337 - 1080 Tunis Cedex – TUNISIA
car-asp@spa-rac.org
https://www.spa-rac.org/