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Athens, 7-8 April 2025

Agenda Item 5: **Proposal to revise IMAP on Biodiversity (EO1), Non-Indigenous Species (EO2), and Fisheries (EO3)**

5.1. Way forward to update common indicators factsheets related to Biodiversity (EO1) and Non-indigenous Species (EO2)

Mediterranean Monk Seal: A comprehensive set of monitor and research techniques for the study and conservation of *Monachus monachus* in the Mediterranean Sea

SPA/RAC

Tunis, 2025

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Note by the Secretariat

The Contracting Parties (CPs) to the Barcelona Convention adopted the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria (IMAP) (Decision IG.22/7) during CoP 19 (Athens, 2016) as part of the Ecosystem Approach (EcAp) process. IMAP establishes monitoring and assessment requirements based on agreed Ecological Objectives (EOs) and their corresponding common indicators. Since 2016, significant progress has been made in IMAP implementation, leading to the development of national IMAP-based monitoring programs and the publication of the 2017 and 2023 Mediterranean Quality Status Reports (MED QSRs). Building on this experience and the findings of MED QSR 2023, the Contracting Parties to the Barcelona Convention, through Decision IG.26/3 of CoP 23, mandated an update of the Ecosystem Approach (EcAp) and IMAP. This update aims to enhance IMAP implementation, strengthen national monitoring and assessment capacities, ensure quality-assured data, and improve the reliability of assessments. Additionally, it includes updates to the Guidance Factsheets for Common Indicators.

As outlined in the SPA/RAC work programme for 2026-2027, SPA/RAC will update the Guidance Factsheets of Common Indicators for EO1 and EO2. With this regard, it is proposed to take into consideration:

- The development of Monitoring and Assessment Scales, Assessment Criteria, Thresholds, and Baseline Values for IMAP Common Indicators 1, 2 related to habitats (Posidonia, Coralligenous, and Maerl), 3, 4, and 5 related to seabirds, marine mammals, and marine turtles, as well as for IMAP Common Indicator 6 related to non-indigenous species.

- Any advancements in marine biodiversity research, ecological monitoring, and the impacts of climate change provide valuable insights that should be integrated to ensure more accurate assessments and effective conservation measures.

Furthermore, the revision will take into account newly developed guidelines, such as the IUCN guideline for the Mediterranean Monk Seal given in this document.

This guide document was developed by IUCN, with partial funding from the Monk Seal Alliance and the Ministerio para la Transición Ecológica y el Reto Demográfico (MITECO).

The guide provides detailed, expert-validated standardised factsheets on monitoring and research methods related to *Monachus monachus* in the Mediterranean Sea, with the aim of obtaining key population data and assessing the conservation needs of the species. It provides guidance on developing adaptative protocols to conduct a wide range of studies, enhancing both research quality and scope. This is the first version of the document and may be updated in future revisions.

Mediterranean monk seal

A comprehensive set of monitoring and research techniques for the study and conservation of *Monachus monachus* in the Mediterranean Sea

B. Quintana Martín-Montalvo and M. Muñoz Cañas

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I. INTRODUCTION TO THIS GUIDE

1. What is the purpose of this guide?

The Mediterranean monk seal (Monachus monachus), the only resident pinniped species in the Mediterranean Sea, stands as one of the most endangered marine mammals on Earth.

The growing interest in the species and its preservation has led in recent years to an intensification of the research, management and conservation initiatives. Different monitoring methodologies in combination with awareness-raising actions are taking place across approximately the entire current range of the Mediterranean monk seal and similar actions are increasing in areas of the species' former historical range. Experts are joining efforts and sharing valuable knowledge to encourage the recovery of the species.

This guide offers a standardised approach for monitoring, data collection, and response to various scenarios in alignment with the conservation priorities for the Mediterranean monk seal. It provides guidance on developing adaptative protocols to conduct a wide range of studies, enhancing both research quality and scope. Additionally, it promotes a more harmonised approach among relevant stakeholders to improve the effectiveness of the protection of the species and its habitat. This is the first version of the document and may be updated in future revisions.

2. What key conservation initiatives are in place?

Joint conservation initiatives enable scientists, stakeholders and decision-makers to leverage collective knowledge, explore innovative ideas, and identify comprehensive solutions to complex conservation challenges. Through collaboration, researchers can optimise studies, resource allocation, and implementation of conservation measures, amplifying the impact of their work and fostering a more unified approach to safeguarding monk seals and their delicate ecosystems. The joint initiatives described below are in place to preserve the Mediterranean monk seal.

2a. Specially Protected Areas/Regional Activity Centre (SPA/RAC)

The Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, also called Barcelona Convention, constitutes the main regional legally binding Multilateral Environmental Agreement in the Mediterranean, and addresses each of the main challenges the Mediterranean countries are facing through 7 Protocols. Since 1985, the Specially Protected Areas Regional Activity Centre (SPA/RAC), as part of the United Nations Environment Programme Mediterranean Action Plan (UNEP/MAP), supports the Contracting Parties in implementing the Specially Protected Areas and Biological Diversity Protocol in the Mediterranean (SPA/BD Protocol).

The SPA/RAC works closely with governmental and non-governmental organisations to conserve and sustainably manage threatened species, ecosystems and areas of particular natural and cultural value. In this context, the SPA/RAC elaborated tools to support and guide monk seal conservation actions in the Mediterranean, such as:

– the Action Plan for the Management of the Mediterranean Monk Seal (Monachus monachus) (UNEP/MAP-SPA/RAC, 1985);

– the Regional Strategy for the Conservation of Monk Seal in the Mediterranean (UNEP/MAP-SPA/RAC, 2019a);
– the UNEP/MAP Integrated Monitoring and Assessment Programme (IMAP - Biodiversity and non-indigenous species) Implementation in the framework of the EcAp Roadmap (UNEP/MAP-SPA/RAC, 2019b), Appendix B;
– the Post-2020 Strategic Action Programme for the Conservation of Biodiversity and Sustainable Management of Natural Resources in the Mediterranean Region (UNEP/MAP-SPA/RAC, 2021).

The current document was created to provide a set of procedures and tools to gain a better understanding on Mediterranean monk seals, and to engage effective conservation actions in alignment with the Barcelona Convention. This guide is complementary to the management plans and tools produced by the SPA/RAC.

2b. International Union for Conservation of Nature (IUCN)

IUCN is an environmental network that harnesses the knowledge, resources and reach of more than 1,400 Member organisations and some 17,000 experts. To foster the preservation of natural resources, IUCN has developed a series of conservation tools.

The IUCN Red List of Threatened Species™ (hereafter "IUCN Red List" or 'Red List') is a comprehensive open-source information on the global extinction risk status of animal, fungus and plant species. Evaluations of the Mediterranean monk seal throughout the years have allowed to gain a better understanding of its conservation status and threats. The Red List assessment is a useful indicator to adapt conservation actions for a given species.

The IUCN Commissions gather scientists and experts from all over the world to volunteer their expertise on a wide range of topics. The IUCN Species Survival Commission (SSC) oversees influencing, encouraging and assisting societies to conserve biodiversity by building knowledge on the status and threats to species. Within the SSC, the Pinniped Specialist Group leads and validates the conservation status assessment of pinnipeds, including the Mediterranean monk seal.

2c. Monk Seal Alliance

The Monk Seal Alliance (MSA) is a consortium of like-minded foundations optimizing resources to support collaborative conservation and rehabilitation of the Mediterranean monk seal. It was created in 2019 by five founding members experienced in funding conservation projects related to the species. By fostering collaboration, knowledge exchange, and resource-sharing among its members, the MSA strives to enhance conservation efforts and develop effective strategies to protect these creatures and their natural habitats.

2d. Mediterranean monk seal Expert Group

The Mediterranean monk seal Expert Group is intended to serve as a reference group for the protection of *Monachus monachus*, comprising researchers and conservationists of the Mediterranean monk seal with a recognised contribution to the protection of the species. It will be divided into Working Groups dedicated to different knowledge areas, including monitoring, ethics, communication and other fields relevant to the conservation of the species.

3. Whom is this guide for?

This document is addressed to monk seal researchers, providing guidance for the study and conservation of the Mediterranean monk seal. It also aims at supporting researchers in addressing monk seal conservation actions in relation to different stakeholders, categorised as follows:

- **Conservation organisations** conducting research, public awareness and education, conservation programmes, and/or legislation development aiming at protecting the species and its habitat.
- **Research institutions** studying the biology, behaviour, and the conservation status of the Mediterranean monk seal.
- **National and regional government agencies** responsible for managing the species and its habitat, by establishing protected areas, enforcing fishing regulations and protective measures.
- **Local communities** living in close proximity to, or interacting with, the habitats of the Mediterranean monk seal or the species itself.
- **Fishing industries and actors** operating in the habitat of the Mediterranean monk seal and that may interact with it.
- **Tourism and marine transportation sectors** operating in the Mediterranean monk seal's habitat and that may interact with the species.

4. How to use this guide?

After this chapter, Chapter II gives detailed information about the species biology, ecology and distribution. Chapter III introduces a decision tree for the different actions that can be taken according to the area of monitoring and study they relate to, and baseline data collection, while Chapter IV discusses the pre-research considerations. Chapter V provides detailed, expert-validated factsheets on monitoring and research methods to acquire vital population metrics and assess conservation needs. Final two chapters cover citizen engagement (Chapter VI), and data application (Chapter VII). Users can adapt these protocols to specific scenarios by following cross-references and consulting the extensive, though not exhaustive, advice provided. Collaboration with expert networks (see Chapter I.2) is highly encouraged to maximize impact.

II. THE MEDITERRANEAN MONK SEAL: BIOLOGY, ECOLOGY, DISTRIBUTION

1. Species description

Mediterranean monk seals are medium-sized phocids, reaching lengths of 2.3-2.8 meters and weighing around 240-300 kilograms (Karamanlidis et al., 2023). The colour and pattern of their fur change distinctly across different life stages (Figure 1) (UNEP/MAP-SPA/RAC, 2019b; Koemtzopoulos et al., 2022):

Pups (first born-2 months) have black woolly fur and a whitish/yellowish ventral patch. At this stage, the pelage pattern of the ventral patch is sexually dimorphic: in females, the caudal delimitation of the patch extends closer to the tail area, whereas in males it extends up to the umbilical slit (oftentimes with a concave shaped border), and the penis groove lies outside of the white patch.

The **juveniles**'fur (2 months-2 years), after the moult of the pups at 2-3 months of age, is light grey on the back and white on the belly. Sex determination is only possible if the ventral part of the body is visible. In the initial phase, animals are often still suckling or are recently moulted pups being weaned.

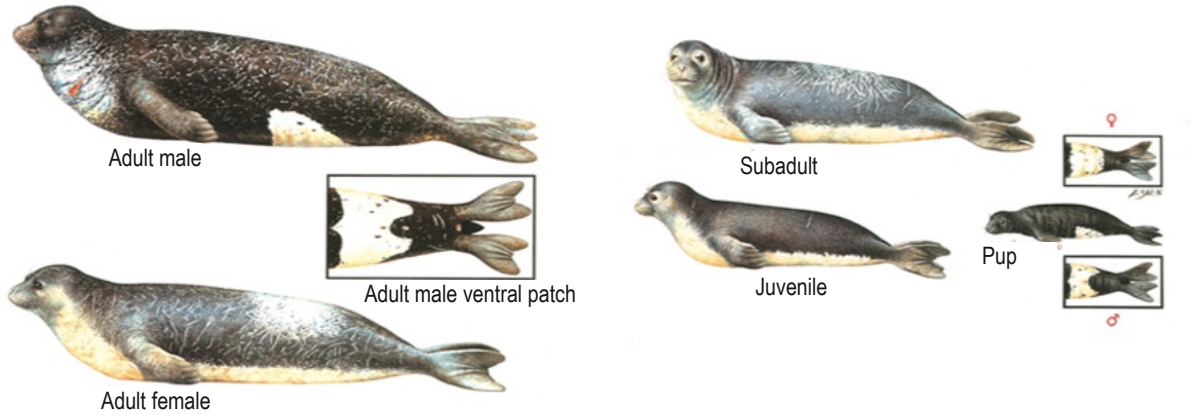

Figure 1. Monachus monachus coloration throughout its life stages. Source: Eduardo Saiz Alonso

Subadults (2-3 years to 5 years) are grey on the back and whitish on the belly. At this stage, scars resulting from the interactions occurring between seals, start becoming visible prevalently on the dorsal, head, throat and rear flippers. Unless the ventral side is clearly observed, sex determination is difficult. It is advisable that seals be considered adults only when there is documented evidence of reproductive activity (i.e., for females when they are observed mating, birthing, lactating; and for males when they moult into their adult male pelage pattern).

Adult males (from 4-5 years old) have a black fur covering all the body except for the ventral white patch, which is believed to be of similar shape and pattern to that displayed in the neonatal pelage when the individual was a pup. While this information is widely suspected by experts and has been presented in a conference setting (see Recommended readings), it has not yet been published in a peer-reviewed journal. Scratches and scars from intense interactions are visible across the body, mainly concentrated along the throat and hind flippers.

Adult females (from 3-5 years old or reproduction proven) are dark grey on the back and whitish on the belly. Scars tend to accumulate on the back with age. Any female associated with an offspring or without an associated offspring showing parenting behaviour (i.e., nursing and fostering other females' offspring, searching for offspring) is considered a reproductive female.

Their diet consists mainly of fish, cephalopods, and crustaceans, reflecting their opportunistic foraging behaviour (Karamanlidis et al., 2011; Kıraç & Ok, 2019; Kıraç & Türkozan, 2023; Pierce et al., 2011; Salman et al., 2001; Tonay et al., 2016).

2. Habitat description

Marine caves and coastal beaches are vital for the Mediterranean monk seal, each serving distinct ecological roles

Marine caves

Marine caves represent the key parts of monk seals' wider coastal habitats, as they provide shelter for resting and rearing of pups, isolated from sources of disturbance (e.g., wave action, humans) and difficult to access (Figure 2). Environmental variables, like cave seclusion, protection from wind and waves, substrate, entrance orientation, corridor length, and others play an important role in the caves' selection.

Figure 2. View of a monk seal cave entrance. Source: Cem Orkun Kıraç

Ideal breeding caves usually have one or multiple entrance(s), preferably underwater (siphon), leading through a corridor to one or more dry surface(s), covered by sand or pebbles, or to a rocky platform above the water. The orientation and position of the beach with respect to the high tide usually prevent the pups from being washed away from the cave, although in some cases the emerged area of the reproductive caves can be temporarily submerged by the sea (Bundone et al., 2022; Dendrinos et al., 2007; Gucu et al., 2004; Mursaloğlu, 1986; Reijnders et al., 1988).

Resting caves may display less characteristics as described above but have at least one or more beaches or platforms above sea level in their interior.

Coastline and beaches

Mediterranean monk seals have long used marine caves as sheltered habitats, but they also historically hauled out on open beaches (González, 2015; Johnson, 2004). Due to anthropogenic pressure and habitat loss amongst others, beach use declined (Karamanlidis et al., 2023) yet recent sightings suggest that monk seals are using open beaches again for resting, pupping, and nursing (Dendrinos et al., 2008, 2022), highlighting the need to monitor and protect both marine caves and coastal/beach segments.

3. Distribution

Once distributed throughout the Mediterranean and Black Seas, the extent of the monk seal population is today reduced to 3 main reproductive subpopulations, one in the eastern and central Mediterranean Sea and two in the central-eastern Atlantic coasts (González, 2015; Karamanlidis et al., 2023) (Figure 3).

The central-eastern Atlantic Ocean hosts two monk seal subpopulations, one in the Cabo Blanco Peninsula and one in the archipelago of Madeira. To date, the former is the largest monk seal aggregation at a global scale. The Madeira subpopulation is very small and hence still very vulnerable.

In the eastern Mediterranean basin, the largest reproductive areas are at islands in the Ionian and Aegean Seas, and along the coasts of mainland Greece, Türkiye and Cyprus (Beton et al., 2021; Karamanlidis et al., 2023). In recent years, sporadic sightings have been reported along the coasts of Syria, Lebanon, Palestine, Israel, Egypt, Libya, Spain, Italy, Croatia, Albania, and Montenegro (Bundone et al., 2019; Bundone et al., 2021, 2022; Panou et al., 2023; Roditi-Elasar et al., 2020). Mediterranean monk seals might be expanding their distribution range and increasing in numbers, although they should not be considered as effectively re-established in an area unless there are signs of successful reproduction. This highlights the need for targeted monitoring actions and protection measures in these regions.

Since the Mediterranean monk seal conservation status and distribution greatly vary between regions and between countries within those regions, the priorities and responsibilities for its monitoring and protection are very different and are defined at country level. Therefore, the Specially Protected Areas Regional Activity Centre (SPA/RAC) / Mediterranean Action Plan (MAP) of the United Nations Environment Programme (UNEP) proposes within the regional strategy for the conservation of monk seal (UNEP/MAP-SPA/RAC, 2019a), adopted by the Barcelona Convention Contracting Parties (Decision IG.24/7, 2019), to assign

Mediterranean countries to three major groups according to the typology of observed seal presence in the country, thereby foreseeing different type of conservation actions for each country specificity:

Group A. Countries where monk seal breeding has been reported after year 2010.
Group B. Countries where no monk seal breeding is reported, but where repeated sightings of monk seals (>3) were reported since 2010.
Group C. Countries where no monk seal breeding is reported, and where very rare or no sightings of monk seals (≤3) were reported since 2010.

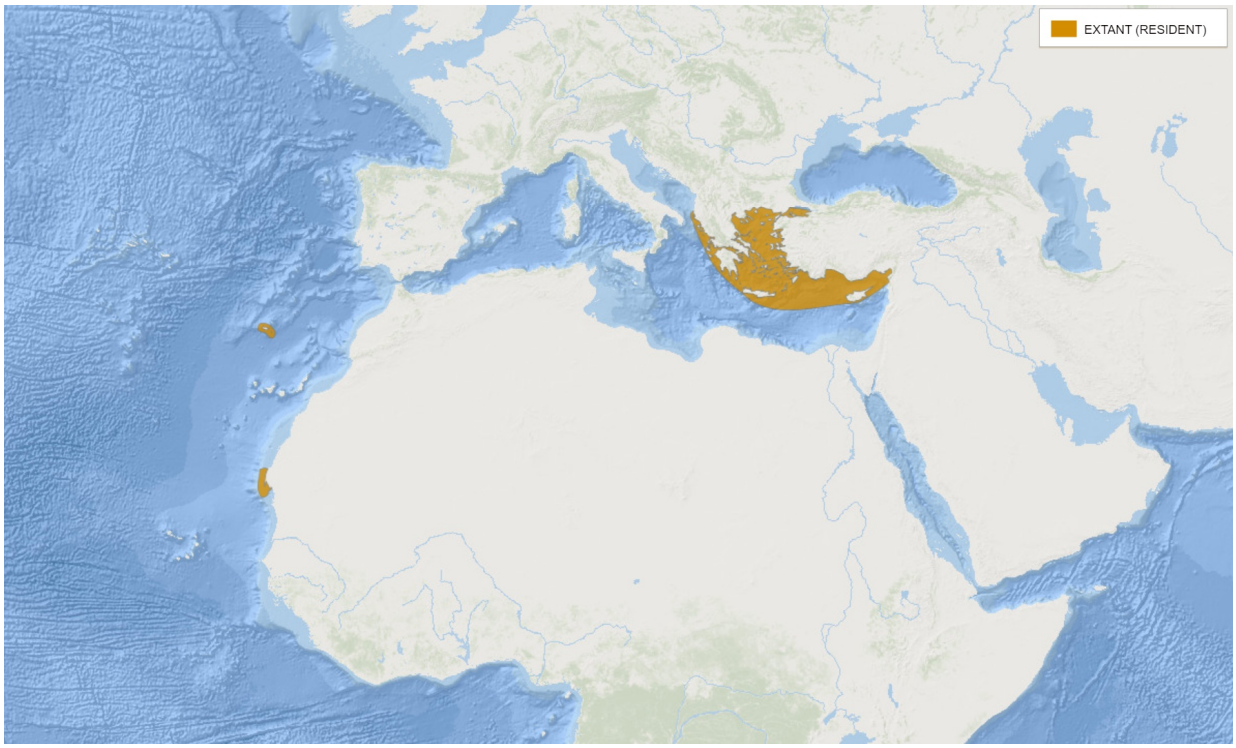

Figure 3. Current distribution of the Mediterranean monk seal. Source: IUCN Red List Assessment (Karamanlidis et al., 2023)

It is important to highlight that the monk seal distribution goes beyond national boundaries, requiring a collaborative approach to their conservation. For example, a country B bordering with a country A could host important feeding grounds or temporary dispersal areas, thereby playing an important conservation role for the survival of the breeding population in country A. Actions conducted in coordination between countries proximate to each other in specific subregions should therefore be encouraged.

4. Conservation status

Historically, Mediterranean monk seals were hunted for their fur, meat and blubber, but also for medical and cosmetic use (Johnson, 2004). During the past century the population dramatically declined, mainly due to intense anthropogenic pressure, including habitat destruction, pollution, overfishing, disturbance, and deliberate killings. Reduced to near extinction with 350-450 individuals estimated globally, the Mediterranean monk seal was listed as Critically Endangered on the IUCN Red List (Aguilar & Lowry, 2008).

Owing to the increasing conservation efforts over the last decade, early signs of population recovery are becoming more common. The 2015 species re-assessment listed the Mediterranean monk seal as Endangered (Karamanlidis & Dendrinos, 2015), and the 2023 evaluation uplisted species status to Vulnerable (Karamanlidis et al., 2023). The current global population is estimated at around 815-997 individuals of all age classes and comprises three reproductive subpopulations in localised areas in the eastern Mediterranean and the central-eastern Atlantic Ocean (Karamanlidis et al., 2023).

III. WHERE TO START MONITORING?

© Meltem Ok

Monitoring the Mediterranean monk seal effectively requires a strategic approach to identify where to focus efforts. This chapter helps researchers and conservationists determine the best starting points by using a decision tree and systematically acquiring baseline data to pinpoint priority study areas.

1. The decision tree

When Mediterranean monk seal presence is first considered, different actions can be undertaken to identify priority study areas and adequate monitoring efforts. The decision process (Figure 4) has been broken down to systematically and progressively guide the user towards choosing the most appropriate monitoring methods according to each specific scenario. Detailed protocols validated and approved by international experts are included in the form of factsheets, categorised according to the area of monitoring and study they relate to (**habitat**, **species**, **threats**). Citizen and stakeholder engagement is a powerful tool to obtain various kinds of information and to facilitate the identification of areas of interest.

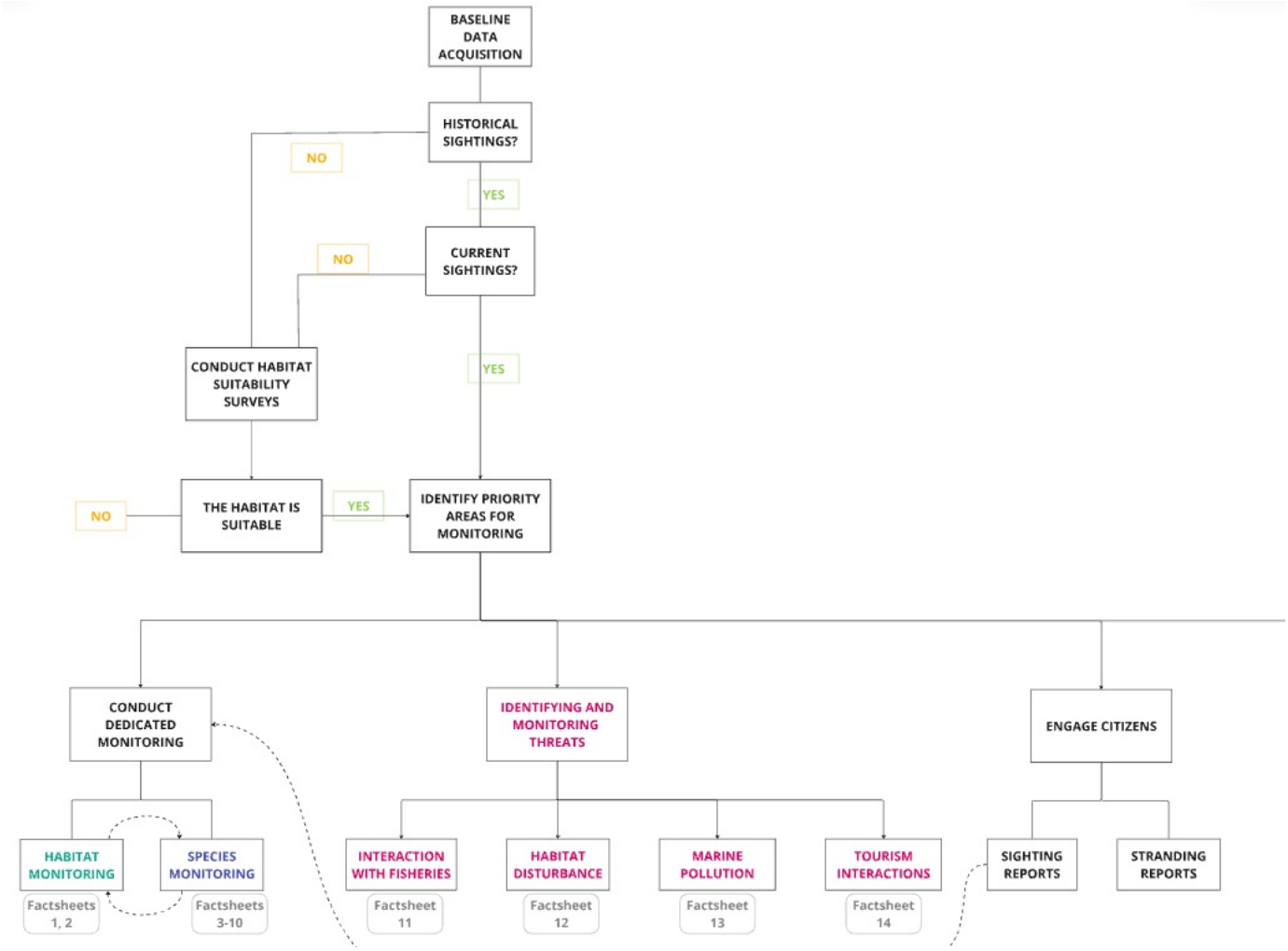

Figure 4. The decision tree developed to guide the reader to the available survey methods based in the context at a given location and the research priorities. Source: prepared by the authors

This approach to study the Mediterranean monk seal population is intended to provide an integrated view on the species, its habitats and threats, adapted to the context of the study area and the research capacities. The obtained results can be used to support conservation actions at wider levels, providing data-driven recommendations to policymakers, managers and stakeholders.

2. Acquisition of baseline data

Collating baseline data on the monk seal's presence is a necessary step to support the identification of priority monitoring sites. From desk-based research to field-based data collection, the information obtained will provide a basis to further develop monitoring efforts, enforcing one or a combination of the protocols listed in this guide.

The following data gathering methods are listed in order of increasing effort and resources required to obtain information.

Literature review and historical data check

The identification of areas characterised by historical distribution and the location of critical habitats for the species can be obtained through searches of national/regional archived data available through internet engine queries or specific information nodes, and relating to a combination of data sources: scientific papers and publications, museum records, stranding records, grey literature, newspaper articles, etc. (Bundone et al., 2023).

Collating all available historical records of monk seal sightings spanning from past occurrences to the present in a given area will support the creation of a map of the seals' historical distribution patterns. Results of recent sightings provide information on current presence but also indicate the existence of researchers or organisations working with the species.

Social media

Social media can provide near real-time information on the presence of monk seals, including sightings, strandings or unusual behaviours. Repeated presence of the species in a given location will support the identification of potential site(s) in which habitat suitability studies and monitoring activities may need to be conducted.

Interviews

Local communities, coastal residents and fishers can provide useful information on the presence of monk seals in a given area.

Engaging with fishers using questionnaires will help gathering insights on monk seal presence (historical and current) in the area and possible threats the species is facing. More details on the interactions with fisheries and how to obtain sensitive data from fishers are outlined in Factsheet 11.

Engaging in conversations with residents, tourists and individuals familiar with the coastal area will help obtaining additional information about seal sightings and potential habitats. More details on citizen engagement are described in Chapter VI. It is advisable to verify communal knowledge by resorting to multiple sources.

Field surveys

Coastal surveys and geomorphological studies of a given stretch of coast will allow to identify caves or beaches likely to be used or already used by monk seals.

BOX #1 – Habitat suitability surveys: Step by step

- Gain the required research permits when planning ahead for the survey.
- Identify priority stretches of coast to survey based on the analysis of your baseline data collection of sightings and historical distribution in addition to considerations on the geomorphology of the coast in your study area.
- Survey short stretches of coast via snorkelling or kayak and longer stretches via boat or jet ski. Some cave entrances have been reported at 5-10m depth, it may thus be useful to conduct scuba-diving surveys to explore deeper waters, using existing technological tools to facilitate the surveys if required.
- Record and document all identified suitable sites for monk seals, keeping note of:

GPS coordinates, date and weather/sea conditions, photo of the entrance; size and orientation of the entrance, the size and shape of the aquatic passageway(s) leading into the cave and the internal basin; geologic structure and ceiling height; slope of the beach and/or platform; evidence of degree of exposure of the internal part of the cave to wave action (i.e., floating objects lodged between rocks above sea-level height); suitability for monk seal use; any signs of seals (Figure 5); any signs of human interference.

- Establish a research objective and monitoring plan, considering all relevant variables (e.g., level of priority for monk seal conservation, available resources, etc.).

Figure 5. Tracks of a monk seal inside a cave. Source: Luigi Bundone

3. Identification of priority study areas

The baseline information obtained from the methods listed above will support the identification of potential hotspots or areas where the monk seals are most likely to be found, as well as identifying data gaps or areas requiring further investigation. This includes areas where the species has been sighted or was formerly present but also areas in proximity to known breeding areas or within a short distance range from a well-established population. Historical data is also very useful for evaluating the overall carrying capacity and also the causes of death in previous decades (Panou et al., 1993).

The insights gained from the analysis will facilitate the prioritization of specific areas to optimize survey efficiency, especially if the coastline is extensive and time is limited.

IV. CONSIDERATIONS BEFORE STARTING TO WORK WITH THE SPECIES

When starting work with the Mediterranean monk seal, there are important steps to take to ensure both the species' safety and the success of the research efforts. This chapter helps by outlining key considerations, from legal requirements to practical logistics.

1. Research permits

The Mediterranean monk seal is protected under several international conventions in the Mediterranean basin:

- the Barcelona Convention (Annex II of the SPA/BD Protocol), listing endangered and threatened species, for which protection, conservation and management are required),
- the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Appendix I, which includes species threatened with extinction and provides the highest level of protection, prohibiting international trade except under exceptional circumstances,
- the Convention on Conservation of European Wildlife and Natural Habitats (Bern Convention), Appendix II, which dictates the strict protection of the species and its habitat, forbidding any form of disturbance or killing to animals,
- the Convention on the Conservation of Migratory Species of Wild Animals (CMS), Appendices I and II, respectively outlining the conservation of its habitat and the need of international agreements for its protection,
- the EU Habitat Directive (92/43/EEC), Annex II for designated areas of special conservation and IV providing strict protection to the species, and
- the African Convention on the conservation of nature and natural resources (listed as Class A species), for which any form of killing or taking from the wild is prohibited except for scientific purposes or national interest.

The General Fisheries Commission for the Mediterranean, although not legally binding, also includes the monk seal in its guidelines (GFCM; Recommendation GFCM/35/2011/5 on fisheries measures).

Countries where monk seals are present or were formerly present may also have included the species in the national or regional regulations. If monitoring involves activities conducted within the boundaries of protected areas such as national or regional Marine Protected Areas /Natura 2000 sites, it is highly recommended to also contact the corresponding management authority. Likewise, activities conducted in areas under surveillance for national security reasons will require authorisation procedures under the competent national administration.

Obtaining the corresponding research permits from the national/regional/local competent administrative body is crucial before initiating any activity related to the monk seal and its habitats. In case of doubt, contact the group of experts (see Chapter I.2).

2. Ethical considerations

All planned activities that involve the potential exposure and approach to a monk seal must be carefully evaluated on the basis of rigorous ethical principles to avoid undue disturbance to the seals and their habitat. The goal is to prioritise the species' protection and well-being, ensuring that every action is assessed for its risk-to-benefit ratio, and aligned with the highest ethical standards. Only through joint efforts and ethically sound approaches the conservation of the Mediterranean monk seal is achievable.

To reinforce ethical research and conservation efforts for the Mediterranean monk seal, a document outlining ethical priorities is being developed and will be incorporated in future updates.

3. Suggested key best practices

Minimise disturbances during surveys

Disturbance of monk seals inside caves should be avoided during habitat surveys and routine monitoring operations. When planning the fieldwork, it is best to strive for activities planned in such a way to minimise the time spent within the cave and reduce the number of accesses to the cave as much as possible throughout the study period.

International agreements generally prohibit any form of disturbance to the species unless specific permits or exemptions are granted for conservation purposes by the relevant authorities. Non-invasive studies, such as the collection of faeces (e.g., for diet analyses, genetic studies, parasite detection, microplastics), fur or other remains, are strongly recommended. Find more in the corresponding factsheets.

No run/abrupt movements

In case of encounter, avoid doing brusque movements or running away from the animal to minimise the risk of stressing the animal or triggering a negative response (i.e., an aggressive or fleeing reaction).

If on land, slowly step backwards keeping an eye on the animal and its movements, until positioning yourself at a safe distance (see next point).

If the encounter occurs underwater or in the aquatic passageway into a cave while diving or snorkelling, slowly swim away from the animal.

Do not chase the animal under any circumstance.

Safe distance

To minimise disturbance to the animal, a minimum distance should be kept. Make sure any person near the animal stays at a safe distance, including researchers (unless any action involving the seal is necessary, such as disentangling, which should preferably be performed by a veterinary).

Use the thumb rule to determine the optimal distance between people and the seal:

- Hold the thumb up front with the arm fully outstretched.
- If the thumb visually covers the seal, the distance is correct. Do not get closer. Keep bystanders beyond that distance (use police tape or any object available to create a protective fence).
- If the silhouette of the seal appears behind the thumb, take a few steps back and check again.

No-touch rule

The direct contact between humans and wild animals should be avoided in any circumstance. Touching a wild animal is a source of distress, which can worsen its health situation and/or trigger aggressive reactions. The risk of zoonosis (transfer of diseases from animals to humans) is high during operations that involve the handling of wild animals and seals are no exception.

If the monitoring or scientific activity involve handling of a seal (i.e., biological sample collection, disentanglement), make sure that the scientific protocols, sampling and handling scheme follow international protocols and have been screened by monk seal scientific experts on the topic (see Chapter I.2), and that their guidance is incorporated into your protocol procedures. Handling of wildlife is generally object of national legislation which may involve an authorising process and the involvement of specific professional operators (i.e., veterinary health specialists).

Regardless of whether handling a seal or just any biological samples (i.e., scat, regurgitated food items, etc.) ensure that all the safety and prevention measures are followed (i.e., use of disposable gloves, washing hands with soap and water or hand sanitizer before and after contact, using specific clothing, footwear or body protection gear reserved solely for the specific activity).

Safe passage

In the event of a monk seal stranded or resting on a beach or area with people, after keeping a safe distance, make sure to leave enough space for the animal to move around.

Ensure there is a safe and clear passage, without obstructing the seal's way towards the sea or around the beach. Operations to handle or manage a stranded seal should be conducted under the responsibility of authorised veterinary staff and specialised teams.

Correct communication

Thoughtful handling of information on monk seals' presence and location details is critical to safeguarding the animals from potential pressures or disturbances. Sharing information responsibly is crucial to mitigating any unintended negative impacts on the species.

4. Data collation and management

Proper data organising is an important step to ensure the information is well reported, manageable, comparable, easy to read and interpret (e.g., data on spreadsheets can be easily used for basic statistics). The creation of detailed protocols on the design and implementation of databases could be useful to ensure data consistency among researchers and should be regularly reviewed and adapted as necessary. Similar databases could facilitate data sharing, comparison and survey follow-up, especially at regional scales or along the same coastlines. Likewise, the forms handed out to the different stakeholders to report their monk seal sightings should aim to collect similar information.

Collating data in spreadsheets

- Organise the data according to the type of survey and data collected: systematic surveys, opportunistic surveys, citizen science surveys, sighting reports, etc.
- Every data entry on a spreadsheet should contain references to the type of survey, where and how extra data is stored (in case of complementary photographic material for example, provide code for the image, folder and sub-folders to locate it).
- Design the spreadsheets according to the type of survey. Record date, location (with coordinates if possible), time, presence/absence of seals, number of animals, etc., and adapt the spreadsheet to the type of survey by adding the relevant information (e.g., individual identification, presence of plastics, etc.). It is essential to plan the survey and clearly establish its aim to create the most appropriate and effective spreadsheet.
- Ensure any spreadsheet contains a legend with the codes and acronyms used, as well as a basic definition of the variables being recorded, for example in the first page or tab. This will ensure all data is consistently reported throughout the spreadsheet, preventing duplicates and facilitating data management.

Organising images and recordings

- Organise the files in folders and sub-folders according to the type of survey and data collected. Ensure all files are consistent with the codes and variables used throughout the data collection. This step must be done systematically, especially when large amounts of material are to be processed.
- All data should be accompanied by spreadsheets reporting the main information. Any image entry should be easily found in the spreadsheet, using basic search or filter queries.

V. MONITORING AND RESEARCH METHODS

1. Scheme of the factsheets

The fact sheets below provide a structured framework for each monitoring and research method, designed for practical application in the field. Each factsheet includes:

Name: the method's title.
Topic: the category it addresses: **Habitat**, **Species**, **Threat**. One method is assigned at least one category.
Objective: the primary goal of the method.
Associated methods: cross-references to related factsheets or chapters.
Actions: Step-by-step procedures, now with subheadings for clarity.
Advantages and disadvantages: a concise table evaluating benefits and limitations of the method.
Definition box: clarifications of technical terms where needed.

These elements ensure that users can adapt methods to their specific contexts, balancing scientific rigor with the species' well-being (see Box #2 for adaptation guidance). The factsheets are grouped into three categories—**Habitat Monitoring**, **Species Monitoring and Research**, and **Threat Assessment and Mitigation**—to enhance navigation and integration with the guide's broader objectives.

BOX #2 – Adaptation, the key to effective conservation

Before engaging in any action, it is crucial to balance the monitoring strategy with the benefits for the monk seal, keeping the species' well-being as a priority. The choice of a methodology (see all Factsheets) will depend on the location, objectives of the survey, and a cautious consideration of the technical aspects and available resources (time, cost, staff). The frequency of monitoring should be adapted to the context at a given location, the monk seal presence and known threats. **The priorities for monitoring and conservation actions can be reviewed after a set number of years** to re-assess the needs and ensure resources and efforts are allocated effectively.

2. Field survey checklist

Pre-survey considerations:
- Hold the most up-to-date research permit according to the local, national or international laws if any (see Chapter IV.1).
- Always follow the most ethical approach possible (see Chapter IV.2,3).
- Inform colleague(s) on the location and expected return time.
- Check the weather forecast before going on a survey. If the conditions become adverse or harsh during a survey, cancel the survey.

In-water surveys:
- Safety platform in proximity (direct and close access to land, boat or other floating platforms where to rest and dry).
- Torch or headlight.
- Wetsuit or protective underwater clothing to protect skin from the cold and from possible scratches.
- Current and waves check before entering the water, especially if accessing any cave.

Cave surveys (in addition to all of the above):
- Appropriate footwear to avoid slippering.
- Helmet, especially if planning to drill the walls/install equipment.
- If monk seals are present or there are signs they could be in proximity, cancel the survey.

3. Monitoring methods

The following pages constitute the research and monitoring methods proposed in this guide in the form of Facthseets.

Cave monitoring

FACTSHEET 1

Habitat

Objective

To detect presence of monk seals, determine active caves, study cave use behaviour and patterns and to identify individuals.

Associated methods

Factsheets 2-10, 12-14.

Actions

Pre-survey considerations:

- The cave roof and walls must be stable enough to support the cameras. A helmet should be mandatory when exploring any cave as well as for the installation of cameras.
- During the breeding season, opportunities to enter the cave are considerably reduced. In case of presence of seal(s) in or around the cave, the survey must be terminated, and the team should depart slowly and silently from the area.
- If the cave is active, images and/or recordings need to be collected continuously if possible. For non-active caves, researchers can set a monitoring frequency, according to known sightings or other relevant criteria.

Using camera traps

Camera traps have many models, types, and specifications. The choice of one tool or another should be based on the evaluation of some parameters: disturbance to seals, objectives to achieve and type of analysis sought, costs (considering long-term feasibility). The use of a cheaper model with minimal features is advised to conduct preliminary surveys to determine presence/absence data, which may be replaced by an upscaled model depending on the outcomes.

Marine caves can be extremely harsh environments. Not only they are open to strong wave activities; some can also occasionally be submerged under water. A camera trap needs to be as waterproof as possible. An Ingress Protection (IP) is a two-digit grading system that is applied to the enclosure of a mechanical or electrical item, giving customers a clear indication of the item's resistance to various types of unwanted intrusions. The higher the IP rating, the higher the protection of the camera casing is.

Camera placement and view direction adjustment

Step 1: Correct camera placement

- Evaluate the cave's unique features, such as wide platforms or narrow corridors, to determine the most suitable camera trap placement.
- Ensure an adequate anchorage of the cameras which guarantees: a relatively easy access for the researchers to reach the camera for replacement or manoeuvrability (orientation), a wide coverage area, the protection of the camera and its setup from damage or theft. Bring the basic tools necessary for the installation of the camera traps (e.g., drill, batteries/generator for heavy drilling, screwdrivers, dry-bags, etc.) (Figure 6).
- Ensure comprehensive surveillance by monitoring all areas of the cave as extensively as possible.
- Consider that cave structures vary, and camera trap setup options differ from cave to cave.

Step 2: Choice of the lens type

- Select appropriate camera trap lenses based on the cave's structure and monitoring needs. For caves with wide platforms, use wide-angle lenses to capture a broader view of the surface. For clear identification of individuals, choose narrow-angled lenses as they provide good quality photos, although they may not cover the entire platform.
- Consider regularly adapting the camera trap lenses to maximize data collection and identification efforts.

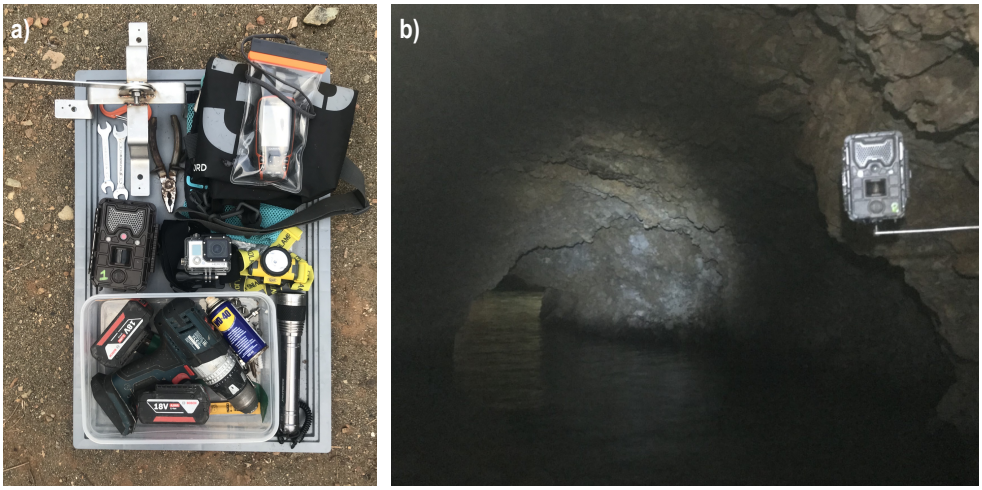

Figure 6. Camera-trap set-up in a monk seal cave. a) Basic equipment for the installation of a camera-trap inside a cave. b) Example of a camera-trap installed and its view to the cave.
Source: Meltem Ok

Step 3: Record and document

- Keep detailed records of camera trap placement and lens usage for each cave, ensuring consistency in monitoring strategies.
- Regularly review the effectiveness of camera trap lenses in each cave setting. Implement improvements based on feedback and experience to optimize monitoring efficiency and individual identification.

Time lapse and/or motion sensor

If the camera trap has Time Lapse and Motion Sensor features, in specific cases it may be worth using both settings simultaneously to ensure optimal image capture. The selection of Time lapse or Motion sensing will depend on the opportunities to enter the cave, the battery's running duration and the storage capacity of the SD card. Consider the following settings:

- Set the time-lapse interval to 1 hour, allowing regular snapshots of the cave's activity.
- Adjust the motion activation interval to 20 minutes for timely recording when motion is detected.

Video settings

Continuous cave monitoring can be conducted through video recordings when the cave characteristics allow for it and/or in caves with high seal activity, according to the monitoring objectives. It involves more complex logistics, as the batteries and the SD card must be replaced frequently, which relies on the researcher's availability to go on site or depends on the possibility of installing a solar powered camera system, which may be more costly.

Cave monitoring in short:

Advantages	Disadvantages
- The continuous monitoring of a cave provides comprehensive information on the species and its habitat, allowing to use the data for multiple studies. - Disturbance to the seals is minimised as the researchers punctually enter the cave, to change the batteries or do some adjustments.	- Costly, depending on the camera model and cave set-up. - The equipment is worn out fast due to the exposure to harsh environments (sea, salt, sun). - Processing the images/recordings can be time consuming.

Beach monitoring

FACTSHEET 2

Habitat

Objective

To assess presence of Mediterranean monk seals on the beach, study their behaviour, and identify potential threats.

Associated methods

Factsheets 1, 3-10, 12-14.

Actions

Cave monitoring has typically been preferred over beach monitoring, as monk seals primarily use marine caves with internal beaches for resting and reproduction. However, beach monitoring may become increasingly valuable, as monk seals have recently shown a growing tendency to haul out on beaches and, on rare occasions, breed. The method here described outlines the steps to carry out in areas where seals are present, even occasionally.

Pre-survey considerations:

– Depending on the location and its accessibility, appropriate outfit is necessary (i.e., shoes, protective clothes).
– A quick geomorphological evaluation of the site (presence of cliffs, rock type, closeness of the bay or creek…) is necessary before starting to monitor or deploying any camera, to ensure the researchers' safety and to avoid any disturbance to the seal(s), if any.
– Be prepared in case a seal is seen on the beach (see Chapter IV.2).

Step 1: Site selection

- Identify key beaches within the monk seal's range where they are known to rest, breed, or haul out (look for tracks on the beach) or based on the findings in Chapter III.1.
- Consider geographic diversity and accessibility to ensure comprehensive coverage of different regions.
- Record the presence of any disturbance, such as human activities or potential threats (more in Factsheets 12-14).

Step 2: Data collection

- Conduct visual monitoring of the beach from a designated lookout site (land survey) or boat to minimize disturbance.
- If the site characteristics allow for it and resources are available, install camera-traps to monitor the area of interest (see Dendrinos et al., 2022).
- Record the date, time, weather conditions, location, number of monk seals observed and behaviour.
- Establish a regular monitoring schedule based on seasonal variations and known monk seal behaviour patterns.
- Prioritize monitoring during critical periods, such as pupping seasons (based on indirect monitoring to avoid disturbance).

Beach monitoring in short:

Advantages	Disadvantages
- Non-invasive method. - Land surveys are cost-effective. - Allows to assess potential threats related to human presence or proximity to human activities. - Allows for a fast response in case of unexpected distressing situations for the seal (e.g., stranding, attempt of interaction from bystanders).	- A constant monitoring of a beach or stretch of coast from a landmark can be time-consuming. - The monitoring effort is high. - If the monitoring is carried out from boat, the equipment needed might increase the cost (boat, fuel, etc.).

Photo-identification

FACTSHEET 3

Species

Objective

To identify Mediterranean monk seals at individual level.

Associated methods

Factsheets 1, 2, 4-6, Chapter IV.

DEFINITION BOX #1

Photo-identification (photo-ID): non-invasive method used to identify individual animals of a given species based on their distinctive natural unique features (e.g., fur patterns, colouring, spots, scars…).

Capture/Recapture: capture designates the first picture taken of a monk seal that allows for its individual identification. Recapture refers to any following picture of an animal that has already been identified.

A **photo-identification catalogue** consists of images representing each animal, showcasing the most distinctive images of the individual, ideally both sides and the ventral patch, and any other relevant side such as the back or the head (see Annex I). The data is organised in a structured and accessible manner that allows to keep regular monitoring of a given population and can be used as a complementary tool to understand population parameters.

Actions

Different methods can be used to store and organise the profiles in the catalogue, but some suggestions are listed here with the aim to facilitate data collection, comparison and possible sharing.

Step 1: Identifying individual seals: Captures

- Search for distinctive features of individual seals from the available images or recordings, taking special care on using high quality images (obtained from camera-traps in caves or beaches, boat surveys, citizen-science…). When possible, recordings will encompass the ventral patch, both the lateral design and scars on the rest of the body (dorsal area, head, etc.).
- Create an "ID-card"/profile of each new individual identified (see Annex I). Drawings of the main identifying features can be useful as a quick cue to ID an individual, at all life stages.
- All profiles should be accompanied by the last date of profile update (whenever a better-quality picture is obtained) and of the seal sighting (see Chapter IV.3).

Step 2: Building a catalogue of seals based on photo-ID: Recaptures

- Search for distinctive features of individual seals from the available images or recordings, taking special care on using high quality images. When possible, recordings will encompass the ventral patch, both the lateral design and scars on the rest of the body (dorsal area, head, etc.).
- During the identification process, simultaneously create a comprehensive catalogue of seals, searching for matches with existing profiles.

The profiles can be created/updated as follows:

Pups (first born-2 months)

- Create an image file for each offspring. Recordings will encompass the ventral patch and both lateral lines. When possible, identify the mother and link their profiles.

Juveniles (2 months-2 years)

- Create an image file of any new juvenile in the catalogue. If identified as an already known pup from the database, add a secondary profile to the existing one for that individual. Juveniles are hard to monitor, and the most reliable way is by tracking their lateral lines.

BOX # 3 – Identifying features in Mediterranean monk seals

Monk seal identification is based on the pattern, shape and dark/light contours relative to the ventral patch, the right and left lateral line designs (this is the area that runs alongside the seal's flanks that may appear as a clearly identifiable demarcation boundary between the upper dark grey pelage and the lighter fur present on the ventral side of the seal's body) and scars on the rest of the seal's body (e.g., dorsal area, head, etc.).

The position of the seal can visually affect the shape and position of the scar/feature. To avoid misidentifications, primary scars are those used as the main identifying features; secondary scars are complementary and can be used to confirm an individual identification when the primary scarring is not determinant. Some scars are not permanent, and moulting may also affect the identification of an individual, highlighting the need to have ID profiles as comprehensive as possible.

Subadults (2-3 years to 5 years)

- When a juvenile that has been identified is deemed to have transitioned to the subadult stage, create a third profile page and add it to the profile of that individual. This file should encompass both sides and the dorsal part of the animal. Additional parts could also be included (head, flippers, etc.)

Adult males (from 4-5 years old)

- When a subadult male moults its fur to its final pattern, create a fourth profile page and add it to the profile of that individual. This file should encompass both sides and the dorsal part of the animal. Additional parts could also be included (head, flippers, etc.).

Adult females (from 3-5 years old or reproduction proven)

- When a subadult female breeds or is old enough to be considered adult, create a fourth profile page and add it to the profile of that individual. This file should encompass both sides and the dorsal part of the animal. Additional parts could also be included (head, flippers, etc.).

Monk seals in the catalogue should have a minimum number of pictures to allow the animals to be individually identified.

Recaptures will guarantee that the animal formerly identified is still present in the area or that the animal is still alive. Dead or disappeared animals should be withdrawn from the catalogue. The number of years without seeing an animal to consider it out of the population should be defined based on the location, context, etc.

Examples of a photo-ID methodology and catalogue creation can be found in Forcada & Aguilar (2000) and Bundone & Panou (2023).

Some considerations:

– For continuous monitoring (e.g., camera traps in caves), the appearance of new scars should be recorded as much as possible.
– Ideally, monitoring should be carried out all year around. If this is not possible, it should preferably be conducted during the breeding and moulting season. All-year-round monitoring is particularly important in low-density areas where the probability of encountering a seal in a cave is low and monitoring effort needs to be high in order to obtain significant results.
– To understand the population dynamics (Factsheet 4), the recapture interval for the individuals is one year.
– For images obtained opportunistically (e.g., citizen-science, other research groups; see Chapter VI), the same procedure can be followed and the profile added to the catalogue accordingly.

Photo-ID in short:

Advantages	Disadvantages
- Depending on the context, it allows to track individuals throughout the life stages which is a great source of information. - The methodology can contribute to provide population data and population parameters affected with an acceptable low bias in comparison to other methodologies. If associated with other methodologies (e.g. records of standings and deaths, pup counting) the bias can be even lowered.	- Processing the images and recordings is time-consuming. - The possibility of human error during the analysis of the images is high until excelling the technique, therefore, a specific training to minimise bias is highly recommended. A routine of "double-checking" and at least two experienced researchers conducting the analysis is advisable.

BOX #4 – Data sharing

Common databases are a useful tool to efficiently and systematically store, manage, and retrieve structured information or data. A shared database for comparing data between the various research groups, especially the ones working within the Mediterranean Sea, is necessary considering that these are highly mobile animals with potentially wide home-ranges.

On-line databases are a valid tool to compare data between different research groups. They can also allow citizens to contribute by adding the data related to their encounters. Such a database should be based on a user-friendly system to upload information and must guarantee property rights of the data to each research group.

Population dynamics

FACTSHEET 4

Species

Objective

To estimate population numbers and overall population health.

Associated methods

Factsheets 1, 2, 3, Chapter VI.

Actions

The choice of the method to estimate population numbers and dynamics will depend on the context and on existing tools to monitor the monk seal population of a given area. In any case, it is important to include information on captures and recaptures to establish a population framework for specific time periods, encompassing population size, mortality, births, and other relevant demographic data.

Population dynamics are determined by analysing the data obtained through one or more of the following methods:

Pup counting

For well-studied populations in which individuals are identified, monitor the number of births and offspring survival to first moult on a yearly basis when possible. Cave and/or beach monitoring efforts using non-invasive methodologies should be maximised during the breeding period.

A recent study has also used a different approach to estimate the population abundance, which extrapolates the number of adults in a given population from the number of pups (more details in Karamanlidis, 2024).

Photo-ID and related catalogue

To estimate the minimum reliable number of identified seals in a given population using capture/recapture studies (Factsheets 1-3), count the number of seals within a catalogue for which there are images of the same side (the estimated number of seals should be less or equal than that of the total profiles in the catalogue). Data on survival rates is crucial before adding individuals to the population estimates. Using adults for population estimates is encouraged, and numbers of juveniles and pups must be used with caution.

Opportunistic records of Mediterranean monk seal sightings of any life stage represent valuable general information on presence, distribution and reproduction (if pups are recorded), but are not sufficient to estimate population size or other dynamics. However, if images are available and allow for the individual's identification, they can be included in the catalogue.

Images capturing groups of seals together serve as evidence of their presence and enable rough estimates of their numbers at a specific location and time, regardless of individual identification. Although not suitable for estimating overall population size, this information can be a valuable tool for conservation efforts.

Strandings and/or record of deaths

For well-studied populations in which individuals are identified, count the number of deaths or disappeared animals (define the number of years without seeing an animal to consider it dead).

Stranding records can contribute to estimate mortality rates and give insight into other important parameters (Solanou et al., 2024). Determining the causes of death can be useful to understand the threats Mediterranean monk seals face in a particular area (e.g., deliberate killing, entanglement, diseases), and thus support targeted conservation actions and threat mitigation measures.

Examples of population estimates and other demographic studies of the Mediterranean monk seal can be found for the Atlantic populations in Cabo Blanco Peninsula and Madeira (Fernández de Larrinoa et al., 2021; Pires et al., 2023). However, due to the difference in contexts, the challenges to estimate population numbers in the Mediterranean might be different to those encountered for the Atlantic populations.

NOTE: Closely monitoring a population will allow to estimate other population parameters (e.g., survival rates at different ages and according to sex, fecundity, annual pregnancy rates, calving interval, male to female ratio (adults and pups), age at first parturition, maximum longevity between others), which can provide insights on the population's overall health, but might not be obtained at first when starting the population monitoring.

Population dynamics studies in short:

Advantages	Disadvantages
- Understanding the population dynamics is important to support conservation measures. **Photo-ID** - Photo-ID is a valuable tool to support the estimation of population numbers in a non-invasive method. **Pup multipliers** - Counting newborn pups reduces monitoring and logistic efforts, as their location is easier to identify, and the efforts can be concentrated during the pupping season.	- Demographic studies require long-term monitoring efforts, which depend on the availability of resources. **Photo-ID** - The population and the catalogues need frequent update to ensure data reliability. **Pup multipliers** - The method can be applied in areas where there are subpopulations well-known and closely monitored that could be used as samples for extrapolation.

Behaviour and seasonality

FACTSHEET 5

Species

Objective

To gain understanding on the seals' behaviour, daily and seasonal patterns, and other ecological aspects.

Associated methods

Factsheets 1, 2, 13, 14, Chapter IV.

Actions

Whether conducting continuous monitoring (e.g., surveillance systems in caves, monitoring efforts at sea and from an advanced point of observation, drone surveys) or reporting a punctual sighting (e.g., beach monitoring, citizen reports), the following information can be recorded:

- Number of monk seals and behaviour, such as resting, swimming, or interactions with other seals or boats.
- Date, time and other relevant environmental variables, to assess their possible impact on the observed behaviours.
- Any signs of distress, injuries, unusual behaviours, or interactions with humans (more details in Factsheets 13, 14).

Some studies are available on monk seal behaviour at sea in the Mediterranean Sea and Madeira (Mpougas et al., 2019; Pires et al., 2007).

Behaviour and seasonality in short:

Advantages	Disadvantages
- Understanding the species behaviour, social interactions, habitat use, and seasonality can support conservation efforts. - Continuous cave monitoring provides very comprehensive and extensive information on the seals' behaviour inside caves. - Monitoring efforts at sea provide crucial information of habitat use outside caves, including interactions between seals, with humans, or other element in their environment. - Opportunistic records can be useful to identify areas for future studies according to the behaviour observed (for conservation and awareness-raising purposes).	- Identifying the behaviour displayed may require specific training. - Processing all recordings obtained from continuous monitoring is time-consuming. - Opportunistic records provide punctual information at given locations and time, unlikely to be used for behavioural pattern studies.

Tracking movement and distribution

FACTSHEET 6

Species, Habitat

Objective

To track the movements and to assess the habitat use of the Mediterranean monk seal.

Associated methods

Factsheets 3, 5.

Actions

Two main methods are used to study distribution, biefly described below. Non-invasive methods should be prioritised over invasive ones.

Photo-ID

- Images of the same individual taken in different locations can be used to track the overall movements of that individual. This highlights the importance of reporting the date and most precise location of any sighting, especially when there are images or recordings that allow for the identification of the individual.
- In areas where monk seal catalogues are available, locating the individuals in space and time provides crucial information to understand the animals' movements in a localised region and to target conservation efforts (Adamantopoulou et al., 2011).

Telemetry

- Telemetry data can provide an insight on the seals' daily and/or seasonal movements (depending on the duration of the tag), habitat use and behaviour, interactions with human activities, etc., and can help identify key habitats or areas to target the monitoring and conservation actions. Tagging animals with telemetry devices requires both technical expertise and in-depth knowledge of the species. Given the invasive nature and potential risks of this method, it should only be carried out by experienced professionals. Improper handling can cause significant stress and harm to the animals, so this procedure must never be undertaken lightly.
- Telemetry research on monk seals is still limited and requires permits, as well as high technical equipment and training. Please contact the group of experts (see Chapter I.2) before starting telemetry studies.

Tracking movement and distribution in short:

Advantages	Disadvantages
Photo-ID - Non-invasive method. -Using citizen-science enhances the sighting possibilities in space and time. **Telemetry** -Provides comprehensive near real-time data on movements, which can be useful to support conservation measures.	**Photo-ID** - Tracking an individual depends on the presence of natural markings that may change through time. **Telemetry** - Costly equipment and risks of losing the tags. - Need trained researchers. - Invasive method.

Trophic ecology studies

FACTSHEET 7

Species

Objective

To gain understanding on the species diet throughout the life stages, main sources of food and feeding grounds.

Associated methods

Factsheets 1, 2, 8.

Actions

Trophic ecology studies can be conducted using different methodologies, briefly explained below.

Traditional methodologies

Non-invasive techniques such as investigating prey items collected from faeces and stomachs are commonly used and provide insights into the last few meals of the individuals.

Faeces (and vomitus if available) are collected during the monitoring surveys of caves (Figure 7), and information on the presence of animals, garbage, beach conditions, and other environmental characteristics should be recorded (see Annex II). Stomachs are collected during necropsies performed by specialized veterinary teams, and all relevant information regarding the animal is recorded.

Genetic studies

Dietary DNA metabarcoding enables researchers to identify and characterize trophic interactions with a high degree of taxonomic precision, unlike traditional techniques. Samples are collected from either faeces or stomachs.

Stable Isotope Analysis (SIA)

The analysis of carbon and nitrogen in animal tissues is a conventional tool used in trophic ecology studies in marine mammals. SIA has also proved to be a useful tool for understanding habitat use and animal movements (based on analysis of isotopes of hydrogen, oxygen, sulphur). Variations on the enrichment of isotopic composition of δ13C and δ15N may be used as valuable tools to understand changes on ocean circulation (Casciotti et al., 2008) and migration patterns (Abend & Smith, 1997), and therefore on climate variability. To date, two studies are published on SIA to evaluate monk seal diet (Karamanlidis et al., 2014; Pinela et al., 2010).

Below is a brief description on sample collection, materials, and other considerations while sampling:

- Wear latex gloves before any contact with animal samples. If metabarcoding or stable isotopes analysis will be performed sterilised tools and sample containers should be used.
- Label each sample with a unique identifier and record associated metadata, including date, location, and individual seal identification (if available).
- For metabarcoding analysis, collect a small sample in a small container (Eppendorf) with ethanol 96%.
- For biopsy samples, collect in a small container (Eppendorf tube) and store in a cool place during the transport. If the sample was collected during the necropsy will be stored frozen (-20ºC) until analysis.
- Preserve the sample in a plastic bag or container and stored it in a cool place until transported to the laboratory. Stored samples at -20ºC until analysis.
- Thoroughly wash your hands with soap after the collection of animal samples.
- For the next steps, consult with experts.

A more comprehensive protocol can be found in Bundone et al. (2024).

NOTE: it is difficult to set a frequency for sample collection. As a general rule, samples should be collected when accessing caves for specific purposes (e.g., battery replacement, etc.) and only when there are no animals in proximity. Sampling during necropsies is also an opportunistic method, which relies on the availability of carcasses and their decomposition status.

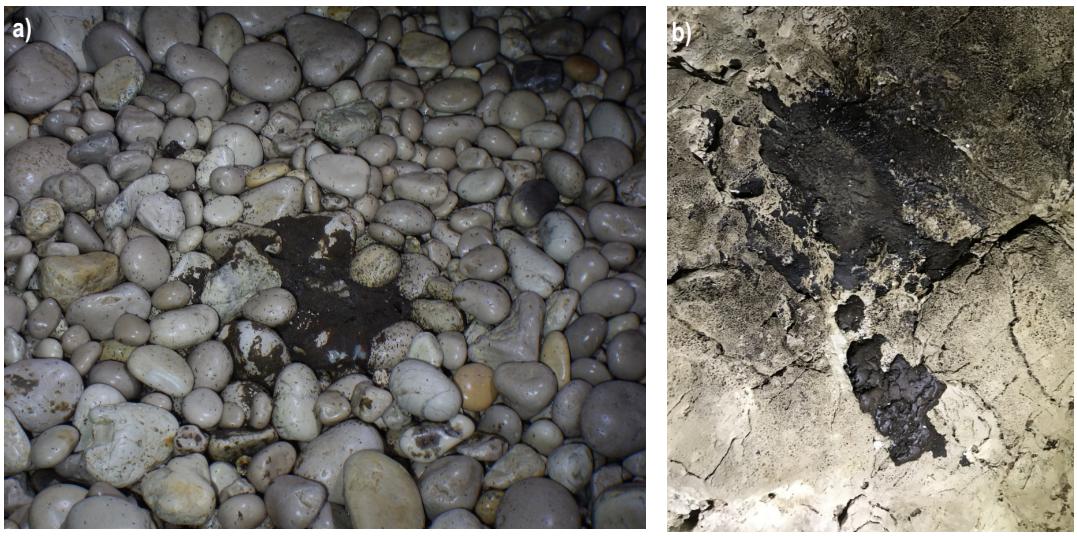

Figure 7. Aspect of monk seal faeces when found inside caves. Source: a) Luigi Bundone; b) Meltem Ok

Trophic ecology studies

Trophic ecology studies in short:

Advantages	Disadvantages
Traditional methodologies - It is the most useful technique when the population of animals is small, like the Mediterranean population, and non-invasive methods are most suitable for the species. - Allow to estimate the biomass of the prey ingested (whether small or large animals) and to assess the individual's food consumption (i.e., how much fish was eaten). - Sample collection is cost-efficient (collected during other surveys) - Storing and transporting samples is easy and little resources are needed. **Metabarcoding** - Storing and transporting samples is easy and little resources are needed **Stable Isotope Analysis** - The trophic ecology of the species can be inferred over a long-term period, depending on the tissue used. - Tissues can be collected during necropsies (non-invasive technique). - Storing and transporting samples is easy and little resources are needed.	**Traditional methodologies** - Provide data on the last meals (or part of the last meal, in the case of faeces). - The main limitations are associated with the degree of erosion of the hard and the presence of broken bones. **Metabarcoding** - Needs specialised training and costly equipment. **Stable Isotope Analysis** - There is a restriction on the number of prey groups that can be used for interpretation, requiring some broad prey categories to be made. - An invasive technique can also be used for tissue collection through biopsies during field surveys (involving the collection of skin and a small piece of blubber). - Needs specialised training and costly equipment.

Chemical pollution studies: microplastics

FACTSHEET 8

Species

Objective

To understand the impacts of microplastic pollution on the species; its effect and biological accumulation in the seal body once ingested, mainly via the prey, is largely unexplored.

Associated methods

Factsheet 7.

Actions

Understanding the microplastic prevalence on monk seals will help clarifying the threats posed by marine plastic pollution in high anthropogenic areas. This knowledge is crucial for developing effective conservation measures to safeguard the health and well-being of these animals and ensure the long-term sustainability of their populations (Panti et al., 2019). To date, there are two comprehensive studies on microplastics in monk seals faeces (Hernandez-Milian et al., 2023; McIvor et al., 2023) and one study published on micro litter found in stomachs (Pietroluongo et al., 2022).

Below is a brief description on sample collection (i.e., faeces and stomachs, generally carried out along with trophic ecology studies, see Factsheet 7), material, and other considerations while collecting samples:

- Wear latex gloves before any contact with animal samples. Use sterilised tools and sample containers or those previously cleaned with pre-filtered water.
- Label each sample with a unique identifier and record associated metadata, including date, location, and individual seal identification (if available).
- Record any information regarding potential plastic influence in the collection area: presence of garbage in the area (at the beach or in the water), type and colour of clothes worn by the researcher team in the cave wear, type and colour of materials introduced into the cave (see example of data collection form in Factsheet 7). This is important because it provides information of potential airborne contamination during the sample collection.
- Preserve the sample in a plastic bag or container and stored it in a cool place until transported to the laboratory. Stored samples at -20ºC until analysis.
- Thoroughly wash your hands with soap after the collection of animal samples.
- For the next steps, consult with experts.

A more comprehensive protocol can be found in Bundone et al. (2024).

Chemical pollution studies: microplastics

Microplastics studies in short:

Advantages	Disadvantages
- Sample collection is cost-efficient (collected during other surveys). - Storing and transporting samples is easy and little resources are needed. - Chemical pollution assessments can provide insights on the contamination levels of the animals and/or the causes of death, which is valuable for conservation efforts.	- Needs specialised training, costly equipment, and lab facilities.

BOX #5 – Chemical pollution

Chemical pollution is a major threat for marine top predators including the monk seal. It is well known that pollutants such as organochlorine compounds like polychlorinated biphenyls (PCBs) and pesticides (DDTs, etc.) cause anomalies in the reproduction of seals and other mammals and have also a strong immunosuppressive capacity in several species. Several heavy metals are also toxic contaminants. The above compounds are bio-accumulated in marine organisms and have a high persistence.

The presence, prevalence and impact of chemical pollutants on monk seal is an underexplored field of research requiring the analysis of blubber or hair samples (Borrell et al., 1997, 2007; Capanni et al., 2024; Yediler et al., 1993).

Genetic studies

FACTSHEET 9

Species

Objective

To understand genetic diversity, kinship relationships, population structure (including subpopulations, migration patterns), and potential genetic threats (e.g., inbreeding, bottlenecks).

Associated methods

Factsheets 1, 2, 7.

Actions

Genetic research on the Mediterranean monk seal is recent (Karamanlidis et al., 2021). It requires high technical equipment and training. Please contact the group of experts (see Chapter I.2) before starting genetic studies.

The protocol here outlined briefly describes the sample collection for the specific occasions where samples are collected for future genetic studies, for example, when entering a cave for other purposes cave (e.g., to replace camera-traps).

- Wear latex gloves before any contact with animal tissues. Use sterilised tools and sample containers.
- Collect samples in a non-invasive manner, such as faeces, shed skin, or tissue samples from dead seals during necropsies, if applicable.
- Label each sample with a unique identifier and record associated metadata, including date, location, and individual seal identification (if available).
- Preserve tissue samples in a buffer solution (e.g., 20% DMSO) or DNA stabilizing storage medium (e.g., EDTA) to maintain DNA integrity.
- Thoroughly wash your hands with soap and hand sanitizer after the collection of animal tissues. Any material in contact with the animal should be kept in a safe container for further washing and sterilisation.
- For the next steps, contact the experts or refer to a genetic lab to conduct the analyses.

Genetic studies in short:

Advantages	Disadvantages
- Provides insights on the population structure and genetic threats, which is very valuable for conservation efforts.	- Needs specialised training, costly equipment and lab facilities.

Emerging survey methods

FACTSHEET 10

Acoustics

This methoid aims to study communication and to assess Mediterranean monk seal presence and abundance through acoustic monitoring.
The underwater communication of monk seals is a new yet growing field of research. A few studies are published (Charrier et al., 2023; Muñoz-Duque et al., 2024), but further research is needed to establish a baseline protocol to collect acoustic data.

Diseases and physiological alterations

The objective is to gain comprehensive insights into the prevalence, causes, transmission pathways, impacts, and management of diseases.
The study of diseases within the Mediterranean monk seal population is a new field of research. Trained researchers and specific lab equipment are needed to conduct this type of research. Contact the group of experts for further information on this (see Chapter I.2).

Environmental DNA (e-DNA)

This method aims to evaluate the presence of Mediterranean monk seals in a given area.
This method relies on the DNA remnants left in the environment (i.e., water) after an animal's passage and can therefore inform about its presence in a given area or nearby locations. Although this method does not provide quantitative or qualitative data, and water currents are not always considered, e-DNA analysis could be a valuable method for initial evaluations of the presence of monk seals in low density areas. The use of e-DNA to assess the presence of monk seals is a new field of research.

Unmaned Aerial Vehicles (UAVs)

The objective of this method is to assess the presence of monk seals at sea and to study their behaviour.
The use of UAVs (drones) to assess the presence of monk seals is recent. It allows to study the seal's behaviour but also to remotely survey a stretch of coast to detect the presence of seals. The footages obtained can serve for behavioural studies, photogrammetry (to study size and body condition for example), etc. Caution is advised, as drones may disturb the animals, require proper authorization, and specialised training for safe and ethical operation (special attention should be given to the distance from the animal during the fly operation).

Interaction with fisheries monitoring

FACTSHEET 11

Threat

Objective

To investigate the interactions between monk seals and fisheries to understand the impact of fisheries on the seal population, behaviour, and their natural habitat. Also, to investigate the impact of seal depredation on fisheries (Gonzalvo & Carpentieri, 2023), which is the actual cause for deliberate seal killings, and elaborate effective compensation measures for affected fishers (Panou et al., 1993, Archipelagos, 1998).

Interaction with fisheries refers here to any interaction with the fishing activity (artisanal or not), fishing gear or fish farms, including overlaps between the fishing grounds and the seals' foraging areas, seal(s) approaching to the fishing activity and/or trying to feed on the fish (eventually provoking gear damage), entanglements, etc.

BOX #6 – Quick intervention in case of monk seal by-catch/entanglement

The incidental capture or entanglement in fishing gear, also known as bycatch, is a major threat to marine mammals and has been reported to be a major threat to the survival of the Mediterranean monk seal (Karamanlidis et al., 2008). If a monk seal is found entangled on fishing gear or is by-caught by fisher, evaluate first the risks for the animal to avoid causing more harm. If possible, a veterinary should handle the animal's release, especially when the fishing gear is strangling the seal or its body parts. In case the seal can be easily released, cut the net as fast as possible to set the animal free. It is important to be careful and to keep an eye on the animal, as if it is in distress, it can bite or scratch.

This information should be disseminated as much as possible in the areas where interactions with fisheries are common or are likely to happen.

Associated methods

Factsheets 1, 2, Chapter VI.

Actions

The protocol here detailed has been developed for studies of the Eastern Mediterranean monk seal population, considering the context and challenges. The interaction between monk seals and fisheries in other areas of the Mediterranean monk seal distribution has also been studied, such as in Madeira (Hale et al., 2011) or Mauritania (González & Fernández de Larrinoa, 2013).

Interaction with fisheries monitoring

Data sources

It is important to define well the purpose of the survey to adequately adapt the methods to the type of data required (e.g., frequency of damage, quality of damage, fish taken by the seals, etc.). The most accurate and reliable method to collect data regarding fisheries interactions with monk seals is to use fishery-dependent onboard observations. Additional information can be obtained through interviews and self-reporting.

Table 1. Summary of main characteristics of fishery-dependent monitoring strategies. Adapted and modified from FAO, 2019.

Source of data	Costs	Inconvenience to industry	Accuracy/ Reliability	Representation of normal fishing operations
Onboard observations	Medium	Medium	High	High
Interviews	Low	Medium	Medium	High
Self-reporting	Low	High	Low	High

Onboard observations

Information about establishing an onboard observation programme can be found at FAO (2019) and Carpentieri & Gonzalvo (2022).

Interviews

Before engaging with fishers, it is important to have a good understanding of the local context and reality, and to build a good relationship with the relevant stakeholders. This will be crucial to adapt the interview process and maximise the results obtained from the conversations or questionnaires.

Data from interviews can be obtained in different ways:
1) one-time in-person questionnaire-based interviews (Papageorgiou et al., 2023),
2) questionnaire-based interviews from regular visits at ports,
3) telephone surveys,
4) in-person interviews to the same fishers on a regular basis (a study conducted on-spot interviews with all fishers of a given harbour on a daily basis for more than 5 years, see Archipelagos, 1998),
5) on-line questionnaires shared at a wide scale among a possibly large pool of respondents.

Detailed information about conducting interviews can be found at FAO (2019) and Carpentieri & Gonzalvo (2022). Different approaches have been used in the past to obtain information on monk seals based on fishers' engagement (Annexes III, IV; Bundone et al., 2023; Mo et al., 2011).

Interaction with fisheries monitoring

Self-reporting

Information about establishing a self-reporting programme can be found at FAO (2019) and Carpentieri & Gonzalvo (2022).

Other studies

Archipelagos carried out a pilot project in Zakynthos Island, Greece, where fishers used an experimental net in order to qualitatively and quantitatively define the seal damage which proved to be considerable (Archipelagos, 1998). However, as it was a pilot project, only one site, one type of gear and one season were considered. This kind of project could be repeated in various sites and seasons with various gear types in order to obtain representative results.

Sampling strategy

Designing the sampling scheme requires to take into consideration several factors specific to the fishery of study and its related fishing operations (FAO, 2019, Carpentieri & Gonzalvo, 2022). The general assumptions and how the data can be later analysed will depend on the local context and should be reviewed and/or updated accordingly.

Step 1: Identify sampling units

- Identify the total number of fishing vessels in each area, port or country of interest.
- Break down the target population into sampling units (i.e., vessels, fishing days, fishing operation).
- Refer to Pinello et al. (2017) for more details regarding the sample size determination and interview sample selection.

Step 2: Conduct statistical analysis

- Apply a random sampling approach to ensure that data obtained could permit an unbiased estimate and that the chosen sampled units are representative of the whole vessel fleet.
- Review literature on probabilistic (simple random sampling and stratified sampling) and non-probabilistic sampling (e.g., snowball sampling) (FAO, 2019, Carpentieri & Gonzalvo, 2022).

Step 3: Continuation and replicability

- Carry out monitoring programmes throughout the year and in different areas to identify any differences between seasons and location (see also Panou et al. 1993).

Interaction with fisheries monitoring

Monk seal-fisheries interactions indicators

According to Papageorgiou et al. (2023) the following indicators can be considered to estimate and quantify the fisheries interactions with the monk seals, based on one-time in-person questionnaire interviews.

Encounter rate (ER) = Total number of monk seal sightings/Total fishing effort
Depredation rate (DR) = Total number of days with depredation/Total fishing effort
Incidental capture rate (ICR) = Total number of individuals incidentally captured/Total fishing effort

The total number of monk seal sightings, days with depredation, incidental captures, and the total fishing effort (measured in days at sea) reported by each fisher during the interview should correspond to either the current year or the preceding year, depending on the time of year when the interview is conducted.

NOTE: Common indicators to assess bycatch are included in the Data Collection Reference Framework issued by the General Fisheries Commission of the Mediterranean (FAO, 2023). A manual to monitor by-catch in the Mediterranean (FAO, 2019) was created as a tool to standardise data collection and offer a harmonised basis for knowledge and informed decision-making.

Incidental catch, damage evaluation and mitigation actions

The prevention and reduction of incidental catch of marine species can be addressed from different perspectives. Awareness-raising, communication campaigns and capacity-building actions are complementary to the existing national and/or international agreements setting a framework for bycatch mitigation (FAO, 2021). While acoustic deterrent devices, commonly known as pingers, and other mitigation measures have been effective in reducing bycatch for certain marine mammals (Sacchi, 2021), their application for Mediterranean monk seals is not well documented.

The socio-economic aspects of the interactions between fisheries and Mediterranean monk seals play an important role in the conservation of the species. While monk seals can damage the fishing gear or catch, deliberate killing of seals has been reported as one of the consequences of these interactions. Quantifying the damage caused by monk seals to the fishing gear could allow for concrete compensation measures for the fishers, which could in turn help changing the behaviour of the fishers and encourage the recovery of the seals (Karamanlidis et al., 2019).

Habitat disturbance monitoring

FACTSHEET 12

Habitat, Threat

Objective

To record signs of natural or human disturbances observed in Mediterranean monk seal habitats and to assess their impacts on the species in short and long terms.

Associated methods

Factsheets 1, 2, 13, 14.

DEFINITION BOX #2

Habitat disturbance: refers to a temporary change in environmental conditions, which causes a pronounced change in the ecosystem. Disturbances can be human-caused or natural.

Natural disturbance: includes any change in the habitat caused by natural pressures, such as strong winds, heavy rains, erosion, landslides, etc.

Human-caused disturbance includes any change in the habitat originated by the human activity, such as construction, digging, burning, releasing chemicals, coastal development, tourism, humans entering caves, oil spills, etc.

With regard to the Mediterranean monk seal, human-caused habitat disturbances have been here divided into two categories, based on their type, frequency and possibilities for monitoring:

> **Marine pollution**: includes plastic and marine litter, noise (including vessel traffic). Impacts of marine pollution vary according to the type of pollution, as does their possible reversibility. (Note: Oil spills, despite being a major source of pollution when they occur, are punctual disturbances generally managed by the local relevant authorities and their impacts on the seals are addressed on a case-by-case basis).

> **Tourism and coastal development**: includes beach infrastructure, presence of tourists and their intrusion in caves, recreational boats, constructions along the coast. Coastal development provokes direct habitat destruction and fragmentation, which is generally irreversible. Disturbance from tourism activities is reversible when well managed.

Actions

To date, there are no standardised indicators to evaluate habitat disturbance and its impacts on the monk seal. However, data on disturbance at local scale can be useful to engage conservation actions and promote impact measures to mitigate the impacts.

Habitat disturbance monitoring

While monitoring monk seal habitats (beaches, caves, underwater habitats, coastline), visual inspections can be conducted to detect visible disturbances:

- Record every collapse in marine caves, independent of their magnitude.
- Record the presence of litter and other kinds of marine pollution. Details on studying marine pollution impact are found in Factsheet 13.
- Record human presence and every major or minor beach modification (e.g., erosion, coastal development, beach furniture, etc.). Visible disturbances due to tourism can be inferred from the observation of the timing, extension and amount of human tracks observed on the beach, but also from camera-trap recordings in caves (provided that the cameras are placed over the majority of the emerged areas). Disturbance due to aquatic entry into the cave needs other means of assessment. Details on studying tourism impact are found in Factsheet 14.
- Record date, time, and GPS coordinates of each observation.
- If possible, obtain images and/or recordings of the impacted areas.
- If seals are present, record the impact on the seal's natural behaviour and stress levels.

Relevant concrete examples and achievements on the threats are provided in the Recommended readings chapter.

Marine pollution monitoring

FACTSHEET 13

Habitat, Threat

Objective

To study the marine pollution that may affect the Mediterranean monk seal and its habitats to evaluate potential threats.

Associated methods

Factsheets 1, 2, 12.

Actions

Step 1: Selection of monitoring sites

- Select representative sites across different regions, based on the results of the habitat surveys, to ensure comprehensive coverage.
- Consider areas with known pollution sources or vulnerable ecosystems.

Step 2: Data collection and sampling

- Design standardized data collection forms to record pollution-related observations.
- Record pollutants according to their type:

Plastic and debris

- Quantify and record according to pre-defined category types information on all the plastic items observed on the emerged areas of a monitored cave or beach, and those encountered during the aquatic passage into the cave.
- Document any entanglement risks and plastic items too heavy/large to be collected.

Chemical pollution

- Analyse water and sediment samples for chemical pollutants. Monitor the concentrations of pollutants such as heavy metals, pesticides, and other contaminants.
- Assess potential impacts on the Mediterranean monk seal and other marine organisms, such as their prey.

Noise pollution

- Non-invasive methods such as passive acoustic monitoring allow to monitor both the seals' vocalisations' repertoires and anthropogenic noise in areas of monk seal occurrence and understand its impacts on the species. Baseline data on noise pollution is crucial to design adequate mitigation measures.

Step 3: Data analysis and interpretation

- Identify trends and patterns in pollution.
- Conduct analysis to understand pollutant distribution and concentration.
- Interpret findings to assess the impact on the Mediterranean monk seals and their habitat.

Step 4: Continuous improvement

- Continuously review and adapt the protocol based on lessons learned and scientific advances.
- Seek feedback from stakeholders and incorporate suggestions for improvement.

Tourism interactions monitoring

FACTSHEET 14

Threat

Objective

To investigate the interactions between Mediterranean monk seals and tourism activities to understand their impact. This further aims to contribute to the development of sustainable tourism practices that protect and conserve the monk seal population.

Associated methods

Factsheets 1, 2, 12.

Actions

In areas where monk seals and tourism activities overlap, monitoring the impacts requires an integrated approach that combines ecological and socio-economic perspectives. However, evaluating tourism impacts remains inherently challenging in any context, including identifying whether a seal has been disturbed. The method outlined here is designed to address all relevant aspects in a standardised way, but it should be adapted to the specific context of each location.

Step 1: Study area selection

- Identify key regions or specific sites where monk seals and tourism activities coexist (Figure 8).
- Consider areas with varying tourism intensity and different seal populations for comparative analysis.

Step 2: Data collection

- Conduct regular field surveys to observe and document monk seal-tourism interactions.
- Use direct observations, photography, and video recording to capture behavioural patterns and responses of seals to tourist presence.
- Record the number of tourists, tour operators, and their activities in proximity to the seals.

Step 3: Behavioural analysis

- Observe and record monk seal behaviour during various tourism activities (e.g., swimming, snorkelling, boat tours) to assess any changes in their natural behaviour.
- Monitor responses to disturbances, such as changes in resting, foraging, or movement patterns.

Step 4: Disturbance assessment

- Quantify the frequency and intensity of disturbances caused by tourism activities on monk seals.
- Categorize disturbances based on direct (e.g., physical contact, noise) and indirect (e.g., displacement, stress) impacts.

Step 5: Tourist perception surveys
- Administer surveys to tourists to gather insights into their awareness and attitudes towards monk seals and their conservation.
- Explore their understanding of responsible wildlife interactions and potential willingness to support conservation efforts.

Step 6: Stakeholder interviews
- Conduct interviews with local stakeholders, including tour operators, environmental NGOs, organizations, and government authorities, to understand their perspectives on monk seal-tourism interactions.
- Discuss existing guidelines or regulations related to wildlife tourism in the study area.

Step 7: Impact on seal health and reproduction
- Monitor the health and reproductive status of monk seals in areas with frequent tourism activities compared to less impacted regions.
- Collect biological samples for analysis, such as faecal samples, to assess potential stress levels and health status.

Step 8: Data analysis
- Analyse the collected data using appropriate statistical methods to identify trends, correlations, and potential cause-effect relationships.
- Interpret findings to assess the impact of tourism on the monk seal population and their habitat.

Step 9: Conservation recommendations
- Develop recommendations for sustainable tourism practices that minimize disturbances to monk seals and their environment.
- Collaborate with local authorities and tour operators to implement responsible tourism guidelines.

Step 10: Public Awareness
- Disseminate research findings through scientific publications, reports, and public awareness campaigns.
- Educate tourists, local communities, and stakeholders about responsible wildlife tourism practices and the importance of the Mediterranean monk seal conservation (see Chapter VI).

Figure 8. Coastal zones with monk seal caves highly impacted by tourism activities. Source: Meltem Ok

BOX #7 – When monk seal and human presence overlap

It is important to understand how tourism and coastal development activities overlap with the seals' presence and habitat use. This should be addressed on a case-by-case basis, as the local contexts vary greatly. The management actions to mitigate human-caused impacts will differ between an area with an established seal population where coastal activities are expanding and a highly disturbed area newly colonized by seals.

Similarly, coastal activities such as construction, beach use (e.g., human presence and infrastructure), nearby roads generating noise, nearby harbours and their type, and marine activities (e.g., boating, kayaking, diving, and water sports), vary in their levels of disturbance and should be managed accordingly.

When assessing the suitability of a habitat, its proximity to a disturbance point should be considered and the possible impact on the seals evaluated. There are currently no defined guidelines on this matter and it should be addressed on a case-by-case basis.

VI. CITIZEN ENGAGEMENT

Citizen science has proved an effective tool to obtain information on sightings and/or strandings, providing data on presence, behaviour, etc., which can complement existing monitoring efforts, and possibly supporting the identification of areas for future monitoring. It is particularly useful in Low Density Areas, where monk seals are present, but no reproducing populations are established, as citizen-science-based sighting dataflow allows to improve monitoring plans at spatial and temporal scales. When near-real-time sightings are reported, it can be an opportunity to engage on-site monitoring and conservation actions.

This chapter comprises some tools and methods to engage locals in reporting monk seal sightings. Citizen engagement involves taking some important steps:

- Informing the citizens about the ethics and codes of conduct during any interaction with the species (see Chapter IV.2).
- Adapting questionnaires to the stakeholders to reduce bias related to the activity of the respondent. Due to the sensibility of the sector, tools to engage fishers and treat fisheries data are detailed in Factsheet 11.
- Evaluating the reliability of the sighting reports (see Chapter VI.4).

NOTE: Thoughtful handling of information on monk seals' presence and location details is critical to safeguarding the animals from potential pressures or disturbances. Sharing information responsibly is crucial to mitigating any unintended negative impacts on the species.

The network of monk seal experts is available for guidance on how to maximise the results of citizen engagement campaigns and can provide existing informative materials (see Chapter I.2). A communication strategy to maximise the Mediterranean monk seal conservation is under development by a group of international experts.

1. Establishing citizen-science programmes

A citizen-science network can be built to support data and sample collection programs. For instance, citizen-science initiatives can be set up through public and/or institutional communication channels to collect information on seal sightings by engaging local stakeholder categories that may come into contact with a seal in areas characterised by potential or known monk seal habitat (e.g., representatives of port authorities, Marine Protected Area management bodies, organisations and cooperatives acting in the local communities, marine recreational activity groups such as sport fishing and diving clubs, artisanal fishermen organisations, etc.). Specific stakeholder categories can also be engaged to collect specific physical information or samples (e.g., marine recreational stakeholder groups that will voluntarily collect water samples for e-DNA analysis used to infer potential monk seal distribution ranges).

Regardless of what the objective be, there are some suggested steps that should be considered when conducting such initiatives.

Step 1: Design and planning
- Clearly define the research question or objective that citizen scientists will help address.
- Identify the target population of citizen scientists and the scope of the project.
- Determine the data collection methods and tools that will be used.
- Establish a timeline for the project and set clear milestones.

Step 2: Identifying citizen scientists or recruitment and training
- Develop a clear and accessible recruitment strategy to engage participants.
- Provide training materials or workshops to ensure citizen scientists understand the project's purpose, protocols, and data collection techniques.
- Encourage open communication channels for questions and support during the project.

Step 3: Data collection
- Design data collection forms or platforms that are user-friendly and align with the research objectives. Some online platforms are in place (see the Ionian Dolphin Project “Report a sighting” programme).
- Instruct citizen scientists on the correct procedures for data collection and ensure they have access to necessary tools and equipment. See Chapter VI.3 for handling live reports.
- Implement a mechanism for quality control and data validation, such as peer-review or expert verification (see VI.4).

Step 4: Data management
- Establish a secure and organized data storage system.
- Create a data entry process to efficiently transfer collected data into the database.
- Ensure proper anonymization and personal data privacy protection.

Step 5: Data analysis
- Develop a clear analysis plan that addresses the research question and data collected.
- Utilize appropriate statistical or analytical methods based on the data types and research objectives.
- Collaborate with experts or researchers to validate findings and draw meaningful conclusions.

Step 6: Community engagement and communication
- Foster a sense of community among citizen scientists through regular communication, updates, and events.

Promote a feedback loop, allowing participants to provide suggestions or improvements to the project.
- Facilitate public engagement by sharing the project's outcomes through social media, public talks, or workshops.

Step 7: Evaluation and continuous improvement
- Conduct regular evaluations of the project's effectiveness and impact.
- Gather feedback from citizen scientists and researchers to identify areas for improvement.
- Use insights from evaluations to refine the protocol and enhance future citizen science projects.

2. Organising awareness-raising and capacity-building programmes

Effective informative programmes aim to increase knowledge on a particular topic and to equip attendees with skills relevant to that topic. This promotes and generates a sense of responsibility and commitment, in this case, towards the conservation of the Mediterranean monk seal, contributing to the species' long-term survival and the protection of its natural habitat.

Step 1: Define the target audience
- Identify specific target groups for the educational programme, such as local communities, tourists, school children, and fishers.
- Tailor the programme content and delivery methods to meet the needs of each group.

Step 2: Develop educational materials
- Create engaging and informative educational materials, including brochures, posters, infographics, and audio-visual content.
- Ensure the materials are visually appealing, culturally sensitive, and accessible to diverse audience.

Step 3: Collaborate with local stakeholders
- Engage with local NGOs, community leaders, schools, relevant authorities, and interested local people to gain support and access to the target audience.

Step 4: Monitor and evaluate
- Implement pre- and post-programme surveys to assess changes in knowledge, attitudes, and behaviours.
- Regularly monitor programme effectiveness and adapt strategies accordingly.
- Foster partnerships with educational institutions, tourism agencies, and local businesses to ensure the continuity of educational efforts.

Step 5: Celebrate achievements
- Acknowledge and celebrate the achievements and contributions of participants in raising awareness about the Mediterranean monk seal.
- Organize events to showcase success stories and inspire continued engagement.

Examples of awareness-raising and capacity-building programmes are found below:

Workshops and Training
- Conduct workshops and training sessions for local educators, tour guides, and community members to enhance their understanding of the Mediterranean monk seal and conservation methods.
- Equip participants with skills and resources to effectively deliver educational messages.

Awareness campaigns
- Launch awareness campaigns in coastal communities, popular tourist destinations, and schools.
- Utilize social media, local media outlets, and community events to promote the programme and attract participants.

Field trips and beach visits

- Organize field trips and beach visits to observe Mediterranean monk seals and their habitats complying with responsible seal watching guidelines.
- Accompany participants with knowledgeable guides to provide first-hand experiences and insights.

Interactive presentations and activities

- Conduct interactive presentations and activities to actively engage the audience.
- Use storytelling, games, quizzes, and role-playing to make the learning process enjoyable and memorable.

3. Live monk seal sighting reports

Live sighting and stranding reports rely on establishing a solid network of citizens that are willing to report sightings. Make sure to provide updated and regularly employed contact coordinates to receive the reports.

When a live or near real-time sighting is reported (e.g., call, social media), the following minimum information should be collected:

– Date and time
– Location: as precise as possible (provide the GPS coordinates if possible) and a brief description of the environment and conditions (e.g., beach/cave, wavy/calm sea, human presence, debris…)
– Information on the seal: how many, presence of pups, physical condition, signs of distress, behaviour…
– Images and/or recordings (if possible)
– Other relevant information such as interactions with tourists, beach furniture, boats, etc.

In case the seal is found in its natural habitat (cave, water surface, beach) in apparent or assumed good health conditions (i.e., not showing distress or injuries), ensure disturbance is minimal (see Chapter IV.2). Contact the experts (see Chapter I.2) to obtain guidance on which actions to engage.

In case of stranding, the monk seal may be found showing signs of distress (e.g., entangled, injured) or dead. It is necessary to obtain as much information as possible about the event from the reporter. When possible, directly go to the stranding location to engage with witnesses to obtain additional information and, if necessary, support rescue actions or necropsies. In any case:

- Stay at a safe distance from the animal and keep bystanders away. More details in Chapter IV.2.
- Contact the focal point of the national stranding network or the monk seal expert (see Chapter I.2) and follow their instructions.

Occasionally, due to the accessibility of the location, logistics, decomposition state, experts' availability to go to the site, or other reasons, samples may be collected under the expert's request and guidance. However, it is always advisable for a veterinary to collect these types of samples.

In case of rescue

The premise is to avoid rescuing, except when absolutely necessary. Decisions must not be made solely on-site, and explicit approval from the local experts or the appointed public authority should be requested.

- If a rescue occurs, the relevant first aid must be provided following the specific clinical protocol (examination of physiological status, rehydration, feeding, etc.).
- Before engaging any intervention with offspring, it is crucial to ensure the mother is not nearby, allowing sufficient time for her possible return, as she may temporarily leave it unattended. If the offspring is in good condition, it must be reintroduced into its original cave as soon as possible, after adequate marking or identification. In most of the cases, the mother will be around. Once reintroduced, the offspring must undergo intensive monitoring using non-invasive techniques to determine its survival.

For each attempt or rescue made, the preparation of a detailed report is necessary.

In case of necropsy

Necropsies provide information about the age, feeding behaviour and causes of death, from which relevant information on the health of the animal (and eventually the population) can be obtained. Necropsies require specific training and animal handling permits, please contact the experts and follow their guidance.

The following points should be considered:

- A corpse can spread disease. Use latex gloves and a mask. Avoid contact with clothing and footwear.
- Images and recordings can help determine the cause of death. If possible, obtain images of:

-Dorsal marks.
-Head marks.
-Lateral marks, especially the lateral line (moisten if necessary).
-Presence of external injuries, bleeding nose or wounds.
-Plastic tags or punctured flippers.

- Follow the expert's guidance for external examination if requested.
- Follow the expert's guidance for sample collection if requested. Ensure the correct labelling and storage of the containers.
- After any contact or proximity to a dead animal, thoroughly wash and disinfect hands and arms with soap and hand sanitizer (70% ethyl alcohol).
- Disinfect the instruments with a 50% bleach solution (mix half bleach and half water) and then rinse them completely with freshwater.

BOX #8 – The stranding location "kit"

When getting to a stranding location, it may be useful to carry a minimum set of equipment to collect samples (only if asked by an expert), containing:

- Spreadsheets and writing material to collect data
- Charged camera + empty SD card
- Latex gloves
- Hand sanitizer
- Bottle with 50% bleach/water
- Bottle with freshwater
- Metal tweezers, scalpel, pliers, scissors
- Few sample containers (previously sterilized) + labelling material

4. Data reliability

Sighting reports from citizens can be categorised according to the reliability of the information obtained, which determines whether the data can be exploited for further studies or not. Preferably, sightings need to be backed up by images or recordings, and if not available, a thorough scanning of the information should be conducted to validate the data. When provided with a seal sighting photo, it is important to verify the copyright and permitted uses before any further use or distribution.

BOX #9 – False positive and false negative reports

A false negative report is the case in which no encounter is reported when the species was effectively present. A false positive report is the mistaken report of a sighting (e.g., the sighting belongs to a different species). Both can lead to biased outcomes: in the first case it leads to consider the species extinct despite still being present in a specific area/ region, in the second case it leads to overestimate and/or mistakenly record recovery or recolonization.

Photographic documentation is available

When sightings are supported by photographic evidence, the content and quality must be assessed and must clearly allow for the species identification.

- If the animal is on the water surface, look for clearly visible signs, like the head emerging from the surface (e.g., eyes and snout visible), the shape of the sleek body or hind flippers, or recognisable monk seal surface behaviours (e.g., logging, spy hoping).
- If the animal is on land, look for fur patterns like the ventral patch, or the size and shape of the seal's specific body characteristics that will allow to confirm that it is a Mediterranean monk seal (i.e., pelage appearance and pattern, shape and proportions of head, snout, vibrissae and flippers, etc.)

Three degree of quality is scored as follows:
1 - **Low quality**: image lacks clear species-identification characterising details. The image is too blurry, light exposure or water reflections are too strong, or the animal moves to fast to clearly identify the species. This material cannot be used.

2 - **Medium quality**: the image allows for the species identification (e.g., clear monk seal shape or behaviour) but the quality of the image is poor (e.g., too light/dark). Individual identification might not be possible.
Medium quality images can indicate the presence of monk seals in a given area and thus be used to support the identification of areas for monitoring.

3 - **High quality**: the image clearly shows species-identification characterising details. The quality is good, with a neat image and good light exposure. The image allows for individual identification, clearly showing the exact shape, size and location of the characterising feature (e.g., scar, marking, etc.).
High quality images can be used to identify and track individuals and can be added to the monk seal catalogue (if any exists in the area).

Photographic documentation is unavailable

Whenever photographic documentation is unavailable, the detailed information must be obtained by interviewing the reporters. Effort must be made to interview in real time or within 24 hours post-sighting. Note that reports of seal sightings generally reflect the distribution of observers in time and space and that are willing to communicate their data, rather than the species' actual distribution and numbers.

The interviewer should first discern how the reporter recognised the monk seal. A brief interview with questions about anatomical and behavioural characteristics should be conducted, guiding the reporter to provide an objective and accurate description of the animal observed, eventually asking for examples (see Mo et al., 2007, 2011). To validate the sighting report, a scoring should be defined on the basis of at least the following criteria (Mo et al., 2007): estimated shape and size proportion of cranium:snout, position and movement of head when swimming on the surface and during dives during observed swimming, position and estimated size of ocular orbits, edge of posterior flippers trailing along water surface during surface swimming, lateral oscillations of posterior body trunk during swimming, proportion of head size with respect to shape of body, shape, estimated size and position of flippers with respect to body, pelage colouration and pattern, described body movement and posture in the water, typology of vocalisation.

Validation should be conducted after having directly interviewed the observer without influencing the reported account contents. Only after having listened to the complete reported account should the interviewer proceed to ask specific questions to clarify behavioural and physical details that may not have been reported in the first instance. The contents of each report and the resulting validation should be stored in a centralised database (see Chapter IV.4) so as to allow considerations over time and space especially because past sighting records may be collected over time, potentially adding value to areas with sparse sightings or with low validation scores. The operator collecting and validating the sighting should have ample scientific and field experience in observing seals and the procedure should be carried out by one or few validators to reduce personal bias.

The validation of sighting events, if conducted with attention, allows to discern seal sightings from false positives involving the observation of species mistakenly assumed by sighters as being seals (see Box #9). However, the validation procedure will seldom allow to discern vagrant seal species, which sometimes occur in the Mediterranean, from potential monk seals. All in all, the collection and validation of sighting records is a very useful baseline tool especially for low density monk seal areas where geographical prioritisation of monitoring activities is necessary.

Sighting forms and interviewing protocols for monk seal sightings can be found in Bundone et al. (2019, 2023) and Mo et al. (2011). See Factsheet 11 for fishers' engagement and interviews.

VII. WHAT TO DO WITH THE DATA? – NOTES ON MANAGEMENT ACTIONS

The multiple methods proposed in this document, used alone or combined, aim to provide solid reliable information to support further conservation actions. At present, there is no preferred or standardised action to be undertaken to bring forward the results of the collected data, as it highly depends on the overall context of a given location (including geomorphology, numbers of monk seals, population dynamics, identified threats, socio-economic aspects, etc.). In any case, any initiative needs thorough evaluation with the local experts before starting, to avoid causing negative impacts.

Here are briefly described some existing actions to consider in areas where Mediterranean monk seals are present or likely to be, or where there are signs of population recovery.

Habitat protection and restoration

As the Mediterranean monk seal population recovers, it is likely that the number of individuals looking for less dense habitats in terms of competition for food and space will increase. Efforts should include, among others:

- The preservation of potential habitats (caves, beaches) in regions where the species apparently no longer exists or in Low Density Areas. This aims to ensure natural re-colonisation and thus, to guarantee genetic flow between distant regions throughout the Mediterranean Basin (Panou et al., 2023).
- The engagement of the local communities neighbouring the monk seal re-colonisation areas to prepare citizens for future co-existence with the species. This involves conducting preliminary studies to assess the local's perception and acceptance of the species, organise awareness-raising campaigns, establish a sighting network, etc. (see Chapter VI).
- The promotion of beach and shoreline conservation actions, such as beach clean-ups, marine litter removal, reduction of beach infrastructure, etc. These can be carried out engaging local communities (see Chapter VI).

NOTE: In cases where natural caves have collapsed sections, the potential for restoration can be explored. However, altering the natural internal features of coastal caves is strongly discouraged. The creation of artificial shelters may be considered only as a last resort, if cave restoration is not feasible and no other options exist, following careful and thorough evaluation.

Priority should be given to habitat protection over reconstruction activities to support the natural re-establishment of the population. Reconstruction efforts can introduce disturbances into habitats where they did not previously exist, potentially leading to unintended negative consequences.

Translocation initiatives

Conservation translocations of wild species must yield quantifiable conservation benefits for both the species and the ecosystem it occupies. It is an intervention that must be thoroughly studied and justified, defining clear objectives and identifying its challenges and risks (IUCN/SSC, 2013).

In the case of the Mediterranean monk seal, to date, translocation initiatives have only taken place in the Cabo Blanco peninsula in Mauritania, where the population is healthy enough to allow for the translocation of some individuals to other sites. To know more about this initiative, see the projects led by CBD-Habitat.

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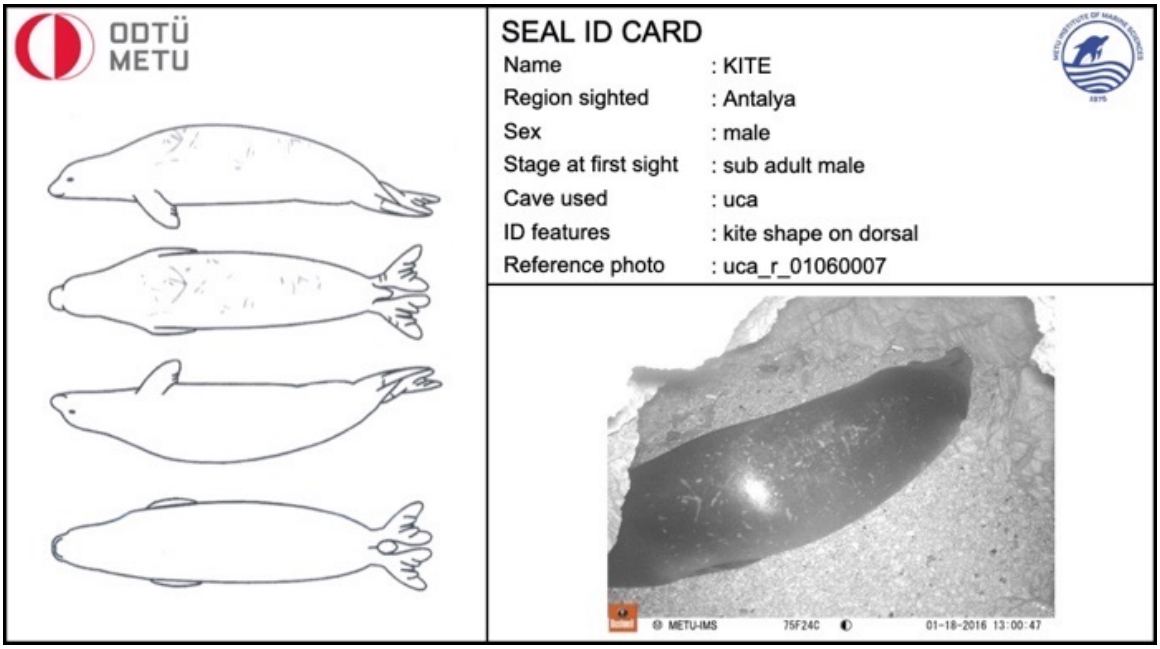
Annexes

Annex I. Examples of monk seal profiles from catalogues

A) Example of a monk seal ID-card from a catalogue (Source: METU)



B) Example of a monk seal profile from a catalogue (Source: Archipelagos)

Code N°/View	Stage	Location/s	Additional Info
Name	Gender	Additional Info	Captures/Recaptures

Annex II. Example of data recording form for faeces collection (source: Bundone et al, 2024)

Recording form for the collection of faecess (MS-MPs project)

(Please fill in as much as possible)

Name of recorders:

Date of sampling (dd/mm/yy): Location (Lat/long):

Cave number: Wind (Beaufort scale): Wind direction: Cloud (%):

Sea state (Douglas scale): Water depth (m): Visibility: Temperature (°C)

Water: Air:

Human activities in the area:

Fisheries: Tourist:

Number of boats: Tourist boats: Yes ☐ No ☐ Num:

Small (<12m): Medium (12-24m): Large (>24m): Tourist close to caves: Yes ☐ No ☐

Type of fisheries: Divers: Yes ☐ No ☐

Presence of seals:
(Indicate if young, juvenile or adult)

Observations related to seals

Evidence of debris in the area:				Evidence of debris in the cave:			
Plastic: Yes ☐ No ☐ Num:		No plastic: Yes ☐ No ☐ Num:		Plastic: Yes ☐ No ☐ Num:		No plastic: Yes ☐ No ☐ Num:	

Number of faecess collected

Storage
Plastic: Foil:

Observations/Notes:

Photos taken:

Annex III. Example of a monk seal sighting form (source: Archipelagos)

1/2

MEDITERRANEAN MONK SEAL

The No. 1 endangered marine mammal of Europe

By sharing your experiences you actively contribute to the conservation of the monk seal!
This information is extremely valuable. Personal data will be treated confidentially.
Thank you very much for your cooperation!

MONK SEAL OBSERVATION DATA

Observer's name: ..... Address (optional): .....

Occupation: fisher / resident / researcher / tourist / sailor / other / specify: .....

Observer's position: land / vessel / aquaculture / other / specify .....

Date of sighting: ..... Time ..... Duration: ..... Number of animals: .....

Region's name: ..... (land, island, off shore, etc.)

Precise location or position (cap, bay, etc.): ..... Closest town/village: .....

ANIMAL No. 1 Photos/videos available? .....YES/NO.....

At sea: approximate distance from observer: ...m From shore: ...m On land: inside cave/beach/rocky coast/other....

State and condition of the animal: normal / injured / ill / dead (corpse fresh / decaying) / unknown

Size class of the animal: up to 1,0 m 1,5 m 2,0 m 2,5 m .....

Colour: black / brown / dark grey / light grey / beige / whitish / unknown / other .....

Marks and description: spots / scars / patches / other .....

Behaviour: swimming / diving / foraging / feeding / resting / sleeping / other .....

ANIMAL No. 2 Photos/videos available? .....YES/NO.....

At sea: approximate distance from observer: ...m From shore: ...m On land: inside cave/beach/rocky coast/other....

State and condition of the animal: normal / injured / ill / dead (corpse fresh / decaying) / unknown

Size class of the animal: up to 1,0 m 1,5 m 2,0 m 2,5 m .....

Colour: black / brown / dark grey / light grey / beige / whitish / unknown / other .....

Marks and description: spots / scars / patches / other .....

Behaviour: swimming / diving / foraging / feeding / resting / sleeping / other .....

Registration, Date: ..... Registered by: .....

In case you observed more than two animals together, for more details, for seals-fisheries interaction and for any other comments please use the space on the second page.

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Data on seals - fisheries interaction:

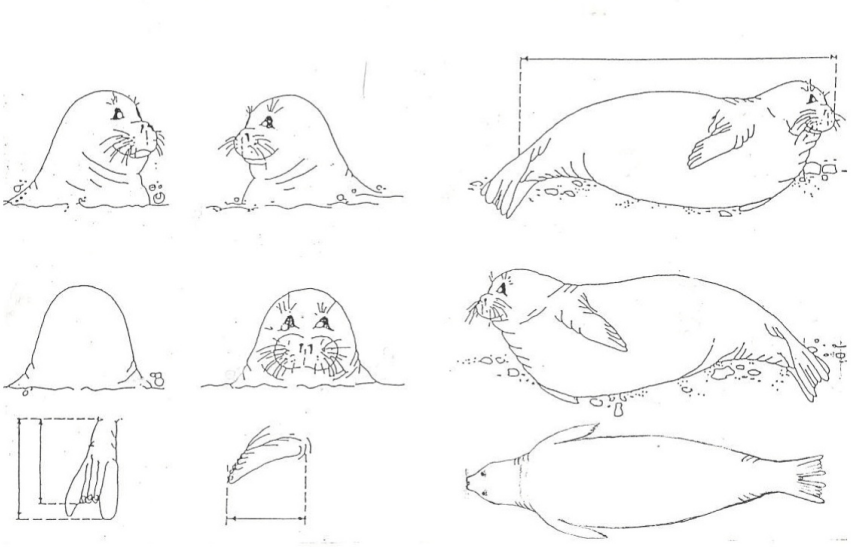
Seal(s) at gear: YES/NO Damage: YES / NO / unknown Remarks: ……

Type of gear: trammel nets / gill nets / bottom long lines / trawler / purse seines / other……

Fish eaten (species): ……

Gear damaged: ……

Please indicate detailed characteristics in the sketches by UNEP (size/colour/marks)



If possible, please draw a map of the sighting's location or insert a google map with the location pinned	Space for data about more animals sighted together or for pictures

Annex IV. Example of questionnaire for fishers (source: Papageorgiou et al. (2023)

1/5

Questionnaire for the structured interviews

Investigating the interactions between coastal fisheries and the Mediterranean monk seal

Consent Statement

Dear participant, please note that by participating in the survey you confirm that you have read/heard the following excerpt on GPDR and give your explicit consent for collecting and using your personal data. The collection of personal information is intended only for the express purpose of contacting you in case of follow-up questions or clarifications. The survey scientists are committed to respect and protect the privacy of the personal data collected. The survey scientists regard your personal data as confidential information and will never communicate it to third parties. Your personal data will be processed strictly in accordance with Regulation (EC) No 2016/679 of 27 April 2016. You may withdraw from this survey at any given time without any consequences and you may notify the scientific team to withdraw your completed questionnaire from the research at any given time.

The following survey aims to understand the interactions between small-scale fisheries and the Mediterranean monk seal in Cyprus.

Interviewer:

Date:

Port:

Questionnaire ID:

Part A – General information of fishing vessel characteristics and fisherman	
Vessel characteristics	
1. Total length (m)	
2. Engine power (Kw)	
3. Gross tonnage (GT)	
4. Port of registration	
Fisherman's information	
5. Age	
6. Years in profession	
7. Are you the vessel owner?	
8. Level of education	
9. Is this your main profession?	

10. Do you have any other source of income?	
11. Are you from a family of fishermen?	
12. Main gears used in fishing operations	
13. Secondary gears used in fishing operations	

Part B – Information on last 12 months
14. How many monk seals have you observed/caught in the last 12 months? a. Observe.....(move to question no. 15) b. Catch..... (move to question no. 15) c. None (move to Part C)
15. Where did you observe/catch it? (show map, collect information of coordinates if possible) a. Record (a): ..... b. Record (b): ..... c. Record (c): ..... d. Record (d): .....
16. When did you observe/catch it? a. Record (a): ..... b. Record (b): ..... c. Record (c): ..... d. Record (d): .....
17. At which depth did you observe/catch it? a. Record (a): ..... b. Record (b): ..... c. Record (c): ..... d. Record (d): .....
18. What was the distance from the shore? (in meters) a. Record (a): ..... b. Record (b): ..... c. Record (c): ..... d. Record (d): .....
19. Which was the life stage of the individuals observed/caught? (Show illustrations: pup, juvenile, adult) a. Record (a): ..... b. Record (b): ..... c. Record (c): ..... d. Record (d): .....
20. What was the interaction with fishing gear? (Entanglement, depredation, swimming nearby, none, other(specify)) a. Record (a): ..... b. Record (b): ..... c. Record (c): ..... d. Record (d): .....
21. What was the condition at capture? (Alive/Dead/ Injured/ Unknown) (if not capture, move to Part C)

a. Record (a): .....
b. Record (b): .....
c. Record (c): .....
d. Record (d): .....

22. What was the condition at release? (Alive/Dead/ Injured/ Unknown)
a. Record (a): .....
b. Record (b): .....
c. Record (c): .....
d. Record (d): .....

Part C – Information on population size and bycatch

Part 1 – Population size

23. Which season(s) do you most often observe monk seals	24. Estimation of population size at your area	25. Cause problems? (Yes/No)

Part 2 – Bycatch

26. Did you ever catch a monk seal on fishing gear? (Yes/No). If yes, state a number (Q. 27). If no, move to part D		27.	
28. Which season(s) do you most often catch monk seals	29. How frequent* do you catch a monk seal	30. Area(s)	31. Gear type

32. What was the condition at capture?
a. Alive
b. Dead
c. Injured
d. Unknown

33. What was the condition at release?
a. Alive
b. Dead
c. Injured
d. Unknown

**Frequency: Rarely, Sometimes, Often, Always*

Part D – Information on the interaction between top predators and fisheries

34. Specify the interaction that you have faced
a. Scare and drive away fish

Yes ☐ No ☐

b. Take fish from nets

Yes ☐ No ☐

c. Cause damage to the catch

Yes ☐ No ☐

d. Cause damage to gear

Yes ☐ No ☐

35. How do you identify if the damage is caused by monk seals?

.....

.....

36. Which species do monk seals prefer to depredate?

.....

.....

37. On which fishing gear do monk seals prefer to depredate?

.....

.....

38. At what depths do monk seals prefer to depredate on catch?

.....

.....

39. Do monk seals have preferred locations/habitats? (e.g. Posidonia meadows, rocky bottoms)

.....

.....

40. How often do monk seals depredate on catch?

a. Rarely
b. Sometimes
c. Often
d. Always

41. Do you take any measures to mitigate the interaction with monk seals

a. No ☐

b. Yes ☐ (please specify) .....

42. Do think there are any possible solutions to mitigate the interaction with monk seals

    a. No ☐

    b. Yes ☐ (please specify) .....

43. Show on map the areas where you have encountered/observed or bycaught monk seals
    .....

44. Are you aware of any monk seal caves? Show on map known sea caves of monk seals
    .....
    .....

45. Do you see any difference in the numbers of monk seals at your area in the last ten years?
    .....
    .....

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