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22nd Meeting of the Contracting Parties to the
Convention for the Protection of the Marine Environment
and the Coastal Region of the Mediterranean and its Protocols

Antalya, Turkey, 7-10 December 2021

Agenda Item 3: Thematic Decisions

Draft Decision IG.25/13: Action Plans for the conservation of species and habitats under the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean

UNEP/MAP
Athens, 2021

Note by the Secretariat

By Decision IG.24/07 of their 21st Meeting (COP 21) (Naples, Italy, 2-5 December 2019), the Contracting Parties requested the Secretariat to work during the biennium 2020-2021 to update the Action Plan for the conservation of cetaceans in the Mediterranean Sea and the Action Plan for the conservation of habitats and species associated with seamounts, underwater caves and canyons, aphotic hard beds and chemo-synthetic phenomena in the Mediterranean Sea (Dark Habitats Action Plan).

By Decision IG.24/14 of COP 21 (Naples, Italy, 2-5 December 2019), the Contracting Parties requested SPA/RAC to identify the first elements for elaborating the list of Reference of Pelagic Habitat Types in the Mediterranean Sea with a view to submitting them to the Contracting Parties at their 22nd Ordinary Meeting.

The Action Plan for the conservation of cetaceans in the Mediterranean Sea and the Action Plan for the conservation of habitats and species associated with seamounts, underwater caves and canyons, aphotic hard beds and chemo-synthetic phenomena in the Mediterranean Sea (Dark Habitats Action Plan) are evaluated and updated every five-year period.

The proposed updated Cetaceans Action Plan has a reviewed structure in line with what has been adopted for the other Regional Action Plans. It is enriched with new sections related to the presentation of cetacean species occurred in the Mediterranean, threats they are facing as well as legislation and agreements for their protection at regional level. In addition, the objective of the Action Plan and the coordination structures have been updated to be in line with decisions adopted by international bodies such as ACCOBAMS, the Pelagos Sanctuary Agreement and the International Whaling Commission (IWC). The priorities and obligations prescribed in the former version (2015) have been further developed to take into consideration the evolving regional context regarding cetacean conservation, new challenges and priorities as identified by the most recent scientific knowledge as well as the UNEP/MAP Decision IG22/7 on the Integrated Monitoring and Assessment Programme and related Assessment Criteria (IMAP). The actions outlined are grouped into four categories: Education and Awareness, Capacity Building, Research and Monitoring, and Management and are reflected in an implementation time schedule. SPA/RAC collaborated closely with the Secretariat of ACCOBAMS in updating the Action Plan given the strong linkages with the implementation of ACCOBAMS agreement in the Mediterranean.

The proposed updated dark habitats Action Plan includes updates in its structure, it distinguishes now between cave habitats and deep habitats. It is also aligned with the monitoring requirements of the MAP Ecological objectives, IMAP and its related monitoring Protocols and considers new scientific knowledge on the related habitats and in its monitoring sections. It includes 5 new activities in the implementation workplan to be implemented at national and regional levels for the next 5 years.

Regarding the update and adjustment of the work timetables of the Action Plan for the conservation of cetaceans in the Mediterranean Sea and the Action Plan for the conservation of habitats and species associated with seamounts, underwater caves and canyons, aphotic hard beds and chemo-synthetic phenomena in the Mediterranean Sea (Dark Habitats Action Plan), an assessment of their implementation has been done at national and regional levels.

The assessment of the implementation of the Action Plans has considered SPA/RAC and Contracting Parties activities achieved during the last biennia (since 2015) as requested by the adopted work timetables.

Relevant Multilateral Environment Agreements, regional organizations and institutions as well as Partners to these Action Plans were also invited to report on their activities for the conservation of these species.

At their 15th Meeting (Videoconference, 23-25 June 2021), the SPA/BD Focal Points reviewed and endorsed the draft updated Action Plan for the conservation of cetaceans in the Mediterranean Sea and the draft updated Action Plan for the conservation of habitats and species associated with seamounts, underwater caves and canyons, aphotic hard beds and chemo-synthetic phenomena in the Mediterranean Sea (Dark Habitats Action Plan) and invited SPA/RAC to submit them to the MAP focal points meeting and to the COP 22 for consideration.

At their 21st Ordinary Meeting (Naples, Italy, 2-5 December 2019), the Contracting Parties, requested SPA/RAC to identify the first elements for elaborating the list of Reference of Pelagic Habitat Types in the Mediterranean Sea with a view to submitting them to the Contracting Parties at their 22 COP (Decision IG.24/14).

During their 15th Meeting (Videoconference, 23-25 June 2021), the SPA/BD Focal Points reviewed the first elements to elaborate the list of Reference of Pelagic Habitat Types in the Mediterranean and recommended to the MAP focal points and COP 22 to invite SPA/RAC to establish a multidisciplinary group of experts, to be designated by Contracting Parties, to elaborate the list of Reference of Pelagic Habitat Types in the Mediterranean for consideration by COP 23.

The Draft Decision on Action Plans for the conservation of species and habitats under the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean was submitted to and reviewed by the Meeting of the Mediterranean Action Plan (MAP) Focal Points 2021 (Teleconference, 10, 13, 14, 15 and 17 September 2021) that decided on its transmission to the 22nd Meeting of the Contracting Parties (COP 22) (Antalya, Turkey, 7-10 December 2021)

The implementation of this Decision is linked to all Outcomes of the Foundational Programme on "Governance" of the proposed Programme of Work 2022-2023. It has budgetary implications on MTF and external resources, reflected in the proposed total budget of 50 000 € on MTF and 152 000 € on secured external funds.

The present Decision relates to the following outputs of the UNEP/MAP Programme of Work and Budget 2022-2023: Output 2.1.1. Promote the implementation of the UN Decade on Ecosystem Restoration in the Mediterranean: Identify innovative actions, capitalize and promote replication, Output 2.3.1. Implement regional and national actions to boost the implementation of the Action Plans on marine key habitats, Output 2.3.3. Implement conservation measures and share best practices related to threatened and endangered species listed in Annex II to SPA/BD Protocol, Output 2.4.1. Update and implement the regional action plan on non-Indigenous species (NIS) and species introductions, as well as targeted measures of the Mediterranean Strategy on Ships Ballast Water Management and Action Plan and Output 6.2.1. Strengthen the implementation of national IMAP-based monitoring programmes for all clusters and deliver quality assured data.

Draft Decision IG.25/13

Action Plans for the conservation of species and habitats under the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean

The Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean (Barcelona Convention) and its Protocols at its 22nd meeting,

Recalling General Assembly resolution 70/1 of 25 September 2015, entitled "Transforming our world: the 2030 Agenda for Sustainable Development",

Recalling also the United Nations Environment Assembly resolution UNEP/EA.4/Res.10 of 15 March 2019, entitled "Innovation on biodiversity and land degradation",

Having regard to the Barcelona Convention, in particular Article 10 thereof, whereby Contracting Parties shall, individually or jointly, take all appropriate measures to protect and preserve biological diversity, rare or fragile ecosystems, as well as species of wild fauna and flora which are rare, depleted, threatened or endangered and their habitats, in the Mediterranean Sea Area,

Having also regard to the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean, hereinafter referred to as "the SPA/BD Protocol", in particular Articles 11 and 12 thereof, addressing national and cooperative measures for the protection and conservation of species,

Recalling Decision IG.22/7, on the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria, adopted by the Contracting Parties at their 19th Meeting (COP 19) (Athens, Greece, 9-12 February 2016),

Recalling also Decision IG.24/07, on Strategies and Action Plans under the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean, including the SAPBIO, adopted by the Contracting Parties at their 21st Meeting (COP 21) (Naples, Italy, 2-5 December 2019),

Taking into account the results of the assessment of the status of implementation of the Regional Action Plan for the conservation of cetaceans in the Mediterranean Sea and the Dark Habitats Action Plan, as well as the first elements for elaborating the list of Reference of Pelagic Habitat Types in the Mediterranean Sea,

Committed to further streamlining the Mediterranean Action Plan Ecological Objectives and associated Good Environmental Status and Targets, as well as the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria into the Regional Action Plans for the conservation of endangered and threatened species and key habitats adopted within the framework of the SPA/BD Protocol,

Recalling the mandate of the Regional Activity Centre for Specially Protected Areas (SPA/RAC), as laid down in Decision IG. 19/5 on the Mandates of the Components of MAP, adopted by the Contracting Parties at their 16th Meeting (COP 16) (Marrakesh, Morocco, 3-5 November 2009), and its relevance to the implementation of this Decision,

Having considered the report of the 15th Meeting of Specially Protected Areas and Biological Diversity Focal Points (Videoconference, 23-25 June 2021),

1. *Adopt* the Action Plan for the conservation of cetaceans in the Mediterranean Sea and the Action Plan for the conservation of habitats and species associated with seamounts, underwater caves and canyons, aphotic hard beds and chemo-synthetic phenomena in the Mediterranean Sea (Dark

Habitats Action Plan), as updated and set out in Annexes I, and II to this Decision (updated sections in grey);

2. *Urge* the Contracting Parties to take the necessary measures for the effective implementation of the Action Plans and to report on their implementation, using the online Barcelona Convention Reporting System;

3. *Request* the Secretariat (SPA/RAC), in coordination with other relevant regional and international organizations, where appropriate, to continue to provide technical support to Contracting Parties for the effective implementation of the Action Plans, through technical cooperation and capacity building activities, including resource mobilization activities;

4. *Request* the Secretariat (SPA/RAC) to update:

- The Action Plan for the conservation of bird species listed in Annex II of the SPA/BD Protocol in the Mediterranean based on its implementation progress at national and regional levels, and to suggest adjustments to its implementation timetable to maintain them in favourable status of conservation,

- The Action Plan concerning species introduction and invasive species in the Mediterranean Sea to address the impact, on biodiversity and ecosystem integrity, of non-indigenous species and invasive non-indigenous species,

and submit them for consideration of COP23;

5. *Invite* the Secretariat (SPA/RAC) to establish a multidisciplinary group of experts nominated by the Contracting Parties to define parameters allowing to use phytoplankton and zooplankton for relevant IMAP biodiversity indicators and elaborate the List of Reference of Pelagic Habitat Types in the Mediterranean Sea so that it can be used, where necessary, as a basis for identifying reference pelagic habitats to be monitored and assessed at the national level under the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria for consideration of COP 23.

Annex I

Action Plan for the conservation of cetaceans in the Mediterranean Sea

Action Plan for the conservation of cetaceans in the Mediterranean Sea

1. The Contracting Parties to the Barcelona Convention, within the framework of the Mediterranean Action Plan, give priority to the conservation of the marine environment and to the components of its biological diversity. This was confirmed by the adoption of the 1995 Barcelona Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol) and of its annexes, among them a list of endangered or threatened species.
2. Elaborating and implementing action plans to conserve one species or group of species is an effective way of guiding, coordinating and strengthening the efforts the Mediterranean countries are making to safeguard the natural heritage of the region. Although they do not have a binding legal character, these action plans were adopted by the Contracting Parties as regional strategies setting priorities and activities to be undertaken. In particular, they call for greater solidarity between the States of the region, and for co-ordination of efforts to protect the species in question. This approach has proved to be necessary for ensuring conservation and sustainable management of the concerned species in every Mediterranean area of their distribution.
3. These Action Plans constitute mid-term regional strategies that should be updated every five years, based on an evaluation of their implementation at regional and national levels. For the biennium 2020-2021, the Contracting Parties to Barcelona Convention requested SPA/RAC during the CoP 21 (Naples, Italy, 2-5 December 2019) to update the Action Plan for the conservation of cetaceans.
4. This update process was done in close collaboration with ACCOBAMS, given that the common obligations relating to cetaceans under the Protocol on Specially Protected Areas and Biological Diversity in the Mediterranean (SPA/BD Protocol) are fulfilled through the implementation of ACCOBAMS (COP 14, Slovenia 2005) and the new Memorandum of Collaboration between ACCOBAMS and SPA/RAC, signed in Monaco on October 15, 2020, defining the joint ACCOBAMS - SPA/RAC work program for the period 2020-2022.

5. The Mediterranean Sea, *Mare medi terraneum* (Latin for a ‘‘sea in the middle of the land’’), is the largest (2,969,000 km^2) and deepest (average 1,460 m, maximum 5,267 m) enclosed sea on Earth. It is a marine biodiversity hotspot, with approximately 17,000 marine species occurring within its basin (Coll et al, 2010). Its cetacean diversity is also remarkable: twenty-five species of cetaceans occur or have occurred at various degrees of abundance in the Mediterranean Sea. Eleven species occur regularly, with resident populations in the basin (Table 1). In addition, the North Atlantic minke whale *Balaenoptera a. acutorostrata*, the North Atlantic humpback whale *Megaptera n. novaeangliae* and the false killer whale *Pseudorca crassidens* are considered visitors, while the remaining 11 species are very rare (Table 2).

Table 1. **Cetacean species with regular occurrence and resident populations in the Mediterranean Sea and their common names in English, French and Arabic.** (Cetacean names in Arabic are usually direct translation from the English version but some Arabic countries translate the French names instead. When two options are given, the upper name refers to English and the lower to French).

Cetacean species represented by populations regularly present in the Mediterranean			
Species	**English**	**French**	**Arabic**
 *Balaenoptera physalus*	Fin whale	Rorqual commun	الحوت الزعنفي روكال شائع
 *Physeter macrocephalus*	Sperm whale	Cachalot	حوت العنبر
 *Ziphius cavirostris*	Cuvier's beaked whale	Ziphius	حوت كوفيير المنقاري زيفيوس
 *Orcinus orca*	Orca	Orque	الحوت القاتل اوركا
 *Globicephala melas*	Long-finned pilot whales	Globicéphale noir	الحوت القائد جلوبيسيفالوس
 *Grampus griseus*	Risso's dolphin	Dauphin de Risso	دلفين ريسو جرامبوس
 *Steno bredanensis*	Rough-toothed dolphin	Sténo	الدلفين ذو الاسنان الخشنة ستينو
 *Tursiops truncatus*	Common bottlenose dolphin	Grand dauphin	الدلفين زجاجي الانف الدلفين الكبير
 *Stenella coeruleoalba*	Striped dolphin	Dauphin bleu et blanc	الدلفين المخطط الدلفين الأبيض والازرق
 *Delphinus delphis*	Common dolphin	Dauphin commun	الدلفين الشائع
 *Phocoena phocoena relicta*	Harbour porpoise	Marsouin commun	خنزير البحر

Table 2. **Cetacean species occurring, or having occurred, in the Mediterranean Sea. Regular species outlined in grey. Habitat (preferred in bold) and status are indicated only for species recognized as regular.** (Adapted from ACCOBAMS, 2021. Conserving Whales, Dolphins and Porpoises in the Mediterranean Sea, Black Sea and adjacent areas: an ACCOBAMS status report. By Giuseppe Notarbartolo di Sciara and Arda Tonay. *In preparation*.)

	Species/subspecies	English name	Classification	Presence	Habitat	Current status (IUCN)
1	*Eubalaena glacialis*	North Atlantic right whale	Mysticeti, Balaenidae	very rare		
2	*Balaenoptera a. acutorostrata*	North Atlantic minke whale	Mysticeti, Balaenopteridae	Visitor		
3	*Balaenoptera b. borealis*	Northern Sei whale	Mysticeti, Balaenopteridae	very rare		
4	*Balaenoptera p. physalus*	North Atlantic fin whale	Mysticeti, Balaenopteridae	**Regular**	**oceanic**, slope, neritic	Vulnerable
5	*Megaptera n. novaeangliae*	North Atlantic humpback whale	Mysticeti, Balaenopteridae	Visitor		
6	*Eschrichtius robustus*	grey whale	Mysticeti, Eschrichtiidae	very rare		
7	*Physeter macrocephalus*	sperm whale	Odontoceti, Physeteridae	**Regular**	**slope**, oceanic	Endangered
8	*Kogia sima*	dwarf sperm whale	Odontoceti, Kogiidae	very rare		
9	*Hyperoodon ampullatus*	northern bottlenose whale	Odontoceti, Ziphiidae	very rare		
10	*Mesoplodon bidens*	Sowerby's beaked whale	Odontoceti, Ziphiidae	very rare		
11	*Mesoplodon densirostris*	Blainville's beaked whale	Odontoceti, Ziphiidae	very rare		
12	*Mesoplodon europaeus*	Gervais' beaked whale	Odontoceti, Ziphiidae	very rare		
13	*Ziphius cavirostris*	Cuvier's beaked whale	Odontoceti, Ziphiidae	**Regular**	**slope**, oceanic	Vulnerable
14	*Delphinus d. delphis*	common dolphin	Odontoceti, Delphinidae	**Regular**	**neritic, slope, oceanic**	Endangered
15	*Globicephala macrorhynchus*	short-finned pilot whale	Odontoceti, Delphinidae	very rare		
16	*Globicephala m. melas*	North Atlantic long-finned pilot whale	Odontoceti, Delphinidae	**Regular**	**oceanic**, slope, neritic	Endangered (proposed)
17	*Grampus griseus*	Risso's dolphin	Odontoceti, Delphinidae	**Regular**	**slope**, oceanic	Vulnerable (proposed)
18	*Orcinus orca*	Orca	Odontoceti, Delphinidae	**Regular**	**neritic, slope, oceanic**	Critically Endangered
19	*Pseudorca crassidens*	false killer whale	Odontoceti, Delphinidae	Visitor		
20	*Sousa plumbea*	Indian Ocean humpback dolphin	Odontoceti, Delphinidae	very rare		
21	*Stenella coeruleoalba*	striped dolphin	Odontoceti, Delphinidae	**Regular**	**oceanic,** slope	Least Concern (proposed)
22	*Steno bredanensis*	rough-toothed dolphin	Odontoceti, Delphinidae	**regular** in the Levantine Sea, visitor	**oceanic**, **slope**, neritic	Data Deficient (proposed)
23	*Tursiops t. truncatus*	North Atlantic bottlenose dolphin	Odontoceti, Delphinidae	**Regular**	**neritic,** oceanic	Least Concern (proposed)
24	*Phocoena p. phocoena*	North Atlantic harbour porpoise	Odontoceti, Phocoenidae	very rare		
25	*Phocoena p. relicta*	Black Sea harbour porpoise	Odontoceti, Phocoenidae	**regular** in N. Aegean Sea	**Neritic**	Endangered

6. The Mediterranean region has been inhabited by humans for millennia. Among the planet's marine environments, the Mediterranean Sea is one of the most affected by anthropogenic activities. Concentration of human populations and activities around the basin cause substantial impacts to the marine and coastal environments, threatening the structure and function of natural ecosystems and the quality and abundance of natural resources to varying degrees. The State of the Mediterranean Marine and Coastal Environment Report 2012 (UNEP/MAP, 2012) highlighted the following as the major issues requiring coordinated policy and management responses to stop the degradation of the Mediterranean ecosystems: coastal development and sprawl, chemical pollution, eutrophication, marine litter, marine noise, invasive non-indigenous species, over-exploitation, sea-floor integrity, changed hydrographic conditions, marine food webs, and biodiversity. This complex scenario of multiple pressures acting simultaneously puts certain habitats and species at high risk. As very mobile, long-lived vertebrates situated at the highest levels of the marine trophic webs and with very low reproductive rates, cetaceans are among those species at risk. Accordingly, nations bordering the Mediterranean and Black Seas created a legal instrument to ensure the survival of whales and dolphins in the area: The Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and Contiguous Atlantic Area (ACCOBAMS), which came into force in 2001. Besides this, and in addition to national legislation, other European and international regulations are also of relevance, either directly or indirectly, to cetacean conservation (Table 3).

Table 3. European legislations, international environmental agreements and Intergovernmental organisations relevant to cetacean protection in the Mediterranean Sea.

European 	Habitats Directive (1992)	• The directive's overarching goal strives to ensure the "preservation, protection and improvement of the quality of the environment, including the conservation of natural habitats and wild fauna and flora". Cetacean species are listed in annexes II and IV. • Establishes a Community-wide network of nature protection areas known as *Natura 2000* with the aim of assuring the long-term survival of Europe's most valuable and threatened species and habitats. The responsibility for proposing sites for *Natura 2000* lies with the Member States[1].
	Pelagos Sanctuary (1999)	• France, Italy and the Principality of Monaco to create jointly coordinated initiatives to protect cetaceans and their habitats from all sources of disturbance: pollution, noise, accidental capture and injury, disruption etc.
	The Mediterranean Regulation (2006)	• Adaptation of the EU Common Fisheries Policy in the Mediterranean Sea context, by laying out the necessary measures for the sustainable exploitation of fishery resources. • Regulation of the European Parliament and of the Council for fisheries technical measures. Newest version Regulation (EU) 2019/1241.
	Marine Strategy Framework Directive (2008)	• Establishment of a framework within which Member States shall take the necessary measures to achieve or maintain *good environmental status*[2] in the marine environment by the year 2020 at the latest. • Designated to create a synergy with the Habitats Directive for marine protection.
	Barcelona Convention (1976 and 1995)	• "Convention for the protection of the marine environment and the coastal region of the Mediterranean". The Mediterranean Action Plan of the United Nations Environment Programme (UNEP/MAP) acts as its Secretariat. • Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean. • Action Plan for the conservation of Mediterranean cetaceans" (1991)
	Bonn Convention (1979)	• The Convention on the Conservation of Migratory Species of Wild Animals (CMS).
	ACCOBAMS (1996)	• The Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea, and Contiguous Atlantic Area.
	CITES (1973)	• The Convention on International Trade in Endangered Species of Wild Fauna and Flora, also known Washington Convention. • Forbids trade in endangered species (e.g., cetaceans).
	Bern Convention (1979)	• The Convention on the Conservation of European Wildlife and Natural Habitats, also known as Bern Convention. • Places all cetaceans regularly found in the Mediterranean in Appendix I (strictly protected fauna species).

International 	Convention on Biological Diversity (1992)	• Also known as CBD, although not explicitly referring to cetaceans, urges Contracting Parties to develop national programmes that will safeguard their natural heritage and biological diversity.
	UNCLOS (1982)	• United Nations Convention on the Law of the Sea. • It has special provisions for marine mammals (Art. 65: "States shall cooperate with a view to the conservation of marine mammals...").
	GFCM (1949)	• The General Fisheries Commission for the Mediterranean was established under the provisions of Article XIV of the Constitution of the Food and Agriculture Organization of the United Nations (FAO). • Its main objective is to ensure the conservation and the sustainable use of living marine resources as well as the sustainable development of aquaculture in the Mediterranean and in the Black Sea.
	IWC (1946)	• The International Whaling Commission is the global body charged with the conservation of whales and the management of whaling. • Currently 88 member governments from countries all over the world. • Today's IWC works to address a wide range of conservation issues.

7.Main threats faced by cetacean species in the Mediterranean Sea are reviewed below:

II.1. Fisheries Interactions

Bycatch in fishing gear (legal/illegal, ghost nets)

8. Interactions between cetaceans and fisheries in the Mediterranean Sea are probably as old as the first human attempts to catch fish with a net (Bearzi, 2002). Direct fisheries interactions pose a serious threat to the survival of many populations and some species of marine mammals, with bycatch (incidental mortality and injury caused by fisheries from accidental entanglement) being the most acute problem (Read, 2008; Brownell et al. 2019). Various types of fishing gear can lead to cetacean bycatch, including passive and active nets, longlines, traps and discarded or lost nets and lines. More than observed bycatch rates themselves, the evidence of entanglement observed in stranded cetaceans in the past few years shows the strong impact of fisheries on Mediterranean (and Black Sea) cetacean populations (ACCOBAMS, 2019). Additionally, larynx entanglement or laryngeal strangulation has also been shown as a cause of death in dolphins depredating fishing gear. During these depredation events dolphins may swallow the net, which may get wrapped around the larynx, get lodged in the stomach or cut into laryngeal tissue (Đuras Gomerčić et al. 2009).

9. Recently, the incidental catch of cetaceans in Mediterranean fisheries has decreased with respect to earlier periods, when marine mammal bycatch, caused mainly by pelagic driftnets, was relevant (also for other groups of large marine vertebrate species). The use of these nets was banned in 2005, and since then, only a few studies have reported on the bycatch of marine mammals from other fisheries in the Mediterranean Sea.

10. Currently, the types of vessel groups with the greatest rates of interactions with marine mammals seem to be those using set gillnets and trammel nets in coastal areas

11. In terms of species bycatch composition, the recorded species of cetaceans decreased considerably once large driftnets were banned and subsequently dismissed. Currently, medium-small cetacean species, such as the striped dolphin (*Stenella coeruleoalba*), the bottlenose dolphin (*Tursiops truncatus*) and the common dolphin (*Delphinus delphis*) are sporadically found in bycatch reports (GFCM SOMFI 2020)

12. In recent decades, the use of static nets extending to the continental slopes in all coastal fisheries has led to an increased risk of fishing gear loss and thus to unaccounted catches (i.e., ghost fishing). Fishing gear can be lost accidentally during storms, but it can also be abandoned deliberately. In the Mediterranean, despite the scarcity and inconsistency of data on derelict fishing gear, this has been recognized as an issue of major concern. The main impacts of abandoned or lost fishing gear are not only the continued catches of fish, but also of other animals such as whales and dolphins. Additional impacts include alterations of the sea-floor environment (FAO, 2019).

Overfishing and prey depletion

13. The Mediterranean Sea is one of the most intensely fished regions in the world and hosts a substantial fishing fleet comprising an estimated 76,280 fishing vessels, of which small-scale fishing vessels represent approximately 82% (FAO, 2020). The intense fishing effort is depleting fish populations and impacting many vulnerable species, including cetaceans but also sharks, Mediterranean monk seals *Monachus monachus* and sea turtles. Unsustainable fishing has contributed to dramatic ecological changes in the Mediterranean Sea (Sala, 2004), where overfishing is well documented and has had negative effects on prey availability for marine mammals, especially for small cetaceans (Piroddi et al. 2010).

Depredation by cetaceans

14. Fish depredation by dolphins appears to be recurrently perceived by Mediterranean fishers to be causing economic hardship, particularly as far as small-scale fisheries are concerned, by causing damage to fishing gear and disturbing fishing activities (Bearzi, 2002). However, dolphin depredation is not limited exclusively to small-scale fisheries and has been also reported, for instance, in purse seiners in Tunisia and Morocco (Benmessaoud et al. 2018). Ecosystem damage resulting from overfishing and habitat degradation in the Mediterranean Sea has probably exacerbated the perception that dolphins reduce fishery yields (Reeves et al. 2001). Therefore, the economic damage caused by dolphins generates conflict with fishers and, although rarely, may lead to intentional kills in retaliation, as well as to occasional demands for organized culls in some places.

II.2. Intentional Killings

15. In some Mediterranean areas, direct killings and bounties for dolphins represented the first human attempts to solve the problem of depredation and competition, a strategy that was supported by several governments and went on until the late 1960s. Nowadays, approaches to marine mammal control such as culling, or harassment are illegal in most Mediterranean countries and are no longer viewed as appropriate by most fishing organizations. Although direct killings are still occasionally enacted by individual fishers or other people, intentional killings likely do not pose a conservation problem to Mediterranean cetacean populations anymore.

II.3. Ship strikes

16. The Mediterranean Sea is subject to some of the heaviest vessel traffic in the world, with about 30 % of the world's total merchant shipping concentrated within only 0.8 % of the global ocean surface.

17. Collisions with large vessels present a major conservation issue for both fin whales (*Balaenoptera physalus*) (David et al. 2011; Panigada et al. 2006) and sperm whales (*Physeter macrocephalus*) (Di Méglio et al. 2018; Frantzis et al. 2019). Fin whales and sperm whales are listed as Vulnerable (VU) and Endangered (EN) under the IUCN Red List Criteria respectively, underlying the urgent need to reduce and mitigate any anthropogenic pressure. An analysis of stranding and collision records showed that the fin whale is the most vulnerable species to ship strikes in the North-Western Mediterranean Sea. Unusually high rates of ship collisions have been reported for this species in the region, where the minimum mean annual fatal collision rate increased from 1 to 1.7 whales/year from the 1970s to the 1990s. It should also be noted that reported strikes greatly underestimate the true number of strikes. The highest number of collisions with fin whales occur in summer, during their feeding season when they

are more often encountered, and when the traffic in ferries and passenger ships increases in the area. Collisions with fin whales tend to occur predominantly on the main passenger ship routes that cross the basin.

18. Sperm whales also are vulnerable to ship strikes, particularly on the main cargo routes that travel parallel to the Italian and French coastlines and along the Hellenic Trench, where sperm whale occurrence and naval traffic overlap substantially (Frantzis et al. 2019).

II.4. Underwater noise

19. Underwater noise from various maritime activities is recognised as a chronic, habitat-level stressor (Williams et al. 2020) and can adversely affect cetaceans in a number of ways. In the most severe cases, such as extremely high levels of acute noise (e.g., from seismic vessels or drilling projects of the offshore industry), this can result in permanent threshold shift or even tissue damage leading to stranding and death. Both acute and chronic noise - at various spatial and temporal scales - can affect cetaceans through a range of mechanisms, including temporary threshold shifts, spatial displacement and habitat exclusion, masking of sounds relevant to communication and foraging, disturbance and elevated stress levels, and modifications of short-term and possibly long-term behaviour (Southall et al. 2007; Weilgart 2007; Clark et al. 2009; Williams et al. 2020). These may lead to impacts on feeding and energetic balance, as well as on reproduction, potentially leading to population-level consequences. In addition to vessel traffic of all types and purposes (cargo, transport, fishing, tourism, whale watching, research), noisy activities can arise from geophysical exploration, military activities (sonar and explosions), dredging and coastal and offshore development (e.g., offshore windfarms). Potentially, the noise emitted by vessels may also affect the ability of cetaceans to avoid collisions with vessels.

II.5. Disturbance from boat traffic

20. There has been a great expansion of recreational boat traffic and shipping in the Mediterranean Sea in recent decades. The relatively closed nature of the Mediterranean Sea, its densely populated coastlines and prominent presence of tourism likely make cetaceans in this basin particularly susceptible to the impacts of recreational boat traffic and the associated acoustic disturbance. A number of studies demonstrated behavioural changes (including acoustic behaviour) in response to recreational boat traffic in some species (Papale et al. 2011), as well as temporary avoidance of areas with high vessel density of recreational boat traffic (La Manna et al. 2010; Gonzalvo et al. 2014), although a certain degree of tolerance has been also reported (La Manna et al. 2013). In addition to its potential to disrupt foraging, socializing or resting behaviour, as well as increase stress levels (see also 4-Underwater noise), boat traffic may also lead to serious injuries or death from boat strikes, as described above.

II.6. Cetacean-watching (including swimming-with)

21. Invasive approaches of boats (e.g., from cetacean-watching activities or even non-careful research activities) can disturb cetaceans through direct physical presence and/or via emitted noise and may interrupt important behaviours, such as feeding and reproduction (Jahoda et al. 2003). Long-term vessel presence can also exclude animals from preferred habitat (see also 4-Underwater noise).

22. Unregulated cetacean-watching activities, which may grow very fast in some areas, may have detrimental population-level effects, which need to be mitigated and prevented.

23. Close and invasive approaches, such as those related to swim-with operations, should be prohibited in accordance with guidance from ACCOBAMS, the Pelagos Sanctuary Agreement and the IWC, as they may lead to severe disturbance to the animals.

24. It is noteworthy to consider also that Unmanned Aerial Vehicles (UAVs), or drones, have recently emerged as a relatively affordable and accessible method for studying, photographing and filming cetaceans. For many cetacean watching operators this relatively new, rapidly evolving and increasingly

affordable technology is seen as a good opportunity to obtain spectacular images and footage for promoting their business.

II.7. Chemical pollutants

25. Effects of chemical pollutants on cetaceans are varied and can be both direct and indirect. They include immunosuppression (Tanabe et al. 1994), endocrine disruption (Tanabe et al. 1994 ; Vos et al. 2003 ; Schwacke et al. 2012), reproductive impairment (Schwacke et al. 2002) and developmental abnormalities (Tanabe et al. 1994 ; Vos et al. 2003). Pollutants may directly impact abundance through reduced reproduction or survival (Hall et al. 2006; Hall et al. 2017), while indirect effects include impacts on the abundance or quality of cetacean prey. Although organochlorine contamination has generally decreased in several areas, levels in several Mediterranean cetaceans remain alarmingly high (Jepson et al. 2016; Marsili et al. 2018; Genov et al. 2019). Currently, Polychlorinated Biphenyls (PCBs) are likely the greatest contaminant threat to cetaceans (Jepson et al. 2016). Within the Mediterranean Sea, PCB concentrations in bottlenose dolphins, a species widespread across the basin, generally decline from north to south, and from west to east (Genov et al. 2019), in line with a general gradient of human activities in this basin. The Mediterranean Sea may also be particularly vulnerable to contamination by mercury, due to its semi-enclosed nature, as well as the relatively high presence of this heavy metal from both natural and anthropogenic sources (Andre et al. 1991).

II.8. Marine debris (macro/micro)

26. Plastic pollution has become one of the biggest environmental concerns of the Anthropocene, as it represents a major threat to both wildlife and human health. The Mediterranean Sea is one of the most plastic polluted environments. This acute marine pollution might threaten entire ecosystems through its impact on marine fauna (entanglement, ingestion, contamination), eventually impacting the tourism industry and the well-being of Mediterranean populations (Lambert at el., 2020).

27. Different cetacean species may be threatened by marine debris to varying degrees (Baulch & Perry 2014), with deep-diving odontocetes apparently particularly vulnerable to ingestion of plastic macro debris (Simmonds 2012; de Stephanis et al. 2013). Baleen whales such as the Mediterranean fin whale may be especially vulnerable to the ingestion of microplastics due to their feeding mechanisms. The interaction between free-ranging fin whales and microplastics in the Mediterranean Sea and elsewhere has only recently started to be investigated. Fossi et al. (2012) found considerable quantities of microplastics and plastic additives in surface water samples of and adjacent to the Pelagos Sanctuary. More recent studies suggest that debris, including micro-plastics and chemical additives (e.g., phthalates), tend to accumulate in pelagic areas in the Mediterranean (Fossi et al. 2016, 2017), indicating a potential overlap between debris accumulation areas and fin whale feeding grounds. Exposure to microplastics (direct ingestion and consumption of contaminated prey) poses a major threat to the health of fin whales in the Mediterranean Sea. Microplastics have also been found in a number of odontocete species, but the scale of impacts is still poorly understood (Nelms et al. 2019).

II.9. Habitat loss and degradation

28. Habitat degradation can be defined as ‘those processes of anthropogenic origin that make habitats less suitable or less available to marine mammals’ (IWC, 2006). It is often difficult to separate physical degradation of certain activities (i.e., physical damage to the habitat such as coastal development or bottom trawling) from other factors associated with those activities (e.g., high levels of noise resulting from coastal development or trophic web effects). Either way, directly or indirectly human development activities (both coastal and pelagic) in key cetacean habitats can have serious adverse impacts.

29. Reduced habitat quality and loss of critical habitat can be caused by coastal and offshore development, marine engineering, port and dam construction, opening and closing of waterways, and exploitation of marine resources (e.g., resulting in sea floor modifications, changes in water quality, eutrophication and harmful algal blooms). The resulting disruption of cetacean behaviour might compromise an individual’s energy balance and, consequently, population vital rates (e.g., survival and

reproduction). Moreover, when this disruption affects most individuals in a population, it can translate into changes in population dynamics. It has been reported, for instance, that higher intensities of dredging related to a harbour expansion project caused bottlenose dolphins to spend less time in the harbour, despite high baseline levels of disturbance and the importance of the area as a foraging patch (Pirotta et al. 2013).

II.10. Climate change

30. Climate change is now widely recognized as a global issue (IPCC, 2007), which has also been documented in the Mediterranean Sea. Boero and colleagues (2008) reviewed water temperature and salinity levels over the last decades, reporting higher levels throughout the entire Mediterranean Sea, attributable to climate change. The effects of climate change over the Mediterranean Sea have been the subject of several studies (Gambaiani et al. 2009; Lejeusne et al. 2009), with predicted changes in prey availability and distribution over the water column and increases in the presence of alien (exotic) species, due to the 'tropicalization' of the entire area (Bianchi, 2007).

31. As an example, the potential effects of global climate change or ocean acidification on Mediterranean fin whales, largely dependent for feeding on euphausiids such as *Meganyctyphanes norvegica* (Notarbartolo di Sciara et al. 2003), as well as possibly susceptible to an increase in water temperature and salinity (Gambaiani et al. 2009), may strongly influence the entire population, leaving no space to move to northern latitudes.

32. The effects of climate change on Mediterranean cetaceans are currently unknown but cannot be neglected and need further investigation. Impacts may occur because of changes in prey availability, increased intra- and inter-specific competition, potentially increased incidence of pathogens, oceanographic changes or interaction of climate change and fishery pressure (Gambaiani et al. 2009).

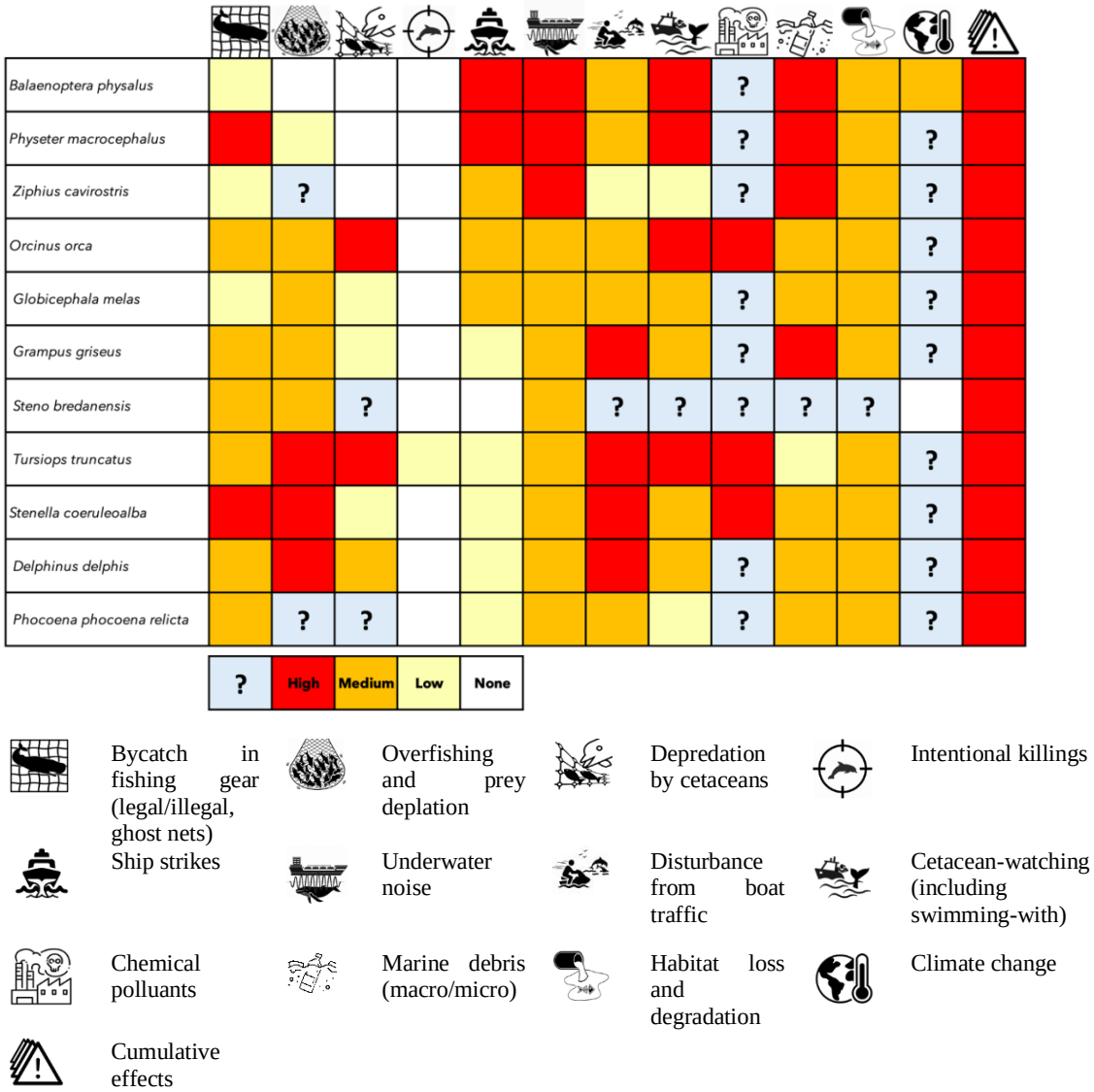
II.11. Cumulative effects

33. The above sections discuss threats individually. However, it is clear that some or all of them may interact temporally and/or spatially.

34. Cumulative effects can be considered as changes in reproduction and/or survivorship that negatively affect population dynamics and status, because of repeated exposure to the same stressor(s) over time, or the combined effects of multiple stressors. Developing robust ways to evaluate this is a complex problem (Stelzenmüller et al. 2018). Perhaps the best-developed framework to date is the Population Consequences of Disturbance (PCoD) model (Booth et al. 2020), which has been extended to consider the Population Consequences of Multiple Stressors (PCoMS) (National Academies of Sciences, Engineering, and Medicine 2017). This approach moves through the effects of stressors on individuals' behaviour and physiology, which is converted to effects on vital rates and then on to population trends and sustainability. However, the approach is extremely data demanding and requires quantitative temporal and spatial information on the target species (distribution, demographics and physiology), their prey and environment, human activities and models linking these - this complexity also contains inherent large levels of predictive uncertainty.

Table 4. Threats faced by cetaceans with a regular occurrence and resident populations in the Mediterranean Sea.

(The attempt to rank threats affecting these 11 cetacean species should be considered as a purely indicative exercise. For instance, some of these threats may be locally high in a given area but considered medium or low at regional level. Moreover, the sparce use of "?" indicating lack of knowledge does not imply that the rest of "ranked" cells have to be considered as definitive, but as stated above, purely indicative based on available evidence).



III. Objective of this Action Plan

35.The main Objective of this Action Plan is to provide a conservation framework and guidance, in line with decisions adopted by international bodies such as ACCOBAMS, the Pelagos Sanctuary Agreement and the International Whaling Commission (IWC), to be used to improve the conservation status of cetacean populations within the Mediterranean Sea.

IV. Methodology

36.According to the IUCN Red List, several cetacean populations in the Mediterranean Sea are Endangered or Threatened. Consequently, measures to enhance their protection and conservation should be considered as priority actions within this Action Plan by all Parties to the Barcelona Convention when defining the best strategies to implement it with the assistance of ACCOBAMS and SPA/RAC.

37.Ongoing efforts at the Mediterranean scale, such as the ACCOBAMS Survey Initiative (ASI), have allowed the collection of robust baseline data on presence, distribution, abundance and density of several

cetacean species. On the other hand, many important aspects of cetacean biology, behaviour, range and habitats in the Mediterranean are still poorly known.

38.In drafting this action plan, references to the ongoing programme of work by ACCOBAMS and by the IWC have been taken into careful consideration. As an example, Conservation and Management Plans should be drafted and implemented for most cetacean species in the Mediterranean Sea, in order to properly manage human activities that may have detrimental effects on cetacean populations.

39.The Action Plan considers the UNEP/MAP Decision IG22/7 on the Integrated Monitoring and Assessment Programme and related Assessment Criteria (IMAP), that aimed at enabling a quantitative, integrated analysis of the state of the marine and coastal environment. IMAP covers three clusters i) pollution and marine litter, ii) biodiversity and non-indigenous species and iii) hydrography. These backbones of the IMAP are the 11 Ecological Objectives and their agreed common indicators, targets and Good Environmental Status (GES) definition. At their 19th Ordinary Meeting (COP 19, Athens, Greece, 9-12 February 2016), the Contracting Parties to Barcelona Convention, when adopting IMAP, stated that species of cetaceans regularly present in the Mediterranean Sea should all be considered when developing the national monitoring and assessment activities. Accordingly, the Contracting Parties should make every effort to identify a minimum of two species (if present) to be included in their national monitoring programme, based on the specificity of their marine environment and biodiversity, and taking account that these species should belong to at least two different functional groups, where possible (Baleen whales/Deep-diving toothed whales/Shallow-diving toothed whales). Moreover, as far as possible, the choice of monitored species should be coordinated at sub-regional scale to ensure coherence with cetacean population distribution in the Mediterranean Sea.

40.Cetaceans are included in two Ecological Objectives of IMAP (EO1 and EO11). EO1 focus on common Indicators 3, 4 and 5 for distribution, abundance, and demography respectively. Most of the actions proposed are expected to provide robust data and inputs relevant for the establishment of a primary, region-wide Standardized Integrated Monitoring and Assessment Programme. Monitoring and assessment of cetacean distribution, abundance and demography at national, sub-regional and regional levels will be used to improve knowledge on the Mediterranean marine environment through the development every cycle of six year a regional assessment product (2023 Mediterranean Quality Status Report (2023 MEDQSR),).

41.While the different actions have not necessarily been specifically designed according to the EcAp/IMAP process, they are aligned with EcAp/IMAP goals and requirements. The data arising from the implementation of each single action will provide key inputs to address the different indicators targeting cetaceans.

V. Regional Coordinating Structure and Implementation

42. The coordinating body is composed by SPA/RAC in collaboration with ACCOBAMS with occasional support/advice from its Scientific Committee, which will be helping by:

- providing support to in the implementation of the AP, its review and update every five years;
- providing recommendations and advice on issues related to cetacean conservation;
- providing support on the creation and maintenance of a forum for cetacean conservation experts, where relevant information and experience is shared, exchanges are facilitated, challenges are discussed, cooperative initiatives are enhanced, transparency and openness of procedures are safeguarded (e.g., NETCCOBAMS);
- Regularly reporting to the National Focal Points for SPAs about the implementation of the present Action Plan;
- ensuring that the Mediterranean region is involved in the pertinent international and/or regional initiatives in relation with cetacean monitoring and conservation.

43. Implementing the present Action Plan is the responsibility of the national authorities of the Contracting Parties. At each of their meetings, the National Focal Points for SPAs shall assess how far the Action Plan is being implemented on the basis of national reports on the subject and a report made by SPA/RAC on implementation at regional level.

44. In the light of this assessment, the Meeting of National Focal Points for SPAs will suggest recommendations to be submitted to the Contracting Parties. If necessary, the Meeting of Focal Points will also suggest adjustments to the schedule that appears in the Appendix to the Action Plan.

VI. Participation in the Implementation

45. Implementing the present Action Plan is the province of the national authorities of the Contracting Parties. The concerned international organisations and/or NGOs, laboratories and any organisation or body are invited to join in the work necessary for implementing the Action Plan. At their ordinary meetings, the Contracting Parties may, at the suggestion of the meeting of National Focal Points for SPAs, grant the status of «Action Plan Associate» to any organization or laboratory which so requests, and which carries out, or supports (financially or otherwise) the carrying out of concrete actions (conservation, research, etc.) likely to facilitate the implementation of the present Action Plan, taking into account the priorities contained therein.

VII. National Action Plan

46. To ensure more efficiency in the measures envisaged in the implementation of this Action Plan, Contracting Parties are invited to establish National Action Plans for the conservation of cetaceans.

47. Each National Action Plan, taking into account the concerned country's specific features, should address the current factors causing loss or decline of cetacean population and their habitats, suggest appropriate subjects for legislation, give priority to the protection and management of marine areas, the regulation of fishing practices and ensure continued research and monitoring of populations and habitats as well as the training and refresher courses for specialists and the awareness-raising and education for the general public, actors and decision-makers.

VIII. Priority Actions

48. The actions outlined in this Plan are grouped into four categories: Education and Awareness, Capacity Building, Research and Monitoring, and Management.

49. In all the actions presented below, there is a section referred to as *Actors* and one as *Evaluation*. In the former, various bodies that may be responsible for the execution and implementation of each action are proposed; this is not meant to be an exclusive or comprehensive list and other actors can be included in a case-by-case basis, depending on the country/region of implementation of the action and its needs (e.g Pelagos Secretariat). Ultimate evaluation of all the actions proposed within this AP is to be carried out by SPA/RAC and ACCOBAMS, as stated above, with support and advice from the ACCOBAMS SC.

50. There are several actions in this Action Plan, and we acknowledge it would be difficult to implement all of them and evaluate their objectives within the next five years. A priority ranking is provided for each action and it is suggested that during the next meeting of the Contracting Parties, these actions are carefully evaluated, their feasibility is considered, and agreement is reached on identifying the actions to be urgently implemented, according to national and international conservation and management priorities.

VIII.1. Education and awareness

VIII.1. INCREASE PUBLIC AWARENESS	
Objective	**Priority** (Low, Medium, High)
To develop a strategy for the timely production of a series of resources to inform citizens of the status and the importance of conservation of Mediterranean cetaceans	Medium
Description	
Aim of this action is to develop a strategy and a series of actions to produce a variety of targeted, accurate, public awareness resources that will inform the general public on the status of Mediterranean cetaceans and on how citizens can assist in conservation efforts, including what they should do if they encounter living or dead individuals. This action refers to a variety of categories of stakeholders for each range state: coast guard, mariners (and their trade associations where applicable), fishers (and their trade associations where applicable), cetacean watching operators, NGOs, research institutes, schools, etc. Outreach should include the use of mass media such as newspapers, radio and television; the internet and social media; public lectures and symposiums; education programmes for teachers and students of all ages; and dissemination of information in written and spoken form in cetacean-watching and other tourism operations. Dedicated smartphone applications could also be developed, or those already existing may be adapted, as necessary.	
Actors	**Evaluation**
Parties to the Barcelona Convention, Ministry of Environment (or equivalent for each country), Ministry of Fisheries, Ministry of Education (or equivalent for each country), NGOs.	SPA/RAC and ACCOBAMS

VIII.2. Capacity building

Ⅷ.2.1. INCREASE AND STRENGTHEN CAPACITY AT THE MEDITERRANEAN LEVEL	
Objective	**Priority** (Low, Medium, High)
To ensure that individuals and relevant management bodies have the motivation, skills and resources needed to implement this plan	High
Description	
The degree of knowledge and expertise throughout the region is unevenly distributed. The transfer of necessary skills is a key step in the process of successfully implementing this AP. Training effort should be diverse and target different aspects of the conservation process, by providing the knowledge needed to conduct adequate research, monitoring and assessment activities on cetacean species and their ecosystems, but also by giving tools to effectively translate the newly acquired information on cetacean distribution and conservation needs into legislative, regulatory and management actions, that will lead to direct conservation benefits. This strategy is to be tailored for each Contracting Party and target groups may vary between countries - while some may be in need of very specific capacity building actions (i.e., training), other may be in a position to play an active role in exchanging of best practices by providing sub-regional training opportunities. Training packages for different approaches to cetacean research (e.g., line-transect surveys, photo-identification, stranding management and sampling protocols, data analysis, etc.) and conservation tools, with the aim of unifying teaching methods, will be designed in synergy with the ongoing activities developed within the EcAp/IMAP process.	
Actors	**Evaluation**
Parties to the Barcelona Convention, the Pelagos Sanctuary Agreement, research institutes, Universities, MedPAN and NGOs	SPA/RAC and ACCOBAMS

Ⅷ.2.2. INCREASE THE CAPACITY OF AND DEVELOP STRANDING NETWORKS THROUGHOUT THE REGION	
Objective	**Priority** (Low, Medium, High)
Set up a pilot project on remote training and advice for stranding networks	Medium
Description	
The Covid-19 pandemic crisis has demonstrated the great potential of remote training and advisory services. This innovative approach can be applied to cetacean stranding capacity building, by setting up	

an online programme based on video tutorials and presentations. While some aspects of training may be carried out remotely, other aspects may be implemented through in-person teaching. These courses can be followed by dedicated personnel going through a final test, which should give access to a formal accreditation (open badge) issued by teaching entities (i.e., universities) and recognized by ACCOBAMS. The course should be tailored depending on resources and skills present in each country. Practical training should be provided for veterinarians and/or biologists by preparing a train-the-trainer program. Training subjects covered by the program will include information on stranding response and management, carcass disposal, data collection and basic post-mortem evaluation, as well as specific instructions on the collection and preservation of samples, related to both life history and histopathology. After compilation of the training, follow-up advice will be provided to support first interventions in stranding events and in more complex cases by using remote support platforms such as WhatsApp, Zoom, etc.

Actors	**Evaluation**
Universities, Research institutes, veterinary professionals, NGOs, already existing and well-established Stranding Networks, SPA/RAC and ACCOBAMS	SPA/RAC and ACCOBAMS

VIII.2.3. INCREASE CAPACITY ON AND DISSEMINATE CETACEAN MONITORING TECHNIQUES	
Objective	**Priority** (Low, Medium, High)
Capacity building on cetacean monitoring techniques, to be complemented with a pilot initiative to facilitate remote training and advice for less experienced researchers	Medium
Description	
Effective national and regional monitoring programmes in line with the EcAp/IMAP process and in synergy with the Marine Strategy Framework Directive (MSFD) are fundamental in setting conservation targets and ensure they are being met. Increasing national and regional capacity for implementing such programmes is therefore of utmost importance. Because institutional and individual capacity in the region is highly uneven and variable, training activities are vital in ensuring wider implementation capabilities and therefore data representativeness. Depending on the specific needs, the methods in question (e.g., boat-based visual surveys, aerial surveys, photo-identification, passive acoustic monitoring) and the level of experience by the trainees, training may be organised in-person, remotely, or as a combination of the two. **Increasing capacity is needed at the level of data collection, data analysis and data publishing.**	
Actors	**Evaluation**
MPA management unit(s), IMAP national committee(s), Universities, research institutes running long-term cetacean monitoring programmes and projects, NGOs	SPA/RAC and ACCOBAMS

VIII.2.4. INCREASE CAPACITY ON AND IMPROVE MONITORING OF THREATS AFFECTING CETACEANS

Objective	**Priority** (Low, Medium, High)
Capacity building on monitoring threats, to facilitate training and advice for less experienced researchers	Medium
Description	
Alongside monitoring of cetacean populations, it is imperative to monitor the threats affecting them. This action is consistent with Action 2.3 and may build into it. As already postulated in Action 2.3, the monitoring capacity is highly uneven across the Mediterranean region and there are clear benefits to carry out capacity building activities to ensure a better data representativeness and region-wide ability to monitor the status of cetacean populations. As with Action 2.3, training activities may be organised through both in-person and remote learning, depending on the specific methodology, threats (e.g., fisheries bycatch, underwater noise, chemical pollutants, etc.) and individual needs in different countries or regions.	
Actors	**Evaluation**
Universities, research institutes running long-term cetacean monitoring projects, National IMAP Committee(s)[1], NGOs	SPA/RAC and ACCOBAMS

VIII.3. Research and Monitoring

Ⅷ .3.1. CETACEAN BYCATCH – IMPLEMENTATION OF LESSONS LEARNT BY MEDBYCATCH PROJECT THROUGHOUT THE MEDITERRANEAN	
Objective	**Priority** (Low, Medium, High)
Implementing lessons learnt from the MedBycatch project throughout the Mediterranean	High
Description	
The scope of the on-going MAVA funded MedBycatch Project is to monitor and mitigate incidental catches of vulnerable species (Marine Mammals, Sharks, rays, seabirds, marine turtles, corals and sponges) and reduce fishing impacts and pressures on marine habitats and species. Phase 1 (Sept. 2017 - Jun. 2020), involving Morocco, Tunisia and Turkey generated several outputs, among them a protocol on Monitoring the incidental catch of vulnerable species in Mediterranean and Black Sea Fisheries: Methodology of data collection, an Identification guide of vulnerable species incidentally caught in Mediterranean fisheries, creation of a Pan-Mediterranean multi-taxa database containing data on bycatch of vulnerable species in the region, and a Review on Incidental Catches of Vulnerable Species in the Mediterranean and the Black Seas as well as national bycatch reports. Phase 2 (Jun. 2020 - Oct. 2022) has expanded the geographical scope of the project, including Croatia and Italy. Phase 2 is primarily focusing on testing mitigation measures and on informing and influencing policy developments related to the bycatch of vulnerable species at national and regional levels. It is of key importance to capitalize the efforts done so far (and on-going) in the context of the MedBycatch project and promoting its approach, deliverables and results to encourage replication across the Mediterranean, establishing a baseline for bycatch in the region and identifying existing gaps.	
Actors	**Evaluation**
Parties to the Barcelona Convention, National IMAP Committee(s), Ministries of Fisheries and Environment (or equivalent for each country), GFCM, partners of the MedBycatch project directly (or indirectly) involved in cetacean conservation	SPA/RAC and ACCOBAMS

Ⅷ.3.2. INVOLVING FISHERS ACROSS THE MEDITERRANEAN SEA ON CETACEAN CONSERVATION	
Objective	**Priority** (Low, Medium, High)
Gather fishers' local ecological knowledge in order to improve information on cetacean conservation status and threats, and increase their marine conservation awareness	Medium
Description	

Fishers' local ecological knowledge (LEK), accumulated over the course of their fishing careers, can be invaluable in helping marine researchers and resource managers obtain critical information to improve management of fish stocks and rebuild and conserve marine ecosystems. Well-designed and carefully conducted interviews with fishers will allow insights into past abundance of fish and changes in ecosystem status and quality, dolphin–fisheries interactions, as well as whale and dolphin population trends and status, and to identify the main conservation management actions needed. In addition, this initiative will contribute to increasing the marine conservation awareness of fishers by inviting them to reflect on issues that, in many cases, have been largely ignored by their community, and to directly contribute to effective ecosystem-based management measures. The LEK protocol used in the context of the MedBycatch project (see above), as well as the experience gained in this field through similar initiatives within the Mediterranean are to be taken into consideration when designing future questionnaires addressed to fishers. Fishers of different ages and from different generations should be ideally included in this exercise, to account for the phenomenon of shifting environmental baselines[2]. Before conducting private interviews, informative talks will be given at the local fishers' cooperatives to call for the collaboration of their members. This action should not be focused exclusively on small-scale fishers, but also on those working in industrial fishing fleets.

Actors	**Evaluation**
Parties to the Barcelona Convention, GFCM, Ministries of Fisheries (or equivalent for each country), Ministry of Environment (or equivalent for each country), NGOs	SPA/RAC and ACCOBAMS

VIII.3.3. STANDARIZATION OF CETACEAN STRANDING PROTOCOLS ACROSS MEDITERRANEAN COUNTRIES	
Objective	**Priority** (Low, Medium, High)
Promote and implement standardized cetacean stranding protocols throughout the Mediterranean	High
Description	
At the Joint ACCOBAMS/ASCOBANS Workshop on standardization of best practices on cetacean post-mortem investigation and tissue sampling, a common approach was adopted. This was followed by the resolution 7.14 on *best practices in monitoring and management of cetacean stranding* being released at the 7th Meeting of the Parties to ACCOBAMS, held in Istanbul, Turkey, in November 2019[3]. This should now be shared across the entire Region, including focusing on the collection of data on marine litter ingestion. Three sub-actions are envisaged: IV Promotion and distribution of the documents to the different stranding networks in the region. Common data sets will be collected annually to have an updated overall view of cetacean interaction with fishing activities and marine litter. V To stress the relevance of a common basic sampling. A common set of tissue samples should be collected and stored for further analyses. These data sets will be dependent on stranding networks skills and resources (see 2.2). Part of these	

[2] The phenomenon of shifting environmental baselines was described by Daniel Pauly (1995) noting that each generation subconsciously views as 'natural' the way the environment appeared in their youth. As one generation replaces another, perceptions of what is natural can change dramatically among local communities and lead to the loss of memory on past ecosystem status.

[3] ACCOBAMS-MOP7/2019/Doc38/Annex15/Res.7.14
https://accobams.org/wp-content/uploads/2019/12/Res.7.14_-Best-Practices-Strandings.pdf
ACCOBAMS-MOP7/2019/Doc 33 - *Best Practice on Cetacean Postmortem Investigation and Tissue Sampling*
https://accobams.org/wp-content/uploads/2019/04/MOP7.Doc33_Best-practices-on-cetacean-post-mortem-investigation.pdf

	samples will be stored in centralized common tissue banks identified by ACCOBAMS that will store and share samples with all the Mediterranean countries where required. A dialogue with CITES will be established as necessary to facilitate sharing tissue samples, including with IWC.
VI	Set-up of veterinary laboratories for those stranding networks not having one national laboratory for ancillary analyses (necropsy, histopathology, microbiology). Through the cooperation with the World Animal Health Organization Marine Mammal Health (OIE) reference centre, based in Torino, laboratories will be identified, training will be provided and contacts with already existing and well-established stranding networks will be facilitated.
VII	All resulting data is to be shared with the Mediterranean database on cetacean strandings (MEDACES)

This action is complementary to 2.2 (Capacity building). A centralized tissue bank system should be identified according to the ISO standards foreseen by the OIE and the Environmental Tissue Bank standards.

Actors	**Evaluation**
Parties to the Barcelona Convention, Ministry of Environment (or equivalent for each country), Coastguards, NGOs, National Stranding Networks	SPA/RAC and ACCOBAMS

VIII.3.4. WEB-BASED EXCHANGE OF SCIENTIFIC INFORMATION	
Objective	**Priority** (Low, Medium, High)
Contribute to a harmonized web-based platform such as NETCCOBAMS by which scientific information (e.g., photo-ID catalogues, tissue sample database, sighting record registry) can be maintained in a centralized location and freely exchanged among interested parties	High
Description	
Integration of information on Mediterranean cetaceans from all areas where they are observed is of substantial value in understanding patterns of habitat use and the links between geographic areas, as well as in determining migration routes and wintering location(s) for some species, such as fin and sperm whales. Having a centralized data repository where all interested parties (including the public) would be able to share and exchange information on Mediterranean cetaceans - in accordance with an agreed data availability protocol - would benefit conservation measures at a broader (i.e., range-wide) geo-spatial scale.	
Actors	**Evaluation**
Parties to the Barcelona Convention, Ministry of Education (or equivalent for each country), Ministry of Environment (or equivalent for each country), Research Institutes, NGOs,	SPA/RAC and ACCOBAMS

Ⅷ.3.5. DEVELOP AND CARRY OUT EFFECTIVE LONG-TERM MONITORING AT THE ENTIRE MEDITERRANEAN BASIN SCALE TO ESTIMATE ABUNDANCE AND TRENDS	
Objective	**Priority** (Low, Medium, High)
To obtain robust and unbiased population estimates and distributional information on Mediterranean cetaceans throughout the Basin at regular intervals (suggested 6 years following the IMAP requirements)	High
Description	
Promote suitable monitoring programme for the entire Mediterranean region to enable abundance trends, potential distributional changes to be identified and demography of population, in order to inform timely mitigation actions. Robust baseline information on parameters following the agreed EcAp/IMAP agreed common indicators (i.e distribution, abundance and demography) are necessary to inform conservation actions and to implement and evaluate the efficacy of any measures currently in place. The European Habitat Directive, the Marine Strategy Framework Directive, and the IMAP/Ecosystem Approach not only require the monitoring of the Good Environmental Status (GES) of species and habitats of community interest, but also require reporting on this status every 6 years. A synoptic survey, applying line transect distance sampling methodologies, to be carried out in a short period of time across the whole Mediterranean Sea, combining visual survey methods (boat- and aerial-based surveys) and passive acoustic monitoring (PAM). The main aim in both aerial and vessel-based surveys is to estimate density and abundance and assess potential trends over time. Standardized and agreed protocols should be used for the monitoring actions, following the guidelines endorsed by the Contracting Parties during the EcAp Coordination Group Meeting and benefits from the ACCOBAMS Survey Initiative (ASI, 2018) experience. Use existing ongoing programs to integrate abundance estimates and trend estimates. Consider the possibility to perform photo-ID and biopsy and eDNA sampling during large scale surveys to: (1) sample data poor areas, (2) monitor changes in hormones levels, stable isotopes, contaminants in areas of interest as identified by previous surveys. Power analysis should be used to design the specific monitoring framework to detect a trend of a given magnitude and to detect specific rates of population change.	
Actors	**Evaluation**
Parties to the Barcelona Convention, National IMAP committee(s), MPA management unit(s), Ministry of Environment (or equivalent for each country), Universities, Research Institutes, NGOs	SPA/RAC and ACCOBAMS

Ⅷ.3.6. DEVELOP AND CARRY OUT EFFECTIVE ANNUAL LONG-TERM MONITORING OF CETACEAN DISTRIBUTION, ABUNDANCE AND TRENDS NATIONALLY AND SUB-REGIONALLY	
Objective	**Priority** (Low, Medium, High)
Ensure that annual/seasonal monitoring of distribution, abundance and density is regularly conducted nationally and at relevant sub-regional units, corresponding to the main distribution areas of Mediterranean cetaceans	High
Description	

Continued monitoring of the Mediterranean cetacean populations and regular updates on population status are essential for meeting conservation objectives; among these, the Barcelona Convention, through the EcAp/IMAP, requests Parties to implement common indicators on a variety of species topics (e.g., distribution, abundance and demography) and prepare periodic regional assessment report (Quality Status Reports), to be presented at regular intervals of six years. In addition, the European Commission, through the implementation of the MSFD, asks its members to systematically report on their monitoring programs, developed at national level. Photo-identification is a widely used technique in cetacean research that can provide information on population demography, estimates of abundance and population parameters such as survival and reproductive rates. Long time series of photo-identified cetaceans of several species are available in different areas, providing opportunities for detecting changes in abundance over time. Similarly, biopsy sampling can be used to obtain information on population genetic structure, contaminant levels, and abundance through genetic mark-recapture analysis. Monitoring at the regional level may require data collection throughout the year, to better understand seasonal patterns in distribution, whereas monitoring at the basin level would mainly address inter-annual changes (3.5.). Mark-recapture models should be applied to photo-identification data (and genetic data where practicable) to estimate abundance for specific areas that populations or part of populations occupy during one or more seasons of the year. Collating information collected by different research groups in these areas is also recommended. Line-transect surveys based on distance-sampling methodology may be appropriate for some species, countries or regions. The use of platforms of opportunity, such as fisheries surveys and/or passenger ferries should also be considered in some cases, while acknowledging their limitations.

Actors	**Evaluation**
Parties to the Barcelona Convention, national IMAP committee(s), MPA management unit(s), Ministry of Environment (or equivalent for each country), Universities, Research Institutes, NGOs	SPA/RAC and ACCOBAMS

Ⅷ.3.7. MONITOR THREATS AT THE NATIONAL AND BASIN LEVEL	
Objective	**Priority** (Low, Medium, High)
To periodically assess the status and trends of threats, and the emergence of potential new threats	High
Description	
Status and trends of threats to cetaceans, including ship strikes, bycatch in fishing gear and other negative interaction with fisheries, underwater noise, micro- and macro litter ingestion, chemical contaminant exposure, physical disturbance and climate change, as well as their cumulative effects in the entire Mediterranean Sea, is key information needed to assess the efficiency of existing and future mitigation measures, and the needs for adaptation of any mitigation strategies. Existing national fishing fleet monitoring programs should be leveraged to obtain information on and monitor cetacean bycatch. Trend maps will inform on the evolution of known threats in previously identified risk areas compared to previous assessments, the identification of new risk areas and the emergence of new threats. The needed know-how to conduct this monitoring is not uniformly distributed among the region; therefore, this action is to be conducted in coordination with 2.4., which aims at providing capacity on monitoring threats to cetaceans where necessary.	

Actors	Evaluation
Parties to the Barcelona Convention, national IMAP committee(s), MPA management unit(s), Ministry of Environment (or equivalent for each country) in collaboration with neighbouring countries (whenever possible), Universities, Research Institutes, NGOs	SPA/RAC and ACCOBAMS

VIII.4. Management

VIII.4.1. WIDER ADOPTION AND IMPLEMENTATION OF STANDARDIZED MEASURES TO MITIGATE ADVERSE IMPACT OF CETACEAN WATCHING ACTIVITIES	
Objective	**Priority** (Low, Medium, High)
Efficient management of cetacean watching activities and the implementation of relevant standardized codes of conduct (IWC, ACCOBAMS, CMS)	Medium
Description	
Harassment risk begins when a vessel is deliberately closer than the minimum distance identified in common rules (Code of Conduct) for commercial cetacean watching or when the vessel stays for a period longer than prescribed. This is especially true for swim-with cetacean activities. Moreover, direct interactions between swimmers and animals may introduce risks of animal violent behaviour and transmission of diseases. Additionally, individuals that are regularly approached (even in respect of the code of conduct) can experience substantial stress, which may lead to medium or long-term population-level impacts. It is therefore necessary to minimize the risk of cetacean-watching activities having negative impacts on cetaceans, by the implementation of effective management strategies including the adoption and implementation of standardized codes of conduct (IWC, ACCOBAMS, CMS). The ACCOBAMS “High Quality Whale-Watching®” Certificate aims at encouraging the implementation of good practices and sustainable know-how by whale-watching operators involved in initiatives fostering quality and environmental responsibility; its implementation throughout the basin must be promoted and implemented, ideally, by all Parties. There have been several attempts to evaluate the potential impact of UAVs on cetaceans. At present, there is very little evidence that UAVs disrupt the behaviour of baleen whales. To date, the behavioural responses of dolphins when approached by a UAV remain poorly investigated and most studies have focused on bottlenose dolphins. The available evidence suggests that when small UAVs are flown at an altitude of 10–30 m above bottlenose dolphins, short-term behavioural responses occur. These responses may vary depending on group size and behaviour. Guidelines and well-defined protocols should be developed, promoted among the industry and properly implemented to minimize any potential adverse effects (See Raoult et al. 2020 for a review on using drones on marine animal research).	
Actors	**Evaluation**
Parties to the Barcelona Convention, Ministry of Environment (or equivalent for each country), Ministry of Tourism (or equivalent for each country), Research Institutes, NGOs, MAP managers	SPA/RAC and ACCOBAMS

Ⅷ.4.2. MITIGATE SHIP STRIKES WITH LARGE WHALES	
Objective	**Priority** (Low, Medium, High)
Reduce ship strike risk for fin and sperm whales throughout the Mediterranean Basin	High
Description	
Measures that separate whales from vessels (or at least minimise co-occurrence) in space and time to the extent possible (e.g., routing schemes, Traffic Separation Schemes TSS) are the most effective in reducing this threat. In the absence of routing options, reducing speed has been identified as the most effective way of reducing ship strike risk. Emphasis should be placed on the collection and reporting of data to the IWC Global Ship Strikes Database which will both: (1) facilitate a proper evaluation, prioritisation and monitoring of ship strikes as a threat to various populations and areas (e.g., the Mediterranean Sea); and (2) assist in the development of specific mitigation measures. One of the key actions is to identify high-risk areas for ship strikes (a high-risk area is defined as the convergence of either areas of high-volume shipping and whales, or high numbers of whales and shipping, reflected in the ACCOBAMS work on Cetacean Critical Habitat, CCH). Important Marine Mammal Areas (IMMAs) represent a systematic and biocentric approach to identifying important habitats and can be helpful in identifying potential high-risk areas for ship strikes. In particular, if an IMMA contains a species or population vulnerable to ship strikes, and is transited by significant shipping, the area can be "flagged" for further investigation and potential mitigation. The following steps should be undertaken as part of a process to identify High Risk Areas for Ship Strikes based on IMMAs and in relation to CCH: (1) Traffic information (e.g., vessel type, size, speed, flag, etc.): plotting major ship routes to determine overlap with IMMAs that host significant populations of species threatened by or vulnerable to ship strikes; (2) Species information (e.g., relative or absolute abundance, status, behaviour/seasonality/key lifecycle use in and within IMMAs); and (3) Management and Mitigation. Further develop the process for the designation of International Maritime Organization (IMO) measures, such as a TSS in the Hellenic Trench and a Particularly Sensitive Sea Areas (PSSA) at a scale that includes the North West Mediterranean Sea, Slope and Canyon IMMA, as well as the Spanish corridor, to take into account whale population movement and distribution. Zoning within the area with ship strike mitigation tools such as speed reduction and routing measures could be proposed as part of Associated Protective Measures within the PSSA. Co-operation with IMO, other IGOs, national authorities, the shipping industry, port authorities and the whale watching industry is essential if effective mitigation is to occur.	
Actors	**Evaluation**
IMO, IWC, REMPEC, European Community Shipowners' Associations (ECSA), relevant Ministries per country, research institutes, NGOs	SPA/RAC and ACCOBAMS

Ⅷ.4.3. DEVELOP CONSERVATION MANAGEMENT PLANS (CMPs) FOR MEDITERRANEAN CETACEANS	
Objective	**Priority** (Low, Medium, High)
Develop a series of CMPs to manage human activities that affect cetaceans in the Mediterranean Sea in order to maintain a favourable conservation status throughout their historical range, based on the best available scientific knowledge	High

Description
It is not possible to 'manage' cetaceans in the Mediterranean Sea themselves, but it is possible to manage human activities that adversely affect the cetaceans and/or their habitat. Thus, by their nature, the management actions associated with CMPs require a degree of control and limitation on human activities. In pursuing this goal, the needs and interests of stakeholders need to be considered to the extent possible, whilst recognising that favourable conservation status is the highest priority. Moreover, scientific uncertainty must be considered while setting priorities and determining appropriate actions, but uncertainty alone should not preclude conservation action. Ideally, all management actions are based on adequate scientific data. However, there are occasions when the potential conservation consequences of waiting for confirmatory scientific evidence are sufficiently serious that it is justified to take action immediately whilst continuing to study the problem. This means following the 'precautionary principle'.

Actors	**Evaluation**
Parties to the Barcelona Convention, IWC, research institutes, NGOs	SPA/RAC and ACCOBAMS

Ⅷ.4.4. ENHANCE EFFORT ON SPECIALLY PROTECTED AREAS OF MEDITERRANEAN IMPORTANCE (SPAMIs) WITH IMPORTANT MARINE MAMMAL AREAS (IMMAs) AND CETACEAN CRITICAL HABITATS (CCH)	
Objective	**Priority** (Low, Medium, High)
Continue with the ongoing effort to monitor existing SPAMIs and designate new ones, assess potential new candidate IMMAs and Areas of Interest and move forward with the overlap with anthropogenic stressors, to identify CCH in the Mediterranean Sea	Medium

Description
There are 2 SPAMIs specifically designated for the protection of marine mammals in the Mediterranean Sea: the Pelagos Sanctuary and the Spanish Migration Corridor. Efforts to continue monitoring these areas, by implementing their management plan, as well as proposing new potential SPAMIs in the Basin should be considered as a priority. The Mediterranean Sea also features 19 IMMAs designated as important habitats for cetaceans. In addition to these, 5 candidate IMMAs relevant to cetacean conservation have been identified, along with 23 AoIs. The re-evaluation period for IMMAs is envisaged every 10 years. The next evaluation for the Mediterranean, following a first workshop organised in 2016, is scheduled for 2026, coinciding with the last phase of this 5-year AP. Furthermore, where possible, efforts should be made to designate some of the existing IMMAs as Marine Protected Areas. SPAMIs and IMMAs provide the initial biocentric process (through the spatial definition of the animals' most important habitats) to be followed by use of the CCH, in which the spatial distribution of threats is identified. Management advice is then based upon an integration of the two approaches and the prioritization of mitigation approaches on a case-specific basis. In addition, other highly relevant initiatives include the post-2020 Regional Strategy for Marine Protected Areas (MPAs) and Other Effective Area-based Conservation Measures (OECMs) in the Mediterranean Sea, coordinated by SPA/RAC. This multidisciplinary effort will assist in providing Countries with advice on targeted and effective conservation measures (where appropriate on a seasonal basis) including: ▪ designation of new (or the extension of existing) MPAs with appropriate focused management actions, ▪ zoning within existing MPAs, ▪ corridors between MPAs,

▪ threat-specific mitigation measures for application throughout the region (shipping or noise directives, e.g., through IMO) during marine spatial planning processes.

Actors	**Evaluation**
IUCN Marine Mammal Protected Areas Task Force, Parties to the Barcelona Convention.	SPA/RAC and ACCOBAMS

Ⅷ.4.5. REDUCE THE INTRODUCTION OF ANTHROPOGENIC SOUND INTO THE MARINE ENVIRONMENT AND MITIGATE ACTIVITIES LIKELY TO PRODUCE UNDERWATER NOISE	
Objective	**Priority** (Low, Medium, High)
Reduce the input of man-made sound into the marine environment, especially from sources and at levels likely to negatively impact cetaceans, as well as provide mitigation measures for noise-producing activities	High
Description	
Cetaceans rely on sound to communicate, navigate and locate prey. Man-made underwater noise is a significant threat to these animals. Efforts should be made to reduce the underwater noise pollution, in order to prevent adverse effects on cetaceans. For activities and development likely to produce high intensity impulse sounds (e.g., seismic surveys for oil and gas exploration, pile driving and the use of sonar) and long-term chronic noise (e.g., planning of ports and shipping routes or other sound-producing activities), appropriate Environmental Impact Assessments should be carried out before such activities are allowed to take place. Appropriate mitigation measures should be put in place to prevent detrimental effects of underwater noise on cetaceans. Within the EcAp/IMAP process, Contracting Parties to the Barcelona Convention are required to monitor and assess the candidate common indicators related to energy including underwater noise (i.e. common indicator 26: Proportion of days and geographical distribution where loud, low, and midfrequency impulsive sounds exceed levels that are likely to entail significant impact on marine animals, and common indicator 27: Levels of continuous low frequency sounds with the use of models as appropriate). It is also important to monitor underwater noise levels nationally and regionally and build on initiatives such as the “Overview of the Noise Hotspots in the ACCOBAMS area”, the EU funded QuietMed I & II projects, the Quit Sea Project and the Mediterranean Strategy on Underwater Noise Monitoring for establishing the methodological basis for a future implementation of a basin-wide monitoring programme on underwater noise.	
Actors	**Evaluation**
Parties to the Barcelona Convention, national IMAP committee, MPA management unit(s), Relevant Ministries for each Government, IWC, CMS	SPA/RAC and ACCOBAMS

Ⅷ.4.6. REDUCE THE INPUT OF CHEMICAL CONTAMINANTS	
Objective	**Priority** (Low, Medium, High)
Reduce the input of chemical contaminants into the marine environment and limit the mobilization of contaminants in marine sediments	High
Description	
Chemical pollutants impact cetacean species in a number of ways. While some pollutants in the Mediterranean Sea have declined or are declining, organochlorine levels, particularly PCBs, are found at high concentrations in several Mediterranean cetacean species. Pollutants and their impact in marine organisms are included in the EcAp/IMAP Ecological Objective 9 and its Common Indicator 19 and the Descriptor 8 of the Marine Strategy Framework Directive (MSFD) At the Mediterranean policy level, PCB concentration in relation to established toxicity thresholds should be used to assess "Favourable Conservation Status" of cetaceans. Chemical pollutants need to be included in impact assessments of other activities likely to affect cetaceans, due to cumulative and synergistic effects. Greater compliance with the Stockholm Convention is needed in order to significantly reduce PCB contamination of the marine and terrestrial environment by 2028. Measures include the safe disposal or destruction of large stocks of PCBs and PCB-containing equipment, limiting the dredging of PCB-laden rivers and estuaries, reducing PCB leakage from old landfills, limiting PCB mobilization in marine sediments, and regulating the demolition of PCB-containing precast buildings.	
Actors	**Evaluation**
Parties to the Barcelona Convention, national IMAP committee, Relevant Ministries for each Government, MED POL, IWC, REMPEC	SPA/RAC and ACCOBAMS

Ⅷ.4.7. REDUCE THE AMOUNT OF MARINE DEBRIS AND MICROPLASTICS ACROSS THE MEDITERRANEAN BASIN	
Objective	**Priority** (Low, Medium, High)
Reduce the input of marine debris and micro/nano plastics into the marine environment and ensure appropriate removal where possible	High
Description	

Different cetacean species are threatened by marine debris to varying degrees, with deep-diving odontocetes likely most vulnerable to ingestion of macro debris and fin whales especially vulnerable to the ingestion of micro/nano plastics. Macro- and microplastics enter the marine environment either directly from improper waste disposal, improperly managed landfills, improperly treated water waste management or result from the degradation of larger items breaking down into smaller particles.

Marine litter monitoring of IMAP is based on the Regional Plan on Marine Litter management (Decision IG.20/10) and on the following agreed candidate indicator 24 "Trends in the amount of litter ingested by or entangling marine organisms focusing on selected mammals, marine birds, and marine turtles (EO10)".

Mitigation measures in relation to marine plastic pollution should focus on 1) preventing the leakage of new micro- and macro-plastic material into the environment and 2) instigating the removal of macro-plastics from the marine environment. The Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 was established to reduce the impact of plastic on the environment (including marine ecosystems) by promoting the establishment of a circular economy. Considering that single-use plastics and fishing-related items represent the vast majority of marine litter, these products should be the main target of mitigation measures. The transition to a circular economy framework will involve the phasing out of single-use plastics, extended producer responsibilities, and recycling schemes. The Regional Plan on Marine Litter Management in the Mediterranean in the Framework of Article 15 of the Land Based Sources Protocol should be implemented.

Actors	**Evaluation**
Parties to the Barcelona Convention, national IMAP committee, Relevant Ministries for each Government, MedPOL, IWC, REMPEC	SPA/RAC and ACCOBAMS

Ⅷ.4.8. MANAGEMENT OF FISHERIES TO MITIGATE CETACEAN BYCATCH	
Objective	**Priority** (Low, Medium, High)
Recognising mitigating cetacean bycatch as intrinsic to successful fisheries management	High

Description

Despite being considered as the greatest threat to cetaceans globally, bycatch is frequently perceived as a separate fisheries management issue. Nevertheless, to achieve effective reduction of cetacean bycatch rates, technical mitigation measures specially designed, promoted and imposed for cetaceans, must be coupled with other intrinsic improvements in fisheries management globally. For instance, the most generally effective mitigation measure of cetacean bycatch is reduction in fishing effort; such strategy is to be seriously considered, starting to incorporate it in future fisheries management initiatives, starting by fisheries with the largest documented impact, which may vary considerably among or even within countries.

According to the ACCOBAMS/ASCOBANS bycatch mitigation measures, the following are proposed:

16.Encourage Parties, Research Institutes, and Private Sector bodies supported by funding bodies, in collaboration with fishers throughout the process, to develop or improve mitigation measures with new technology and/or materials, alternative gears, the shifting of fishing effort etc.

17. The success of particular mitigation measures depends upon a variety of elements including the particular cetacean population, specifics of the gear and its deployment, as well as local conditions. The Working Group should keep a watching brief of case studies relevant to the Agreement Areas that describe which measures have or have not worked. This should be undertaken in liaison with other bodies (e. g. ICES, WGBYC, FAO, IWC, HELCOM, OSPAR) so that actions complement one another rather than duplicate effort.

18. There is a need to improve the involvement of fishers from the start, including transfer of knowledge, in adopting good practices and to contribute prevention and monitoring of bycatches and careful release of entangled animals. Better outreach would help to inform and reduce bycatch and entanglement. Parties should consider the provision of incentives where appropriate.

19. The Working Group should develop guidelines to policymakers, authorities, and the scientific community on how to best incentivise and engage fishers in prevention, mitigation and monitoring programmes.

20. Where the current mitigation measures (e. g. pingers) don't solve the problem, spatio-temporal closures may be the only immediately available solution, although care is needed that this does not simply move the problem elsewhere. Consideration should be given to moving away from métiers of concern, in which case national authorities should consider some means of compensation to help cover fishers' income loss, where appropriate. The precautionary principle should be adopted. Insufficient technology development should not be considered as a reason to postpone decision-making.

21. The need to move towards an internationally standardised approach for dealing with potential interventions (or lack thereof) of free-swimming, chronically entangled cetaceans should be considered. Expansion of the IWC Global Whale Entanglement Response Network across the regions should be encouraged, including dedicated training of entanglement responders.

22. The humane release of live bycaught and entangled animals according to best practices should be encouraged to help ensure their survival (e.g. Guidelines for the Safe and Humane Handling and Release of Bycaught Small Cetaceans from Fishing Gear - CMS Technical Series No.43, FAO/ACCOBAMS Good Practice Guide for the Handling of Cetaceans caught incidentally in Mediterranean Fisheries, IWC Guidelines for entanglement responders) and fishers should be encouraged to report releases of bycaught individuals.

23. Countries should be encouraged to establish Marine Protected Areas (MPAs) and Other Effective area-based Conservation Measures (OECMs) where appropriate, and to develop and implement management plans to reduce cetacean bycatch.

24. Methods to monitor the performance of mitigation measures (such as pingers) as well as compliance in their usage by fisheries in real world conditions should be improved and become standard.

Actors	**Evaluation**
Parties to the Barcelona Convention, national IMAP committee, GFCM, Ministries of Fisheries (or equivalent for each country), Ministry of Environment (or equivalent for each country), IWC	SPA/RAC and ACCOBAMS

VIII.5 IMPLEMENTATION SCHEDULE

Actions		Time	Who
VIII.1. EDUCATION AND AWARENESS	Ⅷ.1.1. Increase public awareness	Continuously	Contracting Parties ;SPA/RAC; ACCOBAMS
VIII.2. CAPACITY BUILDING	Ⅷ.2.1. Increase and strengthen capacity at the Mediterranean level	Continuously and as needed	SPA/RAC; ACCOBAMS; CPs
	Ⅷ.2.2. Increase the capacity of and develop stranding networks throughout the region		SPA/RAC; ACCOBAMS; CPs
	Ⅷ.2.3. Increase capacity on and disseminate cetacean monitoring techniques		SPA/RAC; ACCOBAMS; CPs
	Ⅷ.2.4. Increase capacity on and improve monitoring of threats affecting cetaceans		SPA/RAC; ACCOBAMS; CPs
VIII.3. RESEARCH AND MONITORING	Ⅷ.3.1. Cetacean bycatch – implementation of lessons learnt by med bycatch project throughout the Mediterranean	As soon as possible and continuously	SPA/RAC; ACCOBAMS; GFCM
	Ⅷ.3.2. Involving fishers across the Mediterranean Sea on cetacean conservation		Contracting Parties
	Ⅷ.3.3. Standarization of cetacean stranding protocols across Mediterranean countries		SPA/RAC; ACCOBAMS;
	Ⅷ.3.4. Web-based exchange of scientific information		Contracting Parties; ACCOBAMS
	Ⅷ.3.5. Develop and carry out effective long-term monitoring at the entire Mediterranean basin scale to estimate abundance and trends		SPA/RAC; ACCOBAMS; CPs
	Ⅷ.3.6. Develop and carry out effective annual long-term monitoring of cetacean distribution, abundance and trends nationally and sub-regionally		SPA/RAC; ACCOBAMS; CPs
	Ⅷ.3.7. Monitor threats at the national and basin level		CPs; SPA/RAC; ACCOBAMS;
VIII.4. MANAGEMENT	Ⅷ.4.1. Wider adoption and implementation of standardized measures to mitigate adverse impact of cetacean watching activities	As soon as possible and continuously	CPs; ACCOBAMS; SPA/RAC; Pelagos secretariat
	Ⅷ.4.2 mitigate ship strikes with large whales		CPs; ACCOBAMS; SPA/RAC; Pelagos secretariat
	Ⅷ.4.3. Develop conservation management plans (CMPs) for Mediterranean cetaceans		ACCOBAMS; SPA/RAC; Pelagos secretariat

	Ⅷ.4.4. Enhance effort on specially protected areas of Mediterranean importance (SPAMIs) with important marine mammal areas (IMMAs) and cetacean critical habitats (CCH)		ACCOBAMS; SPA/RAC; Pelagos secretariat
	Ⅷ.4.5. Reduce the introduction of anthropogenic sound into the marine environment and mitigate activities likely to produce underwater noise		CPs, ACCOBAMS; SPA/RAC; Pelagos secretariat
	Ⅷ .4.6. Reduce the input of chemical contaminants		CPs, ACCOBAMS; SPA/RAC; Pelagos secretariat, MEDPOL
	Ⅷ .4.7. Reduce the amount of marine debris and microplastics across the Mediterranean basin		CPs, ACCOBAMS; SPA/RAC; Pelagos secretariat, MEDPOL
	Ⅷ.4.8. Management of fisheries to mitigate cetacean bycatch.		CPs, ACCOBAMS; SPA/RAC; GFCM, Pelagos secretariat

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Annex II

Action Plan for the conservation of habitats and species associated with seamounts, underwater caves and canyons, aphotic hard beds and chemo-synthetic phenomena in the Mediterranean Sea
(Dark Habitats Action Plan)

I. FOREWORD

1. The Action Plan for the conservation of habitats and species associated with seamounts, underwater caves and canyons, aphotic hard beds and chemosynthetic phenomena in the Mediterranean Sea follows a series of eight Action plans adopted by the Mediterranean countries within the framework of the Barcelona Convention, devoted to the conservation of species or groups of species. These Action plans are:

- Action Plan for the management of the monk seal
- Action Plan for the conservation of marine turtles
- Action Plan for the conservation of cetaceans
- Action Plan for the conservation of marine vegetation
- Action Plan for the conservation of bird species registered in annex II of the SPA/BD Protocol
- Action Plan for the conservation of cartilaginous fishes (Chondrichtyans) in the Mediterranean Sea
- Action Plan concerning species introduction and invasive species
- Action Plan for the conservation of the coralligenous and other calcareous bio-concretions in the Mediterranean Sea

2. Dark Habitats are considered as fragile and sensitive habitats requiring protection (Directive 92/43/EEC). They constitute veritable reservoirs of biodiversity that, therefore, must be protected and need further attention.

3. This draft Action plan was the result of a Meeting of the ad hoc group of Mediterranean experts, nominated in consultation with the Contracting Parties and relevant partner organizations (Marseilles (France), May 2013). It was reviewed and adopted by the Eleventh Meeting of Focal Points for SPAs (Rabat - Morocco, 2 – 5 July 2013).

4. The Action Plan was adopted in the Eighteenth Ordinary Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols (Istanbul - Turkey, 3-6 December 2013). The document of the Action Plan was first published in 2015 under the reference: UNEP-MAP-RAC/SPA, 2015. Action Plan for the conservation of habitats and species associated with seamounts, underwater caves and canyons, aphotic hard beds and chemo-synthetic phenomena in the Mediterranean Sea. Dark Habitats Action Plan. Ed. RAC/SPA, Tunis: 17 pp.

5. This document is the draft update of the Action Plan for the conservation of habitats and species associated with seamounts, underwater caves and canyons, aphotic hard beds and chemo-synthetic phenomena in the Mediterranean Sea as requested by the contracting Parties in their decision IG.24/07 (CoP 21- Naples (Italy), 2-5 December 2019).

II. PRESENTATION

6. Dark habitats are those where either no sunlight arrives or where the light that does arrive is insufficient for the development of plant or algal assemblages. These are known as the aphotic and the disphotic or twilight zones. They are distributed throughout the Mediterranean basin and include both shallow marine dark caves[4] and deep-sea habitats (usually at depths below 150-200 m, Figure 1). However, inventorying and monitoring initiatives focusing on marine caves should consider the cave habitat as a whole. Therefore, this document covers both semi-dark and dark caves. Diverse geomorphological structures such as underwater caves, canyons, slopes, isolated rocks, seamounts, abyssal plains and areas presenting chemosynthetic phenomena, can characterise the dark habitats and can support sensitive habitats and assemblages that are of unique scientific and conservation interest and require special protection.

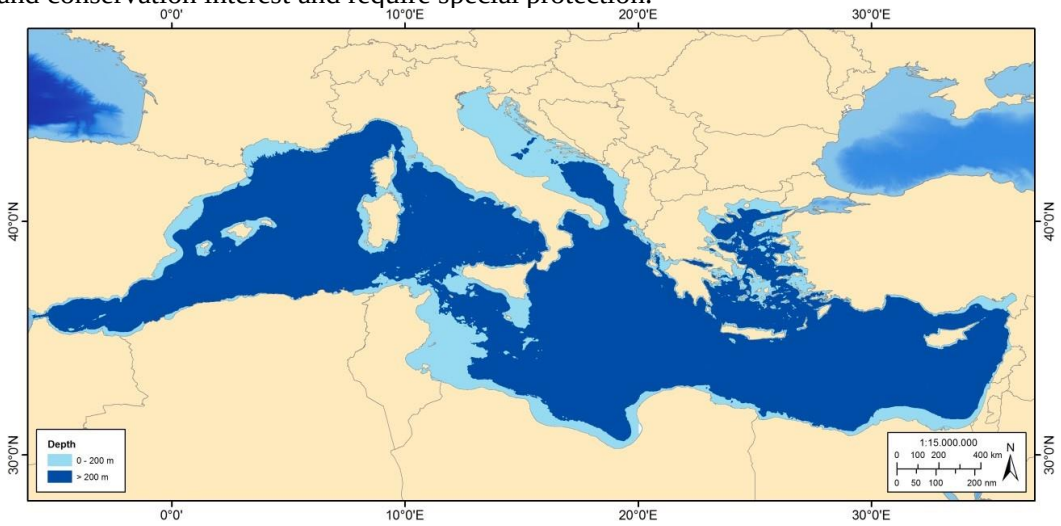

Figure 1:Deep-sea areas in the Mediterranean Sea below 200 m depth (from SPA/RAC-UN Environment/MAP & OCEANA, 2017; compiled by the authors based on data available from different sources)

III. STATE OF KNOWLEDGE

III.1 Distribution

III.1.1 Marine caves

7. To date approximately 3,000 marine caves have been recorded in the Mediterranean Sea (see Figure 2) (Giakoumi et al., 2013; SPA/RAC-UNEP/MAP, 2020). Most of these caves are located in the North Mediterranean, which encompasses a higher percentage of rocky coasts and has been more extensively studied for this particular habitat. Specifically, the highest numbers of known caves are in the Eastern Adriatic, Aegean, Tyrrhenian, Provencal and Ionian coasts, where they are sometimes densely concentrated on islands and rocky peninsulas (SPA/RAC-UNEP/MAP, 2020). Mapping initiatives have taken place in Italy (Cicogna et al., 2003), Corsica (CREOCEAN-DREAL, 2010), Croatia (Surić et al., 2010) and Greece (Gerovasileiou et al., 2015; Sini et al., 2017). Expeditions in the framework of the research projects MedKeyHabitats, MedMPAnet and LIFE BaĦAR for N2K provided information on the distribution of marine caves in Algeria (PNUE/PAM-CAR/ASP, 2016a), Lebanon (SPA/RAC-UN Environment/MAP, 2017), Montenegro (UNEP-MAP-RAC/SPA, 2016a, b), Morocco (Espinosa et al., 2015; PNUE/PAM-CAR/ASP, 2016b), Malta and Gozo (Evans et al., 2016; Borg et al., 2017). The latter studies also extended the bathymetric distribution of the marine cave habitat to the deep sea (between 205 and 795 m). Numerous marine caves from the coasts of Turkey were also described in a recent publication (Öztürk, 2019). However, given the logistic difficulties in the inventorying of underwater caves, and especially the submerged ones, their number is assumed to be much

[4] Semi-dark cave communities have been integrated into the Action Plan for the conservation of the coralligenous and other calcareous bio-concretions in the Mediterranean Sea (UNEP-MAP-RAC/SPA, 2008).

higher than we know (SPA/RAC-UNEP/MAP & OCEANA, 2017). Mapping efforts are required in order to fill current distribution gaps in the Eastern and Southern Mediterranean regions, and in deeper waters.

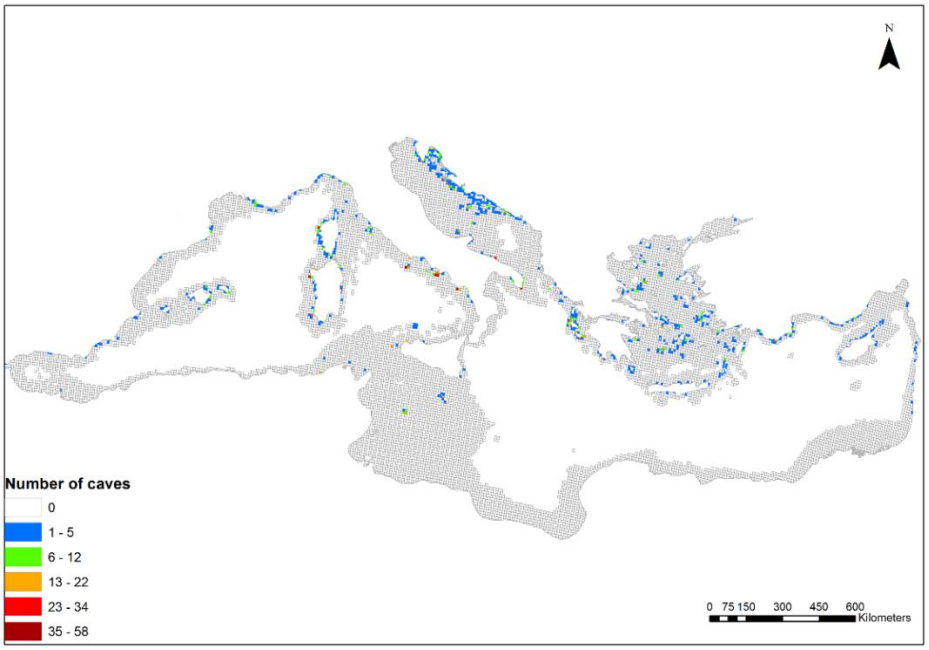

Figure 2: Distribution of marine caves in the Mediterranean Sea. Different colours indicate the number of caves recorded in cells of 10x10 km (from Giakoumi et al., 2013)

III.1.2 Deep sea

8. Geomorphologic structures such as canyons (Figure 3), seamounts (Figure 4) and rocky aphotic escarpments may be localized by the acquisition and study of high-resolution geomorphologic seafloor data. Spatial information on deep-sea geomorphologic structures such as canyons have been compiled at the Mediterranean scale (Würtz, 2012) and have been updated (Harris & Macmillan-Lawler, 2015). The distribution of seamounts and seamount-like structures have also been mapped in the Mediterranean (Würtz & Rovere, 2015).

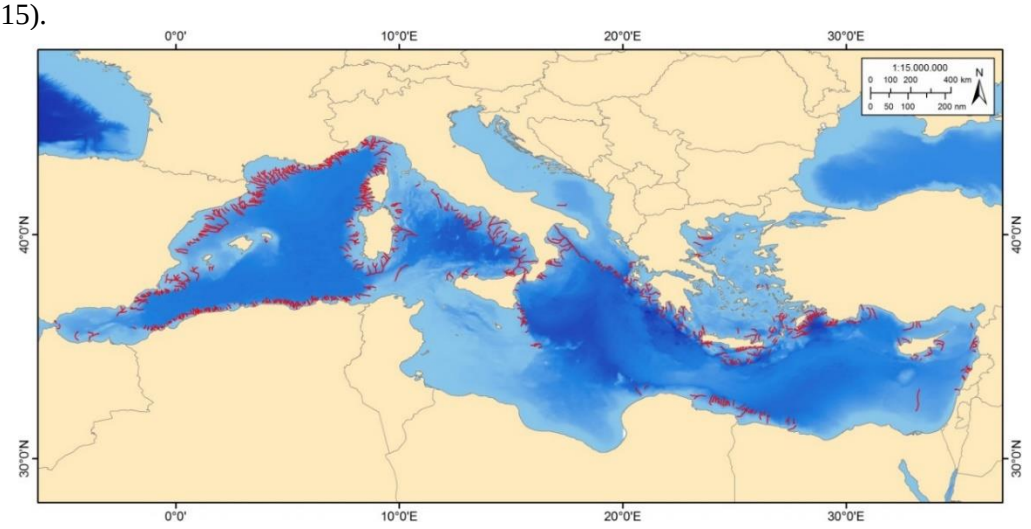

Figure 3: Distribution of Mediterranean submarine canyons (from SPA/RAC-UN Environment/MAP & OCEANA, 2017; compiled by the authors based on data available from different sources)

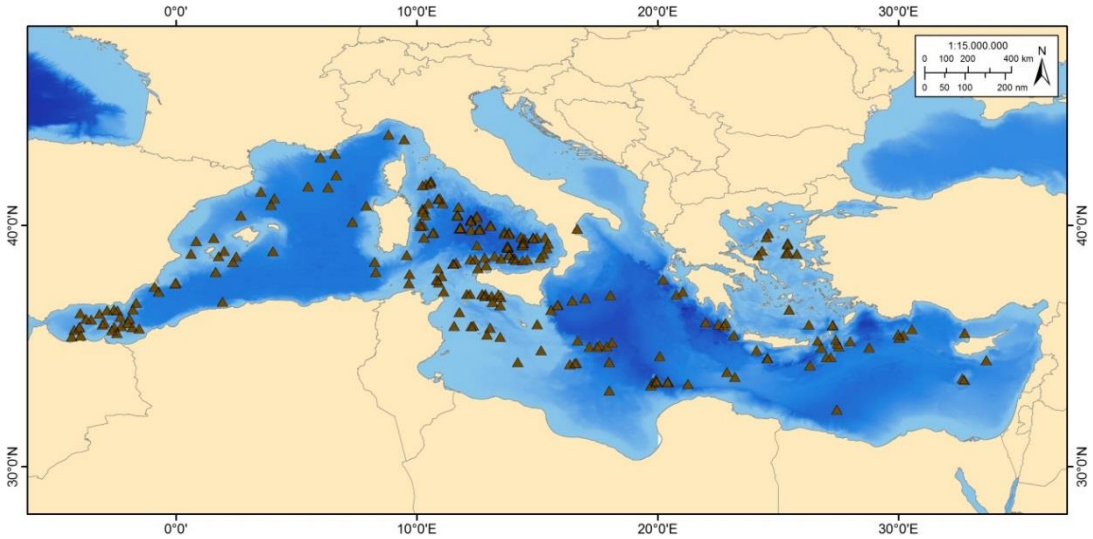

Figure 4: Distribution of Mediterranean seamounts (from SPA/RAC-UN Environment/MAP & OCEANA, 2017; compiled by the authors based on data available from different sources)

9. These structures offer heterogeneous habitats that enhance biodiversity and are considered as hotspots of biodiversity (Danovaro et al., 2010; Würtz & Rovere, 2015). They may harbour slow growing, long-living species, constitutive of sponge aggregations, coral forests and Cold-Water Corals (CWCs) that are considered as Vulnerable Marine Ecosystems (VMEs), according to *The International Guidelines for the Management of Deep-sea Fisheries in the High Seas* (FAO, 2009). Areas with chemosynthetic phenomena (*e.g.* cold seeps, mud volcanoes, hydrothermal fields, pockmarks, brine pools) (Figure 5), represent rare and fragile morphological structures and shelter unique ecosystems and species (*e.g.* Angeletti et al., 2015; Esposito et al., 2015; Beccari et al., 2020).

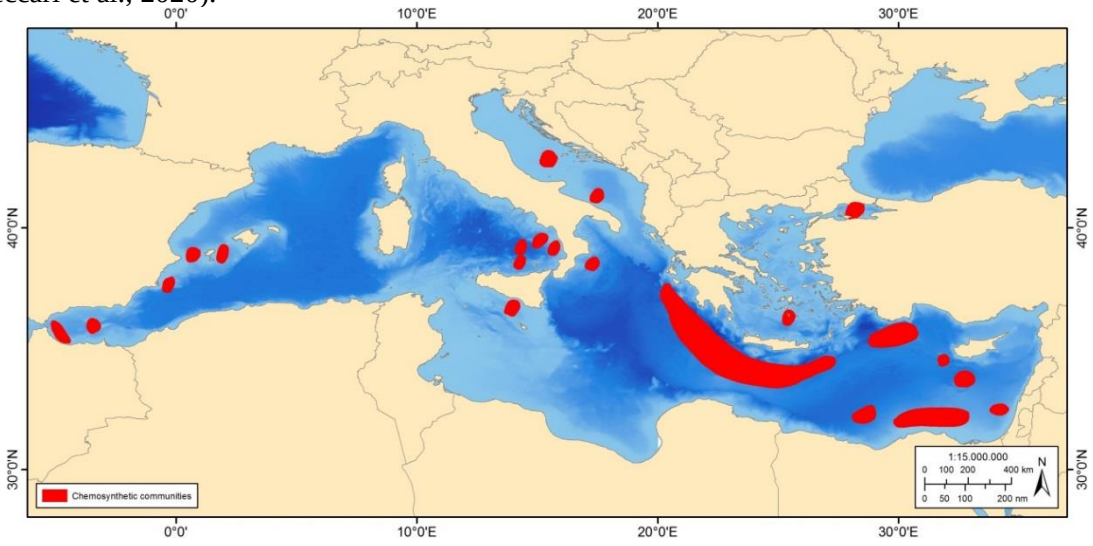

Figure 5: Identified areas with chemosynthetic assemblages (from SPA/RAC-UN Environment/MAP & OCEANA, 2017; compiled by the authors based on data available from different sources)

10.Recent exploration has uncovered unique deep-sea communities on the Israeli continental shelf at the "Palmahim Disturbance". Vast coral gardens are distributed along the margins of the Palmahim disturbance, CWC (Cold Water Coral) meadows grow in the compact sediments around the coral gardens and cold seep communities thrive in the deeper western zones of the site[5]. Recently, brine seepage and brine pools were documented in the north - west part of the proposed FRA[6], with dense chemosynthetic tube-worm cover, and

[5] See https://www.sciencedirect.com/science/article/abs/pii/S0967064519300244?via%3Dihub
[6] See http://mafish.org.il/wp-content/uploads/2021/05/FRA-Proposal-Palmahim-Disturbance-SPNI-revised-310521-.pdf

their vicinity appears to function as a reproduction hotspot for blackmouth catshark (*Galeus melastomus*), with numerous eggs laid on the benthos. These benthic habitats form important deep-sea ecosystems, which are extremely rare in the eastern Mediterranean.

11.The distribution of one of the most emblematic and fragile Mediterranean deep-sea assemblages, the Cold-Water Corals (CWCs), has been mapped at the Mediterranean scale (see Figure 6 from Chimienti et al., 2019).

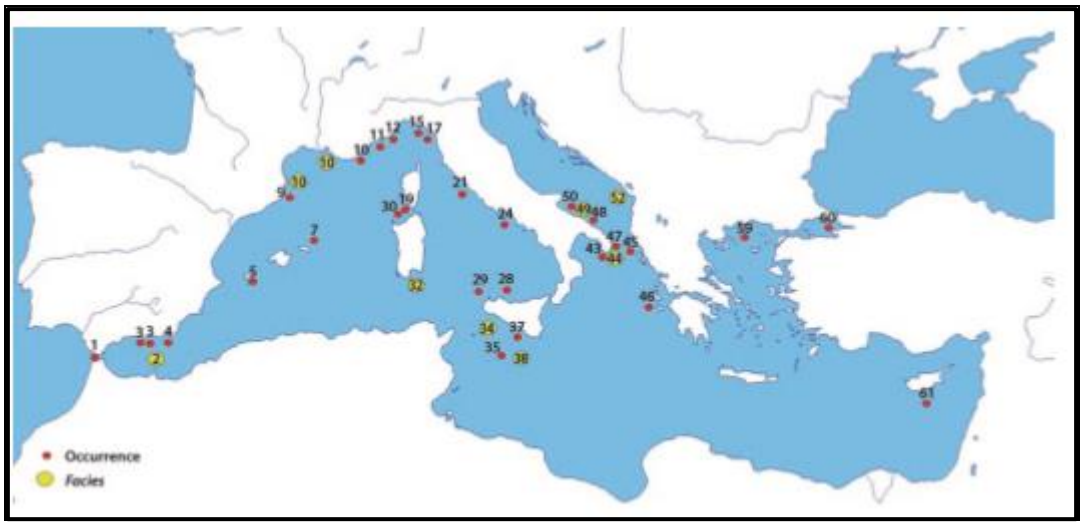

Figure 6: The actual information on the distribution of the Cold-Water Corals (CWCs) in the Mediterranean (Chimienti et al., 2019)

12.A recent book reviews the cold and deep coral habitats known to date in the Mediterranean Basin (see Orejas & Jiménez, 2019). The known distribution of the black coral *Leiopathes glaberrima* (Massi et al., 2018) as well as the scleractinian *Dendrophyllia cornigera* (Castellan et al., 2019) have also been published at the Mediterranean scale. These species are present in the Alboran, Ligurian and Tyrrhenian Sea, the Algero-Provençal Basin, the Sicily channel, the Ionian Sea, the Southern Adriatic, the Aegean Sea and the North Levantine (near Rhodes Island).

13.The spatial distributions of some other deep-sea benthic species have been published but they are limited to an area or a country (*e.g.* distribution of the bamboo coral *Isidella elongata* in the Aegean Sea (Gerovasileiou et al., 2019), 130 taxa from the French Mediterranean canyons and shelf brake (Fourt et al., 2017)).

14.The inventory of Mediterranean canyons, seamounts and areas with chemosynthetic phenomena is still not complete (Harris & Macmillan-Lawler, 2015; Würtz & Rovere, 2015), the distribution knowledge of associated assemblages and ecosystems presents therefore even larger gaps. Only part of the Mediterranean deep-sea habitats has been explored mainly in the north-western sector. To be in capacity of building a coherent Mediterranean network of protected deep-sea marine habitats, efforts are still needed to acquire basic data on spatial and bathymetric distribution of deep-sea habitats in the Mediterranean Sea.

III.2 Composition

III.2.1 Marine caves

15.Marine caves are acknowledged as “biodiversity reservoirs” and “refuge habitats” of great conservation value, as they harbour a rich biodiversity (32-71% of the Mediterranean sponge, anthozoan, bryozoan, tardigrade and brachiopod fauna) that includes several rare, exclusive, endangered, protected, as well as deep-sea species (Harmelin et al., 1985; Gerovasileiou & Voultsiadou, 2012; Gerovasileiou et al., 2015; Ouerghi et al., 2019; SPA/RAC-UNEP/MAP, 2020). A total of 2,369 taxa has been reported from ca. 350 marine caves in 15 Mediterranean countries (Gerovasileiou & Voultsiadou, 2014; Gerovasileiou & Bianchi, in press). Studies in Mediterranean marine caves are continuously bringing to light new species, several of which have not been

yet reported from other habitats, and thus can be considered as cave-exclusive *sensu lato* (Gerovasileiou & Voultsiadou, 2012). However, the majority of species found in marine caves are cryptobiotic or crevicular and deep-water species which secondarily colonize caves, originating from external dim-light and dark environments (*e.g.* coralligenous beds, circalittoral bottoms and deep-water habitats) (Gerovasileiou & Bianchi, in press). Therefore, marine dark caves have been considered as "natural laboratories" or "deep-sea mesocosms" in the littoral zone because they provide direct human access to bathyal-like conditions (Harmelin & Vacelet, 1997).

III.2.2 Deep sea

16. Remotely Operated underwater Vehicles (ROVs) have enabled a better exploration and understanding especially of rocky substrates. Extensive areas can be covered by photographs and video-footages allowing researchers to describe habitats and mega-benthic species composing the assemblages. ROVs, but also landers and dropping cameras can reveal precious information on the habitus, coloration and behaviour of species (Bo et al., 2020). Many explorations of deep-sea habitats, based on images and videos, allow qualitative/quantitative analysis of mega-benthic assemblages and description of the associated megafauna. Nevertheless, sampling is often necessary to assert species identifications and determine composition of small (not identifiable on images) species.

17. Recent publications have focused on the emblematic ecological role of CWC assemblages, describing their composition and function (Orejas & Jiménez, 2019). Other deep-sea anthozoan assemblages, described as gardens or forests because of their three-dimensional development, show a rich biodiversity (*e.g.* Bo et al., 2015; Ingrassia et al., 2016). In parallel, the composition of sponge aggregations has been studied in the western Mediterranean (see Maldonado et al., 2015; Santín et al., 2018).

18. Furthermore, ecosystem functioning and relations between deep-sea benthic and vagile species are more and more investigated. Publications suggest that fish are very abundant in CWC assemblages and canyons (D'Onghia et al., 2015; Capezzuto et al., 2018a, b). Besides, the nursery function of coral forests appears to be important as they are described as spawning areas for fish and sharks (see Cau et al., 2017).

19. To better understand the sensitivity of CWC communities to climate change impacts, relations between bacteria and CWC are also being investigated (Meistertzheim et al., 2016).

20. New species of the Mediterranean deep-sea are regularly described (*e. g.* Boury-Esnault et al., 2015, 2017; López-González et al., 2015; Fernandez-Leborans et al., 2017; Bo et al., 2020) but difficulty in collecting samples limits their identifications. Many species of the deep-sea assemblages are still to be discovered and their population dynamics and interrelations need more systematic and rigorous investigation.

IV. MAIN THREATS

IV.1 For marine caves

21. Considering marine caves as a whole (semi-dark and dark parts), they are fragile ecosystems with low resilience (Harmelin et al., 1985; Rastorgueff et al., 2015) that are vulnerable to seawater warming, unregulated visits by SCUBA divers and tourist boats (*e.g.* mechanical damages by unintentional contact, sediment resuspension and accumulation of exhaled air bubbles), red coral harvesting, spearfishing, urbanization and building of coastal structures, waste outflows, littering and non-indigenous species (Chevaldonné & Lejeusne, 2003; Parravicini et al., 2010; Di Franco et al., 2010; Guarnieri et al., 2012; Giakoumi et al., 2013; Rastorgueff et al., 2015; Gerovasileiou et al., 2016; Nepote et al., 2017; SPA/RAC-UNEP/MAP, 2020).

22. Climate change effects (*e. g.* heat waves and temperature anomalies) and local disturbances caused by coastal interventions and constructions (*e. g.* extension of harbours and beach nourishments) have proved to

generate structural and functional homogenization of marine cave communities, such as the decrease of structural complexity and parallel increase of turf and sediment (Nepote et al., 2017; Montefalcone et al., 2018; Sempere-Valverde et al., 2019). Marine pollution and littering constitute additional threats especially in semi-submerged caves where litter often accumulate on internal beaches, drifted by wave action (Mačić et al., 2018) or dark cave zones where the lack of water movement may also favour the entrapment of litter (Gerovasileiou & Bianchi, in press).

23. An additional threat to Mediterranean marine cave communities involves the continuous spreading of non-indigenous species (NIS), especially in the south-eastern Mediterranean Sea (Gerovasileiou et al., 2016; Öztürk, 2019). NIS are mainly observed at the entrance and semi-dark zones of shallow and semi-submerged caves and less frequently in dark zones. However, their impact on cave communities is unknown and should be urgently monitored, especially in marine caves of the Levantine and Aegean ecoregions.

IV.2 For Mediterranean deep sea

IV.2.1 Trawling

24. The most important threats perhaps for deep-sea habitats are the direct and indirect impacts of trawling activities. In canyons, soft bottom corals undergo direct destruction by trawling activities (Petović et al., 2016; Lauria et al., 2017; Pierdomenico et al., 2018). *Isidella elongata*, the only Mediterranean Anthozoan considered as Critically Endangered (Otero et al., 2017), is directly threatened by trawling impacts (Pierdomenico et al., 2018). CWC assemblages represent a threat for bottom trawling and since the adoption of electronic maps and GPS navigation systems allowing trawlers to navigate precisely, these areas are generally avoided although the present direct trawling impact by destruction of the vulnerable structures of the main builders, is not excluded. Until the mid-1990s, when the GPS systems were not available on trawling boats and scientific knowledge on the CWC areas was minimal, trawlers hit most CWC areas causing severe damage (Tunesi et al., 2001).

25. Trawling also impacts indirectly canyon habitats and CWC assemblages by increasing water turbidity and sediment resuspension and deposit (Puig et al., 2015; Paradis et al., 2017; Arjona-Camas et al., 2019; Lastras et al., 2016; 2019). Thus, recent studies have shown that as well as displacing sediments, trawling affects the morphology of the seabed, as is known by high-resolution relief maps of seabed, causing damage comparable to that caused by ploughing farmland (Puig et al., 2012). Also, discards of vulnerable by-caught species from deep-sea trawling are not negligible (Gorelli et al., 2016).

26. In the Mediterranean Sea, the General Fisheries Commission for the Mediterranean (GFCM), led by the precautionary principal, banned bottom trawling activities in depths over 1000 m since 2005. However, CWC dwell also shallower than 1000 m depth, highlighting the ineffectiveness of this restriction for a large part of these vulnerable ecosystems. Therefore, the deep-sea habitats between 200 and 1000 m depth, especially along canyons, stay threatened and vulnerable to bottom trawling. To address this issue, in certain areas, GFCM has adopted Fisheries Restricted Areas (FRAs), ecosystem based spatial management measures that restrict fishing activities with a total closure to bottom trawling. FRAs ensure the protection of deep-sea sensitive habitats such as VMEs (it is the case of the *Lophelia* reef off Capo Santa Maria di Leuca in 2006; the Eratosthenes seamount in 2006; an area in the Nile delta with cold hydrocarbon seeps since 2006) and essential fish habitats (it is the case of the Eastern Gulf of Lion area in 2009; the three areas in the Strait of Sicily in 2016; and the Jabuka/Pomo Pit in the Adriatic in 2018).

IV.2.2 Other fishing activities

27. Practically every recent publication based on mega-benthic deep-sea observations mentions visible anthropogenic impacts with a high number of derelict fishing gear either on CWC assemblages, or on other coral assemblages (Angiolillo & Canese 2018; Capezzuto et al., 2018a; Chimienti et al., 2019; Giusti et al., 2019; Angiolillo & Fortibuoni, 2020). Presence and impact of lost fishing nets and longlines are especially

noticeable on deep-sea habitats that are close to the coast because more accessible to artisanal and recreational fishing activities.

IV.2.3 Industrial discharges and marine litter

28. Impacts of terrestrial human activities such as industrial discharges (Bouchoucha et al., 2019; Fontanier et al., 2020), dumping (Taviani et al., 2019), marine litter (Pierdomenico et al., 2019; Angiolillo & Fortibuoni, 2020) and transfer of pollutants to the deep-sea (Sanchez-Vidal et al., 2015) represent important pressures on deep-sea habitats and species.

29. Because of their geomorphology and the oceanographic currents occurring around submarine canyons, these structures tend to funnel, collect and accumulate litter at the base or in depression. This is particularly true for canyons that are close to the coast. The Mediterranean holds the submarine canyons with the highest concentration of plastic in Europe (Aguilar et al., 2020; Canals et al., 2021). The other deep-sea geomorphological structures undergo the impact of marine litter as well (see Aguilar et al., 2020).

IV.2.4 Climate change

30. Although poorly known, climate change impacts cumulated to the previous threats, could drive important changes in Mediterranean deep-sea ecosystem structures (Sweetman et al., 2017). The impacts of acidification combined to the increase of the sea temperature on reef building deep species such as scleractinian CWCs is not yet well known but the development of these species seems altered (see Maier et al., 2012; Hennige et al., 2014; Rodolfo-Metalpa et al., 2015; Gómez et al., 2018).

31. Benthic non-indigenous species (NIS) have rather rarely been reported in deep-sea habitats (Galil et al., 2019) and for the moment they do not represent the most important threat. Nonetheless, the rise of sea temperature attributed to climate changes occurs also in deep-sea and could contribute significantly to expand the bathymetric distribution of actual shallow NIS (see *e. g.* Innocenti et al., 2017).

IV.2.5 Other threats that could develop in the future.

32. Offshore oil and gas developments (exploration, offshore infrastructures, drilling operations and transport by pipelines and/or tankers) represent a direct and increasing threat for deep-sea ecosystems, especially for benthic habitats (Cordes et al., 2016). Discoveries of new hydrocarbon resources in the Mediterranean will probably lead to an increasing number of drilling licences as well as the development of pipelines crossing deep-sea benthic habitats and increasing tanker traffic in the Mediterranean.

33. Marine noise pollution (MNP) can be a side effects of such explorations and developments but can also originate from many other anthropogenic activities (*e. g.* maritime traffic, military activities). MNP have considerably increased since the second world war (Frisk, 2012) and can interfere with behaviour and vital processes of marine mammals (*e. g.* Erbe et al., 2018) but also have various impacts on deep-sea fauna including invertebrates (see Di Franco et al., 2020).

V. OBJECTIVES OF THE ACTION PLAN

34. The objectives of the Action Plan are to:

- develop and improve knowledge about dark habitats and their assemblages (*e. g.* distribution, species richness, composition, functioning, and ecology).

- conserve the habitats' integrity, functionality (favourable state of conservation) by maintaining the main ecosystem services (*e .g.* carbon sink, halieutic recruitment and production, biogeochemical cycles) and their interest in terms of biodiversity (*e.g.* specific diversity, genetics);
- encourage the natural restoration of degraded habitats (*e. g.* reduction of anthropogenic impacts)

VI. ACTIONS REQUIRED TO ATTAIN THE OBJECTIVES OF THE ACTION PLAN

VI.1 Improving inventories, location and characterisation

35. During recent decades, interest and concern for dark habitats has increased, and knowledge has been improved by newly available exploration technologies (see SPA/RAC-UN Environment/MAP & OCEANA, 2017). However, this knowledge is often scattered, even at national level, and spatially uneven throughout the Mediterranean. Efforts are made by the scientific community, international and national bodies to acquire information on the distribution and composition of marine caves and deep-sea benthic habitats. Still, the difficulty of access and the high cost of deep-sea scientific campaigns explain the large knowledge gaps on the distribution, biodiversity, ecosystem functioning, dynamics and ecological status of the various types of dark habitats and their assemblages. Yet, this information is vital for the implementation of an optimal management strategy on these ecosystems.

36. The following actions could help improve the lack of knowledge for all dark habitats:

- Aggregate the available knowledge, taking into account not only national and regional data (*e. g.* RAC/SPA, GFCM, IUCN, OCEANA, WCMC) but also scientific works. The information should be integrated within a geographical information system (GIS) and could be shared via online consultation.
- Identify geographical areas of interest presenting important knowledge gaps and enhance national capacities and international cooperation for investigation campaigns.
- Set up a database of people-resources in identified fields (*i. e*. caves, deep-sea populations), of institutes and bodies working in this field and of the available means of investigation.
- Quantify the proven or potential pressures (*e. g.* commercial and recreational fishing, leisure activities and diving, undersea prospecting). New knowledge must be acquired in areas of regional interest to promote a multidisciplinary approach and enhance international cooperation over these sites. Such joint action will permit the exchange of experience and the setting up of shared management strategies (building guidelines).
- Maintain regular theme-based workshops that bring together experts on dark habitats (biodiversity, methodology, monitoring, threats, conservation etc.).

VI.2 Building-up management measures

37. Management procedures involve enacting laws aimed at regulating human activities likely to affect dark habitats and permit their long-term conservation.

VI.2.1 Legislation

38. At national level, endangered and threatened species and populations of dark habitats should be identified in order to update corresponding national species lists. They can then be considered as protected species as defined in Article 11 of the Protocol on Specially Protected Areas and Biological Diversity (SPA/BD Protocol, 1995). Special consideration should be given to species of Vulnerable Marine Ecosystems (VMEs)[7].

[7] See report of GFCM Working Group on Vulnerable Marine Ecosystems (WGVME), Malaga, Spain, 3-5 April 2017

39.The regulations on impact studies must be strengthened to make compulsory the assessment of impacts on species and assemblages of dark habitats. The regulations should pay particular attention in the event of coastal development, the prospecting and exploiting of natural resources and the discharge and dumping of materials at sea.

40.Insofar as regulatory procedures already exist at international level to restrict or ban certain human activities, further actions are required in order to have them applied and develop new propositions. This is particularly so for the setting up of Fisheries Restricted Areas (FRA) as adopted in the context of the mandate of the General Commission on Mediterranean Fisheries, including the ban on trawling, in the Mediterranean, at depths of over 1,000 meters down (FAO-GFCM, 2006; GFCM, 2019). The Mediterranean states are invited to use and enhance, all means already available to ensure better conservation of dark habitats.

VI.2.2 Setting MPAs

41.Numerous Mediterranean MPAs encompass marine caves and in several cases, coastal areas with marine caves have been suggested for protection. Nevertheless, their number in MPAs remains unknown and - despite the establishment of new MPAs, EU environmental legislation and the Dark Habitats Action Plan - in most cases there is a lack of specific regulations or management plans for their protection, monitoring and restoration. Further specific regulations are needed for dark habitats within MPAs, especially marine caves.

42.Mediterranean deep-sea habitats are still poorly represented in MPAs partly due to the fact that these habitats are often distant from the coast and difficult to access, therefore their effective protection represents a real challenge. Adding to the difficulty of access, is the fact that deep-sea habitats are often areas beyond national jurisdiction (ABNJ).

43.Designation of Marine Protected Areas intended to permit more efficient conservation of these assemblages must be based on the identification of sites on the basis of the criteria such as uniqueness or rarity, particular importance for species biological stages, importance for threatened, endangered or declining habitats or species, vulnerability and reduced recuperative capacity after disturbance, biological productivity, biodiversity and naturalness as adopted in 2009 by the Contracting Parties (UNEP-MAP-RAC/SPA, 2009). At the Mediterranean level, the selection of sites to be protected must also be based on the ecosystem approach and take in consideration the patchy distribution of these habitats, as the only way to ensure a coherent and efficient network of MPAs for a sustainable management of the various types of dark habitats.

VI.2.3 Other management measures

44.Measures should be identified to reduce the pressures that hang over assemblages of dark habitats and to implement them. In the light of the precautionary principle, particular attention should be paid to the impacts that could arise as a result of the seawater temperature rise, acidification and/or fertilization of the oceans and the setting up of new emergent fisheries (border areas).

45.MPAs which host dark habitats (e. g. dark marine caves) should update their management plans to include measures adapted to their conservation.

46.Procedures aimed at assessing the efficiency of these measures, as a whole, should be defined in consultation with the organisations concerned by the management of these assemblages (*e. g.* international conventions, GFCM, IUCN, NGOs) to promote sustainable, adaptable and concerted management.

47.In sites that have not yet been studied, a state of reference (‘zero state’) is a necessary precondition for setting up a monitoring system for these assemblages. For the sites for which data already exists, monitoring procedures should be started.

VI.3 Strengthening national plans

48.To give greater efficiency to the measures for setting up the present Action Plan, the Mediterranean countries are invited to build-up national plans for the protection of dark habitats. Each national plan should propose appropriate legislative measures, particularly as regards impact studies for coastal development and check the activities that can affect these assemblages.

49.The national plan should be elaborated on the basis of the available scientific data and should include programmes for:

(i) gathering and continuous updating of data,
(ii) training and updating of specialists,
(iii) education and awareness for the public, actors and decision makers, and
(iv) conservation of dark habitats and their assemblages that are significant for the marine environment in the Mediterranean Sea.

50.These national plans must be brought to the attention of all the concerned actors and as far as possible ensure coordination with other permanent national plans (*e. g.* emergency plan against accidental pollution).

VI.4 Establishing monitoring plans

51.Recent technological advances have enhanced the possibilities of studying and monitoring deep-sea habitats by acoustic, visual or sampling methods. These methods must be combined to obtain the most cost-efficient monitoring of deep-sea habitats to reach the most accurate state of conservation. Plans for monitoring dark habitats and associated assemblages should be communicated at a Mediterranean scale to encourage transboundary exchanges, regional coherence, sharing effort and means of investigations (see Deep-sea exploration in France, Monaco and Italy in the framework of the international agreement Ramoge - Daniel et al., 2019).

52.The *Guidelines for inventorying and monitoring of Dark Habitats in the Mediterranean Sea* (SPA/RAC-UN Environment/MAP & OCEANA, 2017) details the methodologies and the IMAP common indicators selected for monitoring dark habitats. Monitoring of dark habitats should be based on these guidelines. Nevertheless, the absence of long time series depicting the past ecological status of dark habitats (*e. g.* marine caves) is a major impediment to the monitoring and evaluation of impacts and changes in their ecological status.

VI.5 Enhancing transboundary exchanges

53.In the light of the geographical distribution of many types of dark habitats in areas beyond national jurisdiction (ABNJ), and the difficulties of reaching them (bathymetric range, lack of knowledge, scientific means required and cost of study), it is important to:

(i) encourage the establishment of international cooperation to create synergies between the various actors (decision makers, scientists, socio-professionals) and set up shared management.
(ii) organise training courses and encourage the exchange of cross-border experience so as to enhance national capacities in the field.

VI.6 Developing public awareness and information

54.Information and awareness programmes to make dark habitats, their vulnerability and the interest in conservation better known should be crafted and continued for decision-makers, but also users such as SCUBA divers, fishermen and mine operators. Communication on these habitats should also be encouraged for the wider public. The participation of NGOs in these programmes should be encouraged.

VII. REGIONAL COORDINATION AND IMPLEMENTATION

55.Regional coordination of the implementation of the present Action Plan will be handled by the Secretariat of the Mediterranean Action Plan (MAP) via the Regional Activity Centre for Specially Protected Areas. The coordinating structure's main functions are:

(i) gathering, summarizing and circulating knowledge at Mediterranean level and permitting this to be integrated within the available instruments (*e. g.* Standard Data-Entry Form - SDF);
(ii) setting up and updating databases on people/resources, laboratories involved, and investigation means available;
(iii) helping states identify and assess the pressures on the various types of dark habitats and their assemblages at national and regional level;
(iv) promoting studies on dark habitats and making inventories of species in order to better figure out the way they function and better assess the ecosystem services they provide;
(v) promote cross-border cooperation;
(vi) back the setting up of monitoring networks for dark habitats;
(vii) organise meetings of experts and training courses on dark habitats and their biodiversity;
(viii) prepare reports on how implementation of the Action Plan is progressing, for submission to the Meeting of National Focal Points for SPAs and meetings of the Contracting Parties;
(ix) establish a work programme for implementing the Action Plan over a five-year period, which will be submitted to the Contracting Parties for adoption.

56.At the end of this period, if necessary, after assessment and updating, it can be repeated. Implementing the present Action Plan is the responsibility of the national authorities of the Contracting Parties. At each of their meetings, the National Focal Points for SPAs shall assess how far the Action Plan is being implemented on the basis of national reports on the subject and a report made by RAC/SPA on implementation at regional level.

57.In the light of this assessment, the Meeting of National Focal Points for SPAs will suggest recommendations to be submitted to the Contracting Parties. If necessary, the Meeting of Focal Points will also suggest adjustments to the schedule that appears in the Appendix to the Action Plan.

VIII. PARTICIPATION IN THE IMPLEMENTATION

58.Supplementary work done by other international and/or non-governmental organisations, aiming at the same objectives, should be encouraged, encouraging their coordination and avoiding duplication of effort. At their ordinary meetings, the Contracting Parties could, at the suggestion of the Meeting of National Focal Points for SPAs, in order to encourage and reward implementation of the Action Plan, grant the title of 'Action Plan Partner' to any structure that may so request.

59.This label will be granted on the evidence of proven involvement in the implementing of the present Action Plan attested by concrete actions (*e. g.* conservation, management, research, awareness etc.).

60.The label can be extended at the same time as the multi- annual work programme on the grounds of an assessment of actions carried out during that period.

Implementation schedule

Actions	Time	Who
Making a summary of knowledge of dark habitats and their distribution around the Mediterranean in the form of a geo-referenced information system	As soon as possible and continuously	RAC/SPA & Contracting Parties
Setting up a database of people/resources and means of investigation available	As soon as possible and continuously	RAC/SPA
Identify and assess proven pressures on each of the various types of dark habitats	Year 1 and 2	RAC/ SPA, Partners and Contracting Parties
Gathering data and information on research activities	Continuously	RAC/SPA & Contracting Parties
Revise the reference list of types of marine habitats for the selection of sites for inclusion in the national inventories of natural sites of conservation interest, in order to take into account dark habitats	Year 1 and 2	Contracting Parties
Revise the list of endangered or threatened species in order to take account of species and assemblages of dark habitats	Year 1 and 2	RAC/SPA & Contracting Parties
Promote the identifying of areas of interest for the conservation of dark habitats in the Mediterranean and carry out concerted actions in national and/or cross-border sites	Year 1 and 2	RAC/SPA & Contracting Parties
Implement and/or extend MPAs to include already identified sites of interest that host dark habitats at a national level and in areas beyond national jurisdiction (ABNJ)	As soon as possible and continuously	RAC/SPA & Contracting Parties
Introduce national legislation to reduce negative impacts on dark habitats and associated assemblages (including impact studies procedures)	On adoption	Contracting Parties
Regularly hold theme-based workshops (in coordination with those of the 'Coralligenous' AP)	Every three years	RAC/SPA
Update guidelines suited to the inventorying and monitoring of dark habitats and associated assemblages	Every five years	RAC/SPA and Partners
Implement monitoring systems	As soon as possible	RAC/SPA & Contracting Parties
Develop detailed guidelines for effective management measures of dark habitats	Year 1 and 2	RAC/ SPA, Partners and Contracting Parties
Enhance cooperation actions with concerned organisations and in particular with GFCM	Continuously	RAC/SPA
Step up awareness and information about dark habitats and associated assemblages with the various actors	Continuously	RAC/ SPA, Partners and Contracting Parties
Enhance national capacities and improve skills in taxonomy and monitoring methods	As needed	RAC/SPA

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