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5.3. First elements to elaborate the List of Reference of Pelagic Habitat Types in the Mediterranean Sea

First elements to elaborate the List of Reference of Pelagic Habitat Types in the Mediterranean Sea

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Note:

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Note by the Secretariat

The Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean and the Action plan for the Protection of the Marine Environment and the Sustainable Development of the Coastal Areas of the Mediterranean (MAP Phase II), adopted by the Contracting Parties to the Barcelona Convention in 1995, contain provisions for the preparation of inventories at national as well as regional level.

At their 10th Ordinary Meeting (Tunis, 18-21 November 1998), the Contracting Parties to the Convention for the Protection of the Mediterranean Sea against Pollution adopted common criteria for the preparation of national inventories of natural sites of conservation interest. The criteria provided for the establishment of a reference list of marine and coastal natural habitat types, to be drafted on the basis of a model classification. At the same Meeting the Contracting Parties invited the Regional Activity Centre for Specially Protected Areas (SPA/RAC) to work on the elaboration of a model classification of marine habitat types for the Mediterranean region, as well as a reference list of habitat types.

The COP 11 (Malta, 27-30 October 1999) adopted the Classification of benthic marine habitat types for the Mediterranean region and the Reference List of Marine Habitat Types for the Selection of Sites to be included in the National Inventories of Natural Sites of Conservation Interest. It recommended to work on the elaboration of a classification of habitats for the pelagic environment, and invited SPA/RAC to organize to this end a working group of experts.

Since a classification of pelagic habitat types will assist efforts to implement much-needed ecosystem-based management in open and deep seas, SPA/RAC presented to the Eleventh Meeting of Focal Points for SPAs (Rabat, Morocco, 3-4 July 2013) a document entitled “Towards the Identification and Reference List of Pelagic Habitat Types in the Mediterranean Sea”. The document was welcomed and encouraged continuing work to establish the exhaustive reference list.

At their 21st Ordinary Meeting (Tirana, Albania, 17-20 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 (Decision IG.24/14).

In this context, the present document is presented for review and discussion by the SPA Focal Points with the view of proposing recommendations concerning the way forward to develop a comprehensive reference list of pelagic habitat types in the Mediterranean region.

Introduction: Complexity of pelagic habitat characterisation

1. Pelagic habitats cover the 71% of Earth's surface and play an essential role in regulating temperature on land, producing oxygen and food. They are also a management challenge where the alterations of their physical, chemical and biological characteristics negatively impact their ecosystem functioning and services (e.g. provisioning services).

2. Any habitat classification system (e.g EUNIS, Barcelona Classification of Benthic Marine Habitat Types for the Mediterranean Region) aims to provide a common reference set of habitat types within a hierarchical classification, and to cover all terrestrial, freshwater and marine habitats. The classification facilitates reporting of habitat data in a comparable manner, for use in nature conservation (e.g. inventories, monitoring and assessments), habitat mapping and environmental management.

3. Benthic habitats can be considered as fixed (although boundaries of some such habitats can slowly move in response to environmental change and human-induced disturbance), can be taken as proxies for biodiversity hotspots which are normally associated with such habitats, and that might warrant protective efforts. Accordingly, development of a reference list of benthic habitats makes mapping possible, and, in turn, facilitates conservation action.

4. The situation is radically different when dealing with pelagic habitats which refer to an ecological area of the water-column and, specifically hereafter, to species-specific water depths. Pelagic habitats are characterized by biotic factors (chlorophyll fronts and chlorophyll content), seen as a proxy for marine productivity, and abiotic factors (temperature, current velocity, salinity, mixing/stability regime) which are perceived as physical tolerance limits of species.

5. Furthermore, unlike the benthos, the pelagic realm is tri-dimensional, difficult to inspect, mostly located far from land, and although consisting of a wide variety of combinations of physical and chemical characteristics which creates different habitats that marine species readily react to, such habitats cannot be detected by humans without the assistance of sophisticated instrumentation.

Characterisation of pelagic habitats

6. Mediterranean Sea circulation is complex and its interaction with biological processes defines a variety of marine pelagic habitats, from the surface to the deeper waters, and from coastal waters to offshore and oceanic waters. A vertical delimitation of pelagic habitats would also consider from surface to seabed in seasonal thermoclines seas or from surface to the hypoxic layer in permanent halocline areas (e .g. the Baltic and Black Seas) where the hypoxic sub-layer is considered resilient to changes Offshore waters are typically considered as oligotrophic, or nutrient poor. Nevertheless, the enrichment of surface layers is assured by upwelling and water mixing, by the concentration and retention of nutrients by eddies and front action. All these oceanographic features determine favorable conditions both for primary production and for the autotrophic and heterotrophic microbial processes. Microbial food webs exceed a thousand times over the production of the "classic food web" (phytoplankton zooplankton-fishes) which "can now be considered as a variable phenomenon in a sea of microbes" (Fabi and *al*, 2018, Wurtz, 2010), thus enhancing the ecosystem's carrying capacity.

7. Furthermore, narrow continental shelves, steep slopes, canyons and seamounts accelerate through space and time the energy flow and the turnover from the sea bottom to the surface, as well as from coastal to pelagic waters (and vice versa). The presence and abundance of top predators in relation to specific topographic and oceanographic structures seem to confirm this new scenario of pelagic productivity (Wurtz, 2010). Studies have suggested that odontocetes, for example sperm whales, feeding mainly on deep-water squid, are commonly associated with topographic structures such as canyons and submarine mountains, while mysticetes, e .g. fin whales feeding on plankton, aggregate on thermal fronts or convergent structures rich in zooplankton (Fabi and *al*, 2018).

8. Upper–trophic level predators (top predators) feeding, and breeding grounds frequently represent biodiversity hotspots, associated with topographic and oceanographic features. Therefore, using the upper–trophic level predators (top predators) as indicators of the ecosystem status productivity may be considered to characterise the pelagic habitat from the point of view of cost-benefit ratio. Their distribution and aggregation may be effectively used in pelagic habitat mapping where these top predators occur, even if a whole-system approach could be the proper strategy and the top predators approach could be part of a set of insights and interpretations used for management measures (Fabi and *al*, 2018).

Selection of Sites to be Included in the National Inventories of Natural Sites of Conservation Interest in the Mediterranean

9. Water column habitats are generally referred to as 'pelagic' habitats which include the water column and all the organisms that inhabit or using it. In accordance with UNEP/RAC/SPA (2013) , two zones of pelagic habitats are identified: - the neritic zone – also known as coastal zone - which is the portion of the ocean lying above the continental shelf (i.e., extending from the low tide mark to the location corresponding to the continental shelf break - around a depth of 200 m); and - the oceanic zone – also termed the open ocean or open sea - which extends away from the coast beyond the shelf break. Water column habitats are largely dependent on movements of the water masses and the complex interactions between biological and physical processes.

10. For this reason, water column habitats can be classified differently at different times of the year. For example, in the case of Malta such classification would depend on the hydrodynamics in the area, which are mainly dictated by the general flow in the Sicilian Channel, and thermal stratification of the water column that characterises the Mediterranean basin.

11. The following initial draft reference list for the epipelagic layer (0-200m) was proposed by UNEP-SPA/RAC (UNEP/RAC/SPA, 2013). This classification was developed in large part to aid in the derivation of potential feeding and breeding habitat of bluefin tuna and fin whales in the Mediterranean, through habitat modelling (UNEP/RAC/SPA, 2013)..

A. Epipelagic layer (0 – 200 m):

A.1.	Reduced salinity water	coastal lagoons
A.2.	Variable salinity water - high surface CHL (>3 mg/m^3)	estuaries, river plumes
A.3.	Marine water: neritic - medium surface CHL (0.5-3 mg/m^3)	upwellings, re-suspension in shallow waters and outskirts of river plumes
A.4.	Marine water: oceanic - medium surface CHL (0.5-3 mg/m^3)	upwellings
A.5.	Marine water: oceanic - low surface CHL (~0.1-0.5 mg/m^3)	chlorophyll-a fronts (whatever type of horizontal gradient of CHL, thus including e.g. gyres)
A.6a.	Marine water: oceanic - very low surface CHL (<0.1 mg/m^3) with subsurface CHL maximum	euphotic depth > mixed layer depth
A.6b.	Marine water: oceanic - very low surface CHL (<0.1 mg/m^3) without subsurface CHL maximum	euphotic depth < mixed layer depth

12. Proposing a reference list of pelagic habitats in the mesopelagic, bathypelagic, and abyssopelagic layers (200 – 6,000 m) is far more challenging particularly considering the complex structuring and dynamics of the different Mediterranean water masses. Fortunately, these layers are much less relevant for the species selected for the EcAp process: birds are not known to venture below epipelagic depths, and also loggerhead and green turtles normally remain in the upper 10s of m in the water column.

Many cetaceans dive to mesopelagic waters, and some even beyond, however these dives are performed in search of food, and the animals are forced to return to the surface in a range of 10s-100s of minutes after the beginning of their dives. Meanwhile, these zones are still important for the marine ecosystem.

13. Clearly, identifying and classifying pelagic habitat types beyond the epipelagic layer is a very complex task requiring a good understanding of the interplay between abiotic (i.e., depth, temperature, salinity and currents) and biotic factors, and of the time and space scales involved in such interplay.

14. Therefore, it is recommended that an effort of compiling a reference list of Mediterranean pelagic habitat types be achieved through in-depth multidisciplinary expert consultations. However, considering the importance of the inventory of pelagic habitats for the conservation of vulnerable pelagic species as well as for the sustainable exploitation of pelagic fishing stocks, close collaboration with relevant regional organisations as appropriate is strongly recommended for the compilation of the reference list.

Links to the Ecosystem Approach Roadmap

15. Characterisation of pelagic habitats in the Mediterranean is necessary for the implementation of the Ecosystem Approach (EcAp) roadmap and its Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria (IMAP) in particular for the preparation of the MedQSR 2023.

16. According to Magliozzi, 2021, pelagic habitat types are identified, in the EU Marine Strategy Framework Directive (MSFD), horizontally by considering the distance from shore. The four broad habitat types cover two main zones: i) the neritic, which includes variable salinity and coastal habitats, and ii) the oceanic, which extents away from coast and refers to the shelf and oceanic/beyond shelf habitats. It is expected that further vertical and horizontal divisions would be needed to distinguish the range of pelagic habitats in a region. This is a common approach when classifying pelagic ecosystems, it requires focusing on specific mechanisms that underlie Good Environmental Status (GES) and thus support concrete outcomes. To date, different hydro-biogeochemical models exist that describe the pelagic habitats across European marine regions (i.e., Baltic Sea, North-East Atlantic Ocean, Mediterranean Sea, Black Sea).

17. The EU MSFD requires that European Member States that share a marine region or sub-region cooperate when developing their marine strategies (CEC, 2008). In this respect, Regional Sea Conventions, like OSPAR, HELCOM and Barcelona Convention, take a key role as a platform for EU Member States to coordinate their approaches in implementing the MSFD at a regional scale (Rombouts and *al*, 2019).

18. A common approach to estimate pelagic environmental status is to look for plankton community changes. In this approach, abundance, biomass and diversity are often considered as proxies for processes controlling the pelagic physical and biological systems (e. g. eutrophication). Generally, the biological community are assessed by three categories of indicators depending on the targeted taxa: phytoplankton-only, zooplankton-only, and combined phyto- and zooplankton. There are advantages and disadvantages depending on the category and metric addressed by each indicator.

19. Within the OSPAR Regional Sea Convention, marine phytoplankton and zooplankton community indicators are developed to assess the Environmental Status of Pelagic Habitats. Pelagic Habitat indicator 1 (PH1) “Changes in phytoplankton and zooplankton communities” uses the relative changes in abundances of lifeform pairs based on functional traits to indicate ecological change. For example,

in the pairing of diatoms and dinoflagellates, the dominance of the latter could indicate eutrophication resulting in less desirable food webs. Pelagic Habitat indicator 2 (PH2) “Changes in Phytoplankton Biomass and Zooplankton Abundance” provides an indication of deviations in total biomass or abundance of plankton from the assumed natural variability in time-series. Finally, Pelagic Habitat indicator 3 (PH3) identifies changes in the community structure using taxonomic diversity indices. These three common indicators consider plankton communities at different organizational levels: PH2 at the broadest organizational level since it considers total phytoplankton biomass and total copepod abundance, PH1 at an intermediate level since it considers lifeform pairs, and PH3 at the finest level of organization, if possible, down to the species level (Rombouts and *al*, 2019).

20. The use of plankton indicators in the Mediterranean Sea refers mostly to past scientific studies of pelagic habitats in coastal waters and to case studies connected with environmental pressures, e.g. in the Adriatic, Aegean etc. Regional sea conventions (OSPAR, HELCOM, Barcelona and Bucharest Conventions) have long considered phytoplankton as a key element for integrated assessment systems. Phytoplankton biomass, community composition, abundance, frequency, and intensity of blooms are used for such assessment purposes. Regarding zooplankton communities, commonly used indicators have a taxonomic base while recently size structure and biomass can provide a valuable index of zooplankton population dynamics and ecosystem production. The occurrence and frequency of jellyfish blooms are also considered important zooplankton indicators in specific areas, e. g. North Adriatic. (Varkitzi *et al*, 2018).

21. Following Varkitzi *et al*, 2018, a variety of phytoplankton indicators can be found in the scientific literature, webpages, different project reports and deliverables, which have been developed and/or used at the Mediterranean Sea level, all aiming to assess the status of the marine environment. There is considerable scientific and practical interest in understanding how the biological components of marine systems respond to both single and multiple stressors. The response of zooplankton to environmental conditions is of particular interest due to the central and mediating role that this group occupies as atrophic link between planktonic primary producers and larger consumers. Also, information on the zooplankton communities, including the species composition/distribution and seasonal/geographical variability, provide a relevant contribution to the definition of GES for various MSFD Descriptors (e. g. D1, D2 and D4). The use of a combination of multiple indicators (phytoplankton, zooplankton and abiotic) and related parameters is encouraged by the scientific community.

22. In 2016 the Barcelona Convention adopted the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria (IMAP) (UNEP/MAP, 2017). IMAP describes the strategy, themes, and products that the Contracting Parties are aiming to deliver over the second cycle of the implementation of the Ecosystem Approach Process (EcAp process 2016-2021), in order to assess the status of the Mediterranean Sea and coast.

23. One of the main outcomes of this process is that IMAP covers the Ecological Objectives related to Biodiversity (EO1) in accordance with D1 of MSFD. Among the existing five Biodiversity common indicators, there are only two related to pelagic habitats, namely:

- the Common indicator 1: Habitat distributional range (E01) to also consider habitat extent as a relevant attribute, and
- the Common indicator 2: Condition of the habitat's typical species and communities (E01).

24. To provide representative sites and species to include in the monitoring programmes, a reference list of species and habitats is presented in Annex 1 of the IMAP document (UNEP/MAP, 2017). The Contracting Parties need to include the monitoring of the reference list of species and habitats within

at least two monitoring areas in their national monitoring programmes, one in a low-pressure area and one in a high-pressure area from human activity. Key features from this Annex related to pelagic habitats are listed in Table 1.

Predominant habitat or "Functional" group of species	Specific habitat type or species to be monitored	Additional information: specific representative species or habitats	Assessment monitoring scale
Water column - coastal waters	Coastal waters phytoplankton communities	HABs	national/regional
Water column - coastal waters	Coastal waters zooplankton communities	cf. jellyfish population dynamics and blooms	national/ sub-regional
Water column - shelf and oceanic waters	Shelf and oceanic waters phytoplankton communities	HABs	Sub-regional
Water column - shelf and oceanic waters	Shelf and oceanic waters zooplankton communities	cf. jellyfish population dynamics and blooms	Sub-regional

Table 1: Reference list of species and habitats from Annex 1 of the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria (IMAP) (UNEP/MAP, 2017).

25. Besides in the Biodiversity Ecological Objective, phytoplankton biomass is largely considered under the EO5 Eutrophication with the Common Indicator 14: Chlorophyll a concentration in water column (UNEP/MAP, 2017). The common indicator could contribute to assessments for pelagic habitats under EO1 as the distribution and an estimate of the area that is subject to eutrophication in the water column. In fact, Chlorophyll a still remains the most widely used indicator mostly thanks to its time saving, cost-effective and reproducible analytical methods that provide easily comparable datasets (Varkitzi and *al*, 2018).

26. Our knowledge of the pelagic habitats for the Mediterranean Sea is generally limited to coastal areas for which several long-term monitoring stations exist for both zooplankton and phytoplankton. Our knowledge for the open sea is scarcer and less studied and to our knowledge, no available nor operational indicators have been developed in the deep-water parts of the Mediterranean Sea. Satellite data and associated modelling chl-a regionalisation are available, which can be used for the already developed OSPAR pelagic indicator which can be adapted to the Mediterranean (OSPAR, 2017). This data can be used as well for Ecological Objective 5 on Eutrophication.

27. The water column components phytoplankton and zooplankton are covered by fewer indicators in the Mediterranean than in other regional seas, e.g. Black Sea, Baltic Sea and NE Atlantic Ocean. However, many phytoplankton and zooplankton indicators from other areas can be adopted and adapted to Mediterranean situation, but there is still the need to collect data and/or use satellite data. They could be used as “early warning indicator”, because of their ability to respond quickly to environmental changes and give feedback about changes happening in the food webs and ecosystems.

Conclusion:

28. The pelagic environment includes a continuum of mixing and transport depending on the interaction of multiple drivers acting on different spatial and temporal scales. Pelagic physical processes vary spatially with seabed features (e. g. high productivity for seamounts upwelling) and major currents and fronts, and temporally with, for example, wind-driven upwelling. As a result, biota responses would depend on and vary with these hydrographic factors.

29. The elaboration of a classification of pelagic habitat types for the Mediterranean requires a multidisciplinary approach and the availability of data for the parameters governing the dynamics of water masses and the species inhabiting the water column. Such data are not available in many portions of the Mediterranean Sea. The process for elaborating the reference list of pelagic habitats in the Mediterranean needs therefore a preparatory phase to prepare an inventory of existing data and methodologies allowing to define pelagic habitat units in terms of hydrography, ecology considering the spatial and temporal variations.

30. However, characterisation of pelagic habitats in the Mediterranean is needed in a near future for the implementation of the Ecosystem Approach (EcAp) roadmap and its Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria (IMAP) for the preparation of the MedQSR 2023.

31. It is therefore recommended to establish a multidisciplinary group of experts to undertake the following tasks:
In relation to IMAP:

- Define parameters allowing to use phytoplankton and zooplankton for relevant IMAP biodiversity indicators,
- Propose a classification of pelagic habitat types in the epipelagic layer (0-200) using, inter alia, satellite-based chlorophyll-a data as a proxy of pelagic biodiversity as proposed in UNEP/RAC/SPA, 2013

In relation to the elaboration of a typology of pelagic habitat types for the Mediterranean:

- Compile an inventory of existing data and methodologies, including modelling approaches, allowing to define Mediterranean pelagic habitat types in terms of hydrography, ecology taking into account the spatial and temporal variations.
- Define the Mediterranean pelagic habitat type that could be used for defining a pelagic habitat classification. This task is to be implemented, on a pilot scale, in a limited portion of the Mediterranean Sea with sufficient data about the relevant parameters.

References

1. Fabri Marie-Claire, Brind'Amour Anik, Jadaud Angelique, Galgani Francois, Vaz Sandrine, Taviani Marco, Scarcella Giuseppe, Canals Miquel, Sanchez Anna, Grimalt Joan, Galil Bella, Goren Menachem, Schembri Patrick, Evans Julian, Knittweis Leyla, Cantafaro Anna-Lucia, Fanelli Emanuela, Carugati Laura, Danovaro Roberto (2018). Review of literature on the implementation of the MSFD to the deep Mediterranean Sea. IDEM project, Deliverable 1.1. 228 p. www.msfd-idem.eu.http://doi.org/10.13155/53809
2. HELCOM, 2017a. Diatom/Dinoflagellate index. HELCOM pre-core indicator report. Online. 16 Nov 2017. http://www.helcom.fi/baltic-sea-trends/indicators/Diatomdinoflagellate-index.
3. HELCOM, 2017b. Status of development of pre-core and candidate indicators (4J-7). Working Group on the State of the Environment and Nature Conservation. 15-19 May 2017. https://portal.helcom.fi/meetings/STATE%20-%20CONSERVATION%206-2017412/MeetingDocuments/4J-7%20Status%20of%20development%20of%20precore%20and%20candidate%20indicators.pdf.
4. HELCOM, 2017c. Zooplankton mean size and total stock. HELCOM core indicator report.Online. 20 Nov 2017, http://www.helcom.fi/baltic-sea-trends/indicators/zooplankton-mean-size-and-total-stock-(MSTS)/ ISSN 2343-2543.
5. ICES, 2005. Report of the Working Group on Marine Habitat Mapping (WGMHM). ICES WGMHM, ICES, 91
6. Magliozzi, C., Druon, J.-N., Palialexis, A., Artigas, L. F., Boicenco, L., González-Quirós, R., Gorokhova, E., Heyden, B., McQuatters-Gollop, A., Varkitzi, I., Pelagic habitats under MSFD D1: current approaches and priorities, EUR 30619 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-30988-8, doi:10.2760/942589, JRC123960
7. OSPAR Commission, 2017. Eutrophication Status of the OSPAR Maritime Area. Third Integrated Report on the Eutrophication Status of the OSPAR Maritime Area. 164 pp. https://www.ospar.org/documents?v=37502.
8. Rombouts, N. Simon, A. Aubert, T. Cariou, E. Feunteun, L. Guérin, M. Hoebeke, A. McQuatters-Gollop, F. Rigaut-Jalabert, L.F. Artigas, Changes in marine phytoplankton diversity: Assessment under the Marine Strategy Framework Directive, Ecological Indicators, Volume 102, 2019, Pages 265-277, ISSN 1470-160X, https://doi.org/10.1016/j.ecolind.2019.02.009.
9. UNEP/MAP, 2013. Towards the Identification and Draft Reference List of Pelagic Habitat Types in the Mediterranean Sea. http://www.rac-spa.org/nfp11/nfpdocs/working/WG_382_11_ENG_1706.pdf
10. UNEP/MAP, 2017. Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria. United Nations Environment Programme / Mediterranean Action Plan, Athens, Greece.
11. I. Varkitzi, J. Francé, A. Basset, F. Cozzoli, E. Stanca, S. Zervoudaki, A. Giannakourou, G. Assimakopoulou, A. Venetsanopoulou, P. Mozetič, T. Tinta, S. Skejic, O. Vidjak, J-F. Cadiou, K. Pagou, Pelagic habitats in the Mediterranean Sea: A review of Good Environmental Status (GES) determination for plankton components and identification of gaps and priority needs to improve coherence for the MSFD implementation, Ecological Indicators, Volume 95, Part 1, 2018, Pages 203-218, ISSN 1470-160X, https://doi.org/10.1016/j.ecolind.2018.07.036.
12. Würtz, M., 2010. Mediterranean Pelagic Habitat: Oceanographic and Biological Processes, an Overview. IUCN, Gland, Switzerland, and Malaga, Spain. http://www.rac-spa.org/sites/default/files/doc_fsd/med_pelagic_habitats.pdf.