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Meeting of Experts on the finalization of the Classification of benthic marine habitat types for the Mediterranean region and the Reference List of Marine and Coastal Habitat Types in the Mediterranean

Rome, Italy, 22-23 January 2019

Agenda item 6: Draft Updated Reference List of Marine Habitat Types for the Mediterranean region

Criteria for the selection of the Reference List of Marine Habitat Type

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General premises

The process to evaluate a marine protected area to be recognised as a Specially Protected Area of Mediterranean Importance (SPAMI), is based on many different aspects, among which one of the most relevant relies on its importance to host habitats with high conservation value at the Mediterranean scale. In this regard, it becomes fundamental the availability of a list of marine habitat types with high conservation value at the Mediterranean scale, which represents the reference element for the evaluation. To define a list of selected reference benthic habitats types, it is at first necessary to have a complete and updated list of the main marine benthic habitats of the Mediterranean, to be used as the base for the process of selection according to defined criteria. In this regard, a new, updated and revised list of the marine benthic Mediterranean habitats has been produced to support the process of selection (refer to the document UNEP/MED WG.457/3 "Draft Updated classification of benthic marine habitat types for the Mediterranean region", December 2018). This new list was defined according to the recent revisions and updates introduced in the EUNIS classification (Evans et al., 2016).

The first list of the reference marine habitat types for the selection of sites to be included in the national inventories of natural Sites of Conservation Interest was proposed in 1999 by SPA/RAC in the document UNEP(OCA)/MED WG 149/5 Rev.1 (see also Relini, 2000). The list was accompanied by the production of a handbook for interpreting the marine habitats listed, which was a useful tool to identify and assess these reference marine habitats (Bellan-Santini et al., 2002). In the following years, the final list with the criteria used for the selection of reference habitats was published (UNEP/MAP RAC/SPA, 2006), together with a new and updated version of the interpreting handbook (Pergent et al., 2007). The list contained 18 biocoenoses and 55 facies or associations.

Recently, during the 19th ordinary meeting of the Contracting Parties to the Barcelona Convention, SPA/RAC was requested to revise and update the original list of reference marine and coastal habitat types in the Mediterranean for consideration by COP20 taking into account the Integrated Monitoring and Assessment Program (IMAP, 2017) and the common indicator EO1. A first draft list of the reference benthic habitats and the criteria used for their selection was proposed during the 13th meeting of focal points for Specially Protected Areas in Alexandria, with the document UNEP (DEPI)/MED WG.431/6 (Ballesteros et al., 2017). This first draft has been elaborated based on the discussions, comments and suggestions of the ad hoc meeting held in Blanes (Spain) on 22-23 February 2017, in presence of a number of Mediterranean experts and regional partner organizations (GFCM, IUCN-Med, OCEANA, and ETC/BD). The draft list contained 377 reference habitat types, including facies and associations (up to level 5).

This document describes the methodological approach used to select the habitats to be included in a new updated reference list of marine habitat types for the selection of sites to be included in the national inventories of natural sites of conservation interest in the Mediterranean. The solutions adopted are based on some of the criteria and methodologies applied in the previous processes (UNEP/MAP RAC/SPA, 2006; Ballesteros et al., 2017). The revision of this list will be made through a process in consultation with focal points, involving all the Mediterranean countries. SPA/RAC invited Contracting Parties to designate national expert to follow the updating process and to take part in the meeting of experts planned to be organized in January 2019.

Criteria for the selection of reference habitat types

Certain habitats clearly deserve specific attention displaying features that make them important for conservation and are vulnerable to disturbances. Also, the presence of protected species, or considered as having a high heritage value, or the intrinsic value of the habitat from an aesthetic, economic, heritage view point, or its rarity, are effective criteria for the selection of reference habitats. The first reference list of marine habitat types, proposed in 1999 by SPA/RAC (UNEP/MAP RAC/SPA, 2006), adopted for the selection of valuable habitats the following five criteria:

Vulnerability: the inability of the habitat to maintain its structure and its functions when faced with unfavourable influences either potential or existing. Vulnerability can be scored with three levels:
1: high vulnerability
2: medium vulnerability
3: low vulnerability.

Heritage value: the intrinsic value of a habitat for the national or regional natural heritage due to its unique character, which may be endemic, structurally exceptional (e.g., cliff, cave, biogenic reefs) or have a unique ecological situation (meeting of two masses of water, concentration zone) or be of symbolic and cultural value. Heritage can be scored with three levels:
1: high heritage value
2: medium heritage value
3: low heritage value.

Rarity: habitat encountered more or less frequently. Rarity can be scored with three levels:
1: habitat known in only one or in a very limited number of sites
2: habitat rare in most countries for it is endemic to a zone or very scattered
3: habitat not rare.

Aesthetic: evaluation of the aesthetic and landscape value of a given habitat. Aesthetic can be scored with three levels:
1: habitat of high aesthetic value
2: habitat of medium aesthetic value
3: habitat of low aesthetic value.

Economic: evaluation of the economic significance of a given habitat either direct due to its richness in species exploited by fishing activities or indirect due to its significance in the trophic network or of its possible touristic exploitation. Economic can be scored with three levels:
1: high economic value
2: medium economic value
3: low economic value.

The estimation of the level for each criterion was made using three data sources, exploitation of the literature, information collected from amateurs and professionals, and on-site prospection within the framework of local, national or international programmes. Based on these criteria, habitats were classified into three main categories:

- Priority habitats (P): habitats for which the conservation is mandatory. There are several class 1 criteria.

- Remarkable habitats (R): habitats that deserve specific attention or management. There is one class 1 criterion.
- Other habitats (OH): habitats that have no rarity or vulnerability character and their heritage, aesthetic and economic importance is limited. These habitats do not require special conservation or management measures. There is no class 1 criterion.

The first original reference list of marine habitat types (UNEP/MAP RAC/SPA, 2006) contained 11 priority habitats belonging to the Mediolittoral zone, 23 priority habitats belonging to the Infralittoral zone, 19 to the Circalittoral, and 4 to the Bathyal.

Although in the first selection applied in 1999 by SPA/RAC (Relini, 2000), five criteria, each with 3-levels of score, have been used to define priority habitats, more recently Ballesteros et al. (2017) applied, in their exercise, a higher number of criteria for the selection (eight traits), each based on 5-levels of score for the evaluation. These criteria were partially based on those used in the first reference list of marine habitat types (UNEP/MAP RAC/SPA, 2006), and took also into consideration the FAO's criteria for identification of vulnerable marine ecosystems (FAO, 2009).

In the present process of selection, we applied the method proposed by Ballesteros et al. (2017) using the eight criteria (i.e., traits) for the selection, because they are likely to define, more accurately, the "importance" and "vulnerability" of each habitat. While they are sometimes correlated, these traits account for different features of the habitats that make them worthy (or not) for protection. On the contrary, we decided to still maintain the 3-levels of score for the evaluation of each trait in each habitat. The application of an evaluating scale based on 5 levels would require a very good knowledge about the biology and ecology of all the species belonging to a specific habitat, and also in those habitats only recently described and included in the updated list (e.g., habitats in the bathyal zone), for which a comparatively low level of knowledge is still available to date.

The eight traits used for the selection are the following:

1) Fragility: degree of susceptibility of the habitat to degradation (i.e., maintaining its structure and functions) when faced to natural and anthropogenic disturbances.
2) Resilience^{-1}: inability to recover quickly from a disturbance. Usually it is related to life-history traits of component species that make recovery difficult (i.e., slow growth rates, late age of maturity, low or unpredictable recruitment, long-lived).
3) Uniqueness or rarity: degree of rarity, i.e. unusual or very infrequent, at the Mediterranean level.
4) Importance of the habitat for hosting rare, threatened, endangered or endemic species that occur only in discrete areas.
5) Species diversity: the number of species hosted in the habitat.
6) Structural complexity: degree of complexity of physical structures created by biotic and abiotic features.
7) Capacity of modifying the physical environment and the ecosystem processes (i.e., geomorphological traits, fluxes of matter and energy), with a particular relevance to the occurrence of bio-constructors.
8) Significance of the habitat for the survival, spawning/reproduction of species not necessarily typical for the habitat during all their life cycle, and other (ecosystem) services provided by the habitat.

The 3-levels of score have been used to score each habitat type, in relation to each trait and in relation to other habitats situated in the same bathymetric zone. The score 1 corresponds to a low level, the score 2 to a medium level, and the score 3 to a high level. All habitat types having a rating

of 3 in "Uniqueness or Rarity" (i.e., those that are extremely rare) have been selected for the inclusion in the reference list regardless of their final rating. No water column habitats or habitats of anthropogenic origin have been considered for the inclusion in the reference list. When the main habitat-forming species is a non-indigenous species, it has not been selected for the references list whatever it is its final rating.

It is worth noting that the evaluation of the habitats at the level of association and facies (level 5) is not necessarily the same as that of the habitat (up to the level 4), which those associations and facies belong to. Some association or facies could be considered as priority, i.e. requiring a strict protection, whereas the habitat itself or the other facies/association occurring in the same habitat are of no specific interest. Moreover, the evaluation levels of each criterion can vary as a function of the local conditions.

Among the eight traits used to select reference habitats, the "species diversity" fully corresponds to the Ecological Objective "biodiversity" (EO1) of the Ecosystem Approach (EcAp) of the Barcelona Convention, and to the descriptor 1 of the European Marine Strategy Framework Directive (MSFD, 2008/56/EC)[1]. The traits "structural complexity", "fragility", and "resilience^{-1}" well fit with some of the indicators proposed to evaluate the EO6 and the descriptor 6 (i.e., seafloor integrity), which are: (iii) "presence of particularly sensitive and/or tolerant species", and (iv) "benthic community condition and functionality".

However, both the EcAp and the MSFD indicators of the seafloor integrity for (i) "type, abundance, biomass and areal extent of relevant biogenic substrate" were not fully covered by the original selective criteria by Ballesteros et al. (2017), and we thus suggest to better explicit it in the trait named "capacity of modifying the physical environment and the ecosystem processes". This trait should clearly underline the occurrence, into the habitat, of bio-engineers and especially of bio-constructors, which are organisms able to build durable elevated biogenic structures through the aggregation and accumulation of their calcareous skeleton that survive the death of the organism. These biogenic structures are intrinsically complex (in terms of their physical structure, associated biota and processes they generate) and modify the physical environment and the ecosystem processes, thus greatly increasing the value of a habitat. The seventh trait has thus been changed in: "Capacity of modifying the physical environment and the ecosystem processes (i.e., geomorphological traits, fluxes of matter and energy), with a particular relevance to the occurrence of bio-engineers". When a habitat hosts any bio-constructor, able to build large and wide biogenic structures (i.e., reefs or platforms), it must always be scored with a value of 3. All habitat types (except those characterised by non-indigenous species) having a rating of 3 in "capacity of modifying the physical environment and the ecosystem processes" (i.e., those hosting bio-constructors) must be selected for the reference list regardless of the final rating.

Both the EcAp and the MSFD list, among the descriptors for the status of an ecosystem, the occurrence of non-indigenous species (NIS) (EO2 and descriptor 2); however, we did not introduce occurrence of NIS as a negative criterion for the selection, as this aspect is not related to the habitat type but to the particular situation of a habitat in a specific site and a specific time. Although the occurrence of NIS adversely alters the value of an ecosystem, invasion by NIS is a stochastic and unpredictable process.

[1]Available at http://web.unep.org/unepmap/who-we-are/ecosystem-approach, http://ec.europa.eu/environment/marine/good-environmental-status/index_en.htm

Inclusion of a habitat in the reference list depends on the final rating (i.e., the total score) adding the values of the eight traits altogether. The minimum score reached by a habitat can be 8 (score 1 to each of the eight traits), whilst the maximum score can be 24 (score 3 to each of the eight traits). Following an analysis on the frequency distribution of the total scores for all the habitats (up to the level 5), two groups with a normal distribution have been clearly identified (Fig. 1).

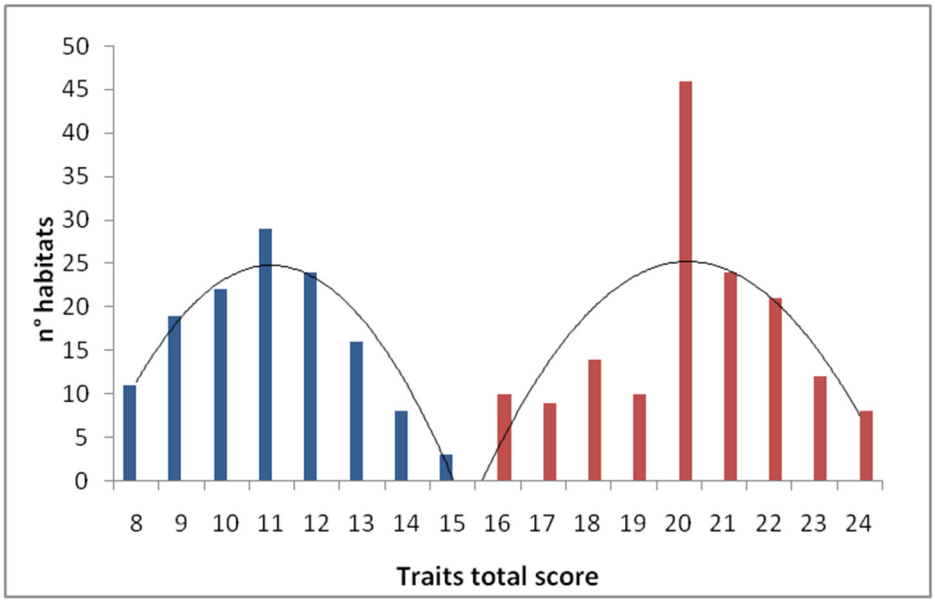

Figure 1. Number of habitats (up to the level 5) belonging to each class of the traits total score. The model describing a normal distribution is also represented for both groups.

The two groups are separated by a threshold value of 16. All habitats reaching a total score in the eight traits equal or higher than 16, should be included in the updated reference list as priority habitats. In particular, the following two categories of habitats can be defined:

- Priority habitats: are habitats reaching a total score ≥ 16. For these habitats conservation and strict protection are absolutely mandatory;
- Least relevant habitats: are habitats reaching a total score < 16. These habitats do not require special conservation or management measures and can thus be used, but always provided a sustainable use of them.

Inspiring to the early attempts to define priority habitats (Bellan-Santini et al., 2002), we also propose an alternative classification of the habitats with four categories, to be discussed during the experts meeting in January 2019. The four categories classification, all including 4 classes of total score (but the last category that includes five classes), is the following:

- Priority habitats: are habitats reaching a total score ≥ 20. For these habitats conservation and strict protection are absolutely mandatory;
- Remarkable habitats: are habitats reaching a total score 16 ≤ score < 20. For these habitats conservative management actions are requested;
- Significant habitats: are habitats reaching a total score 12 ≤ score < 16. For these habitats sustainable management actions are requested;

- Not relevant habitats: are habitats reaching a total score < 12. These habitats do not require special conservation or management measures and can thus be used, but always provided a sustainable use of them.

All habitats reaching a total score in the eight traits equal or higher than 16 (i.e., priority and remarkable habitats), should be included in the updated reference list. In Figure 2 the total number of habitats (up to the level 5) belonging to each of the four categories of habitat classification is shown. The category of priority habitats is the most represented. This 4-levels classification of the habitats would provide managers and stakeholders with a tool to better differentiate the habitats, in order to propose more specific actions for their management and conservation.

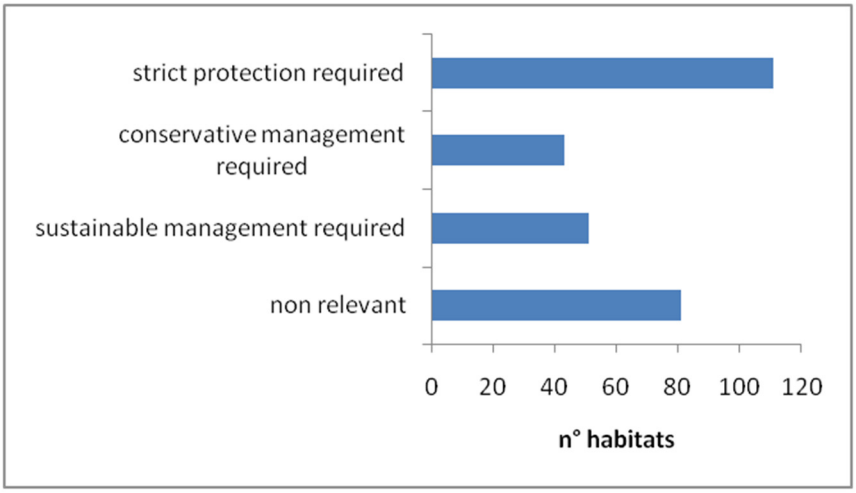

Figure 2. Total number of habitats (up to the level 5) belonging to each of the four categories of the habitat classification.

Proposal of an updated classification of reference habitats

Adopting the criteria listed above, an updated list of marine habitat types for the selection of sites to be included in the national inventories of natural Sites of Conservation Interest in the Mediterranean is here proposed. This list contains a total of 117 main habitats (up to the level 4), and in particular 30 in the Littoral, 26 in the Infralittoral, 24 in the Circalittoral, 13 in the Offshore Circalittoral, 14 in the Upper Bathyal, 8 in the Lower Bathyal, and 2 in the Abyssal. A number of reference facies and associations has also been proposed in each of the selected main habitats to be included in the updated classification.

Conclusions

Given the importance and the vulnerability to impacts of human activities, habitats that are frequently associated with high levels of biodiversity, hosting protected species or bioconstructors, also including juveniles and adults of important commercial species, require specific management and conservation measures for their protection. The present updated list of reference habitats is thus fundamental to identify those benthic habitats worthy of protection and specific management actions. The list could be also relevant for defining specific monitoring activities within the

framework of the Ecosystem Approach (EcAp), which is also full in line with the requirements of the European MSFD.
The updated and revised list of the Mediterranean marine habitat types here proposed has been developed following these main steps:

1. The eight traits for the selection of reference habitats proposed by Ballesteros et al. (2017) were used as the base for the revising process.
2. Some of the Ecological Objectives listed by the Ecosystem Approach (EcAp) of the Barcelona Convention, corresponding also to the descriptors listed by the European Marine Strategy Framework Directive (MSFD) to evaluate the status of an ecosystem, have been considered and consistently integrated, which are: (1) biodiversity, and (6) seafloor integrity.
3. We propose to change the trait "capacity of modifying the physical environment and the ecosystem processes (i.e., geomorphological traits, fluxes of matter and energy)" in "capacity of modifying the physical environment and the ecosystem processes (i.e., geomorphological traits, fluxes of matter and energy), with a particular relevance to the occurrence of bioconstructors", to better valorise the occurrence of bioconstructors within the habitat.
4. We used the original 3-levels rating from 1 (low) to 3 (high) for each trait.
5. All habitats reaching a score ≥ 16 should be included in the updated classification of reference habitats.
6. We propose two different classifications of the habitats: i) two-groups classification, where priority habitats (total score ≥ 16) and not relevant habitats (total score < 16) can be identified; ii) four-groups classification, where habitats are classified as priority habitats (total score ≥ 20), remarkable habitats (total score $16 \leq \text{score} < 20$), significant habitats (total score $12 \leq \text{score} < 16$), and not relevant habitats (total score < 12).
7. All priority habitats using the "two-groups classification" and all the priority and remarkable habitats using the "four-groups classification" must be included in the updated reference list.
8. The draft of the updated classification of reference habitats here proposed follows a process coherent to the revisions already proposed for the classification of the Mediterranean marine benthic habitats types, which has been updated and revised according to the recent revisions done in the EUNIS classification system and the increased knowledge reached for many habitat types (especially in the circalittoral, bathyal, and abyssal zone).
9. The threshold here proposed for definition of reference habitats (total score ≥ 16) and the scores assigned to each trait for each habitat should be verified in some selected sites to evaluate adequacy of the classes and of the scores proposed. For instance, habitats within marine protected areas are expected to reach higher scores in the eight traits than habitats in non-protected areas and can thus be used to calibrate the proposed classification.

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