Decision IG.22/12

**Updated Action Plans Concerning "Cetaceans", "Coralligenous and Other Calcareous Bio-concretions", and "Species Introductions and Invasive Species";
Mandate for update of the "Action Plan on Marine and Coastal Birds" and revision of the "Reference List of Marine and Coastal Habitat Types in the Mediterranean"**

The 19th Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, hereinafter referred to as "the Barcelona Convention",

Recalling Articles 11 and 12 of the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean, hereinafter referred to as the "SPA/BD Protocol", on national measures for the protection and the conservation of species and on the formulation and implementation of action plans for their conservation and recovery respectively;

Recalling Decision IG.19/12 of COP 16 (Marrakesh, Morocco, November 2009) related to the Amendments of the list of Annexes II and III of the SPA/BD Protocol and more particularly the marine and coastal bird species included then in Annex II to the SPA/BD Protocol "List of endangered or threatened species";

Recalling Decision IG.20/4 and IG.21/3 of COP 17 (Paris, France, February 2012) and COP 18 (Istanbul, Turkey, December 2013) respectively adopting Ecological Objectives, Operational Objectives, GES and related targets ;

Recalling Decision IG.21/17 on the Programme of Work of COP 18 (Istanbul, Turkey, December 2013) on the update of the Action Plan for the Conservation of Cetaceans in the Mediterranean Sea and the Action Plan for the Conservation of the Coralligenous and Other Calcareous Bio-concretions in the Mediterranean Sea;

Having considered the report of the 12th Meeting of SPA/RAC Focal Points (Athens, Greece, May 2015);

1. *Adopts* the Updated Action Plan for the Conservation of Cetaceans in the Mediterranean Sea, as contained in Annex I to this Decision;

2. *Adopts* the Updated Action Plan for the Conservation of the Coralligenous and Other Calcareous Bio-concretions in the Mediterranean Sea, as contained in Annex II to this Decision;

3. *Adopts* the Updated Action Plan concerning Species Introductions and Invasive Species in the Mediterranean Sea, as contained in Annex III to this Decision;

4. *Requests* the Contracting Parties to take the necessary measures for the implementation of the updated Action Plans and report according to the cycle and format of the MAP/Barcelona Convention reporting system;

5. *Requests* SPA/RAC to provide support to the full implementation of the updated Action Plans;

6. *Requests also* SPA/RAC to update the Action Plan for the Conservation of Bird Species listed in Annex II to the SPA/BD Protocol including all 25 target species, and to revise the Reference List of Marine and Coastal Habitat Types in the Mediterranean for consideration by COP 20, taking in full account the biodiversity-related MAP Ecological Objectives, IMAP, and GES targets.

Annex I

Updated Action Plan for the Conservation of Cetaceans in the Mediterranean Sea

ACTION PLAN FOR THE CONSERVATION OF CETACEANS IN THE MEDITERRANEAN SEA

Amended Appendix:
Additional Points for the Implementation of the Action Plan for the period 2016-2020

Taking into account (i) the work done at national level for the conservation of cetacean species in the Mediterranean since the adoption of the Action Plan in 1991, (ii) the progress made so far in the implementation of the provisions of ACCOBAMS in the region and (iii) the available knowledge about the status of the Mediterranean cetacean populations, the Contracting Parties to the Barcelona Convention are invited to orient their action regarding the implementation of the Action Plan towards the following priorities during the period 2016-2020.

Legal and institutional measures

- To ratify the ACCOBAMS Agreement, if they have not already done so, and to implement its Resolutions and Recommendations of relevance for the Mediterranean Sea. As agreed during the 14th Ordinary Meeting of the Contracting Parties to the Barcelona Convention (Portoroz, Slovenia, November 2005), the common obligations relating to cetaceans under the SPA/BD Protocol are fulfilled by the implementation of ACCOBAMS. In this context, close cooperation at the national level between the SPA/RAC National Focal Points and the ACCOBAMS Focal Points is highly recommended.
- To ensure that cetaceans are covered, at national level, by appropriate regulation measures providing for the elimination of deliberate killing and for the mitigation of the adverse impacts from their interactions with human activities, in particular in relation to:
    - bycatch and depredation in fishing gears,
    - seismic surveys and other marine noise generating activities,
    - harassment by leisure boating and scientific activities and
    - collisions with ships (ship strikes)
- Ensure, through regulation or other appropriate approaches, that whale-watching activity is environmentally sound and sustainably conducted, using, as appropriate, high quality certification systems for whale-watching.
- Where relevant for cetacean conservation, to support the use of the compliance mechanisms set for the Barcelona Convention and the ACCOBAMS Agreement, in particular by encouraging the notification of non-compliance and of non-follow-up cases.
- SPA/RAC should pursue its collaboration with the Secretariat of ACCOBAMS, by facilitating the implementation of the Annex 2 (Conservation Plan) of ACCOBAMS, in particular in fulfilling its function of the Regional Coordination Unit for the Mediterranean of the ACCOBAMS Agreement.

Improving the knowledge about cetacean populations

- Considering the urgent need of obtaining reliable estimates of cetacean populations and data about their distribution, a special effort should be done in the period 2016-2020 to undertake the comprehensive survey of abundance and distribution of cetaceans being planned by ACCOBAMS (ACCOBAMS Survey initiative). Their contribution (funding, equipment, vessels, planes, etc.) and the involvement of their scientists in all the survey phases (planning, field work and data analysis) being a key factor for the success of the Survey, the Contracting Parties should facilitate and support the Survey Initiative and liaise closely with SPA/RAC to ensure that the data collected by the Survey serve also as baseline data for the Good

Environmental Status concerning cetacean species as defined by the contracting Parties under the Ecological Objective 1 of the EcAp process.

Reducing cetacean-fisheries interactions

- To assess the cetacean bycatch and depredation in their fisheries and adopt mitigation measures taking into account the requirements for cetacean conservation and the need for the development of sustainable and responsible fishing activities. In this context, the Contracting Parties are invited to conform to the recommendations from ACCOBAMS and GFCM on this issue.
- SPA/RAC should strengthen its collaboration with the Secretariats of ACCOBAMS and GFCM to provide assistance to the Mediterranean countries in mitigating the impacts of the interactions occurring between cetacean species and fishing activities, through investigating innovative and environmentally sound mitigation measures and by disseminating information on relevant best practices and successful initiatives.

Mitigating the impact of underwater noise

- Pursue the development and the implementation of a basin-wide strategy for underwater noise monitoring in the Mediterranean, as proposed by the ACCOBAMS/ASCOBANS/CMS Joint Noise working group, under the Ecological Objective 11 of the EcAp process.
- Development of acoustic mapping using standardised methodologies to build a comprehensive picture of the spatial and temporal distribution of anthropogenic noise sources. Mapping effort should be deployed in the noise hotspot areas identified in the Mediterranean by ACCOBAMS, taking into account the available knowledge regarding the distribution of cetacean species, including areas that are affected at different levels of noise.
- Promote awareness of the anthropogenic noise impacts on cetaceans, targeting in particular decision makers, key players in the industry organisations and the stockholders in the shipping sectors.
- Considering the increasing number of seismic surveys in the Mediterranean Sea, SPA/RAC should liaise closely with the Secretariat of ACCOBAMS, the national authorities of the Mediterranean countries and relevant companies to promote the collection and dissemination of cetacean data from MMOs (Marine Mammal Observers) during seismic surveys.

Habitat conservation

- In addition to implementing the provisions of the relevant international and regional agreements related to combatting pollution and eliminating sources of degradation of the marine environment (IMO regulations, relevant Protocols of the Barcelona Convention, Convention on Biological Diversity, etc.), each Contracting Party should establish a list of marine areas under its jurisdiction identified as of special importance for cetaceans, using as appropriate the tools developed at regional and international levels for inventorying sites of conservation interest, in particular the list of areas of special importance for cetaceans in the ACCOBAMS area .
- The areas of special importance for cetaceans should be granted a protection status that ensures the long term preservation of the species and the sustainable management of human activities having impacts on cetaceans.

Annex II
Updated Action Plan for the Conservation of the Coralligenous and Other Calcareous Bio-concretions in the Mediterranean Sea

I. Current situation of coralligenous assemblages

I.1. Current knowledge

1. At present there is a general knowledge on the distribution, species composition and functioning of coralligenous assemblages and other calcareous bio-concretions. However, and despite the efforts conducted since the adoption in 2008 of the Action Plan for Coralligenous and other Calcareous Bioconstructions, in the Mediterranean, there are essential questions that need to be addressed to guarantee the conservation of these emblematic Mediterranean habitats (see specific sections).

2. Probably the number and quality of presentations during the 2nd Mediterranean Symposium on the Conservation of coralligenous and other calcareous bio-concretions (Portorož, Slovenia 29-30 October 2014) are the best example on the interest of Mediterranean scientific/managers community to improve the knowledge on these assemblages (Proceedings 2nd MSC&CBC 2014).

3. Despite of this, it was also noted that (i) most actions regarded individual- national- based efforts and (ii) the lack of structures for coordination in an efficient way of regional and/or pan-Mediterranean research actions. There was a general consensus at the Symposium to establish a series of Working Groups to coordinate the human and resources in order to provide the needed general view on the coralligenous/maërl assemblages and overcome these gaps.

I.2. Distribution

4. Coralligenous buildups and maërl beds are common all around the Mediterranean coasts, even in the easternmost coasts (Giakoumi et al. 2013, Martin et al. 2014). The coralligenous habitats are abundant in the Adriatic, Agean and Thyrrhenian Seas as well as in the Algero-Provençal Basin. The coralligenous is less abundant in the Levantine Sea and Tunisian Plateau/Gulf of Sidra (Martin et al. 2014). Overall, data available cover approximately 30% of the Mediterranean coasts while for the remaining 70% no information was found (Martin et al. 2014). Regarding the depth distribution, most information concern the 10 to 50 m depth less information exists for the deeper range of distribution of coralligenous 50-200 m depth. Besides these large-scale assessments on distribution, at local scale some progress in cartographical data have been acquired in some areas especially in marine protected areas (e.g. Réserve Naturelle de Scandola, Parc National de Zembra, Area Marina Protetta di Tavolara Punta Coda Cavallo, Zakynthos Marine Protected Area). Overall, we lack of a complete and precise distribution information on coralligenous and other calcareous bioconstructions habitats.

5. The main constraints to provide a global view on the distribution of coralligenous and other calcareous habitats are the 1) their intrinsic heterogeneous distribution related with the spatial patterns of the geophysical and oceanographic conditions allowing their development, and 2) the technical and financial constraints of field mapping operations resulting in an unbalanced mapping efforts across the Mediterranean.

6. Geographical as well as depth distributional data are essential in order to know the real extent of these assemblages in the Mediterranean Sea as well as to implement appropriate management measures to guarantee their conservation.

I.3. Composition

7. Coralligenous concretions are the result of the building activities of algal and animal builders and the physical as well as biological eroding processes. The final result is a very complex structure composed of several microhabitats. Environmental factors (i.e., light, water

movement and sedimentation rates) can vary by orders of magnitude in parts of the same concretion situated very close to each other. This great environmental heterogeneity allows several different assemblages to coexist in a reduced space. Assemblages situated in open waters (from horizontal to almost vertical surfaces) can be easily distinguished from those situated in overhangs and cavities.

8. Algae usually dominate in horizontal to sub-horizontal surfaces although their abundance decreases with decreasing irradiance. Two main algal communities have been distinguished in the western Mediterranean: an assemblage dominated by *Halimeda tuna* and *Mesophyllum alternans* (*Lithophyllo-Halimedetum tunae*), thriving in relatively high light levels, and an assemblage dominated by encrusting corallines (*Lithophyllum frondosum, L. cabiochae, Neogoniolithon mamillosum*) and *Peyssonnelia rosamarina* (*Rodriguezelletum strafforelloi*), and receiving low light levels.

9. Animal assemblages can greatly differ according to light levels reaching the coralligenous outcrop but also in relation to current intensity, sedimentation rates and geographical areas. In the richest, relatively more eutrophic zones, with rather constant and low water temperature, gorgonians usually dominate the community, but they are completely absent or rare in the more oligotrophic or low-current areas with rather high or seasonally variable temperature, being replaced by sponges, bryozoans or ascidians.

10. Maërl beds are also very diverse. Even if corallines are the main constituents (*Spongites fruticulosus,Lithothamnion corallioides, Phymatolithon calcareum, Lithothamnion valens, Lithothamnion minervae,Litophyllum racemus, Lithophyllum frondosum*, and others), Peyssonnelia species (mainly *Peyssonnelia rosamarina*) can also be very important. The cover of erect algae depends on each particular site, displaying several facies (*Osmundaria volubilis, Phyllophora crispa,* Kallymeniales, *Laminaria rodriguezii*).

11. The group of experts in Tabarka suggested using the Reference List of Habitat types appearing in the Standard Data-entry Form (SDF) for National Inventories when looking for the composition of coralligenous assemblages. In 2011 a list of species to be considered in the inventory and/or monitoring of coralligenous communities was provided by UNEP-SPA/RAC (2011)[1]. The species were arranged in the following categories:

    - Algal builders
    - Animal builders
    - Agglomerative' animals
    - Bioeroders
    - Species of particular importance (particularly abundant, sensitive, architecturally important or economically valuable)
    - Invasive species

12. The characterization of coralligenous based on the above-mentioned categories list can greatly help in our understanding on the coralligenous patterns across the Mediterranean. Since different regions and areas within regions are characterized by different composition, the assessment considering the proposed morpho-functional categories can provide an interesting comparative basis towards a general view on Mediterranean coralligenous assemblages. This approach besides the composition data would provide a functional perspective which greatly facilitate the development of indicators for the monitoring of the Good Envrionmental Status (GES) within the Marine Strategy Framework Directive and "COP18 EcAp Decision" (see Legislation and regulation section).

[1] Proposal of standard methods for inventorying and monitoring coralligenous and rhodoliths populations UNEP-MAP-RAC/SPA (2011)

13. The suggestion when describing the composition of the coralligenous assemblages or the maërl beds would be to provide quantitative or semi-quantitative estimate on the abundance of typical/indicator species. Different visual and photographic methods as well as the combination of both have been proposed to obtain abundance estimates. For instance, the adoption of Braun-Blanquet (1979) methodology for marine assemblages characterization (Cebrian & Ballesteros, 2004). Through these assessments besides composition data, the abundance estimates of species found in the considered categories would provide insights in the ecological/conservation status of assemblages. For instance, the presence of invasive species (either alien or not normally occurring in the habitat) are often considered very good indicators of poor conservation status.
14. For maërl beds assemblages the same approach could be addressed although the current knowledge need to be improved to better define the categories and composition lists. In maërl beds, description is also possible naming the main maërl species and erect algae, as well as the main macroinvertebrates.

II. Data collection and inventories

II.1. Specific inventories

15. As mentioned the coralligenous habitat includes several assemblages due to its great heterogeneity. There is a small scale heterogeneity in environmental factors throughout the coralligenous outcrops that determine different micro-habitats containing different species. In the surface of coralligenous outcrops, coralline algae usually dominate, together with a variable amount of erect algae and of suspension-feeders. Holes and cavities within the coralligenous structure sustain complex communities without algae and dominated by suspension-feeders. Small crevices and interstices are inhabited by a diverse endofauna, while many vagile species swarm everywhere, thriving also in the small patches of sediment retained by the framework. Large fishes (e.g. *Epinephelus marginatus*, *Scorpaena scrofa*, *Phycis phycis*) and decapods (e.g. *Palinurus elephas*, *Homarus gammarus*) dwell in the coralligenous assemblages. One of the consequences of this great environmental heterogeneity is the presence of a high biodiversity and a wide array of organisms in each coralligenous outcrops.

16. Maërl beds are considerably less complex than coralligenous outcrops although they have some epiflora and epifauna that are more related to plants and animals usually found in rocky substrata, but also they harbour typically invertebrates from sedimentary bottoms.

17. A considerable amount of research has been done on the biodiversity hosted by coralligenous outcrops. Ballesteros (2006) estimates a preliminary account of up to 1666 species at the scale of the Mediterranean Sea. However these estimates are far from providing us a general view of biodiversity dwelling in the coralligenous assemblages. There are at least two levels of information which should be considered i) in fine detailed taxonomic studies specially in less studied groups and ii) comprehensive biodiversity surveys in targeted geographical areas. This information would be complemented by the determination of typical/indicator species of coralligenous in different areas/regions across the Mediterranean (see Point 1.3. Composition).

18. Overall with this information we could improve the estimates on the total number of species associated to the coralligenous and analyze geographical variability biodiversity patterns considering different spatial scales. The same approach should be adopted for maërl beds.

19. Methods:For data collection several methodologies have been used in sampling rocky benthic systems and maërl beds (e.g. Bianchi *et al.*, 2004, Kipson et al. 2011, Cechi et al. 2010, Gatti et al. 2015) and all of them present advantages and disadvantages. Moreover, suitability of each sampling method depends on the purposes of the study and on the taxonomic group considered.

20. As no sampling methodology can be universally applied, a general recommendation when making the assessments on species composition is to take into account the following considerations:

    - Use quantitative or semi-quantitative surveys instead of qualitative surveys wherever possible.
    - Clearly state the sampling and quantification methodology, including the period of the year, in order that it could be repeated in the future by independent teams for further comparison of data.
    - Samples have to be geographically positioned in the most accurate way.
    - Sampling has to be representative. Therefore, sampling areas should be larger than minimal sampling areas. It has to be noted that different taxonomic groups must be sampled using completely different representative areas.
    - Use photographic surveys to help in the identification of species

II.2. Sites of particular interest

21. Since the coralligenous and maërl assemblage in general thrive in deep waters, it is difficult to have an appropriate coverage of all the entire distribution range of the assemblage. Thus, it is recommended that inventories and monitoring be performed in selected sites of particular interest. The sites selection should be based in the most accurate previous information on the distribution, extension and ecological features and conservation status of coralligenous and maërl assemblages.

22. Amongst the criteria to be used in this selection, it is recommended the following ones:
    - Existence of previous information on coralligenous assemblages or maërl beds at the site or, if there is no available information at all, sea bottom geomorphological features suitable for the development of coralligenous frameworks and/or rhodolits.
    - Representativity of the coralligenous assemblages/maërl beds at a wide geographical area, whenever it is possible, according to present knowledge.
    - Existence of control and/or management of anthropic activities at the site. In this sense, marine protected areas are suitable places to be selected.
    - Especially healthy coralligenous and maërl assemblages are worth to be selected in order to assess the reference conditions.
    - Coralligenous communities and maërl beds under the effects of direct or indirect anthropogenic disturbances are worth to be selected in order to assess the impact conditions.

III. Monitoring activities

23. Even if coralligenous/maërl assemblages are characterized by very slow dynamics (Garrabou *et al.*, 2002, Teixidó et al. 2011), at least in the absence of punctual catastrophic disturbances (Teixidó et al. 2013), developing monitoring activities is of great interest to track their conservation status and detect changes associated to pressure and punctual human- as well as natural processes-related disturbances .

24. Monitoring is necessary to understand the processes behind long-term dynamics in the assemblages and is a central element for the implementation and evaluation of efficient management plans. Besides, the monitoring activities on coralligenous assemblages are required for the implementation of European Marine Strategy Framework Directive (MSFD 2008/56/EC) and the Barcelona Convention Decision[2] (see Legislation and regulation section) seeking to maintain the Good Environmental Status of assemblages.

[2] Decision IG.21/3 on the Ecosystems Approach including adopting definitions of Good Environmental Status (GES) and targets

III.1.Types of monitoring

25. The basic scheme of surveillance includes periodic monitoring of reference parameters (indicators) informing about the conservation status of coralligenous/maërl assemblages. The monitoring should be designed to be as simple as possible. Neither standard methods have been proposed nor environmental nor ecological quality indexes have been established yet for the coralligenous assemblages.

26. Due to the heterogeneity and habitat complexity monitoring should be conducted by a combination of methods to gather habitat, species and degree of impacts data.

27. Monitoring parameters should provide information on:
    Structural and functional parameters of assemblages:
    - Species/Categories composition/abundance (semi- or quantitative data)
    - Indicators on the degree of complexity of coralligenous habitats
    - Indicators on coralligenous functioning: bioeroders and bioconstructors
    - Qualitative, semi- and quantitative indicators on the impacts of different disturbances on coralligenous communities (e.g. presence of fishing nets, invasive species, high diving pressure)

    Environmental parameters
    -Temperature, sedimentation

III.2. Monitoring methods

III.2.1. General Considerations for sampling strategies for monitoring schemes

28. Bearing in mind the depth distribution of coralligenous/maerl assemblages monitoring methods have to be adapted to limited bottom working time by scuba divers (due to long decompression times and limitation of diver performance in deep waters; Tetzaff & Thorsen, 2005; Germonpre, 2006) and the limitation of the use of Remote Operate Vehicles (ROVs) beyond the operational depth of scuba divers (0-40m).

III.2.2. Spatial scales.

29. The high scale heterogeneity of coralligenous outcrops which implies a large sampling area to be representative (Ballesteros, 2006). At present, some studies have determined the minimum sampling areas in some assemblages (Kipson et al. 2011), similar approaches should be carried out in other coralligenous morpho-types. In general, in order to gather relevant data on the different indicators in each monitoring site the total sampling area (including different replication strategies) should cover about 5 to 30 m^2 (Deter et al. 2012, Garrabou et al. 2014, Gatti et al. 2015).

30. At each site, determine a specific depth range where the monitoring will be carried out (e.g. 30-35 m), in order to avoid the potential effect of depth on the outcome of the surveys. Within the depth range selected, in order to limit the effects of local heterogeneity on the outcome of the surveys, determine when possible, with the help of remarkable seascape marks, the specific monitoring area (e.g. it should be an area of several 100 m^2) of each sampling site. Eventually some marks can be fixed to help the sample in the same monitoring area. Finally, in each targeted geographic areas several sites should be monitored in order to better infer the conservation trends of assemblages.

31. When selecting monitoring sites one should keep in mind the existence of previous information on the extension and ecological quality of the coralligenous habitat. During selection process, it is recommended to consider the following questions:
    - Is there previous information available on coralligenous assemblages at the site or, if there is no available information at all, are the sea bottom geomorphological features suitable for the development of coralligenous frameworks?
    - According to the present knowledge, are considered coralligenous assemblages representative for a wider geographical area?
    - Are considered coralligenous assemblages especially healthy to be able to serve as reference points?
    - Are considered coralligenous assemblages under some clearly recognizable direct or indirect anthropogenic disturbance that would allow the assessment of the impact of these disturbances?

III.2.3.Temporal scales

32. The low dynamic of coralligenous assemblages (Garrabou *et al.*, 2002, Casas et al. 2015) allows to set the sampling periodicity between 3-5 years for monitoring purposes. Regarding the period of monitoring, the ideal period is late summer (late August to early October). At that time water transparency and temperature allow better performances on data gathering and photosampling. In addition, if any mass mortality occurred during summer it can be observed in this period.

III.2.4. Sampling techniques

33. During the last years different approaches have been adopted for the assessment of conservation status of coralligenous assemblages using visual and/or photographic surveys (e.g. Cormaci *et al.*, 2004, Kipson et al. 2011, Deter et al. 2012, Garrabou et al. 2014, Gatti et al. 2015).The sampling approaches developed are based on non-destructive methods aiming to furnish rapid quantitative and semi-quantitative assessments of different parameters.

34. The basic parameters assessed by photographic sampling and visual census are abundance (e.g. coverage, density) of species found in the assemblages and estimations on the degree of impact ofdifferent key processes (e.g. mortality events, bioerosion, fishing) related with the conservation of coralligenous assemblages.

35. Monitoring of environmental parameters is also needed if we want to relate changes in the coralligenous/maërl assemblages with disturbances related to hydrographic conditions. The most important variables to be monitored are: water temperature, sedimentation rates, nutrient concentration in seawater, particulate organic matter and water transparency.

36. Different initiatives (this Action Plan and EU directives) are focused on the development of indicators about the conservation and good environmental status of coralligenous. Through the monitoring activities presented we could obtain useful indicators (See Annex). These indicators are intended to inform decision makers and stakeholders and to support conservation and management planning (including MPAs network design) to guarantee the conservation of the coralligenous habitat.

37. Standardized protocols for the characterization of coralligenous/maërl assemblages need to be developed. The main goal of this action would be to do a comparative evaluation of the tools and sampling designs to be applied for the characterization of coralligenous habitats (e.g. in terms of species diversity (α, β, Υ), structural complexity and main ecological processes) and to assess the level of impact of human pressures.

38. Indices and/or intercalibration initiatives to determine environmental status of coralligenous conservation should be developed to analyze the available indices developed to determine the

Good Environmental Status of coralligenous to provide a common framework to compare the status of coralligenous across the Mediterranean.

IV. Research activities

IV.1.Taxonomy

39. Coralligenous/maërl assemblages probably are two of the most important hot-spots of species diversity in the Mediterranean, together with *Posidonia oceanica* meadows (Ballesteros, 2006; BIOMAERL team, 2003). In comparison to the large amount of literature devoted to the study of *Posidonia oceanica* meadows, studies devoted to strengthen the knowledge of coralligenous/maërl biodiversity are scarce. Therefore, due to the rich fauna, high heterogeneity at all scales, and complex structure of coralligenous/maërl assemblages, together with the paucity of studies dealing with coralligenous/maërl biodiversity, it can be assumed that at least coralligenous assemblages harbour more species than any other Mediterranean community. The check-list proposed in the second chapter of this Action plan should cover all the species found to date in coralligenous/maërl communities. However research in taxonomy is also needed as a large amount of taxonomic groups absolutely lack not only of a comprehensive study but almost any study dealing with species which can be found in coralligenous outcrops or maërl beds. The use of genetic tools can help in resolving taxonomic “problems” and discovering cryptic species (e.g. Dailianis et al. 2014).

40. Taking into account the current knowledge of biodiversity in coralligenous/maërl communities (Ballesteros, 2006), the following taxonomic groups need an important investment in research:

    - Copepods
    - Cumaceans
    - Isopods
    - Molluscs
    - Mysids
    - Nematods
    - Nemerteans
    - Ostracods
    - Phyllocarids
    - Polychaeta
    - Pycnogonids
    - Tanaidaceans

41. Further research on other groups is also acknowledged, as it will surely provide new reports of species for coralligenous outcrops and maërl beds.

IV.2. Long term evolution

42. To understand long-term dynamics of coralligenous assemblages in some selected areas sentinel/reference sites should be setup. Processes taking place in coralligenous communities in absence of disturbances usually display slow dynamics – i.e. decades – (Garrabou *et al.*,2002). Population dynamics of outstanding and key species show low growth rates and low population dynamics (e.g. Coma et al. 1998, Teixidó et al. 2011). Therefore, even if some of the patterns and processes that have been described so far occur in short time periods (e.g. mortality events; Cerrano *et al.*, 2000; Garrabou *et al.*, 2009), evolution of coralligenous can only be understood from a long-term perspective. Maërl beds are even less known as there are no comprehensive revisions in this subject regarding Mediterranean rhodolits.

43. Sentinel/reference sites are recommended to be visited once a year to obtain a robust temporal series. Even if seasonality in coralligenous/maërl communities is not as important as it is in shallower environments (Ballesteros, 2006, Garrabou et al. 2002), the monitoring is

recommended to be always performed at the same period of the year in order to facilitate comparisons between years and sites.

44. These sites should be selected according to (1) their representativeness at a large geographical scale, (2) their accessibility and (3) the logistical facilities that may contribute to guarantee and facilitate the monitoring operations. We recommend the setup of sentinel/reference sites in fully protected zones within Marine Protected Areas. MPAs offer excellent facilities for long-term studies and are optimum conditions to approach to the “pristine” functioning of coralligenous assemblages. This precious information would serve as reference for guiding the adoption of conservation and management goals at different international and national levels.

IV.3. Functioning

45. Special care is to be taken for the study of the functioning of particular associations and species. Specifically, long-lived plants and animals that usually are the engineering species of the coralligenous or the most abundant calcareous algae in maërl beds, need a detailed knowledge of their growth, demographic patterns, vulnerability to disturbances and recovery capacities.

46. Research actions to fill the gaps of current knowledge should focus on (a) Bioconcretion dynamics (building and erosion processes); (b) Population dynamics of typical/indicator species; (c) Establish response of key/typical species to different stressors

V. Conservation activities

V.1. Major Threats

47. Major threats affecting coralligenous/maërl communities roughly coincide with threats affecting Mediterranean marine biodiversity and are listed in the Strategic Action Program for the Conservation of Biological Diversity (SAP BIO). However, due to its special habitat and features, not all the threats listed in the SAP BIO affect coralligenous/maërl communities, but some of them are especially relevant. It follows a brief description of the main threats.

V.1.1.Trawling

48. Trawling is probably the most destructive impact currently affecting coralligenous communities. Trawling is also completely destructive in maërl beds, being the main cause of maërl disappearance in large Mediterranean areas. The action of trawling gear over coralligenous/maërl assemblages leads to the death of most engineering, dominant and builder species, completely changing the environmental conditions of the coralligenous microhabitats and from the maërl environment. As most of these species are particularly long-lived, have low recruitment and complex demographic patterns, destruction of the coralligenous/maërl structure is critical as their recovery will probably take several decades or even centuries.Trawling has also a great impact on target species that, although not as vulnerable as most suspension feeders, they also suffer from this indiscriminate method of fishing.

49. Finally, even the performance of trawling close to coralligenous outcrops or maërl beds affects negatively to algal growth and suspension-feeding due to an increase in turbidity and sedimentation.

V.1.2.Artisanal and recreational fishing

50. Both traditional and recreational fishing also have an effect on coralligenous communities, although they mainly affect the target species. Fishing leads to a significant decrease in mean specific number of fish species, producing changes in the community composition. Certain fishes, mainly elasmobranchs, are severely decimated by artisanal fishing practices when

fishing pressure is outstanding. This is the case, for example, of several small sharks such as *Scyliorhinus stellaris, Mustelus* spp. or *Squalus* spp. In several places, other species such as groupers and lobsters (e.g. *Epinephelus marginatus* and *Palinurus elephas*) need the implementation of adequate fishery management. Besides, fishing activities can degrade habitat complexity due to the breakage and mortality of fragile macrobenthic species during contact with fishing lines and nets (Bavestrello et al. 2000). The consequent erosion of complexity results from the reduction in the abundance and/or size of large gorgonian and other erect species (e.g. *Axinella* spp., *Hornera frondiculata*) (Tunesi *et al.*, 1991). The reduction of complexity could infer further biodiversity loss, however the extent of this impact and the associated mechanisms are still poorly understood (Cerrano et al. 2010).

51. Special care has to be taken with the commercial exploitation of red coral (*Corallium rubrum*), whose stocks have strongly declined in most areas. Adequate management of this extremely valuable and long-lived species is necessary.

V.1.3.Anchoring

52. Anchoring has a very severe impact on coralligenous concretions, as most of the engineering organisms are very fragile and are easily detached or broken by anchors and chains. Coralligenous concretions of frequently visited sites by recreational fishing or diving activities are degraded by the destructive potential of anchors.

V.1.4. Invasive species

53. Currently, at least three algal species are threatening coralligenous/maërl communities in the Western Mediterranean: *Womersleyella setacea, Acrothamnion preissii, Caulerpa racemosa v. cylindracea and Caulerpa taxifolia* (e.g. Cebrian et al. 2012, De Caralt & Cebrian 2013, Cebrian & Rodríguez-Prieto 2012). All of them are only invasive in relatively shallow water coralligenous outcrops and maërl beds (until 60 m), where irradiance levels are sufficient to permit their growth. However, they are especially dangerous, because they completely cover the basal stratum of encrusting corallines and increase sedimentation rates which lead to a total shut down of coralligenous growth or the survival of rhodolits. Most studies have been carried in the Western Mediterranean. There is an absolute lack of knowledge on the effects that lessepsian species have on coralligenous/maërl communities in the Eastern Mediterranean.

V.1.5. Global warming

54. Anomalous high water temperatures were concomitant with large scale mortalities of several suspension feeders (mainly sponges and anthozoans) growing in coralligenous assemblages (Cerrano *et al.*, 2000; Garrabou et al. 2009). Thus, it is expected that under the current trend of global warming (Somot et al. 2008), coralligenous assemblages will be affected by new mortality events during next decades especially in areas where coralligenous assemblages are situated above the summer level of the thermocline.

V.1.6.Waste water discharges

55. Waste waters profoundly affect the structure of coralligenous communities by inhibiting coralline algal growth, increasing bioerosion rates, decreasing species richness and densities of the largest individuals of the epifauna, eliminating some taxonomical groups and increasing the abundance of highly tolerant species (Hong, 1980, 1982; Cormaci *et al.*, 1985; Ballesteros, 2006). Although no information is available on the impact of eutrophication in Mediterranean maërl beds, the effects must be similar to those reported for coralligenous concretions.

V.1.7.Aquaculture

56. Although there are no studies on the impact of aquaculture facilities situated over or at the proximity of coralligenous outcrops, nor maërl beds, their effects should match those produced by waste water dumping.

V.1.8. Changes in land use and coastal infrastructure construction and urbanization

57. Most anthropogenic changes in coastal areas or at their vicinity involve an increase in water turbidity and/or sediment removal that affect coralligenous/maërl communities.

V.1.9. Recreational activities (excluding fishing)

58. Uncontrolled or over-frequentation of divers in coralligenous communities has been described to produce an important effect over certain large or fragile suspension feeders inhabiting coralligenous communities (Sala *et al.*, 1996; Garrabou *et al.*, 1998; Coma *et al.*, 2004; Linares et al. 2012).

V.1.10. Mucilaginous and filamentous algal aggregates

59. Blooms of mucilaginous and filamentous algal aggregates can cause severe damage over erect suspension feeders (mainly gorgonians). These blooms are still not well understood but they are apparently caused by eutrophication (Giuliani et al. 2005, Danovaro et al. 2009).

V.2. Legislation and regulations

60. Coralligenous/maërl assemblages should be granted legal protection at the same level as *Posidonia oceanica* meadows. A first step would be the inclusion of coralligenous concretions and maërl beds as a priority natural habitat type in the EU Habitats Directive (92/43/EU), which would enable EU countries to undertake surveillance of the conservation status of coralligenous/maërl assemblages and also to set an ecological network of areas of conservation (LICs/ZECs) hosting coralligenous/maërl assemblages, which would ensure their conservation or restoration at a favorable conservation status. Although *Phymatolithon calcareum* and *Lithothamnion corallioides* are present in the Annex V of the Habitats Directive and as such they should be provided by management measures in case of exploitation (which is never the case in the Mediterranean), there is no specific protection for maërl beds. Similar actions should be encouraged in non-EU countries through the existing tools of the Barcelona Convention.

61. Regarding again European countries, recently (21 December 2006), it was published a Council Regulation (EC) No 1967/2006 concerning management measures for the sustainable exploitation of fishery resources in the Mediterranean Sea, amending Regulation (EU) No 2847/93 and repealing Regulation (EC) No 1626/94 which states that “Fishing trawl nets, dredges, shore seines or similar nets above coralligenous habitats and maërl beds shall be prohibited” (Article 4.2) and that this prohibition “shall apply to all Natura 2000 sites, all special protected areas and all specially protected areas of Mediterranean importance (SPAMIs) which have been designated for the purpose of the conservation of these habitats under either Directive 92/43/EU or Decision 1999/800/EU” (Article 4.4).

62. In 2008 the European Union adopted the Marine Strategy Framework Directive (MSFD 2008/56/EC) which requires to maintain European marine waters in "Good Environmental Status" (GES). The MSFD included 11 descriptors for the assessment of GES among them the Sea-floor Integrity is defined as "Sea-floor integrity is at a level that ensures that the structure and functions of the ecosystems are safeguarded and benthic ecosystems, in particular, are not adversely affected." (Rice et al. 2012). This descriptor directly concerns biogenic structures such as the Mediterranean coralligenous and different initiatives are underway to determine the GES of coralligenous habitats (e.g. Gatti et al. 2015). The monitoring of different indicators (such as those indicated in this document and other proposed by other authors) should allow determining reference conditions at regional scales and the proposal of a quantitative index to evaluate the GES in each area. The final aim of MSFD is to guide management and conservation actions for maintaining and when necessary recovering the good environmental status of waters.

63. In line with the MSFD, the contracting parties to the Barcelona Convention set targets for achieving GES of the Mediterranean Sea and its coastal zone by 2020. In achieving these targets it has been recognized the importance to apply the ecosystem approach (EcAp) to the management of human activities that may affect the Mediterranean marine and coastal environment for the promotion of sustainable development (UNEP/MAP 2007). In addition, through Decision IG 21/3 (the so-called "COP 18 EcAp Decision") the contracting Parties agreed to design an Integrated Monitoring and Assessment Program for the next meeting of the contracting parties (COP19) and mandated the Secretariat to carry out an assessment of the state of the Mediterranean environment in 2017 which necessarily will include the coralligenous/maërl habitats (UNEP/MAP, 2013).

V.3. Creation of Marine Protected Areas

64. Within the Convention on Biological Diversity (CBD) countries have committed to protect by 2020 "10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and the effective area-based conservation measures" (Target 11 of the Aichi Strategic Plan for Biodiversity 2020) and the Roadmap for a comprehensive coherent network of well managed MPAs to achieve Aichi Target 11 in the Mediterranean. Overall, only about 1% of Mediterranean coastal waters susceptible to harbor coralligenous/maërl assemblages are protected.

65. Most present Mediterranean MPAs are devoted to protect *Posidonia oceanica* meadows and other shallow water assemblages, in such a way that the percentage of coralligenous/maërl habitat currently protected in the Mediterranean is extremely low. Thus, it is necessary to ptrotect representative coralligenous/maërl assemblages by applying the protection and management measures recommended by Articles 6 and 7 of the SPA/BD protocol. In fact, Marine Protected Areass (MPAs) have to be established taking into account the seascape diversity and trying to include places with several relevant assemblages, as has been already applied in the creation and zonation of some MPAs (Villa *et al.*, 2002; Di Nora *et al.*, 2007).

66. Countries have to identify and cartography as soon as possible sea bottoms covered by coralligenous outcrops and maërl beds in order to design a network of MPAs that enables the protection of coralligenous/maërl assemblages.

67. Those Mediterranean MPAs, which contain coralligenous/maërl assemblages and for which management and monitoring plans have not yet been developed and implemented, must develop and implement such plans as soon as possible.

V.4. National plans

68. To ensure more efficiency in the measures envisaged in the implementation of this Action Plan, Mediterranean countries are invited to establish national plans for the conservation of Coralligenous and other calcareous bio-concretions. Each national plan should take into account the concerned country's, or even areas', specific features. It must suggest appropriate legislative measures, particularly for the environmental impact assessment of coastal infrastructure (building works, pipelines out to sea, and deposits of material from dredging) and to control activities which could affect coralligenous/maërl assemblages. The national plan shall be based on the available scientific data and will include programmes for (i) collection and regular updating of data, (ii) training and refresher courses for specialists, (iii) awareness-raising and education for the general public, actors and decision-makers and (iv) the conservation of coralligenous/maërl assemblages of importance for the Mediterranean marine environment. The national plans must be brought to the attention of all concerned actors and, when possible, coordinated with the relevant national plans (e.g. emergency plan to deal with pollution).

VI. Coordination of this Action plan with other tools and initiatives

69. The Standard Data-Entry Form (SDF), developed by SPA/RAC, can be used to identify potentially good sites for the establishment of MPAs devoted to protect coralligenous/maërl assemblages. Besides the analysis of current data on the distribution of coralligenous assemblages along with information derived from distribution modelling tools can help guiding cost-effective future surveys and monitoring efforts towards the development of basin-wide marine protected areas network for coralligenous/maërl assemblages (Martin et al. 2014).

70. However the SDF is not appropriate to be used in the monitoring of coralligenous/maërl assemblages since it has been designed for the inventory of sites and habitats but not for an accurate assessment of multi-species population densities and their evolution. Annex B (habitat types) from the SDF should be slightly modified in the point IV.3.1 (Coralligenous biocenosis), according to current knowledge. Species appearing in Annex C should be slightly enlarged in order to include several engineering coralligenous species according to the adopted criteria for amendments of the Annexes (II & III) of the Protocol SPA-BD.

71. MPAs classified as SPAMIs and containing coralligenous/maërl assemblages inside their protected areas should develop management and protection plans to ensure their conservation.

VII. REGIONAL COORDINATION STRUCTURE

72. Regional coordination of the implementing of the present Action Plan will be guaranteed by the Mediterranean Action Plan's (MAP) secretariat through the Regional Activity Centre for Specially Protected Areas. The main functions of the coordinating structure shall consist in:
    - collecting, validating and circulating data at Mediterranean level;
    - promoting the drawing up of inventories of species, coralligenous/maërl assemblages of importance for the Mediterranean marine environment;
    - promoting trans-boundary cooperation;
    - promoting and supporting the setting up of coralligenous/maërl assemblages monitoring networks;
    - preparation of reports on progress in the implementation of the Action Plan, to be submitted to the meeting of national focal points for SPAs and to meetings of the Contracting Parties;
    - organizing meetings of experts on specific subjects relating to coralligenous/maërl assemblages and training sessions.

73. Complementary work done by other international organizations, and aiming at the same objectives, shall be encouraged, promoting coordination and avoiding possible duplication of efforts.

VIII. PARTICIPATION IN THE IMPLEMENTATION

74. Implementing the present Action Plan is the province of the national authorities of the Contracting Parties. The concerned international organizations and/or NGOs, laboratories and any organization or body are invited to join in the work necessary for implementing the present 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.

75. The coordination structure shall set up a mechanism for regular dialogue between the participating organizations and, where necessary, organize meetings to this effect. Dialogue should be made mainly by mail, including E-mail.

ANNEX: IMPLEMENTATION TIMETABLE

Action	Deadline	To be implemented by
1. Build and publish the database of scientists and research institutions working on the coralligenous assemblages and maërl beds.	2016	SPA/RAC
2.Guidelines for the assessment of environmental impact on coralligenous/maërl assemblages	2017	SPA/RAC
3. Development of Working Groups on coralligenous assemblages and maërl beds.	2016	SPA/RAC-Contracting Parties
4. Buid-up a coralligenous/maërl assemblages distribution on line database	2018	SPA/RAC-Contracting Parties
5. Improve habitat modeling methods could provide new predictive models on coralligenous distribution and guide cost-effective field surveys for data acquisition	2017	Contracting Parties
6. Characterization of coralligenous habitats at regional scale	2018	SPA/RAC-Contracting Parties
7. Build-up a Check-list / Reference species list for the coralligenous assemblages	2016	SPA/RAC
8. Development of standardized protocols for the characterization of coralligenous /maërl assemblages.	2017	SPA/RAC-Contracting Parties
9. Development of indices and/or intercalibration initiatives to determine conservation environmental status of coralligenous	2017	SPA/RAC-Contracting Parties
10. Set a network of sentinel sites on coralligenous across the Mediterranean	2020	SPA/RAC-Contracting Parties
11. Promote research programs on coralligenous assemblages and maerl beds	2016	Contracting Parties
12. Develop and implement legislation initiatives for the conservation of coralligenous assemblages	Ongoing	Contracting Parties
13. Coordinate the design of an Integrated Monitoring and Assessment Program for the assessment of the state coralligenous/maërl assemblages in view to be included the assessment of the state of the Mediterranean	2016	Contracting Parties
14. Promote the declaration of marine protected areas to preserve coralligenous assemblages in coastal and offshore areas	2018	SPA/RAC-Contracting Parties
15. Build-up a coordination platform on different initiatives devoted to the coralligenous/maërl assemblages	2017	SPA/RAC
16. Organize a Symposium on coralligenous assemblages and maërl beds every 3 years	2018	SPA/RAC
17. Preparation of a communication plan to raise the awareness on the importance of coralligenous assemblages and maërl beds for the conservation of Mediterranean biodiversity	2017	SPA/RAC

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Annex III

Updated Action Plan concerning Species Introductions and Invasive Species in the Mediterranean Sea

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INTRODUCTION

1. In 1975, 16 Mediterranean countries and the European Community adopted the Mediterranean Action Plan (MAP), the first-ever Regional Seas Programme under UNEP's umbrella. In 1976 these Parties adopted the Convention for the Protection of the Mediterranean Sea Against Pollution (Barcelona Convention). Seven Protocols addressing specific aspects of Mediterranean environmental conservation complete the MAP legal framework.

2. In 1995, the Action Plan for the Protection of the Marine Environment and the Sustainable Development of the Coastal Areas of the Mediterranean (MAP Phase II) was adopted by the Contracting Parties to replace the Mediterranean Action Plan of 1975. At the same time, the Contracting Parties adopted an amended version of the Barcelona Convention of 1976, renamed Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean.

3. Currently, MAP has been adopted by 21 countries bordering the Mediterranean Sea, and the European Union. The 22 Contracting Parties to the Barcelona Convention give priority to the conservation of the marine environment and to the components of its biological diversity. This has been confirmed on several occasions, particularly by the adopting (Barcelona, 1995) of the new Protocol concerning specially protected areas and biological diversity in the Mediterranean (SPA Protocol) and of its Annexes.

4. The SPA Protocol invites the Contracting Parties to take "all appropriate measures to regulate the intentional or non-intentional introduction of non-indigenous or genetically modified species into the wild and prohibit those that may have harmful impacts on the ecosystems, habitats or species" (Article 13.1).

5. For established alien[3] species, the SPA Protocol stipulates that "the Parties shall endeavour to implement all possible measures to eradicate species that have already been introduced when, after scientific assessment, it appears that such species cause or are likely to cause damage to ecosystems, habitats or species" (Article 13.2).

6. The Convention on Biological Diversity calls on in its Article 8 (h) each Contracting Party, as far as possible and as appropriate "to prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species". In the tenth meeting of the Conference of the Parties, held from 18 to 29 October 2010, in Nagoya, Aichi Prefecture, Japan, a revised and updated Strategic Plan for Biodiversity, including the Aichi Biodiversity Targets, for the 2011-2020 period, was adopted. According to Aichi Target 9, "By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment."

7. Aichi Target 9 is reflected in Target 5 of the EU Biodiversity Strategy (European Commission COM/2011/244). Furthermore, the new EU Regulation (No 1143/2014) on the prevention and management of the introduction and spread of invasive alien species is a dedicated instrument to mitigate the impacts of biological invasions in Europe. The European Commission, European countries, and their relevant authorities will have, under the new EU legislative instrument, obligations and commitments in respect to invasive alien species (IAS). These include prioritising pathways for prevention, identifying the most harmful species for responses (list of species of EU concern), enforcing effective early warning and rapid response mechanisms for the IAS of EU concern, eradicating such species at an early stage of invasion, and taking management measures for IAS that are widely spread. In addition, the EU Marine Strategy Framework Directive (2008/56/EC) recognises alien marine species as a major threat to European biodiversity and ecosystem health, requiring Member States to consider them when developing strategies so that all European Seas reach Good

[3]Synonym of 'non-indigenous'. The term alien is adopted herein as it is the term currently mostly used by the scientific community and recent legislation (e.g. the new EU Regulation No 1143/2014 on the prevention and management of the introduction and spread of invasive alien species)

Environmental Status by 2020. The European Alien Species Information Network (EASIN)[4] was launched in 2012 by the European Commission to facilitate the exploration of existing alien species information and to assist the implementation of the new Regulation and the other EU policies on biological invasions.

8. The trend of new introductions of alien species in the Mediterranean has been increasing. About 1000 marine alien species have been reported in the Mediterranean Sea up to now, of which more than half are considered established[5]. Many of these species have become invasive with serious negative impacts on biodiversity, human health, and ecosystem services.

9. There are many routes and mechanisms by which new alien species arrive in the Mediterranean Sea. Identification and assessment of the pathways of introduction is essential for predicting future trends of new introductions, identifying management options to mitigate invasions and to prevent new introductions, and communicating related risks and costs to policy makers and high level administration. Among the many important pathways by which human actions have introduced alien invasive species into the Mediterranean Sea are shipping (by means of ballast waters and hull fouling), corridors, maritime transport and water ways, aquaculture, trade in live marine organisms (aquarium trade and fishing bait) and others (e.g. fishing activities and aquarium exhibits). Other additional factors such as global warming may enhance alien species to spread in the Mediterranean.

10. In the Mediterranean Sea, despite the variability in monitoring and reporting effort among countries and the gaps in our knowledge of alien species distribution, there is an enormous amount of information scattered in various databases, institutional repositories, and the literature. By harmonizing and integrating information that has often been collected based on different protocols and is distributed in various sources, the needed knowledge basis to assess the distribution and status of marine alien species can be built.

11. Elaborating and implementing action plans to confront the threats to biological diversity is an effective way of guiding, coordinating and stepping up the efforts made by the Mediterranean countries to safeguard the region's natural heritage. The invasive alien species, including as a side effect of climate change, are seen as being among the main threats to marine biodiversity in the Mediterranean. The adopted Ecosystem Approach (EcAp)[6] to management of human activities with a view to conserve natural marine heritage and protecting vital ecosystem services recognises that to achieve good environmental status "non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem". It is imperative to take immediate steps to prevent the introduction of alien species, control the spread of those already introduced and endeavour to mitigate the damage they cause to the marine ecosystem including through national actions as well as regional and international cooperation ensuring the availability of means of implementation inter alia capacity building, technology transfer, on mutually agreed terms and financing. The present Action Plan is being elaborated on the basis of the existing regional and international policies on invasive

[4] http://easin.jrc.ec.europa.eu/

[5] Zenetos et al. (2012). Alien species in the Mediterranean Sea by 2012. A contribution to the application of European Union's Marine Strategy Framework Directive (MSFD). Part 2. Introduction trends and pathways. *Mediterranean Marine Science* 13(2): 328–352.

[6] The 15th Meeting of the Contracting Parties to the Barcelona Convention (COP15) decided (through Decision IG.17/5) to progressively apply the ecosystem approach (EcAp) to the management of human activities that may affect the Mediterranean marine and coastal environment for the promotion of sustainable development.
The 17th Meeting of the Contracting Parties to the Barcelona Convention (COP17) confirmed the importance given to the EcAp in the Mediterranean, and agreed (through Decision IG.20/4) on an overall vision and goals for EcAp, on 11 ecological objectives, operational objectives and indicators for the Mediterranean, adopted the timeline for implementing the ecosystem approach until 2019 and established a six-year cyclic review process of its implementation, with the next EcAp cycle to cover 2016-2021.
At the 18th Meeting of the Contracting Parties to the Barcelona Convention (COP18), targets for achieving Good Environmental Status of the Mediterranean Sea and its coastal zone by 2020 were adopted. In addition, through Decision IG. 21/3 (the so called "COP18 EcAp Decision‖), the Contracting Parties agreed to design an Integrated Monitoring and Assessment Programme by the next Meeting of the Contracting Parties (COP19), and mandated the Secretariat to carry out an assessment of the state of the Mediterranean environment in 2017.

species data available; it will be adapted and updated, if necessary, to reflect the latest policies and new data available.

12. The actions advocated by the present Action Plan are to be carried out over a five year period, starting from when the Action Plan is adopted by the Contracting Parties. At the end of this period, SPA/RAC will prepare a report on the progress so far made in implementing the advocated actions, and will submit this to the National Focal Points for SPAs, who will make follow-up suggestions to the Parties.

13. Considering the world-wide scope of the issue of alien species introduction, it is important that the implementation of the present Action Plan be done in consultation and collaboration with the initiatives undertaken in this field in other regions and/or by other international organisations.

A. OBJECTIVES OF THE ACTION PLAN

14. The main objective of the present Action Plan is to promote the development of coordinated efforts and management measures throughout the Mediterranean region in order to prevent as appropriate, minimize and limit, monitor, and control marine biological invasions and their impacts on biodiversity, human health, and ecosystem services, particularly by:

1. strengthening the capacity of the Mediterranean countries to deal with the issue of alien species, within the framework of the EcAp;
2. supporting a regional information network for the efficient exploitation of alien species data and to support the regional policies on biological invasions;
3. further developing MAMIAS, an online platform for the collection, exploitation, and dissemination of information on marine biological invasions in the Mediterranean Sea to support relevant regional and international policies;
4. strengthening the institutional and legislative frameworks at the level of the countries of the region;
5. conducting baseline studies and establishing monitoring programmes, within the framework of the EcAp Integrated Monitoring and Assessment Programme, to collect reliable and pertinent scientific data that can be used for decision-making where necessary;
6. setting up mechanisms for cooperation and the exchange of information among the Mediterranean countries;
7. Elaborating guidelines and any other technical documentation.

B. PRIORITIES

B.1 At national level

15. Considering the lack of the data and knowledge necessary for impact and risk assessments, horizon scanning, and the implementation of management actions for prevention, control and eradication, priority at national level should be given to:

1. encouraging all necessary actions (e.g. research work, data collection, monitoring, national impact assessments, horizon scanning etc.) aimed at improving the available knowledge;
2. conducting baseline studies and establishing monitoring programmes to collect reliable and pertinent data on the distribution of alien species in the territorial waters;
3. coordinating the actions that are necessary for the regular provision of essential information for the national and Mediterranean-wide reference lists of alien species;
4. supporting, through the provision of essential information, the ‘Marine Mediterranean Invasive Alien Species’ (MAMIAS) database and online platform, which will include Mediterranean-wide national lists of alien species, including information on their taxonomic

classification, ecology, biology, habitats, and impacts on biodiversity, human health, and ecosystem services;

5. encouraging the implementation of scientifically-backed regionally-harmonised measures of prevention and control in particular for the high risk pathways of Non Indigenous Species (NIS);
6. developing training and raising awareness programmes on risks, legal issues, best practices, and management actions for prevention and mitigation of impacts.

It is understood that the Parties will follow national procedures in implementing these priorities.

B.2 At regional level

16. Considering the breadth and complexity of the issue of alien species introduction, the large amount of relevant information that remains scattered in various databases and repositories, and the need for harmonization and integration of alien-species data, priority at regional level should be given to:

1. coordinating, supporting, and updating the 'Marine Mediterranean Invasive Alien Species' (MAMIAS) database and online platform;
2. creating an active network of partners within the framework of MAMIAS for the continuous updating of the database and the early warning in case of new records of invasive species;
3. linking MAMIAS to other international networks, such as the European Alien Species Information Network (EASIN), increasing its visibility and use for the support of international policies on the management of alien invasive species;
4. elaborating and adopting at regional level guidelines intended to assist the relevant national authorities;
5. assisting national authorities to organise training on taxonomical issues, identification of target species, monitoring methods and reporting, and management practices;
6. coordinating the actions taken by neighbouring Parties to prevent and control the introduction of alien species;
7. supporting cooperation at international level.

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

C.1 At national level

C.1.1. Data collection

17. The Contracting Parties are invited to assess the situation as regards the introduction of marine species and compile the available information to prepare updated national reports. The need to address the operational objectives 2.1, 2.2 and 2.3 for the implementation of the agreed EcAp should be reflected in the national reports. To this end, Contracting Parties will be assisted by SPA/RAC, if necessary. The national reports will particularly deal with:

- inventorying the alien marine species reported in the national territory, and providing the relevant documentation available;
- trends in abundance, temporal occurrence and spatial distribution in the wild of alien species, particularly invasive alien species, notably in risk areas, in relation to the main vectors and pathways of spreading of such species;
- ratio between invasive alien species and native species in some well-studied taxonomic groups (e.g. fish, macroalgae, molluscs) that may provide a measure of change in species composition;
- impacts of alien species on biodiversity, human health, and ecosystem services at national level;
- steps taken at national level to prevent and control the introduction of marine species
- the national institutional framework that governs the controlling of species introduction
- horizon scanning to identify future threats from invasive species

- participation at pertinent international initiatives, including joining international agreements and bilateral cooperation.

18. The Parties are requested to design and implement programmes for data collection, monitoring and assessment, within the framework of the EcAp Integrated Monitoring and Assessment Programme[7], particularly of:

- the presence of alien marine species, the pathways of their introduction, and the state of their population trends, including those used in aquaculture;
- the ratio between alien and native species in some well-studied taxonomic groups (e.g. fish, macroalgae, molluscs) to provide a measure of change in species composition;
- the impact of alien species on biodiversity, human health and ecosystem services, including both negative and positive impacts.

C.1.2. Supporting MAMIAS

19. Considering the need of a comprehensive and continuously updated information system to support coordinated efforts and management measures throughout the Mediterranean region in order to prevent, control and monitor marine biological invasions and their impacts on biodiversity, human health and ecosystem services, the Parties are requested to conduct a baseline study, reporting in particular:

- an inventory of all alien species in their territorial waters;
- for each species: the year of first record, the pathway of introduction (together with the level of certainty in assessing the pathway: direct evidence, most likely, possible), and the state of the population;
- georeferenced records of alien species presence and the date of each record;
- studies on the impact of the alien species at national level;
- any relevant documentation.

It is understood that the Parties will follow national procedures in preparing these base line studies.

The baseline study should be submitted to SPA/RAC to feed MAMIAS. Reporting should follow the forms provided by SPA/RAC.

20. The baseline study should be updated annually based on the outputs of the national monitoring programmes (paragraph 18) and any new information should be submitted to SPA/RAC and made available to MAMIAS.

C.1.3. Legislation

21. Those Contracting Parties which have not yet enacted national legislation for controlling the introduction of marine species must do so as quickly as possible. All the Contracting Parties are strongly recommended to take the necessary steps to express in their national laws the provisions of the pertinent international treaties, especially the IMO Convention on the management of ballast waters, and guidelines and codes adopted on the subject within the context of international organisations[8].

[7] UNEP(DEPI)/MED WG.411/3

[8] Many organisations have elaborated codes, guidelines or other tools providing technical and legal recommendations for the better control of species introductions and mitigation of their negative impacts. Those tools which are most pertinent for the Mediterranean region are:
- Guiding principles for the prevention, introduction and mitigation of impacts of alien species (elaborated within the framework of the Convention on Biological Diversity)
- Recommendation no. 57 on the Introduction of Organisms belonging to Non-Native Species into the Environment (adopted within the framework of the Bern Convention)
- The IUCN Guidelines for the prevention of biodiversity loss caused by alien invasive species
- The Code of Practice on the Introductions and Transfers of Marine Organisms (developed by the International Council for the Exploration of the Sea)

C.1.4. Institutional framework

22. A mechanism should be set up, if possible at the level of each country, to promote and coordinate the following actions:

- compiling an inventory of introduced species and assessing their pathways of introduction;
- cooperating with SPA/RAC and supporting regional initiatives, in particular supporting and updating MAMIAS;
- establishing a directory of relevant specialists and organisations;
- setting up a group of experts who will be responsible for assessing all relevant issues; regarding introduction, spatial distribution, pathways of introduction, and impacts of alien species, and analysing risks and possible consequences, in close consultation with the other Parties and relevant International Organisations
- developing relevant training programmes;
- strengthening and where necessary setting up systems to control the intentional import and export of alien marine species;
- developing and implementing risk-assessment techniques;
- promoting relevant scientific research;
- cooperating with the concerned authorities in neighbouring states regarding the detection of introduced species and risk assessment;
- participating in international initiatives on invasive species;
- promoting citizen science initiatives to support the monitoring of invasive species;
- developing programmes to raise the awareness of the general public and target groups, including decision-makers, concerning the risks associated with species introduction;

C.1.5. National Plans

23. To ensure more efficiency in the measures envisaged in the implementation of this Action Plan, Mediterranean countries are invited to establish National Plans to prevent the introduction of new alien marine species by controlling their pathways, and to mitigate their negative impact. Each National Plan, taking into account the concerned country's specific features, must suggest appropriate institutional and legislative measures. The National Plan shall be based on the available scientific data and will include programmes for (i) the collection and regular updating of data, especially for the support of EcAp (ii) the highest possible dissemination of data and relevant information, especially within the framework of MAMIAS (ii) training and refresher courses for specialists, (iii) awareness-raising and education for the general public, actors and decision-makers and (iv) coordination and collaboration with other states. The national plans must be brought to the attention of all concerned actors and, when possible, coordinated on a regional basis.

C.2 At regional level

C.2.1. Development of the MAMIAS platform

24. Considering that sufficient high quality information on alien species ecology, distribution, pathways of introduction, impacts, and effective management strategies is a prerequisite for the efficient prevention, early detection, rapid response, and management of biological invasions, a regional mechanism for collecting, harmonizing, and integrating information on alien species should be set up as part of the present Action Plan. The MAMIAS online platform will be at the core of this mechanism, and will be further developed to include:

- a comprehensive basin-wide database on all alien species with information on their taxonomic classification, establishment success, year of first introduction in the Mediterranean, years of first record in each Mediterranean country, pathways of both primary and secondary introductions, impacts on biodiversity, human health, and ecosystem services, links to factsheets and other databases with relevant information;

- Guidelines for preventing the introduction of unwanted aquatic organisms and pathogens from ships' ballast water and sediment discharges (adopted within the framework of the IMO)
- The precautionary approach concerning the introduction of species (developed by the FAO).

- for the most invasive and high-impact species, factsheets with details on their biology and ecology, diagnostic characters and field identification signs, native range, distribution maps in the Mediterranean and globally, history of its introduction, population trends, impacts on biodiversity, human health, and ecosystem services, relevant links, and existing management measures for control or eradication;
- a user-friendly web site with online tools and web services for searching the database and extracting data;
- online mapping tools providing distribution maps of alien species in the Mediterranean Sea and possibilities to extract spatial data;
- an early warning system to issue notifications to the Parties, when there is an early new detection of invasive and high-impact species;
- online tools to produce statistics and indicators, such as trends in new introductions by pathway and trends in spatial distribution, especially to support the application of EcAp; these tools should be capable to assist the estimation of the common indicator 6 of the EcAp Integrated Monitoring and Assessment Programme[9].

25. Considering that to effective support international and regional policies and scientific research on biological invasions, and to efficiently use the already accumulated knowledge, there is a need for standardization, harmonization and integration of existing information systems, it is recommended that SPA/RAC will establish collaborations and close links between MAMIAS and other international information systems and organizations. An indicative list of collaborators includes:

- EASIN (European Alien Species Information Network) which is the official platform of the European Commission aiming to facilitate the exploration of existing alien species information in Europe and to assist the implementation of the European policies on biological invasions;
- the GIASI Partnership Gateway, assisting partners of the CBD to implement Article 8(h) and Target 9 of the Aichi Biodiversity Targets;
- IUCN-ISSG (Invasive Species Specialist Group of the International Union for Conservation of Nature) aiming to reduce the threat to natural ecosystems and native species by increasing awareness of invasive alien species, and of ways to prevent, control or eradicate them;
- WORMS (World Register of Marine Species) and WRIMS (World Register of Introduced Marine Species), which provide an authoritative and comprehensive list of names of marine organisms and relevant taxonomic information.

C.2.2. Training

26. To support the implementation of the present Action Plan, a regional training session should be organised in collaboration with the concerned international organisations. In particular, it will deal with the main following themes:

- Methods and protocols for impact and risk assessments, and horizon scanning regarding new introductions of alien species;
- Management measures for prevention, control and eradication of invasive alien species
- Taxonomic issues and identification of alien species;
- Monitoring methods and protocols for marine alien species.

C.2.3. Public education and awareness

27. With a view to promoting the Mediterranean countries' national programmes for raising the awareness of the general public and target groups, including decision-makers, about the risks associated with introducing alien marine species into the Mediterranean and with bad practices that assist the secondary spread of already established alien species, it is recommended that SPA/RAC, in collaboration with the relevant national authorities and international organisations, prepare brochures,

[9]Trends in abundance, temporal occurrence and spatial distribution of non-indigenous species, particularly invasive, non-indigenous species, notably in risk areas (EO2, in relation to the main vectors and pathways of spreading of such species) UNEP(DEPI)/MED WG.411/3

posters and other educational and awareness materials. These will be made available to the National Focal Points for SPAs, to be circulated in their respective countries.

D. REGIONAL COORDINATION

28. Regional coordination of the implementation of the present Action Plan will be guaranteed by the Mediterranean Action Plan's (MAP) Secretariat through the Regional Activity Centre for Specially Protected Areas. The main functions of the coordinating structure shall consist in:

- taking in hand the implementation of those actions required at regional level to attain the present Action Plan's objectives (Section C.2 above)
- insofar as its means permit, assisting the Contracting Parties in implementing the actions required at national level to attain the present Action Plan's objectives (Section C.1 above);
- regularly reporting to the National Focal Points for SPAs about the implementation of the present Action Plan, and preparing the report mentioned in paragraph 12 above;
- collaborating with the concerned organisations and endeavouring to ensure that the Mediterranean region is involved in the pertinent international and/or regional initiatives;
- promoting exchanges among Mediterranean specialists.

E. PARTICIPATION IN THE IMPLEMENTATION

29. 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

In addition to collaborating and coordinating with the Secretariats of the relevant Conventions, SPA/RAC should invite IMO and FAO/GFCM to join and contribute to the implementation of the present Action Plan. It will set up a mechanism for regular dialogue between the participating organisations and, where necessary, organise meetings to this effect.

ANNEX: IMPLEMENTATION TIMETABLE

Action	Deadline	Responsible
1. Preparation of national reports (paragraph 17)	2016	Contracting Parties
2. Set up a mechanism to promote and coordinate the actions listed in paragraph 22	2016	Contracting Parties
3. Launch MAMIAS (paragraph 24)	2016	SPA/RAC
4. Preparation of forms for reporting to MAMIAS (as provisioned in paragraph 19)	2016	SPA/RAC
5. Baseline study with information for MAMIAS (paragraph 19)	2017	Contracting Parties
6. Develop programmes for data collection and monitoring (paragraph 18)	2017	Contracting Parties
7. Launch the procedures for enacting or strengthening national legislation governing the control of alien species introduction (paragraph 21)	2017	Contracting Parties
8. Establish/update a directory of relevant specialists and organisations (paragraph 22)	2017	SPA/RAC, Contracting Parties
9. Develop programmes to raise the awareness of the general public and target groups, including decision-makers, concerning the risks associated with species introduction (paragraph 22)	2017	Contracting Parties
10. Develop online tools and web services for searching the database and extracting data (paragraph 24)	2017	SPA/RAC
11. Annual updates of national data for MAMIAS (paragraph 20)	2017-2019 (annually)	Contracting Parties
12. Develop and implement risk-assessment techniques (paragraph 22)	2018	Contracting Parties
13. Develop online mapping tools (paragraph 24)	2018	SPA/RAC
14. Organise the regional training session (paragraph 26)	2018	SPA/RAC
15. Elaborate the National Plans (paragraph 23)	2019	Contracting Parties
16. Develop an early warning system in the framework of MAMIAS (paragraph 24)	2019	SPA/RAC
17. Establish collaborations and links between MAMIAS and other international systems and organizations (paragraph 25)	2019	SPA/RAC
18. Preparation of material for public education and awareness (paragraph 27)	2020	SPA/RAC, Contracting Parties
19. Develop online tools in MAMIAS for statistics and indicators, especially to support EcAp (paragraph 24)	2020	SPA/RAC
20. Organise a symposium every 3 years	From 2016	SPA/RAC