UNITED NATIONS

EP

UNEP(DEPI)/MED WG.430/Inf.3

UNEP

UNITED NATIONS
ENVIRONMENT PROGRAMME
MEDITERRANEAN ACTION PLAN

31 January 2017
Original: English

Meeting of the Correspondence Group on Monitoring (CORMON), Biodiversity and Fisheries

Madrid, Spain, 28th February – 1st March 2017

Agenda item 3: Implementation of the Integrated Monitoring and Assessment Programme (IMAP)

Draft guidelines for the preparation of the country specific EcAp monitoring programme for biodiversity and NIS

UNEP/MAP
SPA/RAC - Tunis, 2017

Contents:

FOREWORD

This document aims at providing the Contracting Parties to the Barcelona Convention with technical guidance for the implementation at national level of the Integrated Monitoring and Assessment Programme (IMAP) under the Ecosystem Approach (EcAp) process.

It builds on the Decisions of the Contracting Parties related to IMAP, and the information it contains is mainly based on the recommendations of the relevant documents issued by, or at the occasion of, the meetings and workshops organised within the framework of the EcAp process. In particular, the following documents were considered:

> Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria (contained in Document UNEP(DEPI)/MED IG.22/Inf.7)
>
> Draft Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria
> (Contained in Document UNEP(DEPI)/MED WG.420/3/Corr.1)
>
> Draft Integrated Monitoring and Assessment Guidance
> (Contained in Document UNEP(DEPI)/MED WG.420/4)
>
> Decision IG.22/7, Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria (adopted by the 19th Ordinary Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols (Athens, Greece, 9-12 February 2016)
> (Contained in Document UNEP(DEPI)/MED IG.22/28).

Furthermore, the elaboration of this document took due account of the guiding elements developed for monitoring under similar initiatives, such as the EU Marine Strategy Framework Directive (MSFD) and the monitoring processes under other Regional Seas Programmes.

1 Background

The Contracting Parties to the Barcelona Convention decided to apply the Ecosystem Approach (EcAp) to the management of human activities that may affect the Mediterranean marine and coastal environment. In this context, they adopted 11 Ecological Objectives whose achievement should help attaining a Good Environmental Status (GES) of the Mediterranean Sea and Coast.

The elaboration of the GES definition, indicators and targets was conducted through a wide consultation process that involved representatives of the Contracting Parties and relevant organisations.

The Contracting Parties also agreed to design an Integrated Monitoring and Assessment Programme (IMAP) and implement it according to the 6 year-EcAp cycles structure. During the IMAP initial phase (2016-2019), countries are invited to integrate their existing national monitoring and assessment programmes in accordance with the IMAP structure and principles. To this end, the existing national monitoring and assessment programmes should be reviewed and, where necessary revised, with the view of ensuring the implementation, at national level, of IMAP based on a set of agreed common indicators. The expected main outputs of the IMAP initial phase include the update of GES definitions, the further refinement of assessment criteria and the development of national level integrated monitoring and assessment programmes.

During their 19th Ordinary Meeting (Athens, February 2016), the Contracting Parties to the Barcelona Convention adopted the IMAP and took note of the Integrated Monitoring and Assessment Guidance (UNEP(DEPI)/MED IG.22/Inf.7). They requested the Secretariat and the Correspondence Groups on Monitoring to work on its refinement, during the initial phase of IMAP, especially in relation to scales of assessment, specification and further quantification of GES, and further development of the candidate indicators. They also agreed (i) that the Quality Status Report in 2017 and the State of Environment and Development Report in 2019 will build on the structure, objectives and data collected under IMAP and (ii) to continue reporting based on their existing national monitoring programmes until they are updated into a national Integrated Monitoring Programme.

The Contracting Parties having already developed relevant national monitoring programmes for other purposes, such as fulfilling their obligations under other initiatives, will have to update, during 2016-2017, their existing relevant monitoring programmes in order to cover the IMAP areas, common indicators in line with the IMAP.

The integrated monitoring and assessment programme is to run on a 2 year-initial basis in order to assess the effectiveness of the programmes, perform further gap analysis and establish needs for adaptation. The outcomes of the IMAP should allow for a periodic assessment of the status of the Mediterranean environment.

As part of the EcAp governance structure set by the Contracting Parties, a Correspondence Group on Monitoring (CORMON) was established to ensure efficient coverage and in-depth discussions and analysis regarding integrated monitoring and assessment. The CORMON works follow the outcomes of the Correspondence Group on GES and Targets (CORGEST). It is composed of national experts designated by the Contracting Parties and organised in 3 clusters: Cluster 1, addressing Pollution and

Litter (EOs 5, 9, 10 and 11); Cluster 2, addressing Biodiversity and Fisheries (EOs 1, 2, 3, 4 and 6); and Cluster 3, addressing Coast and Hydrography (EOs 7 and 8).

Most of the elements presented in this document are based on the recommendation of CORMON and in particular those of its Cluster 2 (Biodiversity and Fisheries).

2 Recommended steps for the implementation at national level of the Biodiversity and Non-Indigenous Species components of IMAP

Taking into account the IMAP objectives and the relevant recommendations of CORMON and CORGEST meetings, the following steps are recommended for the preparation of the country-specific EcAp monitoring programme for Biodiversity and Non-Indigenous Species (NIS).

2.1 Establishment of a National IMAP Committee

To ensure a high level of coherence and coordination of the monitoring activities to be undertaken as part of IMAP at national level, it is highly recommended to establish a national committee (IMAP National Committee). Taking into account the specific context prevailing in the country, the IMAP National Committee will coordinate the elaboration of the country-specific EcAp monitoring programme and act as a steering committee for the implementation phases, including data compilation and reporting. Considering the wide range of expertise required, the IMAP National Committee might establish thematic working groups mirroring, as appropriate, the 3 CORMON clusters (Pollution and Litter, Biodiversity and Fisheries, and Coast and Hydrography). The number of working groups will be adapted to the national context of each Contracting Party.

2.2 Inventory of existing monitoring activities and available human and technical resources

One of the first tasks to be undertaken by the IMAP National Committee should be the review of relevant existing monitoring programmes and the assessment of their potential to provide data and information of interest to the EcAp process. Reliance on existing monitoring programmes should be evaluated taking into account the data requirements of the Common Indicators adopted by the Contracting Parties as well as the evaluation assessment cycles under EcAp.

For the Mediterranean EU member countries, special attention deserves to be paid to the monitoring programmes already in place or planned for the implementation of the MSFD in relation to Descriptors 1 and 2, as well as monitoring programmes of relevance for the Habitats Directive, Water Framework Directive and Birds Directive.

An assessment of the availability of scientific expertise at national level should be also conducted during this step. To this end, a comprehensive inventory of human resources available in the scientific institutions should be compiled, including as appropriate the expertise existing in other public departments and specialised conservation NGOs.

2.3 Monitoring strategy

Based on the IMAP objectives and the core indicators as defined for EO1 and EO2, a strategy should be defined to guide the elaboration of the concrete monitoring programme at national level. The monitoring strategy should address in particular:

- The clear objectives of the monitoring activities;
- Key principles for the identification of (i) sampling techniques, (ii) sampling frequency, (iii) spatial resolution, (iv) selection of representative sampling sites;
- Protocols for data collection, storage, compilation and sharing;
- Data quality objectives;
- Availability of resources, including capacity building;
- Integration with the IMAP components in relation to other Ecological Objectives.

2.4 Monitoring programme for Biodiversity and Non-Indigenous Species

The Parties agreed to focus the monitoring effort under the EcAp on core common indicators that "summarizes data into a simple, standardized and communicable figure and are ideally applicable in the whole Mediterranean basin, but at least on the level of sub-regions and are monitored by all Contracting Parties". A common indicator is expected to provide a clear indication of the changes in the marine ecosystem as well as of the related threats.

Based on the eleven Ecological Objectives (EOs) and the related indicators they adopted under Decision IG.20/4, the Contracting Parties decided to focus the monitoring effort under the IMAP on the following Core Common Indicators:

1. Habitat distributional range (EO1);
2. Condition of the habitat's typical species and communities (EO1);
3. Species distributional range (EO1 related to marine mammals, seabirds, marine reptiles);
4. Population abundance of selected species (EO1, related to marine mammals, seabirds, marine reptiles);
5. Population demographic characteristics (EO1, e.g. body size or age class structure, sex ratio, fecundity rates, survival/mortality rates related to marine mammals, seabirds, marine reptiles);
6. 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);
7. Spawning stock Biomass (EO3);
8. Total landings (EO3);
9. Fishing Mortality (EO3);
10. Fishing effort (EO3);
11. Catch per unit of effort (CPUE) or Landing per unit of effort (LPUE) as a proxy (EO3);
12. Bycatch of vulnerable and non-target species (EO3);
13. Concentration of key nutrients in water column (EO5);
14. Chlorophyll-a concentration in water column (EO5);
15. Location and extent of the habitats impacted directly by hydrographic alterations (EO7);
16. Length of coastline subject to physical disturbance due to the influence of man-made structures (EO8);
17. Concentration of key harmful contaminants measured in the relevant matrix (EO9, related to biota, sediment, seawater);
18. Level of pollution effects of key contaminants where a cause and effect relationship has been established (EO9);
19. Occurrence, origin (where possible), and extent of acute pollution events (e.g. slicks from oil, oil products and hazardous substances) and their impact on biota affected by this pollution (EO9);

20. Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood (EO9);
21. Percentage of intestinal enterococci concentration measurements within established standards (EO9);
22. Trends in the amount of litter washed ashore and/or deposited on coastlines (including analysis of its composition, spatial distribution and, where possible, source.) (EO10);
23. Trends in the amount of litter in the water column including microplastics and on the seafloor (EO10);
24. Candidate Indicator: Trends in the amount of litter ingested by or entangling marine organisms focusing on selected mammals, marine birds and marine turtles (EO10);
25. Candidate Indicator: Land use change (EO8);
26. Candidate indicator: Proportion of days and geographical distribution where loud, low, and mid-frequency impulsive sounds exceed levels that are likely to entail significant impact on marine animals (EO11);
27. Candidate Indicator: Levels of continuous low frequency sounds with the use of models as appropriate (EO11).

A monitoring programme shall be elaborated for all the Common Indicators. The following sheets provide elements for the elaboration of monitoring programmes for Common Indicators 1 to 6 related to Biodiversity and NIS (respectively EO1 and EO2).

<table>
<tr><th colspan="4">Common Indicator 1: Habitat distributional range</th></tr>
<tr><th>Relevant GES definition:</th><th>Related operational objective</th><th colspan="2">Proposed Targets</th></tr>
<tr><td rowspan="2">The habitat is present in all its natural distributional range</td><td rowspan="2">Coastal and marine habitats are not being lost</td><td>State</td><td>Pressure</td></tr>
<tr><td>The ratio Natural / Observed distributional range tends to 1</td><td>Decrease in the main human causes of the habitat decline</td></tr>
<tr><td colspan="4">General considerations:
This is an area-based indicator aiming mainly at providing information about changes in habitat distribution with particular focus on loss of habitat extent. It is in principle applicable to all habitat types across the Mediterranean region and is considered to be highly sensitive to physical pressures.

Spatial scope
The spatial basis for assessment should be according to the Mediterranean biogeographical sub-areas in order to reflect changes in the biological character of each habitat type across the Mediterranean and its sub-regions.
Each Contracting Party should assess each habitat across their national maritime waters. However, it is recommended to assess on a smaller scale if they belong to different biogeographical sub-regions or if differences in pressure intensity are obvious between sub-basins.</td></tr>
<tr><th colspan="4">Proposed approach for selecting representative/reference</th></tr>
<tr><th colspan="2">Habitats</th><th colspan="2">monitoring sites</th></tr>
<tr><td colspan="2">Through Decision IG.22/7 of COP 19, the Contracting Parties adopted a reference list of habitats to be monitored, noting that those Contracting Parties who have the necessary means and are willing to do so can go beyond the monitoring requirements of the reference list. This list appears in Annex 1 to these guidelines.</td><td colspan="2">Considering that the monitoring under IMAP should follow a risk-based approach, the reference sites to be monitored should be located in zones with infrastructure developments or significant physical activities having the potential to generate damages to the marine habitats (dredging, trawling activities, etc.). Possible damage from pollution should be also considered.

For the marine areas located away from the coast, the identification of monitoring sites has to be based on general geological, hydrological, geomorphological and biological data.

The monitoring programmes of each Contracting Party should cover the reference habitat in at least two monitoring areas[1]:</td></tr>
</table>

[1] For all Biodiversity EOs, locations to be monitored should be prioritised to cover at least the following:

- *Areas of influence from anthropogenic activities which are expected to cause impacts upon biological diversity, with priority on the areas at highest risk1 (i.highintensity activities; ii. Multiple activities; iii. Areas where impacts may be* particularly severe or longterm).
  Areas considered representative of un-impacted (reference) conditions, i.e. not thought to be subject to, or impacted by, pressures:(i.) Without pressure (as far as is possible within the assessment area); (ii.) Representing the physiographic and hydrological conditions of the pressured areas identified in (a) (including the same community types or ecotypes).

	- . The monitoring sites should be selected among those which can showcase the relationship between environmental pressures and their main impacts on the marine environment.[2]
Available monitoring protocol(s)	**Expected outputs of the monitoring**
- RAC/SPA Protocol for the Posidonia meadows monitoring networks[3] - RAC/SPA Protocol for the monitoring of coralligenous community[4]	This indicator will be largely built on mapping and modelling of habitats and available construction footprint and spatial pressure data. The main output of the monitoring will be therefore: - Habitat distribution maps - Changes (trends) in habitat distribution
Recommended monitoring techniques	Considering the close link this indicator has with condition elements, the following four options may be considered in selecting the monitoring approach and the related techniques: - The use of condition indices and a representative sampling and assessment in a restricted number of areas with subsequent extrapolation into the larger area - Modelling habitats and mapping against impacts using sensitivity maps in combination with construction footprint data and spatial pressure intensity data - Combination of the two options above - Direct monitoring of habitats Several methods and technologies are available for direct monitoring of habitats, allowing rapid coverage in monitoring seabed habitats, such as: - multi-beam echo-sounding

[2] Criteria for the selection of representative monitoring sites:
- Where pressures to and risks to/effects on biodiversity are most strongly associated, following a risk based approach(vulnerable habitats and species locations);
- Where most information/historic data are available;
- Where well established monitoring (in general, not only for biodiversity) is already undertaken
- Sites of high biodiversity importance and conservation interest (according to national, regional or international regulations);
- Expert opinion.

[3] Pergent G., 2007. Protocol for the setting up of Posidonia meadows monitoring systems. «MedPosidonia» Programme / RAC/SPA - TOTAL Corporate Foundation for Biodiversity and the Sea; Memorandum of Understanding N°21/2007/RAC/SPA_MedPosidonia Nautilus-Okianos: 24p + Annexes.

[4] RAC/SPA - UNEP/MAP, 2014. Monitoring Protocol for Reefs - Coralligenous Community. By Garrabou J, Kipson S, Kaleb S, Kruzic P, Jaklin A, Zuljevic A, Rajkovic Z, Rodic P, Jelic K, and Zupan D. Ed. RAC/SPA - MedMPAnet Project, Tunis. 35 pages + annexes.

	- side-scan sonar - acoustic ground discrimination systems - Towed cameras Remote sensing techniques, including satellite images and aerial photography may also provide cost/effective options in shallow coastal waters, when combined with ground-truthing techniques (diving, sediment grabs, towed underwater cameras, etc.) The use of non-destructive methods is highly recommended to minimize the impact of monitoring on the habitats. It may also reduce the effort and/or the monitoring cost on the long-term.
Integration with the other Common Indicators	There are possible synergies between this indicator and the following other Common Indicators (CI): Field sampling and surveying: CI 2 to 5 (EO1) Selection of sampling sites and indicator habitats: CI 15 (EO7)

<table>
<tr><th colspan="3">Common Indicator 2: Condition of the habitat's typical species and communities</th></tr>
<tr><th>Relevant GES definition:</th><th>Related operational objective</th><th>Proposed Targets</th></tr>
<tr><td>The population size and density of the habitat-defining species, and species composition of the community, are within reference conditions ensuring the long term maintenance of the habitat</td><td>Coastal and marine habitats are not being lost</td><td>State:
-No human induced significant deviation of population abundance and density from reference conditions
-The species composition shows a positive trend towards reference condition over an increasing proportion of the habitat (for recovering habitats)</td></tr>
<tr><td colspan="3">General considerations:
This is a state condition indicator applicable in all Mediterranean regions. It is expected to provide information about the state of the considered habitats against reference conditions based on the state of species that are considered as typical species of the habitat. When adopting this Common Indicator, the Contracting Parties agreed that "Reference conditions" should be defined, taking into account the natural variability in species composition in space and time.

The monitoring in relation to this Common Indicator requires that a set of Biotic Indices be selected taking into account feasibility consideration and the availability of sampling methodologies and means (scientists, equipment, etc.). A harmonisation effort is needed to ensure consistency and optimization within biogeographical regions.</td></tr>
<tr><th colspan="3">Proposed approach for selecting representative/reference</th></tr>
<tr><th colspan="2">Species and Habitats</th><th>monitoring sites</th></tr>
<tr><td colspan="2">For each considered habitat, a list of species shall be defined in each bioregion including preferably long-lived species and species with high structuring or functional value. Short-lived species may be also included if they characteristically occur in the habitat under natural conditions.

As a first step in defining the list of species, it is highly recommended to identify the species existing lists already used by some Contracting Parties in monitoring programmes under relevant instruments such as the EU Water Framework Directive.
The existing lists shall be used as a starting point and complemented by identifying typical and characteristic species for remaining habitats and biogeographical regions.

Considering the rapid changes in species composition in most of the Mediterranean marine habitats, the lists should be reviewed and where necessary updated every six years.</td><td>Considering that the monitoring under IMAP should follow a risk based approach, the reference sites to be monitored should be located in zones with infrastructure developments or significant physical activities having the potential to generate damages to the marine habitats (trawling, dredging, etc.). Possible damage from pollution should be also considered.

For the marine areas located away from the coast, the identification of monitoring sites has to be based on general geological,</td></tr>
</table>

	hydrological, geomorphological and biological data. Considering that baselines are needed to assess GES against this indicator, priority shall be given to sites where baseline conditions may be realistically established for the species considered.
Available monitoring protocol(s)	**Expected outputs of the monitoring**
- Lepidochronology and phenology protocols for *Posidonia oceanica*[5] - ISO 16665: 2014 Guidelines for quantitative sampling and sample processing of marine soft-bottom macrofauna (http://www.iso.org/iso/catalogue_detail.htm?csnumber=54846) These guidelines provide standard methodology for collection and processing of subtidal soft-bottom macrofaunal samples in marine waters, in particular: - the development of the sampling programme; - the requirements for sampling equipment; - sampling and sample treatment in the field; - sorting and species identification; - storage of collected and processed material. - ISO 19493: 2007 Guidance for marine biological surveys of supralittoral, eulittoral and sublittoral hard substrate for environmental impact assessment and monitoring in coastal areas (http://www.iso.org/iso/catalogue_detail.htm?csnumber=39107): It covers: - the development of the sampling programme, - survey methods, - species identification, - storage of data and collected material.	Data about the status of the selected species, including trends in their population size, abundance and demographic structure

[5] Pergent G., 2007. Protocol for the setting up of Posidonia meadows monitoring systems. «MedPosidonia» Programme / RAC/SPA - TOTAL Corporate Foundation for Biodiversity and the Sea; Memorandum of Understanding N°21/2007/RAC/SPA_MedPosidonia Nautilus-Okianos: 24p + Annexes.

Recommended monitoring techniques	The monitoring techniques depend on the species to monitor and the related habitat. Non-destructive optical methods are recommended for the monitoring of large benthic species such as epibenthic species on hard substrates, while endobenthic species can be monitored using standardized grabs, drill sampling or corers.
Integration with the other Common Indicators	There are possible synergies between this indicator and the following other Common Indicators (CI): Field sampling and surveying: CI 1, 3, 4 and 5 (EO1) Selection of sampling sites and indicator habitats: CI 15 (EO7)

<table>
<tr><th colspan="3">Common Indicator 3: Species distributional range[6]</th></tr>
<tr><th>Relevant GES definition:</th><th>Related operational objective</th><th>Proposed Targets</th></tr>
<tr><td><u>Marine mammals</u>:
Monk Seal is present along recorded Mediterranean coasts with suitable habitats for the species</td><td rowspan="3">Species distribution is maintained</td><td>The distribution of Monk Seal remains stable or expanding and the species is recolonizing areas with suitable habitats.</td></tr>
<tr><td><u>Birds</u>:
The species continue to occur in all their Mediterranean natural habitat</td><td>- No significant shrinkage in the population distribution in the Mediterranean in all indicator species,
- For colonial-breeding seabirds (i.e., most species in the Mediterranean): New colonies are established and the population is encouraged to spread among several alternative breeding sites</td></tr>
<tr><td><u>Reptiles</u>:
The species continue to occur in all their natural range in the Mediterranean, including nesting, mating, feeding and wintering and developmental (where different to those of adults) sites</td><td>- Turtle distribution is not significantly affected by human activities

- Turtles continue to nest in all known nesting sites</td></tr>
<tr><td colspan="3">General considerations:
This indicator is aimed at providing information about the geographical area in which the selected (indicator) species occur. It is intended to determine the species range of seabirds, cetaceans, seals and sea turtles that are present in Mediterranean waters, with a special focus on the species selected by the Parties.

The Integrated Monitoring and Assessment Guidance provided in document UNEP(DEPI)/MED WG.420/4 recommended to use for recording the presence/absence of each species, the standardized 30 x 30 nautical mile grid map produced by FAO/GFCM or the 50 x 50 km grids used by the European Bird Census Council.</td></tr>
<tr><th colspan="3">Proposed approach for selecting representative/reference</th></tr>
<tr><th colspan="2">Species</th><th>monitoring sites</th></tr>
<tr><td colspan="2">For marine mammals, Monk Seal is the only species concerned by this indicator as adopted by the Contracting Parties (Decision IG.21/3)

For the seabirds, all the species listed in Annex II of the SPA/BD Protocol may be</td><td>All sites along the Mediterranean coasts of Contracting Parties with suitable habitat for the Monk Seal deserve to be monitored in relation to this Common Indicator.</td></tr>
</table>

[6] EO1 related to marine mammals, seabirds, marine reptiles

<table>
<tr><td>considered for the monitoring in relation to this Common Indicator. All these species breed in the Mediterranean (Except the Slender-billed Curlew Numenius tenuirostris). Given that all of them, with the exception of the Osprey Pandion haliaetus, breed in colonies, they can be considered for the proposed target in relation to colonial-breeding seabirds.

The loggerhead Caretta caretta and the green turtle Chelonia mydas are the two reptile species to be considered for monitoring in relation to this Common Indictor.</td><td>For seabirds, the monitoring effort should be oriented to nesting and feeding sites.

Concerning Caretta caretta and Chelonia mydas, the monitoring under this Common Indicator should cover nesting sites the wintering areas as well as the migration corridors.</td></tr>
<tr><td>Available monitoring protocol(s)</td><td>Expected outputs of the monitoring</td></tr>
<tr><td>Several protocols are available using different monitoring platforms and approaches such as:
- Dedicated ships or aerial surveys
- By-catch data
- Beached and stranded specimens monitoring
- Opportunistic data
- Tagging (capture-mark-recapture – artificial tags & photo-identification)
- Telemetry: Satellite tracking, GPS/GSM tracking, radio tracking and the use of loggers
- Acoustic data collection
- Automatic infrared camera

A detailed analysis of these platforms and approaches, including their pros and cons, appears in Annex 2 to these Guidelines.</td><td>The range of a given species is commonly represented by a distribution map. The main output of the monitoring under this common indicator will be therefore maps of species occurrence.
The use of Geographical Information Systems (GIS) is required for the compilation of the monitoring data collected and the elaboration of the species distributional range maps.</td></tr>
<tr><td>Recommended monitoring techniques</td><td colspan="2"><u>For Monk Seal:</u>
- Direct observation
- Automatic infrared Cameras may minimise Monk Seal disturbance and provide better information in particular in the caves that are occasionally used by Monk Seal.

<u>For seabirds:</u>
- Direct observation

<u>For marine reptiles:</u>
- Direct observation</td></tr>
</table>

Integration with the other Common Indicators	There are possible synergies between this indicator and the following other Common Indicators (CI): Field sampling and surveying: CI , 1,2, 4 and 5 (EO1) and 6 (EO2) Selection of sampling sites and indicator species: CI 4 and 5 (EO1)

<table>
<tr><th colspan="3">Common Indicator 4: Population abundance of selected species</th></tr>
<tr><th>Relevant GES definition:</th><th>Related operational objective</th><th>Proposed Targets</th></tr>
<tr><td>Marine mammals
The species population has abundance levels allowing to qualify to Least Concern Category of IUCN.</td><td rowspan="3">Population size of selected species is maintained</td><td>Populations recover towards natural levels</td></tr>
<tr><td>Seabirds
The species population has abundance levels allowing to qualify to Least Concern Category of IUCN</td><td>No human induced decrease in population abundance. Population recovers towards natural levels where depleted.

The total number of individuals is sparse enough in different spots.</td></tr>
<tr><td>Marine reptiles
The population size allows to achieve and maintain a favourable conservation status taking into account all life stages of the population</td><td>No human induced decrease in population abundance

Population recovers towards natural levels where depleted</td></tr>
<tr><td colspan="3">General considerations:
This state condition indicator refers to the total number of individuals of selected species in a specified area to inform about the growth or decline of a population. For small populations, all individuals may be counted directly; however, most studies require that the population size be estimated by sampling.</td></tr>
<tr><th colspan="3">Proposed approach for selecting representative/reference</th></tr>
<tr><th colspan="2">Species</th><th>monitoring sites</th></tr>
<tr><td colspan="2">To ensure a comprehensive coverage of the ecosystem, the indicator species should be selected taking into account their functional role. In this context the Contracting Parties agreed to monitor the following indicator species (Decision IG.22/7):
Marine mammals:
Pinnipeds: Monachus monachus (Hermann, 1779)
Baleen whales: Balaenoptera physalus (Linnaeus 1758)
Toothed whales:
- deep feeder: Physeter macrocephalus (Linnaeus, 1758)
Ziphius cavirostris (Cuvier G., 1832)(*)
- epipelagic feeder: Delphinus delphis (Linnaeus, 1758)
Tursiops truncatus (Montagu, 1821)
Stenella coeruleoalba (Meyen, 1833)(*)
Globicephala melas (Trail, 1809)(*)</td><td>Most of the species selected as indicator species in relation to this Common indicator are migratory species whose range extends over wide areas in the Mediterranean.
It is therefore recommended to consider monitoring these species at regional or subregional scales for the assessment of their population abundance.

For cetacean species, the Secretariat of ACCOBAMS is planning to undertake a regional</td></tr>
</table>

Grampus griseus (Cuvier G., 1812)(*) (*) considered as priority 2 species for the monitoring under IMAP **Seabirds:** Inshore surface-feeders: *Sterna spp*. Inshore benthic feeders: *Phalacrocorax aristotelis* (Linnaeus, 1761) Offshore surface-feeders: *Larus audouinii* (Payraudeau, 1826) Offshore feeder: *Puffinus spp.* **Reptiles:** *Caretta caretta* (Linnaeus, 1758) *Chelonia mydas* (Linnaeus, 1758)	synoptic survey covering most of the Mediterranean waters. This survey initiative is expected to start in 2017 and to provide useful and reliable data concerning population abundance of cetaceans in the Mediterranean zone. All the cetacean species present in the Mediterranean will be covered.
Available monitoring protocol(s)	**Expected outputs of the monitoring**
Several protocols are available using different monitoring platforms and approaches such as: - Dedicated ships or aerial surveys - By-catch data - Beached and stranded specimens monitoring - Opportunistic data - Tagging (capture-mark-recapture – artificial tags & photo-identification) - Telemetry: Satellite tracking, GPS/GSM tracking, radio tracking and the use of loggers - Acoustic data collection - Automatic infrared camera - Monitoring of turtles nesting beaches A detailed analysis of these platforms and approaches, including their pros and cons, appears in Annex 2 to these Guidelines.	Data about the population abundance for the selected species showing trends in relation to the considered subregions.
Recommended monitoring techniques	- Direct observation - Automatic infrared Camera - Acoustic surveys for cetaceans
Integration with the other Common Indicators	There are possible synergies between this indicator and the following other Common Indicators (CI): Field sampling and surveying: CI , 1,2, 3 and 5 (EO1) , 12 (EO3) and 6 (EO2) Selection of sampling sites and indicator species: CI 3 and 5 (EO1)

<table>
<tr><th colspan="3">Common Indicator 5: Population demographic characteristics</th></tr>
<tr><th>Relevant GES definition:</th><th>Related operational objective</th><th>Proposed Targets</th></tr>
<tr><td><u>Cetaceans</u>:
Species populations are in good condition: Low human induced mortality, balanced sex ratio and no decline in calf production
<u>Monk Seal</u>:
Species populations are in good condition: Low human induced mortality, appropriate pupping seasonality, high annual pup production, balanced reproductive rate and sex ratio.</td><td rowspan="3">Population condition of selected species is maintained</td><td><u>Cetaceans</u>:
Appropriate measure implemented to mitigate incidental catch, prey depletion and other human induced mortality

<u>Monk Seal</u>: Decreasing trends in human induced mortality</td></tr>
<tr><td><u>Seabirds</u>:
Species populations are in good conditions: Natural levels of breeding success & acceptable levels of survival of young and adult birds.</td><td>- Populations of all taxa, particularly those with IUCN threatened status are maintained in long term following the indication of population models.
- Incidental catch mortality is at negligible levels, particularly for species with IUCN threatened status.</td></tr>
<tr><td><u>Marine reptiles</u>:
- Low mortality induced by incidental catch
- Favourable sex ratio and no decline in hatching rates</td><td>Measures to mitigate incidental catches in turtles implemented</td></tr>
<tr><td colspan="3">General considerations:
Demographic characteristics of a given population may be used to assess its conservation status by analysing demographic parameters as the age structure, age at sexual maturity, sex ratio and rates of birth (fecundity) and of death (mortality). For some of these parameters, availability of recent and accurate data on population size is essential.</td></tr>
<tr><th colspan="3">Proposed approach for selecting representative/reference</th></tr>
<tr><th colspan="2">Species</th><th>monitoring sites</th></tr>
</table>

To ensure a comprehensive coverage of the ecosystem, the indicator species should be selected taking into account their functional role. In this context the Contracting parties agreed to monitor the following indicator species (Decision IG.22/7): **Marine mammals**: Pinnipeds: *Monachus monachus* (Hermann, 1779) Baleen whales: *Balaenoptera physalus* (Linnaeus 1758) Toothed whales: - deep feeder: *Physeter macrocephalus* (Linnaeus, 1758) *Ziphius cavirostris* (Cuvier G., 1832)(*) - epipelagic feeder: *Delphinus delphis* (Linnaeus, 1758) *Tursiops truncatus* (Montagu, 1821) *Stenella coeruleoalba* (Meyen, 1833)(*) *Globicephala melas* (Trail, 1809)(*) *Grampus griseus* (Cuvier G., 1812)(*) (*) considered as priority 2 species for the monitoring under IMAP **Seabirds:** Inshore surface-feeders: *Sterna spp*. Inshore benthic feeders: *Phalacrocorax aristotelis* (Linnaeus, 1761) Offshore surface-feeders: *Larus audouinii* (Payraudeau, 1826) Offshore feeder: *Puffinus spp.* **Reptiles:** *Caretta caretta* (Linnaeus, 1758) *Chelonia mydas* (Linnaeus, 1758)	Monitoring effort should be directed to collect long-term data series covering the various life stages of the selected species. This would involve the participation of many teams using standard methodologies and covering sites of particular importance for the key life stages of the species. For cetacean species, the Secretariat of ACCOBAMS is planning to undertake a regional synoptic survey covering most of the Mediterranean waters. This survey initiative is expected to start in 2017 and to provide useful and reliable data concerning population abundance of cetaceans in the Mediterranean zone. All the cetacean species present in the Mediterranean will be covered.
Available monitoring protocol(s)	**Expected outputs of the monitoring**
- Guidelines for monitoring threatened population of marine and coastal bird species in the Mediterranean[7]. - RAC/SPA-ACCOBAMS Guidelines for the Development of National Networks of Cetacean Strandings Monitoring[8]. - Monitoring guidelines to assess cetaceans' distributional range, population abundance and population demographic characteristics[9].	The monitoring in relation to this Common Indicator is expected to provide data allowing the assessment at regional or subregional scales of the selected species. The main outputs of the monitoring will be data about: - Age structure - Sex ratio - Fecundity

[7] UNEP/MAP - RAC/SPA, 2012. Guidelines for Management and Monitoring Threatened Population of Marine and Coastal Bird Species and their Important Areas in the Mediterranean. By Joe Sultana. Ed. RAC/SPA, Tunis. 24pp.

[8] http://www.rac-spa.org/sites/default/files/doc_cetacean/stranding.pdf

[9] Document elaborated based on the documents prepared by the ACCOBAMS Scientific Committee that has worked for several years on the definition of the most appropriate methodologies for collecting data on cetaceans at the Mediterranean and Black Seas scale, taking into account the protocols used in other regional contexts.

	- Mortality
Recommended monitoring techniques	Direct observation Stranded animal monitoring
Integration with the other Common Indicators	There are possible synergies between this indicator and the following other Common Indicators: Field sampling and surveying: CI , 1,2, 3 and 4 (EO1), 12 (EO3) and 6 (EO2) Selection of sampling sites and indicator species: CI 3 and 4 (EO1)

Common Indicator 6: Trends in abundance, temporal occurrence, and spatial distribution of non-indigenous species (NIS)		
Relevant GES definition:	**Related operational objective**	**Proposed Targets**
Decreasing abundance of introduced NIS in risk areas	Invasive non-indigenous species introductions are minimized	Abundance of NIS introduced by human activities reduced to levels giving no detectable impact

General considerations:

This is a trend monitoring whose efficiency will be strengthened through the establishment of reliable long-term data-sets.

Under IMAP, NIS are defined as species, subspecies, or lower taxa introduced outside of their natural range (past or present) and outside of their natural dispersal potential. Established NIS which have spread, are spreading, or have demonstrated their potential to spread elsewhere, and which have an effect on biological diversity and ecosystem functioning are considered "Invasive Alien Species" (IAS). They have the potential to compete with and, on some occasions, replace native species. They may also affect socio-economic values, and/or human health in invaded regions.

The challenge for the early detection of IAS being to determine where their introduction is likely to occur, the monitoring should be risk oriented by focusing on risk areas in relation to the main vectors and pathways of spreading of NIS in the water column and seabed. Compared to non-targeted random approaches, the risk-based approach will allow to detect more species with a lowest sampling effort in order to obtain an overview of the NIS present at a large spatial scope while only monitoring a relatively small number of locations.

Proposed approach for selecting representative/reference	
Species	**monitoring sites**
During the initial phase of the IMAP, each Contracting Party will define the list of IAS to be monitored in its national monitoring programme, starting with species for which information is available, using, as appropriate, the information available in the existing regional databases[10]. IAS species that are already recorded in neighbouring countries and those having a high likelihood of introduction may be a useful starting point for the development of the list.	The monitoring of NIS should focus on sites known as introduction hot spots of invasive alien species (IAS), in particular: - Ports and their surrounding areas, - docks, - marinas, - aquaculture installations, - heated power plant effluent sites, - offshore structures. Marine Protected Areas (MPAs), coastal lagoons and other marine areas of special

[10] Such as the Marine Mediterranean Invasive Alien Species database (MAMIAS), the "Andromeda" invasive species database for the Mediterranean and Black Sea, and the European Alien Species Information Network (EASIN).

<table>
<tr><td>Guidance on developing IAS national lists and a regional and/or sub regional reference list will be developed in 2017 by RAC/SPA.

Mobilise existing expertise for species inventory and review, based on a partnership approach (universities, research institutes, botanic gardens, NGOs, other stakeholders)</td><td>interest may be selected as monitoring sites, on a case by case basis, depending on the proximity to IAS introduction hot spots.

The use of Habitat Suitability Models[11] and Ecological Niche Modelling (ENM) may be considered in a later stage of IMAP to identify priority monitoring sites and to predict the spread of IAS.</td></tr>
<tr><td>Available monitoring protocol(s)</td><td>Expected outputs of the monitoring</td></tr>
<tr><td>There is no standard protocols for the monitoring of IAS, however, sampling methods are used by monitoring activities implemented in many Mediterranean countries, in particular in relation to the Ballast Water Convention[12] and the EU Water Framework Directive. These methods may be useful for the early detection and inventory of IAS.</td><td>Considering the GES definition in relation to this key indicator, monitoring effort should be directed to collect information on:
- species taxonomy
- date and place of the first detection
- spatial distribution of the recorded IAS species
- population size and trends

The monitoring should also produce information about :
- Invaded ecosystems
- impacts recorded, including level of threat
- risk of expansion to neighbouring countries</td></tr>
<tr><td>Recommended monitoring techniques</td><td colspan="2">The monitoring objective being the early detection of IAS and the determination of their spatial distribution, the recommended monitoring techniques are the direct observation and sampling in the water column, on the seabed, the ship hulls, the underwater structures in ports and aquaculture facilities, etc.</td></tr>
<tr><td>Integration with the other Common Indicators</td><td colspan="2">There are possible synergies between this indicator and the following other Common Indicators (CI):

Field sampling and surveying: CI , 1 to 5 (EO1)

Selection of sampling sites and indicator species: CI 1 and 5 (EO1)</td></tr>
</table>

[11] Habitat Suitability Models may be developed where reliable data sets are available. They allow to produce maps of the possible spreading scenarios for a species.

[12] Guidelines for ballast water sampling adopted within the framework of IMO (Resolution MEPC.173(58), Adopted on 10 October 2008).

2.5 National IMAP Data Repository

The central objective of the monitoring activities under IMAP is to build long-term series of data allowing to calculate the Common Indicators and to deliver the IMAP assessment products to be elaborated by the UNAP/MAP Secretariat. These include in particular the Common Indicator Assessment Fact Sheets, and the planned integrated assessments (2017 Status Quality Report, 2019 State of Environment and Development Report, 2023 State of Environment Report).

Efficient procedures and systems will be needed to ensure appropriate handling, storage and compilation of data issued by the monitoring activities, with clear arrangements as for the roles and responsibility of the involved organisations and individuals. In this context, it will be very useful to establish, from the early stages of IMAP implementation, a National IMAP Data Repository designed to ensure the timely storage of the amounts of data collected and to facilitate data mining.

During COP 19, the Contracting Parties agreed that the IMAP "requires an updated and integrated data and information system for UNEP/MAP Barcelona Convention with clear set roles for data handling and assessment for the various components and with a user-friendly reporting platform for Contracting Parties". This information system will be based on the structure of the Common Indicator Fact Sheets and will include up-to-date tools for data exchange.

2.6 Elaboration of Monitoring Manuals

The adequate implementation of monitoring programmes requires that teams in charge of sampling operations are fully aware of the objectives of the monitoring programme and have sufficient knowledge about the techniques it involves in order to collect representatives samples and to maximise the accuracy of census operations. In addition to the training sessions for the monitoring staff, it is highly recommended to elaborate practical manuals presenting the objectives of the monitoring and providing a substantive description of the sampling techniques, including sample handling, storage and analysis. The use of the same manuals by different monitoring team will minimise sampling bias and promote harmonisation of data.

3 Recommended approaches for monitoring in relation to the core indicators

As a general approach for the IMAP monitoring activities, the Contracting Parties agreed that data and information will be collected at national level and "shared in a manner that creates a compatible, shared regional pool of data, usable by each Contracting Party" and allowing to deliver the IMAP products. They also agreed that the development of the IMAP be conducted taking into account a series of overarching principles that can be depicted as follows in relation to monitoring:

(i) Adequacy: The ultimate goal of IMAP being to provide all the data needed to assess whether GES has been achieved or maintained, the distance from and progress towards GES, and progress towards achieving the agreed targets, it is essential that the monitoring activities generate suitable, accurate and sufficient data and

information to enable assessment of progress towards achievement of GES and/or the related agreed targets.

(ii) Coordination and coherence: The Contracting Parties are encouraged to ensure a high level of coordination and coherence in their national monitoring programmes undertaken under IMAP. To this end, consultation should be promoted, in particular among neighbour countries within the same biogeographical sub-region), to ensure they monitor common sets of elements, using similar sampling methods at agreed frequencies and following comparable spatial resolution. Such coordinated approaches are particularly important when monitoring migratory species and/or species with populations of whose range encompass the waters of more than one country.

Coordinated and coherent monitoring programmes will ensure that GES assessment is consistent across Contracting Parties and may result in reduced monitoring efforts.

(iii) Data architecture and interoperability based on common parameters: In identifying the parameters to be monitored and in designing their national monitoring programmes under IMAP, the Contracting Parties are encouraged to take into account existing databases and data flows at international and regional level. Consultation at regional and subregional level is also encouraged.

(iv) Adaptive monitoring programme: Non-predictable changes may occur in the marine environment under the effect of natural phenomena or human-induced pressures and may generate changes in the structure and functions of marine and coastal ecosystems. The monitoring programmes under IMAP should be designed to allow the adjustments that may be required to adapt to changing situation. Adaptation may be also required following progress in scientific knowledge or in sampling and monitoring techniques.

The IMAP implementation has a 6-year cycle (with upcoming cycle of 2016-2021) but more frequent adjustment of monitoring programmes may be needed.

The first years of the IMAP (2016-2019) will focus only on the core set of common indicators monitoring, where data and practice is the most mature.

(v) Risk-based approach to monitoring: In designing their monitoring programmes under IMAP, the Contracting Parties are invited to give priority to areas with greatest sensitivity and highest pressures. Collecting data and information in these areas will enable general statements about environmental status at large scales with a lowest monitoring effort.

(vi) Precautionary principle to monitoring: According to the precautionary principle, uncertainty and the absence of scientific evidence must not be used for postponing action. The application of the precautionary principle in designing the monitoring programmes implies that the choice on what to monitor and on the monitoring frequency be oriented to provide information that facilitate GES assessment even in situations where the state of the marine environment is approaching the boundary for GES.

4 Quality control

A special quality assurance and quality control measures should be incorporated during all stages of sampling and sample processing programmes. These principles help to guarantee that all data produced are of a specified quality, and that all parts of the work are carried out in a standardised and intercomparable manner. All procedures should therefore be clearly described and carried out openly, such that all of the laboratory's activities can be audited internally and externally at any time.

The overall aim is to assure traceability and full documentation of samples and equipment from beginning to end from sampling, sample transport, offloading from survey vessel (where used), placement within and retrieval from a sample store to sample processing, reporting and final archiving.

For some biodiversity components such as benthic fauna, international quality assurance and/or ring testing schemes are well established (e.g. BEQUALM). Some approved national schemes exist. For other components, there may be a lack of specific quality assurance schemes, in which case, appropriate modifications may be developed.
A quality assurance/quality control scheme should encompass the following:

- training and training records;
- traceability of work and samples;
- standardised practices throughout;
- calibration of sampling and sample processing equipment or procedures;
- in-house and external audit, also referred to as Analytical Quality Control schemes;
- literature updates;
- reference or voucher collections (where specimens are collected; photographs or other documentation for non-destructive sampling).

4.1 The citizen science

Conventional monitoring approaches based on the involvement of scientists may be in some cases complemented by observations made by the public. The involvement of some public categories proved to be effective in providing useful reliable data for evaluating the status of populations and species. It is however important to ensure that the data provided fulfil certain minimum quality standards. The use of observations by public made according to appropriate technical specifications, may be particularly useful in the case of rare species, it is however crucial to ensure that encouraging the involvement of public in the monitoring will not result in increasing harassment to endangered species.

5 Proposed contents for the national monitoring programmes under IMAP for Biodiversity and NIS Common Indicators

1. Background information

2. National context (*General information on the marine biodiversity, main threats and conservation issues, etc.*)

3. Relevant Research/Scientific institutions and organisations (*including information about their activities in relation to marine biodiversity monitoring, available expertise, monitoring platforms (vessels, etc.), sampling equipment, etc.*)

4. Existing monitoring activities of relevance for biodiversity and NIS

5. Monitoring programme

- ❖ General institutional arrangements for coordination and follow-up of the implementation

- ❖ Monitoring for Biodiversity Common Indicators
  - Habitat distributional range (EO1):
    - Identification of reference habitats to be monitored, with brief description of each habitat, the rationale for its selection and a brief synthesis of the available knowledge about its distributional range;
    - Selection of the indicator sites to be monitored, with brief description of each site and the rationale for its selection.
  - Condition of the habitat's typical species and communities (EO1):
    - Identification of habitats to be monitored and their respective typical species and communities, with a brief synthesis of the available knowledge about condition of the selected species;
    - Selection of the reference sites to be monitored, with brief description of each site and the rationale for its selection.
  - Species distributional range, Population abundance of selected species, Population demographic characteristics (EO1):

    <u>For Marine Mammals</u>:

    If there are records of Monk Seal occurrence in the country, the monitoring should cover representative sites with suitable habitat for the species. To this end, the National Monitoring Programme shall include:
    - Synthesis of historical records of the species in the country
    - Identification of reference sites to be monitored with brief description of each site and the rationale for its selection.

    Monitoring of cetacean being required under IMAP only in relation to Population abundance of selected species and Population demographic characteristics, the Monitoring programme shall include:
    - Identification of reference species to be monitored with brief description of the status of the populations and the rationale for their selection
    - Identification of reference areas to be monitored with brief description of each site and the rationale for its selection. *Considering the migratory character of most of the cetacean species, the selection of the monitoring areas should be done in consultation with neighbour countries (Relevant regional organisations (RAC/SPA and the Secretariat of ACCOBAMS) may facilitate the consultation process. Surveying campaigns for cetaceans designed and undertaken jointly at subregional or regional scales are highly recommended.*

    <u>For Seabirds</u>:
    - Identification of reference species to be monitored with brief description of the status of the populations and the rationale for their selection
    - Identification of reference sites to be monitored with brief description of each site and the rationale for its selection.

    <u>For Marine Reptiles</u>

    If there are records of Caretta caretta *and/or* Chelonia mydas *occurrence in the country, the monitoring should cover representative sites with suitable habitat for the species. To this end the National Monitoring Programme shall include:*

- Synthesis of historical records of the species in the country, including the nesting beaches and other habitats (feeding, mating, wintering, etc.)
- Identification of reference sites to be monitored with brief description of each site and the rationale for its selection.

❖ Monitoring for NIS Common Indicators

- Trends in abundance, temporal occurrence, and spatial distribution of non-indigenous species, particularly invasive non-indigenous species, notably in risk areas (EO2):
  - Synthesis of historical records of Non-indigenous marine species in the country;
  - Analysis at national level of existing or potential main vectors and pathways of spreading of Invasive Alien Species (IAS)
  - Identification of potential Invasive Alien Species
  - Identification of risk areas to be monitored with brief description of each area and the rationale for its selection.

The monitoring plan shall include also the following elements for each Common Indicator:

- Identification of monitoring parameters
- State of the art in monitoring the identified parameters (relevant past and on-going monitoring activities, tested monitoring techniques and methodologies)
- Selected monitoring techniques, including feasibility assessment and cost-effectiveness analysis
- Monitoring requirements (monitoring platform, equipment (for sampling, sample handling and storage, laboratory analysis), etc.)
- Expected outputs
- Integration with other Common Indicator
- Data management
- Monitoring calendar
- Leading organisation, sharing of tasks

❖ Summary table of the monitoring programme (*monitoring sites, frequency, equipment requirement, sharing of tasks and responsibility for the implementation*)

❖ Mechanism for data storage, compilation and exchange

❖ Data quality control (*including procedure of the assessment of the field data collected, identification of potential sources of errors, protocols for safe handling and storage of samples, minimisation of sampling bias*)

❖ Capacity building needs

❖ Collaboration and harmonisation with other countries

❖ Procedure for the evaluation and adjustment of the national monitoring programmes

6 Proposed workplan for the elaboration of country-specific EcAp monitoring implementation plan for Biodiversity and Non-Indigenous Species

Month	1		2		3		4		5		6	
Inception phase (Inventory of Relevant Research/Scientific institutions and organisations, information and consultation workshop(s))												
Establishment of the National IMAP Committee												
Inventory of existing monitoring activities and available human and technical resources												
Monitoring strategy												
Elaboration of the Monitoring Plan for Biodiversity and Non-Indigenous Species												
National IMAP Data Repository												
Consultation with neighbouring countries for synergy and harmonisation of monitoring activities												
Elaboration of Monitoring Manuals												
Elaboration of procedures for Quality control												

Annex 1

Reference list of habitats to be monitored

(minimum list, Contracting Parties who have the necessary means and are willing to do so can go beyond the monitoring requirements of the reference list)

Predominant habitat or "Functional" group of species	Specific habitat type or species to be monitored		Vessel	Lab facilities, equipment, consumables	Taxonomic expertise (technicians, scientists)	Monitoring techniques developed	Satellite / Remote Sensing / aerial platforms	Oceanographic platforms
Seabed - mediolittoral - infralittoral rock	Communities in the mediolittoral and infralittoral that are based on bio-construction	(1)	No	Yes	Low	Diving, ROVs, drop cameras,quadrats, photo quadrats, Side scan sonar, Multibeam bathymetry		No
Seabed - infralittoral rock	Hard beds (bottoms, substrates, reefs) associated with communities of photophilic algae	(2)	No	Yes	High	Diving, ROVs, drop cameras,quadrats, photo quadrats etc		No
Seabed - mediolittoral- infralittoral sediment	Seagrass meadows	(3)	Yes	Yes	Moderate	Diving, ROVs, drop cameras,quadrats, photo quadrats, Side scan sonar, Multibeam bathymetry		No
Seabed - mediolittoral- infralittoral sediment	Infrallitoral sands or muddy sands	(4)	Yes	Yes	High	Grabs, corers; dredges		

Seabed - circalittoral rock	Hard bottom habitats associated with coralligenous communities, sciaphillic algae and semi dark caves, deep reefs (dominated by sponges and other filter feeders)	(5)	Yes	Yes	Moderate	Diving, ROVs, drop cameras,quadrats, photo quadrats, Side scan sonar, Multibeam bathymetry		
Seabed - circalittoral sediment	Communities of the coastal detritic bottom	(6)	Yes	Yes	High	Grabs, corers; dredges, / ROVs, drop cameras,quadrats, photo quadrats, Side scan sonar, Multibeam bathymetry		
Seabed - circalittoral sediment	Maerl communities	(7)	Yes	Yes	High	Grabs, corers; dredges, / ROVs, drop cameras,quadrats, photo quadrats, Side scan sonar, Multibeam bathymetry		

Seabed - circalittoral sediment	Biocoenosis of coastal terrigenous muds	(8)	Yes	Yes	High	Grabs, corers; dredges		
Seabed - circalittoral sediment	Communities of shelf-edge detritic bottoms	(9)	Yes	Yes	High	Grabs, corers; ROV, Side scan sonar, Multibeam bathymetry		
Seabed - bathyal-abyssal	Communities of deep-sea corals	(10)	Yes	Yes	High	ROVs, Side scan sonar, Multibeam bathymetry		
Seabed - bathyal-abyssal	Seeps and communities associated with bathyal muds	(11)	Yes	Yes	High	ROVs, corers, Side scan sonar, Multibeam bathymetry		
Seabed - bathyal-abyssal	Communities associated with seamounts	(12)	Yes	Yes	High	ROVs, corers, Side scan sonar, Multibeam bathymetry		
Water column - coastal waters	Coastal waters phytoplankton communities		Yes	Yes	High to low (*)	Niskin bottles	sea surface temperature, chlorophyll etc	Buoys

Water column - coastal waters	Coastal waters zooplankton communities	(13)	Yes	Yes	High to low (*)	Plankton nets, LOPC, UVP, PCR, CUFES, pump, trawling net (for jellyfishes), ZooCam and zooscan (for analyse)	No	Buoys
Water column - shelf and oceanic waters	Shelf and oceanic waters phytoplankton communities		Yes	depends of the ship	High to low (*)	Niskin bottles	sea surface temperature, chlorophyll etc	Buoys, gliders, argo floats
Water column - shelf and oceanic waters	Shelf and Oceanic waters zooplankton communities	(14)	Yes	depends of the ship	High to low (*)	Plankton nets, LOPC, UVP, PCR, CUFES, pump, trawling net (for jellyfishes), ZooCam and zooscan (for analyse)	No	Buoys, gliders, argo floats

(*) depends of the laboratory where are analysed the samples)

ADDITIONAL INFORMATION (to be further discussed): specific representatives species or habitats (Invertebrates associated with habitats)

(1) e.g. vermetid reefs, e.g. Dendropoma paetreum, Cladocora, Astroides calicularis, ; some Cystoseira spp. belts, ...)

(2) e.g. facies with Cystoseira amentacea, Mytilus galloprovincialis, Corallina elongata/Herposiphonia secunda, Dasycladus vermisularis, Alsidium helminthochorton, Gelidium spinosum, Lobophora variegata, Cladocora caespitosa, Cystoseira brachycarpa, Cystoseira crinita, Cystoseira crinitophylla, Cystoseira sauvageauana, Cystoseira spinosa, Sargassum vulgare, Dictyopteris polydioides, Calpomenia sinuosa, Stypocaulon scoparium, Cystoseira compressa, Pterothamnion crispum/Compsothamnion thuyoides, Schottera nicaeensis, Rhodymenia ardissonei/Rhodophyllis divaricata or facies with big hydrozoans

(3)Posidonia oceanica, Cymodocea nodosa, Zostera sp

(4) e.g. facies with Pinna nobilis, Asterina pancerii, Callianassa tyrrhena/Kellia corbuloides, Cerastoderma glaucum, Cyathura carinata, Loripes lacteus or Tapes spp.

(5) e.g. facies with Cystoseira zosteroides, Mesophyllum lichenoides, Lithophyllum frondosum/Halimeda tuna, Rodriguezella strafforelli, Eunicella spp., Lophogorgia, Paramuricea, Parazoanthus spp. or facies of Corallium rubrum, Leptosammia spp.

(6) e.g. facies with Laminaria rodriguezii, Osmundaria and Peysonnelia, Ophiothrix quinquemaculata, Neolampas rostellata or Leptometra phalangium

(7) e.g. Lithothamnion corallioides, Phymatolithon calcareum

(8) e.g. facies with Turritella tricarinata communis, Virgularia mirabilis/Pennatula phosphorea or Alcyonium palmatum/Stichopus regalis

(9) e.g. facies with Leptometra phalangium

(10) e.g. facies with Lophelia pertusa or Madrepora oculata

(11) e.g. facies with Isidella elongata, Funiculina quadrangularis, Thenea muricata, Brissopsis lyrifera , Apporhais seressianus or Pheronema carpenteri

(12) (cf. mediterranean deep sea experts)?

(13) bcf. jellyfish population dynamics and blooms; Jellyfish species : Phyllorhiza punctata and Mnemiopsis leidyi. Secondary Cassiopea andromeda Catostylus tagi Geryonia proboscidalis Marivagia stellata Pelagia benovici Rhopilema nomadic, Beroe ovate

(14) cf. jellyfish population dynamics and blooms; HABs

Annex 2:
Analysis of monitoring platforms
in relation to the Common Indicator 3: Species distributional range
(Extracts from Document UNEP(DEPI)/MED WG.420/4: Draft Integrated Monitoring and Assessment Guidance)

Dedicated ships or aerial surveys:

Dedicated ship or aerial surveys (including the use of drones) are conducted by performing linear transects with qualified observers following a rigorous protocol. Two types of sampling strategies are proposed: in coastal (neritic) waters and in oceanic (pelagic) waters. Coastal transects consistently cover the same area of coastline uniformly, while pelagic transects are more variable, but will be generally straight and perpendicular to coast. However, both types of transects must be corrected for the likelihood of observing surfacing animals, according to species. For instance, sea turtles are much smaller (particularly juveniles) and spend less time at the surface than sea birds or mammals. Furthermore, animals are more likely to be sighted in shallow waters (<10 m depth) versus deeper waters. All of these issues need to be incorporated into the survey techniques and subsequent extrapolation/analyses. Drones have the additional benefit in that they can fly low over the water surface and can operate in areas that cannot be accessed by planes. In addition they are cheaper and safer, with less effort being required. The use of drones to monitor sea turtles populations is currently being developed, with specific protocols being required, along with the need to statistically model population size based on the numbers of individuals at the surface during surveys.

When cetaceans, seals, seabirds or sea turtles are located, the species, position, number of individuals and social structure are documented in as much detail as possible/conditions allow. For certain species, it may be necessary to interrupt surveys to confirm these parameters.

Aerial surveys should be conducted at specified altitudes (ranging from 600 to 1000 ft., approx. 200 to 330 m, depending on target species) and 100 knots or less, navigation is done at 10–12 knots covering the whole arc of the horizon at a distance of about 4 nautical miles (SEC[13] protocol[14]). Aerial surveys are not effective at locating and identifying smaller seabirds (Lesser tern, Gull-billed tern or Sandwich tern) or shearwaters and are only effective for sea turtles at shallow sites where they may be observed under the water surface as well as when surfacing (drones may also prove highly effective here). For sea turtles, aerial surveys should be conducted at the peak of the nesting season (around mid-July in the Mediterranean) to locate tracks on previously unidentified nesting beaches.

[13] Spanish Cetaceans Society

[14] SEC (1999). Recopilación, Análisis, Valoración y Elaboración de Protocolos sobre las Labores de Observación, Asistencia a Varamientos y Recuperación de Mamíferos y Tortugas Marinas de las Aguas Españolas. Ministerio de Medio Ambiente.

PROS:	Medium life-span (from day to decade) Medium range (from kilometre to thousands of kilometres)
CONS:	Very expensive Need high qualification

By-catch data:

Many research projects focus on collecting by-catch data for sea turtles and cetaceans, with researchers being present on-board vessels to document this information throughout the Mediterranean. Such studies provide information on mortality caused by bycatch, as well as the numbers of live animals that are captured and released. Such work provides an opportunity to collect information about animal morphometrics (e.g. size class, sex etc), population dynamics (including abundance and sex ratios), as well as movement (through capture-mark-recapture of individuals). Such studies are considered low cost and highly effective at obtaining information about animals in deep ocean waters. Monitoring of EO1 sea turtle indicators/GES/targets (i.e. distributional range - feeding, wintering, breeding, migratory, developmental sites) could be facilitated by monitoring to be implemented by GFCM under EO3 (Harvest of commercially exploited fish and shellfish), by documenting live/dead captures by incidental catch, as well as collecting morphometric and demographic data on sea turtles.

PROS:	Medium life-span (from day to decade) Medium range (from kilometre to thousands of kilometres) Low cost
CONS:	Quality and reliability of the observations Restrictions in space and time, but obtains comprehensive information in open seas

Beached and stranded specimens monitoring:

Creating a network of strandings and beached individual census‘ to obtain important information, usually with the help of volunteers and officials. This is a good indicator of seabirds after storms. It is also a good indicator for the presence/absence of cetaceans, seals and dolphins in different geographical regions. Dedicated stranding networks already exist for sea turtles in several Mediterranean countries, with stranding information being confirmed to reflect distribution patterns based on satellite telemetry studies. Sea turtle strandings represent a useful index of population abundance and can be used if data are approrpiately collected and standardized. Specific tracts of coast can be selected as index zones for this purpose, or coastlines may be opportunisitcally surveyed with the assistance of the general public.

PROS:	Medium life-span (from day to decade) Medium range (from kilometre to thousands of kilometres) Low cost
CONS:	Quality and reliability of the observations Restrictions in space and time

Opportunistic data:

Opportunistic data may be obtained from whale-watching observations, fisheries sightings (logbooks), surveys on non-dedicated platforms (ferries, merchant marine ships or amateurs/yachts, use of citizen science), by-catch data (where dedicated research programs do not exist, for sea turtles and shearwaters in long-lines and other types of fishing gear, and small cetaceans in fishing various types of fishing gear). However, location (i.e. compass or GPS) information may not always be provided in sufficient detail.

PROS:	Medium life-span (from day to decade) Medium range (from kilometre to thousands of kilometres) Less expensive
CONS:	Quality and reliability of the observations Restrictions in space and time

Tagging (capture-mark-recapture – artificial tags & photo-identification):

In many populations animals are given individual markers (i.e. metal/plastic tag) or are subject to ongoing photo identification programs. This information allows the dispersal of animals in a population to be determined, especially if injured tagged animals are found at distant locations (for sea turtles, satellite telemetry has confirmed the distribution range inferred from retrieved tags for one sea turtle population). Sometimes, this is the only way to obtain the information necessary to determine the distribution, abundance and population demographic of a species. Thus, marking key populations is useful, but the effectiveness of marking programs must be regularly re-evaluated (so as not to tag animals/populations endlessly without producing valuable information). The method used depends on the objectives and species. Recapture may be synonym of resighting marked animals.

Photo-identification is being increasingly used for the non invasive natural identification of cetaceans and sea turtles; thus, a photographic database for whales, dolphins and sea turtles could be established, or existing ones strengthened, allowing anyone in the Mediterranean to upload photos and the position that the animal was sighted. This could involve citizen science, such as tourists at coastal sites, people travelling on yachts, ships, fishing boats, etc. Such a system could help fill in the gaps where information about species presence/absence remains limited in the Mediterranean.

PROS:	Long life-span (from hour to decade) Wide range (from meters to few thousands of kilometres) Provide other data Cheap (articifical plastic/metal tags or photo id) Large sample sizes, and across sexes/age classes for photo-id
CONS:	Basic training required (tag application, photo identification) Low effort recording resightings of tags; slightly higher effort required for photo id databases, although automated systems have made this much easier Tagging primarily limited to females on nesting beaches for sea turtles but can be extended to males via by-catch/in-water surveys; includes a better cross section of the population for birds.

Telemetry:
Satellite tracking, GPS/GSM tracking, radio tracking and the use of loggers.

The method of capturing and attaching transmitters/loggers to animals depends on the objectives and species. Radio tracking is effective to obtain movement information at a known site used by individuals, but not movement over long distances. Satellite tracking provides detailed information about the movements of individuals within a population, including breeding area use before and during mating/nesting, clutch frequency of individuals (i.e. number of nests laid by specific individuals), internesting period (duration between each nesting event), date of departure from breeding grounds, migration distance and time, idenitification of foraging and wintering sites, wintering/foraging site fidelity and/or the use of multiple sites, remigration intervals to breed (1-2 years in males and 1-3+ years for females, depending on foraging site and animal condition), residency at breeding sites, prospecting of alternative (possibly future under climate change) nesting sites. However, many individuals (>50) need to be tracked to obtain population level inferences about distributional area use (home range), with this technique being very expensive. Also, it is not possible to place transmitters on many smaller animals, due to weight issues.

PROS:	Long life-span (from hour to decade) Wide range (from meters to few thousands of kilometres) Provide other data
CONS:	Very expensive (radio and satellite telemetry) – Human effort, tracking effort, transmitter running costs etc. Need experience attaching units and an understanding of the technology involved Requires great effort Small sample sizes

Acoustic data collection:

Active devices (e.g. echo-sounders), towed hydrophone arrays, and autonomous seafloor instruments. Linear transects trailing a hydrophone behind the ship at the end of a long cable. Hydrophones are used in remote locations and acoustic recording devices (e.g. POD "porpoise detector") in coastal areas. This is a recommended method for cetaceans. Underwater sound travels large distances with whale calls often detected at ranges of tens, or even hundreds, of kilometres. Acoustic surveys of cetacean habitats are therefore a powerful method for identifying the species present, and for locating and tracking individuals.

PROS:	Very long life-span (from hour to century) Very wide range (from meters to ten thousand kilometres)
CONS:	Expensive Need high qualification and technology Data analysis required