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Agenda item 5: Data Standards and Data Dictionaries for selected biodiversity and non-indigenous species common indicators

Biodiversity and Non-Indigenous Species: Data Standards and Data Dictionaries for Selected IMAP Common Indicators

UNEP/MAP
SPA/RAC - Tunis, 2019

Note by the Secretariat

In the framework of the Programme of Work and Budget for 2018–2019 of UN Environment/MAP (Decision IG.23/14), INFO/RAC is leading the work on the implementation of point 1.5.1 of the PoW on the development of the "Info-MAP platform and platform for the implementation of IMAP fully operative and further developed, connected to MAP components' information systems and other relevant regional knowledge platforms, to facilitate access to knowledge for managers and decision-makers, as well as stakeholders and the general public."

The EcAp-MED II Project supports the above, by the development of a **Pilot IMAP compatible Data and Information System**, which would lay down the base of the Info System, as well as the principles of its work and which would enable countries to start reporting data as of May 2019 for **selected 10 common indicators**.

With the support of the EcAp-MED II Project, INFO/RAC developed the draft pilot information system, based on close consultations with UN Environment/MAP components and further updated it based on the initial feedback of Contracting Parties during the presentation of the draft system during the 20th Ordinary Meeting of the Contracting Parties and the additional comments received at the Regional Meeting on IMAP Implementation: Best Practices, Gaps and Common Challenges (10-12 July 2018, Rome, Italy).

The developed IMAP compatible Pilot Info System is able to collect data according to the proposed **Metadata Templates (Standards)**. They are Excel spreadsheets in which every column is representing a field to be filled by the data providers. The data uploaded with the initial standards can be included in the database. The metadata templates are accompanied by **Data Dictionaries**, excel spreadsheets in which every field is explained to guide the data provider into the filling of the Metadata Templates (or Standards).

Please consider that Metadata Templates (Standards) and Data Dictionaries as part of the same excel file uploaded on the Pilot info system. For each Common Indicator can be provided one or more Metadata Template and Data dictionary, according to the number of modules available.

While the system is operational, it can be only fully effective, once the Contracting Parties agree in the upcoming meetings of the Ecosystem approach Correspondence Group on Monitoring (CORMON) dedicated among others to discuss Metadata templates and Data Dictionaries, after which additional work will be needed to align the changes of standards with the system.

In order to support discussion of the respective CORMON meetings, with the support of the EcAp-MED II Project, INFO/RAC has developed draft Metadata Templates (Standards) and Data Dictionaries for each of the 10 selected common indicators, covering all three clusters of IMAP (**Biodiversity and non-indigenous species (NIS)**, **Pollution and Marine Litter**, **Coast and Hydrography**), 10 of the 27 IMAP Common Indicators, namely: **1,2,6,13,14,15,16,17,22,23,** were selected with the aim to cover all clusters of IMAP, while taking note of the maturity of the Common Indicators as of 2017, considering existing data collections and national best practices, as well as available IMAP Common Indicator Fact Sheets.

The first proposal of the Metadata and Data Dictionaries related to the "10 selected IMAP Common Indicators" has been discussed and updated with respective UN Environment/MAP Components: with MEDPOL for Pollution and Marine Litter, with SPA/RAC for Biodiversity and NIS as well as with PAP/RAC for Hydrography and Coast.

Starting from the middle of 2019, after the conclusion of the EcAp MED II Project, further modules will be discussed and agreed with the thematic MAP Components for each already selected Common Indicator and for the remaining ones in view of the completion of the IMAP 27 Common Indicator set, according to the available resources specifically allocated.

Apart from the 17 remaining Common Indicators, the selected 10 will also go through a process of enlargement and development. At this moment, INFO/RAC is proposing a series of modules for each Common Indicator covering the main monitoring issues but in the next period (from June 2019) they will be integrated with new modules that are currently in discussion or in development.

After the approval of the CORMON meeting, the finalized Metadata Templates (Standards) and related Data Dictionaries will be uploaded in the Pilot and the consequent changes to the data base structure will be provided. In other words, once all the parameters and measure units are defined, the correspondent data flow will be activated (by May 2019).

The **testing phase** of the Pilot will be realized with the voluntary participation of interested countries, who will be invited to start providing data flow for the selected Common Indicators supported by the Pilot Info System (starting from May 2019).

The aim of the current document is to present the state of play of work on the IMAP compatible Pilot Info System and to enable Contracting Parties to provide guidance, input, early reflections on the draft Meta Data Templates and Data Dictionaries for the selected common indicators.

In this case, CORMON participants are asked to further review the structure of the Metadata Templates and information available in the proposed Data Dictionaries, to assure that all the needed elements for the implementation of the IMAP Common Indicators are in place and they are aligned with IMAP Factsheets.

In the Metadata Templates the **mandatory** data are represented in **black** and the **NOT mandatory** ones in **red**. The possibility to fill in also NOT mandatory fields is given to allow Countries that already have monitoring systems collecting a wider kind of data to report also the additional ones.

In this light, Countries are kindly asked to propose additional NOT mandatory fields to add to the Metadata Templates if they have complementary information that can improve the set of data available for each Common Indicator.

The current document presents the Data Dictionaries and related Meta Data Proposals for the **3** selected **Biodiversity and Non-Indigenous species** IMAP Common Indicators:

Common Indicator 1 Habitat distributional range (EO1) to also consider habitat extent as a relevant attribute;

Common Indicator 2 Condition of the habitat's typical species and communities (EO1);

Common Indicator 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);

The draft Metadata and Data Dictionaries were developed by INFO/RAC, as a first proposal, based on the IMAP guidance Factsheets that provide only a wide framework of reference at moment.

A close cooperation with SPA/RAC experts was started in order to align the metadata to the Biodiversity and NIS monitoring data flow. This process is yet ongoing as well as the harmonization with IMAP guidance factsheets and the common indicators monitoring protocols, which needs a lot of additional work.

All the structure of the Metadata and Data Dictionaries has to be revised and harmonized on the basis of the final result of the standards developing process.

Biodiversity (EO1):

The draft Metadata and Data Dictionaries for Biodiversity CI **1&2** were developed for habitats expressly reported in the IMAP guidance factsheets. At moment, in the framework of the EcAp-MED II project the following habitats have been taken into account:

- Coralligenous habitat,
- Maerl-Rhodolith beds habitat,
- *Posidonia oceanica* meadows habitat.

The reference document for the **habitats** to be monitored is:

- **Draft Updated Reference List of Marine Habitat Types for the Selection of Sites to be included in the National Inventories of Natural Sites of Conservation Interest in the Mediterranean,**

In order to draw up the updated Reference List of Marine Habitat Types, an updated and more comprehensive draft classification of benthic marine habitat types for the Mediterranean region (UNEP(DEPI)/MED WG.431/Inf.17) was elaborated based on:

- Classification of benthic marine habitat types for the Mediterranean region of the Barcelona Convention (1998),
- the schemes of the new EUNIS classification system (Table 1),
- the List of French Mediterranean habitats (Michez et al, 2014),
- the Spanish inventory of marine habitats (Templado et al., 2012),
- the Croatian List of Marine Habitats (Bakran-Petricioli, 2011), and
- new habitats based on the experts' inputs.

Furthermore, the following lists were taken into account:

- the European Red list of marine Habitats in the Mediterranean
- the list compiled by OCEANA, with the contribution of experts on Mediterranean deep -sea habitats, in order to implement the UNGA Resolutions for the protection of Vulnerable Marine Ecosystems (VMEs) in the GFCM context.

The proposed Reference List will be periodically reviewed, remaining dynamic to ensure adequate harmonisation with other classifications defined in relevant frameworks, such as EUNIS, and according to the implementation inputs of the IMAP.
For each module, the relative habitats are extracted from the updated list (Maerl/Rodolith beds and Coralligenous Habitats) and reported as reference. The list of habitats showed in the Data Dictionaries will be updated according to the new IMAP decisions.

The Data Dictionaries will present also a List of species to be monitored for each habitat type. The list will be the sum of the list of species chosen at level of country and part of the monitoring national plans. At moment this list is not available and will be updated as soon as the correspondent information will be provided.

To avoid typing errors, two main databases for consultation are proposed as reference:

- WORMS World Register of Marine Species (http://www.marinespecies.org/)
- ALGAEBASE (http://www.algaebase.org)

As guide into the comprehension of the Metadata template (Standards) & Data Dictionaries, the following methodological documents are provided as annex (I, II):

- **Methodological Document on "Data Dictionary on IMAP C.I. 1&2 related to Coralligenous Habitat"** (Annex I)
- **Methodological Document on "Data Dictionary on IMAP C.I. 1&2 related to Maerl-Rodolith Habitat"** (Annex II)

Non – indigenous species (EO2):

The draft Metadata and Data Dictionaries for NIS (Common Indicator **6)** were developed based on the Common Indicator guidance Factsheets (UNEP(DEPI)/MED WG.430/3), in which is remarked that *"no established standard protocols for the monitoring of NIS are available"*.

Waiting for the next development of agreed standards, the draft metadata are proposed for the limited number of species included into the IMAP list. Further updating of this list will be reported into the Metadata Templates (Standards)

Annex I
Coralligenous Habitat

List of parameters to be determined at each sampling station, related survey tool and reference methodology

	Parameter	Survey tool	Reference methodology
Habitat presence and extension	Morpho-bathymetry	Multibeam / side scan sonar	Biodiversity Factsheet
	Area	ROV (Remotely Operated Vehicle) - with high definition optics and underwater positioning system	
Habitat conditions	Abundance and conditions of sessile species	ROV (Remotely Operated Vehicle) - with high definition optics and underwater positioning system / diver	
	Population structure		

CRITERIA FOR SELECTION OF SURVEY AREAS

The areas of investigation should be selected to be representative of the different environmental conditions of the sub-region and impacts of different intensity; wherever possible, the areas must also be located within **Marine Protected Areas** (priority should be given to those locations for which consolidated historical data are available).

In addition, the survey areas must be positioned where the habitat is sufficiently extensive or where the presence of such habitat is likely based on geomorphological data or existing literature data. Where possible, the areas of investigation must be identified in such a way as to be able to acquire data and information relating to the coralligenous habitat of both the platform and the wall.

PROTOCOL OF SURVEY

In areas for which you do not have cartographic detail information is necessary to acquire bati-morphological data on the nature and shape of the substrate through surveys with echo sounder multibeam (multibeam) or, possibly, by means of side-scan sonar (side scan sonar - SSS) on areas of 25 km2 (possibly divisible).

Subsequently, in each survey area it is necessary to proceed to:

1. identification and monitoring of the populations present through vehicles operated remotely and/or underwater operators along investigative transects;

2. collection of high definition and georeferenced photographic documentation of the investigated populations.

Acquisition of detailed bathy-morphological data of the survey area

The acquisition of detailed bathy-morphological data must be performed using a multibeam, preferably with hull installation and able to acquire backscatter data, and which allows to restore bathymetric data and morphological with a high detail of the sections of the bottom of interest. The use of the multibeam is to be considered a priority for investigations on the coralligenous habitat, however, a secondary scan sonar can be used in a secondary way, in particular when the multibeam system adopted does not allow the acquisition of the backscatter. In any case, digital terrain models (DTM) with a cell resolution of 5x5 m shall be generated.

Minimum technical requirements of the instruments:

- Multibeam: operating frequency not less than 200 kHz

- Side Scan Sonar: operating frequency not less than 400 kHz

Identification and monitoring of the populations present

The surveys are aimed at verifying both the presence of the habitat and the description of the present population. On the basis of the bathy-morphological data of acquired details, in each area 3 survey sites must be identified, possibly distant not less than 500 m from each other and in each site 3 transects must be placed, possibly distant not less than 50 m from each other, along which to carry out surveys for the identification and monitoring of populations present. The position and the dimensions of the transects must be such as to represent the extension (both horizontally and vertically), the continuity and the bathymetric range within which the coralligenous habitat is included.

Up to the depth of 40 m, surveys can be performed using georeferenced photographic surveying techniques with a diver; beyond 40 m depth the surveys must be performed with a geo-referenced remote platform (acquiring high-definition photos or movies). Each video and photographic survey must be associated with unique geographic coordinates in the WGS84 datum (expressed in degrees sixteenth to the fifth decimal: GG °, GGGGG).

Investigations by use of divers

The detection with the use of a diver must be made using a digital camera delimited by a frame which acts as a focuser and which allows to always photographing the same surface; the parallelism of the sensor of the appliance must be guaranteed with respect to the bottom by means of a rigid spacer. Along each transept must be sampled 3 areas of 2 m^2 each on horizontal or vertical surface, a few meters apart. For each area, 10 photographic samples of 0.2 m^2 each (0.5 x 0.4 m approximately) are acquired. Each photographic sample must then be subjected to image analysis in order to evaluate the percentage coverage/coverage of the main taxa and/or animal morphotypes and macroalgae.

For each sampling area of photographic samples must be noted:

- depth;
- the morphology of the substratum (rock wall, blocks, biogenic formations);
- exposure;
- inclination.

Investigations using remotely operated vehicles (ROVs)

Investigations by ROV (Remotely operated Vehicle) must be carried out by a suitable support vessel on which there is a dashboard for the remote control of all systems (motors, lights, manipulator,

instrumentation), which is equipped with monitors for the control and recording in real time of the images, depth information, route and travel times.

Furthermore, it is necessary to provide that the ROV is equipped with the following instrumentation:

- underwater acoustic geographic positioning system (USBL);
- automatic adjustment system of depth (depth car);
- compass;
- navigation sonar;
- camera with HD sensor
- camera with HD sensor, minimum resolution 1920 x 1080 pixels (optional only if the camera ensures the acquisition of images with the same resolution);
- 2 positioning LED pointers (10 cm apart from each other) to calculate the size of the area;
- lighting headlights.

The ROV transects must have a length not less than 200 m each and must be performed at the same bathymetric level, between 30 and 100 m, in homogeneous environments from the topographic point of view. The route that the ROV must follow is decided on the basis of the bathymetric gradient and according to the morphological characteristics of the seabed.

The ROV must proceed along the transept established as far as possible at a constant distance from the bottom to a height of about 1.5 m from the same and at a constant speed, max 1 node or in any case such as to allow an adequate analysis of the images acquired for the purposes of studying the condition of the habitat.

The initial and final coordinates of each transect and those of the entire route must be recorded in the WGS84 datum (expressed in degrees sixteenth to the fifth decimal: GG °, GGGGG).

The video capture must be performed along the entire extension of the transept. During the acquisition of the videos, the abundance and type of anthropic waste that may be present must be recorded. (not mandatory)

Along the entire transept, in addition to the acquisition of the video track, high-resolution photographs of the seabed must also be collected; photographs can be collected with the camera as well as with the camera on the ROV. From all the acquired photographic images it must be extracted at random at least 20. The camera (optional) must be placed on the upper part of the vehicle (ROV), with an inclination of about 10 ° and equipped with 2 led pointers spaced from each other 10 cm fixed, which allow the calculation of the size of the area covered by the frame. The amplitude of the photographed area represents the sample size, by means of which measurements of coverage or density (n ° of individuals per m^2) of the species detected can be carried out. For each site must be noted the depth, the morphology of the substrate (rock wall, blocks, biogenic formations), exposure, inclination.

Indices or parameters to be calculated/detected

Based on the detailed bathy-morphological data and the images acquired (video and / or photos) must be evaluated:

- Location and extension of the habitat (map return);
- Substrate characteristics (nature, morphology, inclination, exposure, qualitative estimation of sedimentary cover); (not mandatory)
- Habitat status through the evaluation of structuring species:
  - Specific richness

- Specific abundance, expressed in number of colonies on m2, of the megabenthonic taxa, in particular of the structuring and arborescent species, percentage of covering of the substratum;
- Status of conspicuous sessile species (percentage of epibiosis and / or necrosis);
- Population structure (species morphometry);
- Abundance and type of anthropic waste present. (not mandatory at moment)

Annex II
Maerl - Rodolith Seabed Habitat

List of parameters to be determined at each sampling station, related survey tool and reference methodology

	Parameter	Survey tool	Reference methodology
Habitat presence and extension	Substrate / morpho-bathymetry texture	Multibeam / side scan sonar	Biodiversity Factsheet
	Area	ROV (Remotely Operated Vehicle) - with high definition optics and underwater positioning system	
Habitat vitality	Identification and evaluation of structuring species	ROV (Remotely Operated Vehicle) - with high definition optics and underwater positioning system / direct sampling	
	Population structure		

The maerl/rhodolith beds are characterized by the accumulation, on the substrate of mobile bottoms, of live and dead thalli of calcareous red algae that form habitats with a high specific diversity capable of increasing the biological and functional diversity of coastal sediments. This accumulation over time forms a three-dimensional biogenic structure that houses a rich biodiversity. A bed of rhodoliths (including maerl) is defined and identified when a surface of not less than 500 m2 of mobile substrate has a covering of live corals greater than 10%. Two rhodolith / maerl beds are to be considered distinct when their borders are far at least 200 m in each point.

CRITERIA FOR SELECTION OF SURVEY AREAS

The areas of investigation should be selected to be representative of different environmental conditions of the sub-region and different levels of possible impacts; where possible areas must also be located within Marine Protected Areas. The survey areas must also be positioned in areas where the habitat of maerl/rhodolith funds is sufficiently extensive or in areas where the presence of such habitat is likely based on geomorphological data or existing literature data.

PROTOCOL OF SURVEY

In areas for which you do not have cartographic detail information is necessary to acquire texture data of the sediment and bathy-morophological data of the substrate, by means of surveys with *side-scan sonar* (SSS) or *multibeam* able to acquire backscatter data on areas of 25 km2 (possibly divisible).

Subsequently, in each survey area the following should be carried out:

1. verification of the habitat presence of the maerl/rhodolith funds through vehicles operated remotely along investigative transects and preliminary characterization;

2. collection of samples for the study of habitat vitality.

Acquisition of detailed bathy-morphological data of the survey area

The acquisition of sediment and substrate morphology data must be performed using a side scan sonar. The use of this tool is to be considered a priority for the surveys on the habitat of the maerl / rhodolith funds; however, a multibeam can also be used on a secondary basis, if it allows the acquisition of backscatter data. In any case, digital terrain models (DTM) with a cell resolution of 5x5 m shall be generated.

Minimum technical requirements of the instruments:

- Multibeam: operating frequency not less than 200 kHz
- Side Scan Sonar: operating frequency not less than 400 kHz

Verification of habitat presence and preliminary characterization

The surveys are aimed at verifying the presence of the habitat, to provide a first characterization of the habitat and to highlight any portions of habitat affected by anthropogenic activities.

On the basis of the sediment weaving data and the acquired substrate morphology, in each survey area 3 survey sites must be identified, possibly distant not less than 100 m from each other; in each site 3 transects must be placed along which to carry out the investigations, possibly distant not less than 10 m from each other. The position and the length of the survey transects must be such as to represent the extension, the continuity and the bathymetric range of the survey area in which the habitat of the maerl/rhodolith is included. Surveys must be performed using video/photographic survey techniques from a georeferenced remote platform (ROV, Remotely operated Vehicle), with photos or movies in HD. Each survey must be associated with unique geographic coordinates in the WGS84 datum (expressed in degrees sixteenth to the fifth decimal: GG ° , GGGGG).

Investigations by ROV (Remotely operated Vehicle) must be carried out by a suitable support vessel on which there is a console for the remote control of all systems (motors, lights, manipulator, instrumentation), which is equipped with monitors for the control and recording in real time of the images, depth information, route and travel times.

Furthermore, it is necessary to provide that the ROV is equipped with the following instrumentation:

• underwater acoustic geographic positioning system (USBL);
• automatic adjustment system of depth (depth car);
• compass;
• navigation sonar;
• video camera with HD sensor;
• camera with HD sensor, minimum resolution 1920 x 1080 pixels (optional only if the camera ensures the acquisition of images with the same resolution);
• 2 positioning LED pointers (10 cm apart from each other) to calculate the size of the area;
• lighting headlights.

The route of the ROV must be decided on the basis of the bathymetric gradient and according to the morphological characteristics of the seabed. The ROV must proceed along the transept established at a constant distance from the bottom, at a height of about 1.5 m and at a constant speed, max 2 knots or in any case such as to allow a reliable verification of the habitat presence.

The initial and final coordinates of each transect and those of the entire route must be recorded in the WGS84 datum (expressed in degrees sixteenth to the fifth decimal: GG °, GGGGG). The video capture must be performed along the entire extension of the transept.

During the acquisition of the videos, the abundance and type of anthropic waste that may be present should be recorded. At moment data about anthropic waste are not mandatory but there is the possibility to provide this type of data for the countries interested to implement this aspect.

Along the entire transept, in addition to the acquisition of the video track, high-resolution photographs of the seabed must also be collected; pictures can be collected with the camera as well as with the camera on the ROV. From all the acquired photographic images it must be extracted at random at least 20 ones. The camera (optional) must be placed on the upper part of the vehicle (ROV), with an inclination of about 10 ° and equipped with 2 led pointers spaced from each other 10 cm fixed, which allow the calculation of the size of the area covered by the frame.

Through the acquired images, video and/or photographic, it is necessary to evaluate:

- the percentage of covering of live *thallus*;
- the main morphologies of algal nodules structuring the habitat (morphotypes: pralines, free ramifications, boxwork);
- the presence of macroscopic sedimentary structures on the substrate.

Collection of samples for the study of habitat vitality

In each of the 3 survey sites and in correspondence of the areas with the highest coverage of live *thallus* (identified in the preliminary characterization phase) we proceed to random sampling of 3 samples, via box- corer (opening ≥0.16 m2), taken along the detected depth gradient.

As an alternative to the box-corer, where the sediment is particularly coarse and does not allow penetration into the substrate, a bucket (volume 18-20 litres) can be used; in this case, care must be taken to reduce as much as possible the mixing of the substrate and the loss of material during recovery.

For each sample of recovered substrate carry out the following operations:

- photograph the total surface of the sample for the recognition of the main morphotypes (pralines, free ramified structures, boxwork);
- define the coverage percentage and the thickness of the live limestone layer of calcareous algae;
- make a Visual estimation of the ratio of live *thallus* compared to the dead one calculated with respect to the surface of the sample;
- collect and fix the samples.

Fixation of the whole samples is carried out in formalin (formaldehyde in 37-38% aqueous solution) buffered with sodium tetraborate; to the sample in sea water, formalin is added in order to obtain a 4% solution. Fixing operations must be carried out in environments provided with the necessary safety equipment (both on boats and in the laboratory) provided for the protection of the operator. Unable to fix the sample on board, it must be kept in sea water until it reaches the laboratory and fixed within a few hours. As a last resort, where it is impossible to use formalin, samples of calcareous red algae can be dried in the air or using a stove (temperature max 30-35 ° C) for 24-36 hours and subsequently stored in silica gel.

For all the samples recovered, perform the analysis of the granulometric characteristics of the sediment, on about 200 g of sediment (first 10 cm of the surface layer of the sample) and divided into the classes: pebbles, gravels, sand and perlite.

The fixed live material must then be analysed and identified at the taxonomic level of the species at least as regards the macroscopic and volumetrically most important component of calcareous red algae.

For each site in question it is desirable that the following physical parameters are also detected:

- Temperature
- Salinity
- Transparency (Secchi disk)

Indices or parameters to be calculated / detected

Based on the texture data of the sediment and morphology of the substrate, the acquired images (video and/or photos) and following analysis of the samples taken must be evaluated:

- location and extension of the habitat (cartography);
- granulometry of the sediment (percentage by weight of each of the classes);
- percentage of coverage and thickness of the layer of live *thallus* of calcareous algae;
- main morphotypes present;
- list of species of calcareous red algae volumetrically conspicuous;
- estimation of the ratio of live/dead *thallus* with respect to the surface of the sample;
- abundance and typology of the anthropic waste present and of the traces of impact detected. (Not mandatory)