Decision IG.23/6

2017 Mediterranean Quality Status Report

The Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean, and its Protocols at their twentieth meeting,

Having regard to the Barcelona Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols, in particular article 12 of the Barcelona Convention and relevant articles of its Protocols addressing monitoring and assessment,

Recalling decision IG.17/6 on the ecosystem approach road map adopted by the Contracting Parties at their fifteenth meeting (COP 15) (Almeria, Spain, 15-18 January 2008),

Recalling also decision IG.20/4, adopted by the Contracting Parties at their seventeenth meeting (COP 17) (Paris, France, 8-10 February 2012) and decision IG. 21/3, adopted by the Contracting Parties at their eighteenth meeting (COP 18) (Istanbul, Turkey, 3-6 December 2013) on the ecosystem approach, with particular focus on monitoring and assessment,

Recalling further decision IG.22/7 on the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria and IG.22/20 on the Programme of Work and Budget for 2016–2017, mandating the preparation of the 2017 Quality Status Report, adopted by the Contracting Parties at their nineteenth meeting (COP 19) (Athens, Greece, 9-12 February 2016),

Expressing appreciation for the work of the correspondence groups on monitoring, the Ecosystem Approach Coordination Group, Contracting Parties, Mediterranean Action Plan partners, Mediterranean Action Plan components and the Secretariat,

Having considered the reports of the meetings of the correspondence groups on monitoring, component focal points and the Ecosystem Approach Coordination Group,

Noting the recent adoption of a Mid-Term Strategy towards the sustainability of Mediterranean and Black Sea Fisheries, within the context of the General Fisheries Commission for the Mediterranean as the Regional Fisheries Management Organization acting in the Mediterranean and Black Sea areas,

1.   *Endorse* the Key findings of the 2017 Mediterranean Quality Status Report and welcome the Recommendations for the Further Implementation of the Ecosystem Approach Roadmap, as set out in Annex I to the present decision;

2.   *Request* the Secretariat and the EcAp Coordination Group to consider the recommendations included in Annex I to the present Decision and the way to follow them up;

3.   *Request* the Contracting Parties to continue their work towards finalizing their updated national monitoring and assessment programmes in line with the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria as soon as possible;

4.   *Urge* the Contracting Parties, with the support of the Secretariat and taking into consideration the need to fill existing data gaps as highlighted in the 2017 Mediterranean Quality Status Report, to regularly report quality-assured data deriving from the implementation of the updated integrated national monitoring and assessment programmes, as doing so will support the development of future regional assessment products, as well as the design, implementation and monitoring of

coherent and consistent national and regional measures based on a sound science-policy interface and aimed at achieving Good Environmental Status;

5.   *Request* the Secretariat to make all possible efforts to overcome the knowledge gaps that are recognized in the 2017 Mediterranean Quality Status Report, contributing to the success of the initial phase of Integrated Monitoring Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria implementation (for the period 2016–2019) and enhancing the capacity of Contracting Parties to deliver the second Mediterranean Quality Status Report in 2023 to demonstrate the progress made towards Good Environmental Status and its related targets;

6.   *Request* the Secretariat to prepare in cooperation with the Contracting Parties through the Ecosystem Approach governance structure, in the first year of the biennium 2018-2019, a roadmap accompanied with a Needs Assessment on how to improve data collection to address knowledge gaps and strengthen the capacities of the system. To this aim, priority activities needed to successfully deliver the 2023 Mediterranean Quality Status Report shall be identified for inclusion in the Programme of Work;

7.   *Urge* the Mediterranean Action Plan system and the Contracting Parties in the context of the work of the EcAp governance structure to undertake priority activities needed to ensure successful delivery of the 2023 Mediterranean Quality Status Report;

8.   *Request* the Secretariat to develop synergies between the Integrated Monitoring and Assessment Programme of the Mediterranean Sea and Coast and Related Assessment Criteria and related common indicators, and the ongoing work by the United Nations and Regional Seas Programmes and Regional Fisheries Management Organizations on indicators monitoring progress towards the Sustainable Development Goals and in particular Goal 14, and to share the Mediterranean experience at the global level;

9.   *Take note* of the proposed update of the pollution assessment criteria and thresholds as presented in Annex II to the present Decision and encourage the Contracting Parties and the Secretariat to test them for indicative purposes in the different contexts that exist in the Mediterranean.

Annex I
Key Findings of the 2017 Mediterranean Quality Status Report and Recommendations for the Further Implementation of the Ecosystem Approach Roadmap

A) **Key Findings of the 2017 Mediterranean Quality Status Report**

1.   This document presents key findings of the 2017 Mediterranean Quality Status Report (2017 MED QSR) as current status of the Mediterranean marine and coastal environment. The key findings are summarized below per each Ecological Objective.

2.   The **Ecological Objective (EO 1) on Biodiversity** is to ensure that biological diversity is maintained or enhanced. The quality and occurrence of coastal and marine habitats and the distribution and abundance of coastal and marine species are in line with prevailing physiographic, hydrographic, geographic and climatic conditions. It includes five common indicators:

Common Indicator 1: Habitat distributional range and Common Indicator 2: Condition of the habitat's typical species and communities

Conclusions

3.   Regional expertise, research and monitoring programmes over the last few decades have tended to concentrate their attention on only a few specific Mediterranean habitats. The exploration of other habitats, such as bioconstructions, from very shallow to the deep-sea should be further supported, with a focus on threats and pressures in order to improve the conservation status as well as the policy assessments.

4.   Despite the scientific importance of time series studies, the funding for many monitoring programmes is in jeopardy and much of the Mediterranean Sea remains not only just under-sampled, but also unsampled in many areas. Risk based monitoring should be coordinated and standardized so that results can be easily comparable at least for some, decided *a priori*, variables. Coordination and planning of works, notably by UNEP/MAP, is crucial to ensure coherence and synergies at regional or sub-regional scale.

5.   Beside criteria such as reduction in quantity and in quality and the geographical distribution, more research should focus on processes leading to low diversity of habitats. Regime shifts are ubiquitous in marine ecosystems, ranging from the collapse of individual populations, such as commercial fish, to the disappearance of entire habitats, such as macroalgal forests and seagrass meadows. Lack of a clear understanding of the feedbacks involved in these processes often limits the possibility of implementing effective restoration practices. Moreover, these habitats are selected in the IMAP reference list and they will be monitored in this cycle of IMAP implementation.

6.   There is a need to increase the geographical coverage of protection, establishing new arrays of MPAs (and then networks of MPAs) in the southern and eastern parts of the Mediterranean Sea, with the aim among others to achieve Aichi Target 11 (most MPAs are concentrated in the north-central Mediterranean Sea) since the IMAP Ecological Objectives 1, 3, 4 and 6 have been shown to evolve favorably in Mediterranean MPAs. The use of MPA networks as a reference where to assess the attainment of GES should be taken into account, but the need to reach GES (sustainable use), for the whole Mediterranean Sea area, should be kept in mind. This Regional scale objective is important to avoid moving, and thus increasing, pressure (by activities) outside MPAs, where sensitive habitats could be then more exposed. The GES should be achieved in all Mediterranean waters by 2020, but this current assessment clearly indicates that much more progress and management of pressures should be undertaken to progress towards this objective.

7.   In addition, there is a need to establish MPAs in area beyond national jurisdiction to protect deep-sea habitats. The procedures for the listing of SPAMIs are specified in detail in the SPA/BD Protocol (Art. 9). For instance, as regards the areas located partly or wholly in the high

seas, the proposal must be made "by two or more neighboring parties concerned" and the decision to include the area in the SPAMI List is taken by consensus by the Contracting Parties during their periodical meetings. Once the areas beyond national jurisdiction are included to SPAMI List, all contracting Parties agree "to recognize the particular importance of these areas for the Mediterranean", and consequently "to comply with the measures applicable to the SPAMIs and not authorize nor undertake any activities that might be contrary to the objectives for which the SPAMIs were established". This gives to the SPAMIs and the measures adopted for their protection an *erga omnes* effect, at least as far the parties to the protocol are concerned.

8.   The coastal states are currently formulating their criteria and the associated monitoring protocols for determining GES. The monitoring guidance factsheets that have been developed for all the IMAP Common Indicators significantly support these national endeavors, allowing for a reduction of the inconsistencies in interpretations of the Ecological Objectives and Indicators (not least in the ecological terminology used), as well as in their related national monitoring programmes which suffer of the same. The harmonization of criteria for implanting GES has been clarified with the adoption of a new EU legal act in 2017 (Decision 2017/848/EU) for most European countries. It should be noted that a significant work has been also carried out for the MSFD at the European level, through the OSPAR and HELCOM conventions notably, where monitoring guidelines have been produced.

9.   Current assessment is mainly qualitative and based on compilation of published studies and assessments. Large-scale analyses have been critical to expand our knowledge about the *extent* of habitats and threats but are often biased by the extrapolation of either a few small-scale studies or low-resolution large-scale assessments. The massive lack of ground-truth data and standardized monitoring for most of offshore habitats compromise quantitative assessment of their condition. This limits the potential to assess the condition and the trajectories of change in Mediterranean habitats. Additional inputs (methods and case studies) from ongoing and recent projects like ActionMED project (http://actionmed.eu/) should also be considered for the 2019 State of Environment and Development Report.

10.   Baseline data ('reference' with low or least disturbance) are lacking at the Mediterranean scale for many habitats exposed to abrasion by bottom-trawling fisheries. This compromises our ability to identify a sustainable condition for those habitats, which are under continuously high-pressure levels. 'Pristine' baselines (no disturbance) are lacking for most of the habitats; this compromises our knowledge of the potential best condition of natural habitat communities. It is not practical or feasible to use this pristine state as an environmental target everywhere, but it is useful for understanding the natural dynamic and recovery potential of a given habitat. Increasing the establishment and management of Marine Protected Areas (MPAs), notably including 'no take or low-pressure areas' could help provide data in the future, for the relevant habitat types.

11.   Many potentially relevant data exist but are not all available (e.g. fishing pressure data at fine spatial resolution, or biological data from marine research and marine industry).

12.   Many biological datasets exist, but few have associated data on pressure at a compatible spatial and temporal scale.

13.   Each country currently stores its own monitoring data, so common methodology (and tools) still needs to be developed/ further harmonized. The need for this should be anticipated and relevant work should be coordinated to ensure coherence and facilitate the computation of data for indicator assessment.

14.   Ocean warming, acidification, extreme climate events and biological invasions are expected to increase in the next years. These are difficult to be assessed and managed. More attention should be directed to those threats that can be more easily mitigated such as trawling,

maritime traffic and nutrient loading from some land-based activities. In this framework, improve knowledge of the distribution and intensity of threats (e.g. fishery, bioinvasions, marine litter, seabed mining, coastal and non-coastal infrastructures) to reduce uncertainties on their effects should be also increased.

15.   Promote open access to data is very critical, especially those deriving from EU projects, through institutional databases sustained under rules and protocols endorsed by EU. The data ensuing from EU projects are still much fragmented and are not stored in a single repository where data are available in a standard format with a stated access protocol. As regards the European Countries, the European Marine Observation and Data Network (EMODnet) is assembling marine data, products and metadata to make fragmented resources more available to public and private users relying on quality-assured, standardized and harmonized marine data which are interoperable and free of restrictions on use. At regional scale, a new platform on biodiversity has been developed by SPA/RAC (http://data.medchm.net) in order to integrate data on biodiversity cluster. This Mediterranean biodiversity platform is interoperable with EMODnet or any regional and national spatial data infrastructure (SDI).

16.   The process of Maritime Spatial Planning (MSP) across the Mediterranean should be largely supported, considering activities that are expected to increase in the future (e.g. aquaculture, maritime traffic, seabed mining).

Key messages

17.   For habitats:

• The shift from Habitat conservation approaches to Biodiversity and Ecosystem Functioning approaches reflects much better the rationale which sustains the management and conservation of marine ecosystems.

• This shift calls for holistic, integrative and ecosystem based approaches, which are still under development and will require a reappraisal of the way we tackle ocean monitoring, assessment and management.

Knowledge gaps

18.   The analysis of marine systems is mostly compartmentalized, with a series of approaches that should be complementary but that, instead, are developed with little connections with each other. The distinction between benthic systems and pelagic ones, for instance, is based on the patterns of distribution of biodiversity but does not consider processes much. Some of the main gaps that require further research include the following:

• Role of resting stage banks for plankton dynamics.

• Impact of gelatinous macrozooplancton on the functioning of ecosystems.

• Links between deep sea systems and coastal ones.

• Habitat identification for the pelagic habitats and mapping processes.

• Knowledge of connectivity processes.

• Development of innovative techniques such as remote sensing and acoustic for the study of seabed to cover large areas at high resolution.

Common Indicator 3: Species distributional range (EO1 related to marine mammals, seabirds, marine reptiles)

Conclusions

19. Current knowledge about the presence, distribution, habitat use and preferences of Mediterranean marine mammals is limited and regionally biased, due to an unbalanced distribution of research effort during the last decades, mainly focused on specific areas of the Basin. Throughout the Mediterranean Sea, the areas with less information and data on presence, distribution and occurrence of marine mammals, are the south-eastern portion of the basin, including the Levantine basin and the North Africa coasts. In addition, the summer months are the most representative and very few information have been provided for the winter months in the data pool, when conditions to conduct off-shore research campaigns are particularly hard due to meteorological adversity.

20. Marine mammals' presence and distribution are mainly related to suitable habitats and availability of food resources; anthropogenic pressures, as well as climate change, may cause changes and shifts in the occurrence of marine mammals, with potential detrimental effects at the population levels. Accordingly, in order to enhance conservation effort and inform management purposes, it is crucial to obtain detailed and robust descriptions of species' range, movements and extent of geographical distribution, together with detailed information on the location of breeding and feeding areas.

21. Ongoing effort by ACCOBAMS to start a synoptic region-wide survey referred to as the ACCOBAMS Survey Initiative (ASI), to assess the presence distribution and to estimate density and abundance of cetaceans in the summer of 2018. Concurrently, local scientists are working on the identification of Cetacean Critical Habitats (CCHs) and Important Marine Mammal Areas (IMMAs) in the entire Mediterranean Sea. A gap analysis has also been conducted within the Mediterranean Sea, to provide an inventory of available data and to select areas where more information should be collected.

22. This general overview stresses the importance of assimilating all available information on the distribution of sea turtles at breeding, foraging, developmental sites and how these areas are connected to understand the distribution patterns of sea turtles at the size class, population and species level to select key areas for protection. Parallel mitigation strategies are required to build the resilience of existing populations.

23. Nesting sites - In general, knowledge about currently used nesting sites of both loggerhead and green turtles in the Mediterranean is good. However, all potential nesting beaches need to be surveyed throughout the Mediterranean to fill gaps in current knowledge (e.g. nesting in North Africa, particularly Libya). This could be done via traditional survey methods, but also by aerial surveys (plane or drone) at the peak period of nesting (July), or even by high resolution satellite imagery, which is becoming commercially available.

24. Existing stable nesting beaches should be afforded full protection, in parallel to collecting key information on why turtles use them, including geographic location, beach structure, sand composition, sand temperature ranges, coastal sea temperatures etc. In parallel, sporadically used beaches should be monitored at regular intervals (i.e. every 5 years or so), to identify changes in use over time, and pinpoint sites where use changes from sporadic to stable. Again, all these sites should be assessed with respect to geographic location, beach structure, sand composition, sand temperature ranges, coastal sea temperatures etc. on the ground, which will help with identifying future viable beaches for nesting. Ideally, all sandy beaches, whether used or not should be subject to the same analyses, to identify any beaches that might be used in the future by turtles, due to range shifts under climate change, which will alter sand temperatures on beaches and in the water,

as well as causing sea level rise, which will alter the viability of current beaches, forcing turtles to shift to alternative sites. In this way, future beaches of importance can be detected and protected from certain human activities.

25. Foraging (adult and developmental) and wintering sites - It is necessary to determine how to focus protection effort of foraging (adult and developmental) habitats, i.e. protect easy-to-define areas where high numbers of turtles aggregate from different populations and size classes, protect protracted areas of coastline where 10-20 individuals may aggregate at intervals from different populations and size classes, but amounting to representative numbers over a large expanse.

26. The former is easier to design and protect, but the latter may be more representative of sea turtle habitat use in the Mediterranean. The latter is more at risk of loss too, as management studies for the development of e.g. marinas and hotels would assume that the presence of just 10-20 turtles was insignificant; however, if this action was repeated independently across multiple sites, one or more turtle populations could become impacted.

27. Thus, it is essential to determine how developmental, foraging and wintering grounds are distributed throughout the Mediterranean, as well as the numbers of turtles of different size classes and from different populations that frequent these sites, including the seasonality of use and connectivity across sites. Only with this information can we make informed decisions about which sites/coastal tracts to protect that incorporate the greatest size class and genetic diversity.

28. The aerial (plane or drone) surveys are recommended to delineate areas used by sea turtles in marine coastal areas, along with seasonal changes in use, by monitoring these sites at 2-4 month intervals. Following this initial assessment, representative sites should be selected and sampled on the ground (i.e. boat based surveys) to delineate species, size classes and collect genetic samples to determine the extent of population mixing. Where possible, stable isotope and tracking studies should be conducted (including PIT tagging) to establish the connectivity among sites.

29. The southeast to northwest increasing diversity gradient might be partly influenced by prospection/monitoring effort. For many eastern and southern countries, as well as some Adriatic countries, the information on seabird breeding populations or occurrence at sea is patchy or completely lacking. This might be partly because the birds are actually rare or absent there, but could also be related to lack of data. Particularly little information is available for Algeria, Egypt, Israel, Lebanon, Syria, Cyprus and Turkey, as well as Albania. There is no information from Bosnia-Herzegovina, but this country has extremely limited coastal area, and most likely has no relevant seabird breeding populations. Information from Libya is also patchy, and focuses on terns.

30. The lack of information is not limited to the above countries, however. Most of the remaining countries have some important gaps, particularly at assessing population sizes, but also at properly inventorying all breeding colonies present in their territories, particularly in the case of the shearwaters. For instance, a colony of over 1,500 Yelkouan shearwaters was recently found in Greece, near Athens, although this area is reasonably well prospected. Likewise, the breeding of the storm-petrel in the Aegean Sea was not confirmed until a few years ago.

31. The waters off the Tunisian and Libyan coasts serve as a major foraging ground for Procellariiforms (shearwaters, storm-petrels) nesting in the Cap Bon – Strait of Sicily – Malta Important Area.

32. The world population of Audouin's gull is estimated at <60,000 individuals; 90% of the breeding population is found in only 4 sites, and 70% concentrate in a single site (Ebro delta). The species scavenges around fishing vessels, and uses discards extensively and very efficiently. The species' association with fisheries is more pronounced in the western than in the central and

eastern Mediterranean. The Sicily Channel / Tunisian Plateau area is a minor breeding area for Larusaudouinii, with a small colony on the Galite archipelago, Tunisia (40 breeding pairs; BirdLife International 2013) and also on Zembra (10 pairs; BirdLife International 2013). Another colony is present on the Ionian island of Vendicari, Sicily. However, tracking has revealed that, although breeding only in small numbers, the waters off NW Tunisia are important foraging grounds for Audouin´s Gulls from colonies in southern Sardinia (Baccetti et al. 2014).

33.   Information regarding seabirds in the Alboran Sea is patchy and requires of further research, particularly on the African side. This includes information on seabird breeding populations, as well as on distribution patterns at sea. But it is also necessary to improve the knowledge on human activities and their potential impact on seabirds. Information (and conservation action) regarding predation by introduced mammals in the colonies, and fisheries bycatch at sea, deserve particular attention.

Key messages

34.   For marine mammals:

- A risk based approach for monitoring-should be carried out to assess the marine mammal distribution throughout the whole Mediterranean Sea.

- More effort should be devoted in poorly monitored areas.

- Those species which are listed as Data Deficient under the Red List criteria should be considered as a priority.

35.   For marine reptiles:

- This general overview stresses the importance of assimilating all information on the distribution of green and loggerhead sea turtles in the Mediterranean at breeding, foraging, developmental and wintering grounds to understand how these areas are connected when considering different size classes, populations and species for effective conservation management.

- Parallel mitigation strategies are required to build the resilience of existing populations.

36.   For sea birds:

- Despite breeding distribution patterns are relatively easy to assess, information is patchy and often lacking.

- A southeast to northwest increasing diversity gradient has been observed, in agreement with productivity patterns in the region, but this might be confounded by larger data gaps in the southernmost and easternmost countries.

Knowledge gaps

37.   For marine mammals:

- Most of the Mediterranean Sea has been surveyed to some extent to evaluate cetaceans' occurrence, distribution and ranges.

- Nonetheless, there is a great disparity in the overall distribution of research effort, with most research been done and still carried out in the north-western portion of the basin, where long time series of data, covering up to three decades, exist. In southern

Mediterranean countries information on species occurrence and distribution mostly arises from anecdotal information and localized research projects. Systematic surveys in these areas are still scarce. Effort should be done to allocate research in those areas to consolidate baseline information and to eventually obtain long time series of data.

- The current gap in the availability of data, and by consequence of knowledge, is hampering the identification of protection measures towards the conservation of species at the regional level.

38. For marine reptiles:

- Location of all breeding/nesting sites;
- Location of all wintering, feeding, developmental sites of adult males, females, juveniles;
- Connectivity among the various sites in the Mediterranean;
- Vulnerability/resilience of these sites in relation to physical pressures;
- Analysis of pressure/impact relationships for these sites and definition of qualitative GES;
- Identification of extent (area) baselines for each site and the habitats they encompass;
- Appropriate assessment scales;
- Monitor and assess the impacts of climate change;
- Assimilation of all research material on sea turtles (e.g. satellite tracking, stable isotope, genetic, stranding aerial surveys) in a single database.

39. For sea birds:

- Information on gulls and terns seems reasonable good, although some southern and eastern countries might need updating their surveys. For the shearwaters, it is more difficult to find information for these same countries, which might be a combination of both small/inexistent breeding populations and lack of prospection.
- The priority actions needed involve: a) formal and effective site protection, especially for Important Bird Area (IBA) breeding sites and for marine IBA feeding and aggregation sites; b) removal of invasive, especially predatory, alien species as part of habitat and species recovery initiatives; and c) reduction of bycatch to negligible levels, as part of comprehensive implementation of ecosystem approaches to fisheries.

Common Indicator 4: Population abundance of selected species (EO1 related to marine mammals, seabirds, marine reptiles)

Conclusions

40. Some of the cetaceans species present in the Mediterranean Sea are migratory species, with habitat ranges extending over wide areas; it is therefore highly recommended to monitor these species at regional or sub-regional scales for the assessment of their population abundance. Priority should be given to the less known areas, using online data sources, such as Obis Sea Map and published data and reports as sources of information.

41. There is general consensus among the scientific community that long-term systematic monitoring programmes, using techniques such as the photo-identification, provide robust and

crucial data that can be used in assessing abundance at sub-regional levels and inform local conservation and mitigation measures. Establishing international collaborations between different research groups, merging existing data-sets allows performing robust analysis and estimating population parameters at larger scales.

42.   The Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS) has been working for several years on defining an exhaustive program for estimating abundance of cetaceans and assessing their distribution and habitat preferences in the Black Sea, Mediterranean Sea and the adjacent waters of the Atlantic (the "ACCOBAMS Survey Initiative"). This initiative consists in a synoptic survey to be carried out in a short period of time across the whole Agreement area and it will combine visual survey methods (boat- and ship-based surveys) and passive acoustic monitoring (PAM).

43.   This general overview indicates that overall, programs at nesting sites need to place a strong focus on ensuring long-term recognition of unique female individuals and incorporate counts of males. The monitoring based on Common Indicator 1 will help with delineating developmental, foraging and wintering sites to make counts of adult vs. juvenile turtles and fluctuations in numbers over time. Information obtained through Common Indicator 2: Condition of the habitat's typical species and communities will be intrinsically linked with Common Indicator 3: Species distributional range.

44.   Major gaps exist in estimating the population abundance of sea turtles. First, the use of nest counts as a proxy for female numbers must be treated with caution, and variation in climatic factors at the nesting site and trophic factors at foraging sites taken into account. Counts of males at breeding grounds must be incorporated into programs at nesting sites. If just a total of 100 males frequent Zakynthos, which has around 1000 nests/season, then most sites throughout the Mediterranean (of which most have <100 nests) are likely to support very low numbers of males, making the protection of these individuals essential. Finally, with the delineation of developmental, foraging and wintering habitats (Indicator 1), it will be necessary to obtain counts of the number of individuals, particularly juveniles, that frequent these various habitats seasonally and across years. While information on the number of juveniles alone at given habitats does not reflect on any given nesting population, the relative numbers of immature to mature animals will provide baseline information about key juvenile developmental habitats and actual numbers relative to those obtained to adults.

45.   Overall, programs at nesting sites need to place a strong focus on ensuring long-term recognition of female individuals and incorporate counts of males. The monitoring of the Common Indicator 1, will help with delineating developmental, foraging and wintering sites to make counts of adult vs. juvenile turtles and fluctuations in numbers over time. Information obtained through monitoring of Common Indicator 2 will be intrinsically linked with Indicator 3 (see this section).

46.   The overall pattern of seabird abundance in the Mediterranean region is consistent with the results of common indicator 3 (distribution): seabirds tend to be more abundant in the north and west of the Mediterranean basin. This is particularly so in the case of the most marine species (shearwaters, Mediterranean shag and Audouin's gull). As in the case of the distribution patterns, it remains to elucidate to which extent this pattern, that makes sense in terms of productivity and maybe also of suitable breeding habitat availability, is not confounded by prospection effort/data quality.

47.   Obtaining reliable estimates of population size is harder than just confirming presence/absence (which is the basis for assessing distribution patterns), so there are more gaps regarding this common indicator. Information for some countries and species is old and just repeated from one publication to another, so it is important to break with this tradition and ensure

that the different countries start implementing proper monitoring programmes. Information will be easier to collect and more reliable for the diurnal species breeding in open habitats, such as Audouin's gull and the terns, whereas for the most "secretive" species (shearwaters) it might be important to rely on demographic studies of representative colonies to properly assess population trends (see common indicator 5).

Key messages

48. For marine mammals:

- Effort should be dedicated to providing density and abundance estimates at the Mediterranean level, with synoptic surveys, such as that currently ongoing with the ACCOBAMS Survey Initiative.

- The conservation priorities listed by the European Directives and the Ecosystem Approach should be implemented.

49. For marine reptiles:

- This general overview indicates that major gaps exist in estimating the population abundance of sea turtles.

- Programs at nesting sites need to place a strong focus on ensuring long-term recognition of female individuals and incorporate counts of males.

- Programs need to be developed at foraging, wintering and developmental grounds, providing counts of individuals and linking them to their source breeding populations.

50. For sea birds:

- Patterns of abundance roughly match those of distribution for seabirds, with a southeast to northwest increase.

- Information is patchy, often old and subject to potentially high biases, particularly in the case of the shearwaters. Establishing population trends for the latter is complicated without censuses.

Knowledge gaps

51. For marine mammals:

- Gaps still exist on baseline information such as abundance and density for many species of cetaceans occurring in the Mediterranean Sea, especially in those sectors where research is carried out on limited resources and not systematically.

- Even though for some species such as the striped dolphin and the fin whale estimates have been obtained for a large portion of the Basin, for none of the species there are available estimates at the regional scale.

- The lack of these baseline critical information is therefore detrimental for conservation, slowing down the identification of potential and actual threats, the assessment of their effect on populations and eventually the evaluation of trends and the triggering of mitigation and conservation measures.

52. For marine turtles:

- Seasonal and total numbers of adult males frequenting breeding sites;

- Numbers of adult males and females frequenting foraging and wintering sites, including seasonal variation in numbers;

- Vulnerability/resilience of documented populations and subpopulations in relation to physical and anthropogenic pressures;

- Analysis of pressure/impact relationships for these populations and subpopulations, and definition of qualitative GES;

- Identification of extent (area) baselines for each population and subpopulation with respect to adult females, adult males and juveniles to maintain the viability and health of these populations;

- Appropriate assessment scales;

- Monitor and assess the impacts of climate change on nest numbers (clutch frequency) and breeding periodicity (remigration intervals) of females, as these parameters are used as proxies for inferring female numbers;

- Monitor and assess the impacts of climate change on the breeding periodicity (remigration intervals) of males, as this provides an indication of total male numbers;

- Assimilation of all research material on sea turtles (e.g. satellite tracking, stable isotope, genetic, stranding aerial surveys) in a single database.

53. For sea birds:

- The geographic gaps are similar to those described for Common Indicator 3.

- For many eastern and southern countries, as well as some Adriatic countries, the information on seabird breeding populations is patchy or completely lacking. Particularly little information is available for Algeria, Libya, Egypt, Israel, Lebanon, Syria, Cyprus and Turkey, as well as Montenegro, Bosnia-Herzegovina and Albania.

Common indicator 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)

Conclusions

54. Available data on demography for Mediterranean marine mammals are rather scarce and fragmented and at present it is rather difficult to provide strong and robust evidence on baselines and changes over time in demographic parameters.

55. Data are available for localized regions only, where more effort has been devoted over the years allowing to estimate survival rates for specific species and time intervals.

56. Demographic studies can supply useful tools to the management and the conservation of threatened and overexploited species. Population models, based on life-history tables and transition matrices, allow to assess population performance, to project population trends overtime and thus to foster the conservation of the studied populations, suggesting specific measures for their protection.

57.   At present our knowledge on sea turtle demography is patchy at best for each component, with certain information being more widely available than other information. To understand the demography of loggerhead and green turtle populations in the Mediterranean, greater effort needs to be placed on filling existing gaps. Only then can we predict with any certainty the future viability of sea turtle populations in the Mediterranean.

58.   Information for this common indicator is far scarcer than that for common indicators 3 (distribution) and 4 (population size). However, for some species this type of information is essential to properly understand population trends, as well as to assess the relevance of different threats in context. This is particularly so for the Procellariiformes, represented here by the Balearic and Yelkouan shearwaters. The good news is that collecting this type of information might be quite simple and less resource-consuming than conducting exhaustive population counts. It only requires of the selection of a few, representative colonies where breeding monitoring schemes could be conducted on a year-basis. These schemes would require the follow-up of standard protocols that might be simple enough, with 2-3 visits per year to ensure the assessment of breeding success, the ringing of chicks and the ringing/control of adults. The very limited schemes in place suggest that Balearic and Yelkouan shearwaters are undergoing a severe decline.

59.   For the remaining species, although population counts already provide relevant information, it is important to systematically collect demographic data as to better understand their population dynamics, and to put the different threats that they face in context. Colour-ringing schemes such as that of Audouin's gull, coupled with the detailed monitoring of a few, representative breeding colonies might provide high quality data on this regard. In addition, a systematic compilation of information from dead birds, particularly from wildlife recovery centers, might greatly help to understand the impact of different threats.

Key messages

60. For marine mammals:

- Systematic and long-term photo-identification programs, jointly to the use of appropriate instruments to measure observed animals, would be essential tools to supply basic knowledge on population structure needed for conservation plans.

61. For marine reptiles:

- This general overview, indicates that at present our knowledge on sea turtle demography is patchy at best for each component and that effort needs to be placed on filling existing gaps in order to predict with any certainty the future viability of sea turtle populations in the Mediterranean.

62. For sea birds:

- Demographic information is essential to properly assess the trends of certain seabirds, particularly shearwaters.
- The limited information available for Balearic and Yelkouan shearwaters suggests that both species are undergoing a severe decline, which threatens them with extinction. Introduced predators and fishing bycatch deserve particular attention on this regard.

Knowledge gaps

63. For marine mammals:

- There is a strong need for systematic monitoring programmes over time, to collect time series and allow the assessment of trends over time and space.
- Monitoring programmes should be repeated at regular intervals, ideally every year for photo-identification using a risk-based approach and following international regulations (e.g.: Habitat and Marine Strategy Directives, Ecosystem Approach).

64. For marine turtles:

- Knowledge on the sex ratios within different components (breeding, foraging, wintering, developmental habitats), age classes and overall within and across populations.
- Knowledge about recruitment and mortality into different components of the population.
- Knowledge about the physical and genetic health status of these groups.
- Vulnerability/resilience of these populations/sub-populations in relation to physical pressures;
- Analysis of pressure/impact relationships for populations/sub-populations and definition of qualitative GES;
- Identification of extent (area) baselines for each population/subpopulation and the habitats they encompass;
- Monitor and assess the impacts of climate change on offspring sex ratios.

65. For sea birds:

- Information on seabird demographic parameters is extremely scarce in the Mediterranean region, except for Audouin's gull. It is essential to set in place breeding monitoring programmes, particularly for the Balearic and Yelkuoan shearwaters, as well as ensure the continuity of the few already existing.

- Special attention must also be paid to their main threats, particularly predation by introduced mammals in the colonies and fishing bycatch at sea.

66. **EO 2 on Non-indigenous species** aims that non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem. It introduces one common indicator:

Common Indicator 6: Trends in abundance, temporal occurrence, and spatial distribution of non-indigenous species, particularly invasive, non-indigenous species, notably in risk areas

Conclusions

67. Important progress has been made the last decade in creating inventories of non-indigenous species (NIS), and on assessing pathways of introduction and the impacts of invasive alien species on a regional scale. The development and regular updating of MAMIAS (data partner of EASIN) substantially contributes to address Common Indicator 6. SPA/RAC is establishing formal exchange of information with relevant information system (such AquaNIS) as provided for in the Mediterranean Action Plan concerning Species introduction and invasive species.

68. Nevertheless, monitoring and research effort currently greatly varies among Mediterranean countries and thus on a regional basis current assessments and comparisons may be biased. Thus, the implementation of the IMAP at national level, following the IMAP recommendations, will enable obtaining much more consistent results.

69. The lack of dedicated and coordinated monitoring at national and regional scale implies a low confidence in this assessment, even if the continuous and regular occurring of new introductions are demonstrated. This lack of standardized monitoring and data currently compromises representability and comparability between assessment cycles, and thus complicate assessment of effects of management measures on these trends.

Key messages

70. For non -indigenous species:

- Progress has been made in creating national and regional inventories of alien species and assessing their pathways and impacts.

- There is an increasing trend in the rate of new alien species introductions in the Mediterranean Sea.

- Corridors are the most important pathways of new introductions in the Mediterranean, followed by shipping and aquaculture.

- There is a need for better coordination at National and sub-regional level on NIS monitoring.

Knowledge gaps

71. For non -indigenous species:

- Evidence for most of the reported impacts of alien species is weak, mostly based on expert judgement; a need for stronger inference is needed based on experiments or ecological modelling. The assessment of trends in abundance and spatial distribution is largely lacking.

- Regular dedicated monitoring and long time series will be needed so that estimation of such trends is possible in the future. NIS identification is of crucial importance, and the lack of taxonomical expertise has already resulted in several NIS having been overlooked for certain time periods. The use of molecular approaches including bar-coding are often useful besides traditional species identification.

72. **Ecological Objective 3 (EO3) on commercially exploited fish and shellfish** is to ensure their populations are within biologically safe limits, exhibiting a population age and size distribution that is indicative of a healthy stock and includes three common indicators:

Common Indicator 7. Spawning stock Biomass

Conclusions

73. Validated reference points for Spawning Stock Biomass are only available for a few stocks, and therefore the quality assessment included in this report is based on the empirical approach taken by the GFCM Working Groups on Stock Assessment that compares current biomass with the historical series of biomass as estimated from a validated stock assessment or directly from validated surveys at sea. The analysis of 60 different stocks, along the Mediterranean Sea, shows that around 42% show low biomass, 37% were considered to show an intermediate biomass and 22% showed high biomass.

74. With the aim to provide a spatio-temporal analysis of Mediterranean stock status, based not only on the most reliable recent data but also on indicators and reference points as most certain as possible, this analysis was conducted only on the endorsed assessments by either SAC of GFCM or STECF of European commission. Despite that many obstacles were fixed, some limitations, which can be a scope of improvement in the future, still persist. Amongst them, (i) the spatio-temporal coverage of stocks considered in the analysis, (ii) the shortness of indicator time series used, (iii) the absence of analytical biomass reference points and, (iv) the issue of standardized data and methodologies at regional level.

75. In terms of the relative biomass indicator, the analysis of 57 different stocks, along the Mediterranean Sea, shows that around 42% of the reviewed stocks were found to be in a situation of low biomass, 37% were considered to show an intermediate biomass and 22% showed high biomass.

76. Recently Froese et al., (2016) analyzed the status of European stocks and found that in the Mediterranean and the Black Sea region the average biomass is less than half (44%) of the sustainable level. Overall, this finding is in line with the present analysis with some slight difference that can be explained by the fact that the present analysis concerns all the Mediterranean stocks, taking into account the European and no European fisheries, whereas in Froese et al., (2016) only the European stocks were included. Furthermore, the proportion of stocks with biomass above or below the reference point was used to inform about the regional status, while the other study adopted the average biomass as a regional indicator of stock status.

77.   Concerning the stock status by sub-region, most stocks in the Western and Central Mediterranean and the Adriatic Sea are at low or intermediate levels (i.e. below the precautionary reference point or B_{PA} proxy), while the Eastern Mediterranean is poorly covered with only two stocks having the necessary reference points for the analysis.

78.   The low biomass levels observed in some of Mediterranean key stocks (specially on some important small pelagic stocks), together with the high fishing pressure (see Indicator EO3_CI08) has been repeatedly pointed out by the GFCM SAC, which has requested to initiate recovery plans for the stocks considered to be depleted, and to reduce fishing mortality to levels considered to be sustainable. Mediterranean countries are recently taking measures to correct these problems that jeopardize the sustainability of fisheries in the area, including through the implementation of the mid-term (2017-2020) strategy towards the sustainability of Mediterranean and Black Sea fisheries adopted in 2016, which includes as one of its targets to *reverse the declining trend of fish stocks through strengthened scientific advice in support of management*[1]. Furthermore, the GFCM has recently adopted two dedicated sub-regional management plans and several riparian countries have reported a significant reduction of their fishing capacity, in line with the adopted GFCM resolution on the management of fishing capacity[2]. These measures are expected to be complemented with additional fisheries management measures within the mid-term strategy, with the objective to reduce fishing mortality and to increase biomass levels for low biomass stocks, especially those of priority species, before 2020.

79.   Notwithstanding the above, it should be considered that the level of overfishing as well as the current biomass levels depends on the productivity of the stocks, which is affected by variables other than fishing itself. The reference point used in the assessment (FMSY or its proxies) as well as the carrying capacity of the ecosystem, which relates to the maximum biomass that can be sustained, are affected by issues such as climate change or anthropogenic effects other than fisheries, including pollution and habitat destruction (Colloca et al., 2014). The combination of all these effects generates a strong biological stress and can be the cause of major ecological alterations, which in turn may affect the productivity of fisheries and therefore jeopardize Mediterranean fisheries and the production of local seafood for coastal communities.

Key messages

80.   For Spawning Stock Biomass:

- Up to 42% of the stocks assessed in the Mediterranean show a low biomass in comparison with the existing time series, and only for 22% of the stocks the biomass is considered to be relatively high in relation to the time series

- Riparian states have recently explicitly recognized low biomass of key stocks in the Mediterranean as a key challenge in the context of blue growth and food security for coastal communities, and have included a specific target in the mid-term (2017-2020) strategy towards the sustainability of Mediterranean and Black Sea fisheries aimed at reversing the declining trend of fish stocks through strengthened scientific advice in support of management

- The increase of biomass for key stocks requires the adoption of sub-regional management plans in the context of the GFCM, to complement those already in place for the Adriatic small pelagics and the Strait of Sicily demersal fisheries, as well as the adoption of measures that ensure the efficient management of fishing capacity.

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[1]http://www.fao.org/gfcm/activities/fisheries/mid-term-strategy
[2] Resolution GFCM/37/2013/2 on Guidelines on the management of fishing capacity in the GFCM area

- Although examples of recovery/increase of spawning stock biomass exist elsewhere in the world, it is also known that stock recovery/rebuilding may depend on factors other than fishing, and that in some cases stocks may require some time to rebuild after management measures are taken.

Knowledge gaps

81. For Spawning stock Biomass:

- The advice on the status of Mediterranean commercially exploited stocks, as provided by the GFCM SAC have largely improved in recent years, as recognized by Mediterranean riparian states. However, the level of information differs between species and geographical areas, with information concentrating on a few stocks and lacking or being fragmented in other commercially exploited stocks.

- Even if stock assessments and advice are now available for an increasing number of stocks, the number of stocks for which MSY-based SSB reference points (or its proxy) existis still very limited. Thus, it is not possible to establish reproductive potential levels relative to MSY, and the indication on current biomass levels is often based (as in this assessment) on an empirical analysis of often short time series.

- The update and adoption of new specific binding recommendations related to the mandatory requirements for data collection and submission, underpinned by the operationalization of the GFCM Data Collection Reference Framework (DCRF)[3] is expected to improve the quality of the data in support of advice, in line with the need expressed by riparian states. The mid-term strategy (2017-2020) towards the sustainability of Mediterranean and Black Sea fisheries is also expected to contribute in this endeavour through specific actions such as, for example, the execution of harmonized scientific surveys-at-sea.

Common Indicator 8. Total landings

Conclusions

82. The temporal trend in annual production of demersal fish, crustaceans, cephalopods and small pelagic showed a rapid increase from the 70s to the beginning of the 90s, followed by a declining trend since then, obvious in all Mediterranean sub-regions with the exception of the Adriatic, where the decrease started in the mid-80s and the production has remained stable at low levels since the 90s. Small pelagics (composed of few species like anchovy, sardine and other clupeids) are by far the dominant group, representing almost the 38% of total landings in the GFCM area of application. On the contrary, the landings of demersal species show large differences among sub-regions, mainly due to different species and fishing activities. The western Mediterranean is the area with the highest annual production, amounting to around 270.000 tons, whereas the other three Mediterranean sub-regions show a similar yield (160.000 tons).

83. The maintenance of a sustainable and as large as possible yield of fish and shellfish is a priority for Mediterranean riparian countries in the context of food security and blue growth. In this respect, riparian countries recognize that it is important to maintain, and when necessary rebuild, the biomass of fish stocks in order to ensure Maximum Sustainable Yield. In this context, they are committed to implementing the mid-term (2017-2020) strategy towards the sustainability of Mediterranean and Black Sea fisheries adopted in 2016, which includes as one of its targets to reverse the declining trend of fish stocks through strengthened scientific advice in support of

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[3]http://www.fao.org/gfcm/data/dcrf/en/

management[4]. Furthermore, the GFCM has recently adopted two dedicated sub-regional management plans and several riparian countries have reported a significant reduction of their fishing capacity, in line with the adopted GFCM resolution on the management of fishing capacity[5]. These measures are expected to be complemented with additional fisheries management measures within the mid-term strategy, with the objective to efficiently manage key fisheries by 2020.

84.   Catch in numbers or weight represents the removal of biomass and individuals from the ecosystem. Data based on landings, when accurately reported, can be a fair indicator of the status of Mediterranean fisheries' stocks and, the trend analysis can provide evidence of how well target populations are performing in response to fishing pressure (i.e. the impact that fishing has on fish populations).

85.   Currently, the Mediterranean Sea is exploited by about 80.000 vessels, most of which are small-scale boats using many different fishing gears. The small-scale fishing component of the fleet is still extremely important for its socio-economic implications on many coastal communities, in addition to being a source of food and representing an important cultural heritage with relevant repercussions on activities related to tourism, for example.

86.   It is worth noting that official landings statistics selectively represent landings from the commercial fisheries sector and do not provide an indication of all that is being harvested from the sea. Furthermore, landing/catch data should be associated to stock assessment analysis, in order to provide detailed information regarding the biological characteristics of a species or stock under fisheries' management.

87.   Based on scientific advice, fishing must be adjusted to bring exploitation to levels that maximize yields (or catch) within the boundaries of sustainability.

Key messages

88.   For Total landings:

- The maintenance of a steady production of fish from Mediterranean fisheries is a priority in the context of blue growth and food security for coastal communities.

- Mediterranean catches are stagnant, with current yields at around 800.000 tons, below the maximum yield of around 1 million tons, obtained in the mid-90's.

- The current fishing pressure (see Indicator EO3CI9), the biomass levels of some key species (see Indicator EO3CI7) and other pressures on Mediterranean ecosystems jeopardize the sustainability of catches of fish and shellfish, and riparian states have agreed to undertake necessary management measures to revert the status of Mediterranean fisheries, including through the implementation of the *mid-term (2017 – 2020) strategy towards the sustainability of Mediterranean and Black Sea fisheries*.

Knowledge gaps

89.   For Total landings:

- The correct estimation of total landings requires a precise knowledge of the fishing activities carried out by the active fishing fleet operating in the Mediterranean. The specificities of the Mediterranean fleet, composed by a large majority of small scale polyvalent vessels, as well

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[4]http://www.fao.org/gfcm/activities/fisheries/mid-term-strategy
[5] Resolution GFCM/37/2013/2 on Guidelines on the management of fishing capacity in the GFCM area

as the existing variety of landing sites, and the different capacity of Mediterranean riparian states to accurately monitor the landings in such sites, make difficult an accurate estimation of landings in the region. Furthermore, Illegal, Unregulated or Unreported (IUU) fishing activities in the area also affects the estimates.

- Ultimately, the ideal indicator for the production of fisheries as well as the removal of organisms due to fisheries should be total catch, but information on discards is fragmented.

- The GFCM has proposed a number of solutions to improve the quality of the estimation of total catch. On one hand, the GFCM DCRF[6] is expected to provide the technical elements to improve and harmonize the collection of information on fisheries throughout the Mediterranean. Also, the mid-term strategy towards the sustainability of Mediterranean and Black Sea fisheries foresees specific activities such as a bycatch monitoring programme or a survey of small-scale fisheries, as well as the implementation of dedicated actions to assess and curb IUU fishing, which are expected to largely improve the quality of the estimates for this indicator.

- Care needs to be taken in interpreting trends in the indicator for total landings because variations in total catch/landing may be a result of various factors, including the state of the stock, changes over time in the selectivity of fishing gear, changes in the species targeted by fishing activities, as well as inconsistencies in the reporting.

Common Indicator 9. Fishing Mortality

Conclusions:

90. In the Mediterranean, the majority (around 85 percent) of stocks for which a validated assessment exists are subject to overfishing. Current fishing mortality rates can be up to 12 times higher than the target for some stocks. In general, demersal species suffer higher exploitation rates than small pelagic species, with the latter showing average fishing mortality rates that are lower than the target.

91. The level of overfishing in the Mediterranean has been repeatedly pointed out by the GFCM SAC, which has requested fishing mortality to be reduced through adequate management measures. Mediterranean countries are recently taking measures to correct this problem that jeopardize the sustainability of fisheries in the area, including through the implementation of the mid-term (2017-2020) strategy towards the sustainability of Mediterranean and Black Sea fisheries adopted in 2016, which includes as one of its targets to reverse the declining trend of fish stocks through strengthened scientific advice in support of management[7]. Furthermore, the GFCM has recently adopted two dedicated sub-regional management plans and several riparian countries have reported a significant reduction of their fishing capacity, in line with the adopted GFCM resolution on the management of fishing capacity[8.] These measures are expected to be complemented with additional fisheries management measures within the mid-term strategy, with the objective to reduce fishing mortality, especially for priority species, before 2020.

92. In the Mediterranean, the majority of stocks, for which a validated assessment exists, are fished outside biologically sustainable levels, either in terms of biomass (see also fishery indicator EO3CI7), exploitation or both criteria, with the degree varying among stocks, functional groups and geographical sub-areas. The ratio F/FMSY illustrates that on average Mediterranean stocks are exploited three times greater than the target level and the biomass is lower than the reference point, which confirm a regional status of overexploitation. Current fishing mortality rates can be

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[6]http://www.fao.org/gfcm/data/dcrf/en/
[7]http://www.fao.org/gfcm/activities/fisheries/mid-term-strategy
[8] Resolution GFCM/37/2013/2on Guidelines on the management of fishing capacity in the GFCM area

up to 12 times higher than the target for some stocks.

93.   All Mediterranean sub-regions, without exceptions, are subject to high overfishing status, as the majority of their assessed stocks are not within biologically sustainable levels in terms of either stock size or fishing mortality. The Western Mediterranean stocks are in the worst shape compared to other sub-regions, with an average fishing mortality around three times higher than the target level, followed by the Central Mediterranean stocks with an average exploitation rate of about 2.9. Adriatic Sea and the Eastern Mediterranean stocks have shown an average exploitation rate of about 1.75 and 1.77, respectively.

94.   Among the stocks listed in overexploitation status ($F > FMSY$), 33% are close to reach the target level. Those stocks could only need as little as 10% of fishing mortality reduction to shift their status from overfishing to a sustainable exploitation. In general, demersal species suffer higher exploitation rates than small pelagic species, with the latter showing average fishing mortality rates that are lower than the target. Most stocks fished within biologically sustainable levels are of small pelagic species (e.g. sardine and anchovy), while only a few stocks of demersal species, such as whiting, some shrimp species, picarel and red mullet, are estimated to be fished at or below the reference point for fishing mortality. In light of this review, it was concluded that around 85% of the examined stocks (for which FMSY or its proxy is available) are fished unsustainably (FAO, 2016).

95.   Notwithstanding the above, it should be considered that the level of overfishing depends on the productivity of the stocks, which is affected by variables other than fishing itself. The reference point used in the assessment (FMSY or its proxies) are affected by issues such as climate change or anthropogenic effects other than fisheries, including pollution and habitat destruction (Colloca et al., 2014). The combination of all these effects generates a strong biological stress and can be the cause of major ecological alterations, which in turn may affect the productivity of fisheries and therefore jeopardize Mediterranean fisheries and the production of local seafood for coastal communities.

Key messages

96.   For Fishing Mortality:

- The majority of Mediterranean stocks (~85%) are subject to overfishing.

- Riparian states have recently explicitly recognized overfishing in the Mediterranean as a key challenge in the context of blue growth and food security for coastal communities, and have included a specific target in the mid-term (2017-2020) strategy towards the sustainability of Mediterranean and Black Sea fisheries aimed at reversing the declining trend of fish stocks through strengthened scientific advice in support of management.

- The reduction of fishing mortality requires the adoption of sub-regional management plans in the context of the GFCM, to complement those already in place for the Adriatic small pelagics and the Strait of Sicily demersal fisheries, as well as the adoption of measures that ensure the efficient management of fishing capacity.

Knowledge gaps

97.   For Fishing Mortality:

- The advice on the status of Mediterranean commercially exploited stocks, as provided by the GFCM SAC have largely improved in recent years, as recognized by Mediterranean riparian states. However, the level of information differs between species and geographical areas, with information concentrating on a few stocks and lacking or being fragmented in other commercially exploited stocks.

- The correct estimation of fishing mortality requires a precise understanding of riparian states' fishing capacity. Due to the specificities of the Mediterranean fleet, composed of a large majority of small scale polyvalent vessels, information on fishing capacity is sometimes incomplete or inaccurate. Furthermore, the estimation of robust reference points for fishing mortality requires the use of long time series and the incorporation of environmental and ecosystem variables, as well as the design of robust methods that can integrate information from different sources.

- The update and adoption of new specific binding recommendations related to the mandatory requirements for data collection and submission, underpinned by the operationalization of the GFCM Data Collection Reference Framework (DCRF)[9]is expected to improve the quality of the data in support of advice, in line with the need expressed by riparian states. The mid-term strategy (2017-2020) towards the sustainability of Mediterranean and Black Sea fisheries is also expected to contribute in this endeavour through specific actions such as, for example, the execution of harmonized scientific surveys-at-sea.

98.   **EO 5 on Eutrophication** aims that human-induced eutrophication is prevented, especially adverse effects thereof, such as losses in biodiversity, ecosystem degradation, harmful algal blooms and oxygen deficiency in bottom waters. It includes two common indicators:

Common Indicator 13: Concentration of key nutrients in water column

Conclusions

99.   The available data show that in areas were assessment is possible the key nutrient concentrations are in ranges characteristic for coastal areas and in line with the main processes undergoing in the interested area. The result also confirms the validity of this indicator as support in assessing eutrophication. Coastal Water type assessment criteria for reference condition and boundaries for key nutrients in the water column have to be built and harmonised through the Mediterranean region, which will greatly help the implementation of a clear sampling strategy with a simplified approach in monitoring design and data handling for the future implementation of IMAP.

100. Whilst data was available through the MEDPOL database, and substantial data is also available through EEA, EMODnet-Chemistry (http://www.emodnet-chemistry.eu/) and other sources, priority should be given to ensure Mediterranean countries regularly report quality assured data nutrient data to UNEP/MAP in line with IMAP, and ensure common reporting. Potential integration of data-sets in the future could be considered with EMODnet-Chemistry.

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[9]http://www.fao.org/gfcm/data/dcrf/en/

Key messages

101. For key nutrients:

- The available data show that assessment is possible. Key nutrient concentrations are within characteristic ranges for coastal areas and in line with the main processes undergoing in concerned interested area.

- Criteria for reference condition and boundaries for key nutrients in the water column have to be built and harmonized through the Mediterranean region.

Knowledge gaps

102. For key nutrients:

- At the eutrophication hot spots in the Mediterranean Sea, a comprehensive trend analysis of key nutrient concentrations in the water column would be beneficial. Significant trends need to be detected from long time series that are able to capture nutrient concentrations changes in coastal waters as the analysis of short time series can erroneously lead to interpret some spatial patterns produced by random processes nutrients concentration trends. For that reason, data availability should be improved. A possible approach is to use data stored in other databases were some of the Mediterranean countries regularly contribute.

- Criteria for reference condition and thresholds/boundary values for key nutrients in the water column have to be built and harmonised through the Mediterranean region. Data availability have to be improved. A possible approach is to use data stored in other databases were some of the Mediterranean countries regularly contribute.

Common Indicator 14: Chlorophyll-a concentration in water column

Conclusions

103. The trophic status of the Mediterranean Sea is controlled by the highly populated coastal zone and the riverine input from a draining area. Offshore waters of the Mediterranean have been characterized as extremely oligotrophic with an increasing tendency for oligotrophy eastwards. The Eastern Mediterranean Sea (EMS) is still the most oligotrophic area of the whole Mediterranean basin, and the largest phosphorus-limited body of water in the global ocean.

104. The coastal area of the south-eastern part of the Mediterranean shows clearly eutrophic trends. Although the River Nile is the major water resource in the area, its freshwater fluxes are getting limited because of the Aswan Dam and increasing trends in anthropogenic water use in the lower Nile. Eutrophic conditions in the area are mainly induced by the sewage effluents of Cairo and Alexandria. The Northern Aegean shows mesotrophic to eutrophic trends explained by the river inputs from northern Greece and the water inflow from the nutrient rich Black Sea.

105. The nutrient regime and primary productivity in the Western Mediterranean Sea (WMS) are relatively higher compared to the EMS. However, the primary productivity of the main WMS, away from the coastal areas and influenced by rivers and urban agglomerations, is still higher than the primary productivity in the EMS.

106. The main coastal areas in the Mediterranean which are historically known to be influenced by natural and**/or** anthropogenic inputs of nutrients are the Alboran Sea, the Gulf of Lions, the Gulf of Gabès, the Adriatic, Northern Aegean and the SE Mediterranean (Nile–Levantine).

107. The available data show that in areas were assessment is possible the IMAP assessment criteria for eutrophication based on CI14 (Chlorophyll *a* concentration in the water column) are applicable and confirm the main status of eutrophication in the coastal area. In term of GES achievement in these areas (Eastern Adriatic and Cyprus) it is maintained.

108. Coastal Water type reference condition and boundaries for CI14 (Chlorophyll *a* concentration in the water column) have to be harmonised through the south Mediterranean region which has not yet participated in the assessment effort. The assessment can also help to identify areas were the criteria have to be improved. Of great help will be the implementation of a sampling strategy with simplified approach in monitoring design and data handling.

109. Satellite synoptic measurements for the estimation of chlorophyll *a* concentration trends have the potential to detect anomalous, local biogeochemical processes and to assess the different applications of environmental regulations.

Key messages

110. For Chlorophyll-a:

- Offshore waters of the Mediterranean have been characterized as extremely oligotrophic with an increasing tendency for oligotrophy eastwards.

- The main coastal areas in the Mediterranean which are historically known to be influenced by natural and/or anthropogenic inputs of nutrients are the Alboran Sea, the Gulf of Lions, the Gulf of Gabès, the Adriatic, Northern Aegean and the SE Mediterranean (Nile–Levantine).

- The available data show that in areas were assessment is possible the IMAP assessment criteria for eutrophication based on CI14 (Chlorophyll *a* concentration in the water column) are applicable and confirm the main status of eutrophication in the coastal area.

Knowledge gaps

111. For Chlorophyll-a:

- There are no main gaps identified in the Mediterranean Sea concerning the assessment of the Common Indicator 14.

- However, significant chlorophyll *a* trends need to be detected from long time series that are able to capture biomass changes in coastal waters, and for that purpose data availability have to be improved.

- A possible approach is to use data stored in other databases were some of the Mediterranean countries regularly contribute. Satellite synoptic measurements for the estimation of chlorophyll *a* concentration trends have the potential to detect anomalous, local biogeochemical processes and to assess the different applications of environmental regulations.

112. **EO7 on Hydrography** is to ensure that the alteration of hydrographic conditions does not adversely affect coastal and marine ecosystems and includes one common indicator:

Common Indicator 15: Location and extent of the habitats impacted directly by hydrographic alterations

Conclusions

113. The EO7 Common Indicator 15 reflects location and extent of the habitats impacted directly by hydrographic alterations due to new developments. The major challenge on deriving concluding remarks for this indicator at the regional level is that the national monitoring programmes are currently being developed for most Mediterranean countries. Therefore, assessment results on this indicator (as proposed in indicator guidance fact sheet) were not available at the national, nor regional level.

114. The findings here were mostly based on literature review of technical assessments on EU countries' reports on hydrographic alterations. However, these reports mainly focus on measurement of trends for certain hydrographic parameters, which is not completely in line with requirement for common Indicator 15. However, the measurement of baseline hydrographic conditions can serve as a baseline for more detailed assessments in the future. Two local scale projects are presented as case studies namely, LNG terminal in Monfalcone Port, Italy; and container terminal Haifa Bay in Israel.

Key messages

115. For hydrography:

- The EO7 Common Indicator 15 considers marine habitats which may be affected or disturbed by changes in hydrographic conditions (currents, waves, suspended sediment loads) due to new developments.

- The national monitoring in Mediterranean countries regarding EO7 has not been initiated yet (except for the Contracting Parties that are EU member states, and their obligation of implementing Descriptor 7 of the Marine Strategy Framework Directive), or it is just being initiated.

- There is no sufficient data to derive conclusions/observe trends on Common Indicator 15 on regional, sub-regional or even national level.

Knowledge gaps

116. For hydrography:

- There are significant knowledge gaps on implementation of the Common Indicator 15. It is a complex multi-parameter indicator. The main knowledge gaps are related to insufficient surveys and monitoring of this indicator on all geographical levels, and lack of sound assessment methodologies. Assessments that estimate the extent of hydrographic alterations (knowing conditions before and after construction) and its intersection with marine habitats are currently rare in the Mediterranean, except for some local studies of Environmental Impact Assessment (EIA) /Strategic Environmental Assessment (SEA).

- There is certainly a lack of hydrographic data with detailed temporal and spatial scale in the Mediterranean Sea (bathymetric data, seafloor topography, current velocity, wave exposure, turbidity, salinity, temperature, etc.), which is one of the main challenges to implement this indicator, in particular to define the base-line conditions. To identify these gaps, a clear inventory of existing and available data in Mediterranean Sea should be done.

- Other difficulties come from the use of numerical model to assess hydrographic alterations

before the structure is built. These tools need substantial data (bathymetry, offshore hydrodynamics data, field data); which can be costly and time-consuming; and their use requires experience and knowledge about the processes and theories involved.

- The link to EO1 is so essential, as map of benthic habitats in the zone of interest (broad habitat types and/or particularly sensitive habitats) is required. Therefore, identifying the priority benthic habitats for consideration in EO7 together assessment of impacts, including cumulative impacts, is a cross-cutting issue of high priority for EO1 and EO7. In addition, effort needs to be given to detect the cause-consequence relationship between hydrographic alterations due to new structures and habitat deterioration.

- To conclude, such an integrated assessment of impacts calls for additional research efforts on habitat modelling, pressure mapping and cumulative impacts, along with monitoring of potentially affected areas.

117. **EO 8 on Coastal ecosystems and landscapes** is to ensure that the natural dynamics of coastal areas are maintained and coastal ecosystems and landscapes are preserved and includes one common indicator:

Common Indicator 16: Length of coastline subject to physical disturbance due to the influence of man-made structures

Conclusions

118. The inclusion of the EO8 Common Indicator aims to address the need for a systematic monitoring in Mediterranean regarding the physical disturbance of coastline due to the influence of manmade structures. On the other hand, it offers very few examples to follow, especially since this indicator has no operationalprecedents in regional ecosystem approach initiatives, such as Helcom or OSPAR, neither in Marine Strategy Framework Directive.

119. Some countries, such as Italy, France and Montenegro, have developed the inventories of the share of their urbanized coastline, while some countries of South and East Mediterranean will begin to do so in frame of the EcAp MED II project.

Key messages

120. For Coastal Ecosystems and Landscapes:

- Mediterranean coastal areas are threatened by intensive construction of buildings and other infrastructure that can impact landscapes, habitats and biodiversity. The national reporting on state and evolution of coastal zones is required by the ICZM Protocol.

- There was no systematic monitoring in Mediterranean regarding coastal artificialization by now. The only country that has implemented the monitoring of the EO8 common indicator on a national level by this moment is Italy, with Montenegro and France performing similar inventories.

- Targets, GES thresholds, measures and interpretation of results regarding this indicator should be left to the countries due to strong nation-specific socio-economic, historic and cultural dimensions and geographical conditions.

Knowledge gaps

121. For Coastal Ecosystems and Landscapes:

- It is difficult to point out the knowledge gaps in this phase since there are so few examples of implementation of the EO8 Common Indicator. However, there are some "known" knowledge gaps that could hinder successful implementation of this indicator.

- First, it is a choice of a fixed reference coastline that each Contracting Party should select in order to assure comparability of results between successive reporting exercises. Unfortunately, it is not unusual to find out that more than one 'official' coastline exists for the same Contracting Party produced with different technological techniques. In addition, coastlines change due to coastal erosion, sea level rise and morphological modifications. If spatial resolution is too low or time period is too long, manmade structures could be poorly identified or completely missed with heavy consequences on the calculation of length of artificial coastline.

122. **EO 9 on Chemical Pollution** is to ensure that contaminants cause no significant impact on coastal and marine ecosystems and human health and includes five common indicators:

Common Indicator 17: Concentration of key harmful contaminants measured in the relevant matrix (EO9, related to biota, sediment, seawater)

Conclusions

123. A main conclusion of this first pollution assessment against assessment criteria performed for heavy metals in the Mediterranean Sea show that environmental conditions differ largely between biota and coastal sediments. This current situation, in terms of environmental protection from chemical pollution and GES achievement, may indicate that the LBS inputs in the coastal surface waters (and/or atmospheric inputs) from both urban or industrial activities exhibita high proportion of values in biota around natural background levels and under the EC criteria. On the contrary, historical heavy metal pollution impacted, clearly, the coastal sediments close to known historical hotspots (both industrial and natural geological point sources) in the Mediterranean Sea.

124. In terms of GES (Good Environmental Status) assessment, the biota (mussel and fish) show a situation where the acceptable conditions exist for coastal surface marine waters with levels below the assessment criteria (i.e. ECs), except for Pb in some mussel monitoring areas. These areas correspond to known coastal sites (hotspots) were measures and actions should be further considered to improve the marine environmental quality. The sediment evaluation in terms of GES show an impacted situation for the coastal benthic ecosystem, especially for HgT, which should be further investigated and assessed against assessment criteria. Therefore, these assessments should consider sub-regional differences in the Mediterranean Sea basins, in terms of natural sources and geological backgrounds. Development of the assessment criteria for sub-regional assessments should be ensured and these initial results should be taken with caution.To this regard, there is a need to consider the relationships between different policy standards and assessment metrics (i.e. WFD, MSFD, etc.) as well.

Key messages

125. For concentration of key harmful contaminants:

- Levels of heavy metals in coastal water show a roughly acceptable environmental status assessed from bivalves and fish against BACs and ECs criteria.

- For Pb a 10% of the stations show levels above the set EC threshold for mussel samples.

- Heavy metal concerns are found in the coastal sediment compartment for Pb and HgT indicating an impact of these chemicals.

- For HgT, a 53% of the sediment stations assessed are above the ERL, set as regional assessment criteria for acceptable environmental conditions for the Mediterranean basin, although sub-regional differences have to be taken into account.

- Measures and actions should focus on known hotspots associated to urban and industrial areas along the coasts of the Mediterranean Sea, as well as to include sea-based sources, as these are also important inputs. Riverine inputs and coastal diffuse run-off play also an important role.

- Background and Environmental Assessment Criteria (BACs and EACs) should be continuously improved to take in consideration sub-regional specificities in the Mediterranean basins for heavy metals and trace elements.

Knowledge gaps

126. For concentration of key harmful contaminants:

- The improvements in the limited spatial coverage, temporal consistency and quality assurance for monitoring activities hinder to some extent the regional and sub-regional assessments, as previously observed (UNEP/MAP/MED POL, 2011a and 2011b). The availability of sufficient synchronized datasets for a state assessment should be improved. To this regard, the evaluation performed have further shown the necessity to explore the new criteria at sub-regional scale for the determination of background concentrations of those chemicals occurring naturally, such a Pb in sediments. However, there are important gaps in the selection and measure of emerging contaminants, an issue that may be addressed by monitoring programmes. There is also a need to know the level of contaminants in deep-sea environments, and the dynamic of inputs, streams and distribution of contaminants, to be able to link sources, input entrances and environmental status. Two recent reports (UNEP/MAP MED POL, 2016a and 2016b) have reviewed and proposed updated background assessment criteria (BACs) for the Mediterranean Sea. These reports were built in line with the 2011 reports (UNEP/MAP MED POL, 2011a and 2011b).

- The current spatial assessment covered different periods according the most recent data available, despite the number of datasets did not increased significantly the potential for the evaluation of temporal trends. At present, the major studies are performed in coastal populations of marine bivalves (such as *Mytilus galloprovincialis*), fish (such as *Mullus barbatus*) and sediments. Bioaccumulation on large predator fish stocks may represent a concern that still needs to be properly addressed by ad hoc monitoring activities. Sediment sieving and normalization factors also require proper standardization to improve the comparability of monitoring data in sediments.

Common Indicator 18: Level of pollution effects of key contaminants where a cause and effect relationship has been established

Conclusions

127. The ongoing research developments and controversy with regard biological effects and toxicological methods (ca. confounding factors) is one of the main reasons for the slow implementation of these techniques in marine pollution monitoring programs in the Mediterranean Sea, although as mentioned, some are proposed within the framework of the MED POL Programme. At present, in many Mediterranean countries, different research programmes and projects leaded by universities, research centers and government agencies are undergoing and will be the providers of the future quality assured and reliable measurements, as well as new tools, to guarantee the correct implementation of a biological effects programme to assess the Common Indicator 18 in the Mediterranean Sea. Both biological effects parameters and contaminants concentration measurements need to take into consideration these biological factors, as they affect directly the responses and bioaccumulation of marine organisms, respectively. It is recommended to make the assessments in the same period each time, selecting the period of more physiologic stability of the species.

128. Assessing biological effects in a similar manner to contaminant concentrations, the ICES/OSPAR has proposed three categories (two threshold criteria), and it has been the framework to evaluate the Mediterranean Sea MED POL datasets. Assessing biomarker responses against BACs and EACs allows establishing if the responses measured are at levels that are not causing deleterious biological effects, at levels where deleterious biological effects are possible or

at levels where deleterious biological effects are likely to occur in the long-term. In the case of biomarkers of exposure, only BAC can be estimated, whereas for biomarkers of effects both BAC and EAC can be established. However, unlike contaminant concentrations in environmental matrices, biological responses cannot be assessed against guideline values without consideration of factors such as species, gender, maturation status, season and temperature.

129. It is important to point out that a few BACs for biomarkers of exposure and effects (Stress on Stress, Acetylcholinesterase activity-AChE and Miclonuclei Frequency) have been determined for the Mediterranean Sea (mussel) and proposed to the Contracting Parties for use on indicative purpose in pilots. However, the biological responses cannot be assessed against guideline values without strong consideration of confounding factors. To this regard, ensuring systematic and accurate long-term monitoring of the bioaccumulation of chemical contaminants in biota has been addressed for many decades now. The monitoring strategy minimizes the environmental variability (e.g. sampling month (pre-spawning), pooling of samples, calculation of condition factors, etc.). For biological effects, however, these confounding factors are difficult to control in the field, as well as the combination of them, which affect the organisms' responses and their uncertainty in relation to the cause-effect pollution relationship, an issue which still need to be addressed.

Key messages

130. For pollution effects of key contaminants:

- Biological effects monitoring tools still in a research phase for biomarker techniques (i.e. method uncertainty assessments and confounding factors evaluations) which limits the implementation of these tools in the long-term marine monitoring networks.
- Lysosomal Membrane Stability (LMS) as a method for general status screening, Acetylcholinesterase (AChE) assay as a method for assessing neurotoxic effects and Micronucleus assay (MN) as a tool for assessing cytogenetic/DNA damage in marine organisms have been selected as primary biomarkers.

Knowledge gaps

131. For pollution effects of key contaminants:

- Important development areas in the Mediterranean Sea over the next few years should include: confirmation of the added value of these batteries of biomarkers in long-term marine monitoring as 'early warning' systems; test of new research-proved tools such as 'omics', analytical quality harmonization, development of suites of assessment criteria for the integrated chemical and biological assessment methods, and review of the scope of the biological effects monitoring programmes.
- Through these and other actions, it will be possible to develop targeted and effective monitoring programmes tailored to meet the needs of CI18 within the IMAP implementation and GES assessments.

Common Indicator 19: Occurrence, origin (where possible), extent of acute pollution events (e.g. slicks from oil, oil products and hazardous substances), and their impact on biota affected by this pollution

Conclusions

132. The rates of accidents have gone down globally and regionally despite the increase in shipping transportation and it can be concluded that the impact of the international regulatory framework adopted through the IMO as well as technical cooperation activities undertaken at

regional level is very positive, especially as far as prevention of accidental pollution is concerned. However, risks associated with the transport by ships of oil and HNS with possible harmful consequences on biota and ecosystems cannot be completely eliminated, especially in vulnerable areas such as the Mediterranean Sea. In addition, efforts have to be made to strengthen monitoring and reporting of illicit discharges from ships.

133. Decrease of pollution occurrences globally: Accidents rates have gone down globally and regionally despite the increase in shipping transportation. Accidental pollution from both oil and HNS has decreased which can be related to the adoption and implementation of environmental maritime conventions addressing oil and HNS pollution prevention, preparedness and response. Indeed, statistical analysis indicates that there is a correlation between the period where the IMO regulatory framework was put in place (in the 70') and the years when this downward trend started to happen (in the 80'). It can therefore be concluded that the impact of the international regulatory framework adopted through the IMO as well as technical cooperation activities undertaken at regional level is very positive, especially as far as prevention of accidental pollution is concerned. However, the issue of illicit discharges from ships remains of concern, especially in semi-enclosed areas where the ability of the marine environment to regenerate is less likely to happen.

134. Oil pollution long-term effects: It is also important to keep in mind that recovery of habitats following an oil spill can take place from between a few seasonal cycles (plankton) to several years (within one to three years for sand beaches and exposed rocky shores; between 1 and 5 years for sheltered rocky shores; between 3 and 5 years for saltmarshes; and up to 10 years or greater for mangrove).According to ITOPF, while considerable debate exists over the definition of recovery and the point at which an ecosystem can be said to have recovered, there is broad acceptance that natural variability in ecosystems makes a return to the exact pre-spill conditions unlikely. Most definitions of recovery instead focus on the re-establishment of a community of fora and fauna that is characteristic of the habitat and functions normally in terms of biodiversity and productivity. Therefore, despite the progress achieved in mitigating oil spill incidents from ships, it is clear that continuous monitoring of illicit discharges occurrences as well as cumulative effects and impacts, and continuous monitoring of accidental post-spill consequences on biota and ecosystems are needed.

Key messages

135. For acute pollution events:

- Chronic sources (illicit discharges) of pollution into the marine environment from ships are the principal target for pollution reduction, as the trends for acute pollution (accidents) are controlled and decreasing.

Knowledge gaps

136. For acute pollution events:

- The information collected via pollution reports is related to specific pollution events and not always useful or compatible with the information needed to assess the status of the marine environment.

- Maintaining the Mediterranean Alerts and Accidents Database is a prerequisite and the condition for being able to measure Common Indicator CI19.

- There is no obligation for countries to carry out environmental surveys of sea and shorelines affected by a spill. Systematic environmental shorelines assessment post spill is today

recognised as a "must do" practice and can provide information on biota on a case by case basis.

- Very little data is available regarding illegal discharges from ships.

- Environmental monitoring and reporting: the focus of IMO conventions and guidelines relating to prevention of marine pollution is on ships' compliance monitoring rather than on monitoring or measuring the state of the marine and coastal environment. The same can be noted with respect to reporting obligations. Reporting is required in the case of an accident causing pollution or in case of an illegal pollution is discovered (operational discharges). This perspective is reflected in the 2002 Prevention and Emergency Protocol. Therefore, the information collected is related to specific pollution events and not always useful or compatible with the information needed to assess the status of the marine environment.

- Accidents monitoring and reporting: there is an increase in the number of accidents reported to REMPEC, which is most likely due to a better compliance by the Contracting Parties to the Barcelona Convention to report casualties, as required by Article 9 of the 2002 Prevention and Emergency Protocol. It is of utmost importance that the Contracting Parties to the Barcelona Convention continue to report on accidents as accurately as possible, as it is paramount that REMPEC continues to maintain the Mediterranean Alerts and Accidents Database to keep track of pollution events. This is a prerequisite and the condition for being able to measure Common Indicator CI19.

- Impact on biota affected by pollution: for the reason explained above, there is little information on the impact of pollution events caused by shipping on biota. Ship generated pollution impact is usually considered from a response perspective (protection of sensitive areas and facilities). There is no obligation for countries to carry out environmental surveys of sea and shorelines affected by a spill. However, systematic environmental shorelines assessment post spill is today recognised as a "must do" practice in terms of assessing the level of cleanliness of the affected area, as well as from a remediation perspective.

- Illicit discharges from ships: There is very little data is available regarding discharges from ships. As these are illegal operations by nature (when not within the limits set by MARPOL), it is extremely difficult to get information on occurrences and extent of spills. Marine surveillance requires aerial means and equipment (planes, airborne radars and sampling sets) or special technology such as the use of satellite images. There is no regionally centralised system for surveying the Mediterranean waters as defined in the Barcelona Convention. The CleanSeaNet platform, the European satellite-based oil spill monitoring and vessel detection service, is a good resource, but only available in principle to countries that are Members States of the European Union.

Common Indicator 20: Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood

Conclusions

137. At present, few research studies and EU policy driven reports (ca. MSFD) in some Mediterranean countries have investigated the occurrence of contaminants in seafood from an environmental perspective (ca. Ecosystem Approach), which are exceeding the maximum regulatory levels established within regulatory standards. Overall, from available studies, no major significant concerns or extreme high levels were observed within these recent research studies by different authors and no confirmation based on temporal trends have been performed yet.

138. For future assessments within this indicator, the GFCM-FAO defined areas in the

Mediterranean Sea (Area 37 and their subdivisions), could be selected and assessed under different national strategies, although harmonized at a regional scale, to evaluate contaminants in commercial species to assess CI20 under IMAP. A recent study with tuna (Thunnusthynnus) in Mediterranean FAO areas, shown that residues of PCBs and PBDEs are present. The study concludes that the Mediterranean area show the highest levels for these chemical compounds compared to other evaluations in FAO areas worldwide (Chiesa et al., 2016).

Key messages

139. For acute levels of contaminants:

- Regular datasets are unavailable to perform an assessment of the Common Indicator 20.
- Chemical contaminants occurrence in fish and shellfish and the possible intake scenarios for population have been studied in different locations, including some of the FAO delimited zones in the Mediterranean Sea for a number of legacy and emerging contaminants within research studies.
- Pelagic, demersal and benthic species have been targeted and investigated to assess GES in terms of potential seafood contamination and to reflect the health condition of the marine ecosystem.

Knowledge gaps

140. For acute levels of contaminants:

- The regular information required to assess this indicator is clearly lacking on a regional scale (ca. comparable and quality assured data), and at sub regional scale to some extent to be able to perform a complete assessment.
- Monitoring protocols, risk-based approaches, analytical testing and assessment methodologies would need to be further developed focusing on the harmonization between Contracting Parties. The liaison with national food safety authorities, research organizations and/or environmental agencies will be required.

Common Indicator 21: Percentage of intestinal enterococci concentration measurements within established standards

Conclusions

141. The implementation of measures (e.g. sewage treatment plants) to reduce, among others, the fecal pollution in coastal waters, has been a story-of-success in the Mediterranean Sea through the UN Mediterranean Action Plan. The generalization of the domestic waters depuration in a number of countries the latest decade has demonstrated the benefits of implementing the LBS protocol and environmental measures to reduce pollution, despite some few improvements still need to be taken.

Key messages

142. For intestinal enterococci concentration:

- An increasing trend in measurements is needed to be able to test that levels of intestinal enterococci comply with established standards for GES achievement under Common Indicator 21.

Knowledge gaps

143. For intestinal enterococci concentration:

- The lack of recent datasets on microbiological pollution in the Mediterranean Sea submitted to the MAP Secretariat is the main current gap and concern, and therefore, to be able to monitor the future progresses under the Common Indicator

144. **EO 10 on Marine litter** aims to assess that marine litter does not adversely affect the coastal and marine environment and includes two common indicators:

Common Indicator 22: Trends in the amount of litter washed ashore and/or deposited on coastlines

Conclusions

145. Knowing the amounts of marine litter found stranded on beaches can help us assess the potential harm to the environment and would also enhance our knowledge on sources (JRC, 2013). Currently there is limited data and great spatial variability on the amounts and composition of marine litter reflecting the different characteristics along the shorelines of the Mediterranean.

146. Existing studies however indicate that the main types of beach litter are of land-based origin, coming from poor waste management practices, recreational and tourism activities, household items and smoking related waste (Table 4). For the time being, it is difficult to draw conclusions regarding the overall increase or decrease of marine litter in the Mediterranean (UNEP/MAP, 2015). Assessments of the composition of beach litter in different regions of the Mediterranean Sea show that synthetic polymer items (bottles, bags, caps/lids, fishing nets, and small pieces of unidentifiable plastic and polystyrene) make up the largest proportion of overall marine litter pollution.

147. The amount of marine litter originating from recreational/tourism activities greatly increases during and after the tourism season. Smoking related wastes in general also seems to be a significant problem in the Mediterranean, as several surveys suggest (UNEP 2009). According to the analysis of data collected, shoreline and recreational activities were the main source every year during the last decade, until it was surpassed by smoking-related waste (UNEP, 2011). In addition, the fishing industry is a significant source, as well as the shipping industry, especially off the African coast (UNEP, 2013).

148. National case studies may provide more detailed information on local constraints and effective factors related to the distribution of marine litter. National data coming from national monitoring programmes on marine litter will also improve the picture for beach marine litter. It is important to note, that volunteer groups should be informed about the necessity to submit standardized research data for statistical purposes. Clean up actions by NGOs are usually organized to raise awareness and not so much for data collection, and cleanup programmes should increase public knowledge of the scientific relevance of information and information sharing.

149. There are certain limitations to the results on beach marine litter in the Mediterranean. As it has been already stated for the moment the Contracting Parties are not submitting official marine litter data to the Secretariat as a result of the national monitoring programmes. The smaller sized items are not included in most of the case among the cleanup campaigns items list and thus these results are not at all representative for the presence of smaller fragments i.e. micro-litter along the beaches in the Mediterranean.

150. However, interesting observations have been made on the proliferation of lighter marine litter items in the Mediterranean (plastics, aluminum and smoking-related litter), as opposed to heavier items from basic use (bottles, cans, see Figure 3) or marine litter originating from dumping activities (household appliances, construction materials, tires, etc.). This could be related to the efficiency of preventive actions (easier collection, recycling, adoption and/or implementation of stricter legislation with regards to dumping activities, etc.) for larger items and the difficulty to manage inputs from sources such as the general public.

Key messages

151. For trends in the amount of litter washed ashore and/or deposited on coastlines:

- Information on beach marine litter exists but the picture is still fragmented and is geographically restricted to the northern part of the Mediterranean.
- Plastics are the major components with cigarette butts, food wrappers and plastic bags being the top marine litter items.
- Land-based sources are predominant but they have to be further specified. Tourism is directly affecting marine litter generation on beaches.
- There is an urgent need to develop and implement the Integrated Monitoring and Assessment Programme for the Mediterranean Sea and Coast (IMAP) related to Common Indicator 22, and corresponding data are submitted to the Secretariat at national level.

Knowledge gaps

152. For trends in the amount of litter washed ashore and/or deposited on coastlines:

- Information on the distribution, quantities and identification of marine litter sources for beach marine litter needs to be further advanced. For the moment information and data are inconsistent for the Mediterranean.
- In that aspect, monitoring strategies should be encouraged at regional level based on harmonized and standardized monitoring and assessment methods.
- Mapping of the shorelines and coasts at basin scale, where marine litter accumulates, needs to be implemented.
- Accumulation and stranding fluxes needs to be evaluated coupled with information on corresponding loads and linkage with specific sources.
- Efforts should be enhanced towards engaging citizens, informing them about certain aspects and effects of marine litter found stranded on beaches, along with make responsible citizens (responsible consumption and littering behavior).
- Harmonized beach clean-up campaign at basin scale should be organized based on a science-based protocol which will enable the collection of relevant scientific information.

Common Indicator 23: Trends in the amount of litter in the water column including microplastics and on the seafloor

Conclusions

153. Plastic is the main component of floating marine litter and also for those lying on the Mediterranean seafloor, from shallow water, the continental shelf, till the deep abyssal plains. Regarding marine litter (floating and on seafloor) that are accumulating in the Mediterranean basin, no safe conclusion can be drawn for the moment. Probably hydrodynamics and geomorphology favor the constant circulation. More consistent, interconnected and interlinked studies need to be promoted in order to have a better picture at basin scale. The comparability of the existing and future studies seems to be a key point towards an integrated assessment at basin scale. The Mediterranean Sea is heavily impacted by floating marine litter items, giving concentrations comparable to those found in the 5 sub-tropical gyres. Moreover, the seafloor seems to be the final global sink for most marine litter items with densities ranging from 0 to over 7,700 items per km². The deep-sea canyons are of particular concern as they may act as a conduit for the transport of marine litter into the deep sea. As in any other marine litter cases, the human activities (fishing, urban development, and tourism) are primarily responsible for the increased abundance of marine litter items in the Mediterranean Sea.

154. Marine litter and mainly plastics are present in the Mediterranean basin from the shallow water, the continental shelf, till the abyssal plains, in all different sea compartments and basins and thus, posing an important problem for the marine environment. Unfortunately, so far, we do not have a clear picture regarding the areas in the Mediterranean where the accumulation of marine litter and plastics is significant although several ongoing studies try to give a clearer picture. The Eastern Mediterranean is certainly the least studied of the three compartments (western, central, eastern).

155. The Mediterranean Sea is very peculiar as there are no areas where marine litter permanently accumulate. Instead, the constant circulation is favored. The picture is fragmented as only through nonrecurring studies information becomes available and this is not enough to drawn safe results or even to partially assess the situation. In addition, information on floating and seafloor marine litter is only available for the northern part of the Mediterranean Sea. The combination of the last two points makes the assessment of floating and seafloor marine litter in regional scale almost impossible.

156. Floating Marine Litter: Once floating litter has entered into the marine environment, the hydrographic characteristics of the basin may play an important role in its transport, accumulation, and distribution. Atlantic surface waters enter the Mediterranean Sea through the strait of Gibraltar and circulate anticlockwise in the whole Algero-Provencal Basin, forming the so-called Algerian Current, which flows until the Channel of Sardinia and most often leads to the generation of a series of anticyclonic eddies 50–100 km in diameter wandering in the middle basin (UNEP/MAP, 2015). Despite not being permanent, these mesoscale features could act as retention zones for floating litter and would help explain the high litter densities found in the central Algerian basin at around 80 nautical miles from the nearest shore. For the southern Adriatic Sea, it should be noticed that about one-third of the total mean annual river discharge into the whole Mediterranean basin flows into this basin, particularly from the Po River in the northern basin and the Albanian rivers (UNEP, 2012).

157. The highest densities found in the Adriatic Sea and along the North-western African coast are related to some of the heaviest densities in coastal population of the entire Mediterranean basin (UNEP/MAP 2015). The Adriatic Sea has more than 3.5 million people along its shores, which along with fisheries and tourism seems to be the most significant sources for floating marine litter in the region. In addition, the significant cyclonic gyres which are found in the central and

southern Adriatic Sea (Suaria and Aliani, 2014), are favoring the retention of floating marine litter in the middle of the basin. This is also the Case in the Northeastern part of the Aegean Sea, where densities of floating litter are higher due to circulating waters and Black sea/Mediterranean Sea water exchanges.

158. Coastal population is an important aspect also for the North African countries in particular also have the highest rates of growth in coastal population densities, including touristic densities. Algeria, for instance, has a coastal population that has increased by 112% in the last 30 years, and it currently represents one of the most densely populated coastlines in the whole basin (UNEP, 2009). In addition, it should be noted that in some countries appropriate recycling facilities have not been fully implemented yet, and the cost of proper solid waste disposal is still often beyond their financial capacity (UNEP, 2009). Suaria and Aliani (2014), demonstrated that 78% of all sighted objects were of anthropogenic origin, 95.6% of which were petrochemical derivatives (i.e. plastic and Styrofoam). The authors then evaluated the number of macro-litter items currently floating on the surface of the whole Mediterranean basin to be more than 62 million.

159. As for anthropogenic litter accumulating in oceans gyres and convergence zones, the existence of Floating Marine Litter accumulation zones is a stimulating hypothesis, as their presence was supported recently (Mansui et al., 2015). The existence of one or more ''Mediterranean Garbage Patches'' should be investigated in more detail, as there are no permanent hydrodynamic structures in the Mediterranean Sea where local drivers may have a greater effect on litter distribution (CIESM, 2014).

160. Seafloor Marine Litter: The deep-sea floor is probably the final global sink for most marine litter and there are several areas in the Mediterranean for which marine litter have been recorded in densities exceeding 1000 items/km2 (i.e. Gulf of Lions, Catalan Coast, Murcian Coast, Corsica, Saronikos Gulf, Antalya Coast). However, long-term data is scarce for the Mediterranean Sea. Density of litter collected on the sea floor between 1994 and 2014 in the Gulf of Lion (France), does not clearly show any significant trends with regards to variations in marine litter quantities (Galgani, 2015). In another example in Greece (Gulf of Patras, Echinades Gulf) albeit the increase of marine litter abundance plastic percentage seems to remain stable over the years. In much deeper marine environments, Galgani et al. (2000) observed decreasing trends in deep sea pollution over time off the European coast, with extremely variable distribution and litter aggregation in submarine canyons.

161. The abundance of plastic litter is very location-dependent, with mean values ranging from 0 to over 7,700 items per km². Mediterranean sites tend to show the highest densities, due to the combination of a populated coastline, coastal shipping, limited tidal flows, and a closed basin with exchanges limited to Gibraltar. In general, bottom litter tends to become trapped in areas with low circulation, where sediments accumulate.

162. Only a few studies have focused on litter located at depths of over 500 m in the Mediterranean (Galil, 1995; Galgani et al., 1996, 2000, 2004; Pham et al., 2014; Ramirez-Llodra et al., 2013). Submarine canyons may act as a conduit for the transport of marine litter into the deep sea. Higher bottom densities are also found in particular areas, such as around rocks and wrecks, and in depressions and channels. In some areas, local water movements carry litter away from the coast to accumulate in high sedimentation zones. The distal deltas of rivers may also fan out into deeper waters, creating high accumulation areas.

163. A wide variety of human activities, such as fishing, urban development, and tourism, contribute to these patterns of seabed litter distribution. Fishing litter, including ghost nets, prevails in commercial fishing zones and can constitute a considerable share of total litter. It has been estimated that 640,000 tons of ghost nets are scattered overall in the world oceans, representing 10% of all marine litter (UNEP, 2009). More generally, accumulation trends in the

deep sea are of particular concern, as plastic longevity increases in deep waters and most polymers degrade slowly in areas devoid of light and with lower oxygen content.

Key messages

164. For trends in the amount of litter in the water column:

- The abundance of floating litter in Mediterranean waters has been reported at quantities measuring over 2 cm range from 0 to over 600 items per square kilometer (Aliani et al., 2003; UNEP, 2009; Topcu et al., 2010, Gerigny et al., 2011, Suaria and Aliani, 2015).

- The 2015 UN Environment/MAP Marine Litter Assessment report states that approximately 0.5 billion litter items are currently lying on the Mediterranean Seafloor. Moreover, there is great variability in the abundance of seafloor marine litter items ranging from 0 to over 7,700 items per km² depending on the study area.

- However, the information on floating and seafloor marine litter in the Mediterranean is fragmented and is spatially restricted mainly to its northern part. To this extent, no basin-scale conclusions can be exerted and information is only available at local level.

- There are many areas with significant marine litter densities, ranging from 0 to over 7,700 items per km² depending on the study area. Plastic is the major marine litter component, found widespread in the continental shelf of the Mediterranean, ranging up to 80% and 90% of the recorded marine litter items.

Knowledge gaps

165. For trends in the amount of litter in water column:

- Research and monitoring have become critical for the Mediterranean Sea, where information is inconsistent. UN Environment/MAP-MED POL (2013), MSFD (Galgani et al., 2011), the European project STAGES (http://www.stagesproject.eu), and CIESM (2014) recently reviewed the gaps and research needs of knowledge, monitoring, and management of marine litter. This requires scientific cooperation among the parties involved prior to reduction measures due to complexity of issues.

- Accumulation rates vary widely in the Mediterranean Sea and are subject to factors such as adjacent urban activities, shore and coastal uses, winds, currents, and accumulation areas. Additional basic information is still required before an accurate global litter assessment can be provided. Moreover, the available data are geographically restricted in the northern part of the Mediterranean Sea.

- For this, more valuable and comparable data could be obtained by standardizing our approaches. In terms of distribution and quantities, identification (size, type, possible impact), evaluation of accumulation areas (closed bays, gyres, canyons, and specific deep-sea zones), and detection of litter sources (rivers, diffuse inputs), are the necessary steps that would enable the development of GIS and mapping systems to locate hotspots.

- An important aspect of litter research to be established is the evaluation of links between hydrodynamic factors. This will give a better understanding of transport dynamics and accumulation zones. Further development and improvement of modelling tools must be considered for the evaluation and identification of both the sources and fate of litter in the marine environment. Comprehensive models should define source regions of interest and accumulation zones, and backtrack simulations should be initiated at those locations where monitoring data are collected.

- For monitoring, there is often a lack of information needed to determine the optimum sampling strategy and required number of replicates in time and space. Moreover, the comparability of available data remains highly restricted, especially with respect to different size class categories, sampling procedures, and reference values.

- Data on floating and seafloor marine litter are inconsistent and geographically restricted in only few areas of the Mediterranean Sea. In addition to that, the lack on long-term assessment data makes the assessment of trends of the years extremely difficult. Sources needs also to be further specified and linked to macro- and micro-litter contribution. Moreover, monitoring and assessment of marine litter should be done in a consistent way, based on common protocols and standardized methods, leading to comparable results at basin scale. Effective management practices are also missing, requiring strong policy will and societal engagement. Further work should also be promoted towards identifying marine litter sources more precisely. Cooperation and collaboration between the major marine litter partners in the region with common priority actions is also considered important.

B) **Recommendations for the Further Implementation of the Ecosystem Approach Road Map**

Implementation of the IMAP at national and where applicable sub-regional level

1. Implementation of IMAP at national level needs to be strengthened through generation of specified data-deriving from implementation of the updated integrated national monitoring and assessment programme.

2. Contracting Parties need to improve their regular reporting to a fully-fledged and operational InfoMAP System of quality-assured and comparable national data in specified common formats, as a prerequisite for more complete future assessment products (2023 MED QSR).

3. Contracting Parties need to ensure their experts have sufficient resource (especially time) and mandate to contribute to the preparation of the 2023 Mediterranean QSR, including assessment and interpretation of the data to produce regional and sub-regional assessments for the Common Indicators.

Towards the Fully Data-Based 2023 MED QSR: Filling the Data Gap

4. **Acknowledging findings, needs and gaps identified in 2017 MED QSR, the following directions are recommended:**

General directions

– Harmonize and standardize monitoring and assessment methods.
– Improve availability and ensure long time series of quality assured data to monitor the trends in the status of the marine environment.
– Improve availability of the synchronized datasets for marine environment state assessment, including use of data stored in other databases were some of the Mediterranean countries regularly contribute.
– Improve data accessibility with the view to improve knowledge on the Mediterranean marine environment and ensure that Info-MAP System is operational and continuously upgraded, to accommodate data submissions for all the IMAP Common Indicators.

Biodiversity

– Improve knowledge on distributional range, extent and condition of habitats, as well as on the pressures affecting them, their spatial distribution and potential cumulative effects, leading to structured data-led assessments of environmental status of the Mediterranean's marine habitats.
– Define the reference state of habitats and species as well as a target threshold value to achieve at the national and sub-regional levels.
– Improve information on distribution, population abundance and demographic characteristics of key species (marine birds, mammals, reptiles, fish and cephalopods) and on the condition of their habitats, as well as on the pressures affecting them, leading to structured data-led assessments of environmental status of the Mediterranean's marine species.
– Work to further improve the assessment criteria, when feasible, for those habitats and species based on adequate data availability.
– Develop a specific roadmap, in line with Decision IG20/4, for the upcoming CORMONs to discuss, on how to further develop Ecological Objectives, which are currently not part of

IMAP, namely Ecological Objective 4 "Food webs" and Ecological objective 6 "Sea-flor integrity".

− Better estimate the abundance and rates of introduction of new non-indigenous species and, where possible, the distribution or presence of invasive alien species, through elaboration of dedicated monitoring according to the possibilities and resources that exist.

− Provide for sound conclusions with regard to impacts of non-indigenous species, based on experiments or ecological modelling.

Coast and Hydrography

− Enhance human and technical capacities for monitoring and assessment of the coast and hydrography.

− Fill the knowledge and scientific gaps (e.g. impacts of hydrographic alterations to habitats).

− Further develop the indicator on land use change with the view to be included in the Common Indicators list.

Pollution and Litter

− Review the scope of the biological effects monitoring programmes and confirm the added value of biomarkers in long-term marine monitoring as 'early warning' systems.

− Further develop harmonized monitoring protocols, risk-based approaches, analytical testing and assessment methodologies for monitoring levels of the contaminants in commonly consumed sea food.

− Test new research-proved tools for monitoring toxic effects.

− Develop region-wide harmonized criteria for reference condition and threshold/boundaries values for key nutrients in water column, taking account of available standards for coastal waters.

− Develop assessment criteria for integrated chemical and biological assessment methods.

− Continue the work on underwater noise and its impact on marine fauna, in close collaboration with the relevant bodies, especially ACCOBAMS.

− Improve knowledge on Emerging Chemicals.

− Ensure testing of the Background Assessment Criteria (BACs) and Environmental Assessment Criteria (EACs) and thresholds application on a trial basis in interested countries and regional and sub-regional level.

− Application of the BACs and EACs as an evolving process to be updated on a continuous basis, their further update and refinement need to be ensured as to take into account new available data, as well as sub-regional specificities in the Mediterranean basins.

− Sea-based sources of litter should be further analyzed and specified, given the fact that Mediterranean is a global hotspot for maritime transport and sea-based tourism such as cruises.

− Follow up development of harmonized and standardized monitoring and assessment methods for marine litter and its impacts, including through active participation of MAP in relevant processes such as the ongoing work of MSFD Technical Group on Marine Litter. Such methods would facilitate and be used for monitoring the implementation of the Regional Action Plan against marine litter and of achievement of the 20% reduction target (by 2024) established by COP 19 Decision on marine litter, including enhancement of the identification and evaluation of marine litter accumulation (stranding fluxes, loads and linkage with specific sources) and hotspots using GIS and mapping systems and modelling tools, as well understanding of transport dynamics and accumulation zones.

Advancing the Implementation of the Ecosystem Approach Road Map

5.   Ensure strengthened implementation of the existing measures under the legal framework of the Barcelona Convention and its Protocols, acknowledging its key importance for achieving/maintaining Good Environmental Status (GES) of the Mediterranean Sea and Coast.

6.   Continue the work on the implementation of the Ecosystem Approach Roadmap, with a particular focus on full implementation of IMAP, including national level of implementation, data collection, reporting and assessment and further development of thresholds and assessment criteria.

7.   Taking into consideration the key findings of the 2017 MED QSR and of the 2017 Regional Measures Analysis, the Secretariat to undertake, in consultation with the Contracting Parties, an initial reflection on the next steps of the Ecosystem Approach Roadmap implementation beyond 2021. This will address in particular the elaboration of new/updated measures required to achieve Good Environmental Status in the context of the SDGs, as well as synergies with other assessment processes such as the Assessment of Assessments process, the UNEP Global Environment Outlook, Regional Seas and, where appropriate, the EU MSFD.

Annex II
IMAP Updated Assessment Criteria for Contaminants and Biomarkers

I. Revised pollution assessment criteria

A)   Mediterranean BAC Levels for Trace Metals in Sediments and Biota

Table 1(a): Mediterranean BAC Levels for Trace Metals in Sediments

Contaminant	Sediments (μg/kgd.w.)
Cd	127.5
Hg	79.5
Pb	25425

Note: Table 1(a) presents the new proposed Med BAC assessment criteria calculated for heavy metals in sediments (Cd, Hg, Pb) using the reference stations from the MED POL national monitoring networks submitted to the Secretariat until 2012, as well as the datasets submitted by Contracting Parties in 2015.

Table 1(b): Mediterranean BAC Levels for Trace Metals in Mussels and Fish

Contaminant	Mussels (*Mytilus galloprovincialis*) (μg/kg d.w.)	Fish (*Mullus barbatus*) (μg/kgf.w.)
Cd	1095.0	3.7[*]
Hg	173.2	101.2
Pb	2313	31[*]

[*]Cd and Hg values show mainly below detection limits in fish flesh tissue, liver tissue is recommended. d.w.: dry weight, f.w.: fresh weight

Note: Table 1(b) presents the new proposed Med BAC assessment criteria calculated for heavy metals in biota (mussel and fish) for Cd, Hg, Pb using the reference stations from the MED POL national monitoring networks submitted to the Secretariat until 2012, as well as the datasets submitted by Contracting Parties in 2015. The metrics have been changed to match standards (e.g. fresh weight for fish data) which allow comparison with other relevant lists.

B)   Mediterranean EAC Levels for Trace Metals in Sediments and Biota

Table 2. Mediterranean EAC Levels for Trace Metals

Contaminant	[a]Mussels (*Mytilusgalloprovincialis*) (μg/kg d.w.)	[b]Sediments (μg/kg d.w.)	[a]Fish (*Mullus barbatus*) (μg/kgf.w.)
Cd	5000	1200	50
Hg	2500	150	1000
Pb	7500	46700	300

[a]EC/EU 1881/2006 and 629/2008 Directives for maximum levels for certain contaminants in food stuffs
[b]Long et al. 1995 (idem OSPAR adopted values)

Note: Table 2 provides the revised ECs and ERLs values for heavy metals in biota (mussels and fish) and sediments in line with the EC/EU 1881/2006 and 629/2008 Directives for maximum levels for certain contaminants in foodstuffs and Effects Range Low (US ERLs), respectively. These proposed values serve for indicative purposes to evaluate the environment and should be revised when toxicological data will be available.

C)   **Mediterranean BAC Levels for Organic Compounds in Sediments and Biota**

Polycyclic Aromatic Hydrocarbons (PAHs) in Mussels

Table 3(a): Mediterranean BAC Levels for Polycyclic Aromatic Hydrocarbons

PAH compound	Mussels (µg/kgd.w.)
Fluorene	2.5
Phenantrene	17.8
Anthracene	1.2
Fluorantene	7.4
Pyrene	5.0
Benz[a]anthracene	1.9
Chrysene	2.4
Benzo[k]fluoranthene	1.4
Benzo[a]pyrene	1.2
Benzo[ghi]perylene	2.3
Dibenz[a,h]anthracene	1.3
Indene[123-c,d]pyrene	2.9

Note: Table 3(a) presents the new calculated Mediterranean Background Assessment Criteria (BACs) for PAHs in biota using the reference stations datasets submitted by Contracting Parties in 2015.

Organochlorinated Compounds in Sediments

Table 3(b): Mediterranean EAC Levels for Organochlorinated Compounds based on the respective OSPAR values[10]

Contaminant	Sediments (µg/kg d.w.)
CB28	1.7
CB52	2.7
CB101	3.0
CB105	-
CB118	0.6
CB138	7.9
CB153	40
CB156	-
CB180	12

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[10]Table 3(b) shows the ERLs for Polychlorinated Biphenyls (PCBs) to serve as the initial assessment criteria that are based on the respective OSPAR criteria. It complements Table 5 (b) of IMAP Decision IG. 22/28.

D) Mediterranean BAC and EAC Levels for Biomarkers

Table 4: Mediterranean BAC and EAC Levels for Biomarkers[11]

Biomarkers/Bioassays	BAC levels in Mussels (*Mytilus galloprovincilais)* (µg/kg d.w.)	EAC levels in Mussels (*Mytilus galloprovincilais)* (µg/kgd.w.)
Stress on Stress (days)	11	5
Metallothioneins (µg/g digestive gland)	247	
Micronuclei frequency (0/00) in haemocytes)	1.0	

II. Assessment criteria maintained as in IMAP Decision IG.22/7 for indicative purposes, already approved by COP 19

1) Mediterranean EAC Levels for Organic Compounds

Polycyclic Aromatic Hydrocarbons (PAHs)

Table 5(a) of IMAP Decision IG. 22/7: Mediterranean EAC Levels for Polycyclic Aromatic Hydrocarbons based on respective OSPAR adopted values

PAH compound	Mussels – OSPAR ECs (µg/kg d.w.)	Sediments – OSPAR ERLs (µg/kg d.w.)
Fluorene	-	-
Phenantrene	1700	240
Anthracene	290	85
Fluorantene	110	600
Pyrene	100	660
Benzo[a]anthracene	80	261
Chrysene	-	384
Benzo[k]fluoranthene	260	-
Benzo[a]pyrene	600	430
Benzo[ghi]perylene	110	85
Indene[123-c,d]pyrene	-	240

ECs: EC/EU 1881/2006 and 629/2008 Directives for maximum levels for certain contaminants in food stuffs; ERLs: Effects Range Low.

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[11]Table 4 shows the the new calculated BACs and revised EACs for Stress on Stress (SOS) and Micronuclei Frequency (MN) to serve as the initial assessment criteria. It includes also Metallothioneins (MT), although the latter has not been included as a primary biomarker under IMAP. These proposed values were calculated using datasets from reference stations submitted by Contracting Parties in 2015. This table complements Table 6 of IMAP Decision IG. 22/7.

Organochlorinated Compounds (OCs)

Table 5(b) of IMAP Decision IG. 22/7: Mediterranean EAC Levels for Organochlorinated Compounds based on respective OSPAR adopted values

Contaminant	Mussels (µg/kg d.w.)	Sediments (µg/kg d.w.)	Fish (µg/kg lipid)
CB28	3.2	**	64
CB52	5.4	**	108
CB101	6.0	**	120
CB105	-	-	-
CB118	1.2	**	24
CB138	15.8	**	316
CB153	80	**	1600
CB156	-	-	-
CB180	24	**	480
∑7CBs ICES	-	11.5	-
Lindane	1.45	3.0[c]	11[b]
α-HCH	-	-	-
pp'DDE	5-50[a]	2.2[c]	-
HCB	-	20.0[c]	-
Dieldrin	5-50[a]	2.0[c]	-

[a]Earlier data from QSR2000 Report; [b]µg/kg wet weight (CEMP 2008/2009); [c]Effects Range Low (ERLs)
** This table is complemented with the values presented in above Table 3 (b) for here highlighted Polychlorinated Biphenyls (PCBs).

2) Mediterranean BACs and EACs Levels for Biomarkers

Table 6 of IMAP Decision IG. 22/7: Mediterranean EAC Levels for Biomarkers based on respective OSPAR adopted values[12]

Biomarkers/Bioassays	BAC levels in Mussels (*Mytilus galloprovincilais*)	EAC levels in Mussels (*Mytilus galloprovincilais*)
Lysosomal membrane stability Neutral Red Retention Assay (minutes)	120[a*]	50 [a*]
Lysosomal membrane stability Cytochemical method (minutes)	20 [a*]	10 [a*]
AChE activity (nmol min-1 mg-1 protein) in gills (French Mediterranean waters)	29	20
AChE activity (nmol min-1 mg-1 protein) in gills (Spanish Mediterranean waters)	15	10

[a]Technical annex: assessment criteria for biological effects measurements. Integrated monitoring of chemicals and their effects. ICES Cooperative Research Report No. 315. Davies, I.M. and Vethaak, A.D.Eds.
*Moore et al., 2006 (Standard values adopted by ICES)

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[12]This table is complemented with the biomarker values presented above in Table 4.