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REGIONAL ACTIVITY CENTRE FOR SPECIALLY PROTECTED AREAS

National monitoring program for biodiversity and non-indigenous species in Egypt

PROF. MOUSTAFA M. FOUDA

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Study required and financed by:
Regional Activity Centre for Specially Protected Areas
Boulevard du Leader Yasser Arafat
BP 337
1080 Tunis Cedex – Tunisie

Responsible of the study:
Mehdi Aissi, EcApMEDII Programme officer

In charge of the study:

- Prof. Moustafa M. Fouda
- Mr. Mohamed Said Abdelwarith
- Mr. Mahmoud Fawzy Kamel

Ministry of Environment, Egyptian Environmental Affairs Agency (EEAA)

With the participation of:
Name, qualification and original institution of all the participants in the study (field mission or participation of national institutions)

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Particular thank are to all participants who attached at annex XI.

Preamble

The Ecosystem Approach (EcAp) is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way, as stated by the Convention of Biological Diversity. This process aims to achieve the Good Environmental Status (GES) through the elaborated 11 Ecological Objectives and their respective common indicators. Since 2008, Contracting Parties to the Barcelona Convention have adopted the EcAp and agreed on a roadmap for its implementation.

First phases of the EcAp process led to the accomplishment of 5 steps of the scheduled 7-steps process such as: 1) Definition of an Ecological Vision for the Mediterranean; 2) Setting common Mediterranean strategic goals; 3) Identification of an important ecosystem properties and assessment of ecological status and pressures; 4) Development of a set of ecological objectives corresponding to the Vision and strategic goals; and 5) Derivation of operational objectives with indicators and target levels.
The remaining 2 steps will include: 6) Revision of existing monitoring programs for ongoing assessment and regular updating of targets; and 7) Development and review of relevant action plans and programs.

The following decisions were adopted by the Contracting Parties to the Barcelona Convention in order to achieve more effective ecosystems-based management in the Mediterranean:

- Decisions IG.17/6: "Implementation of the ecosystem approach to the management of human activities that may affect the Mediterranean marine and coastal environment" adopted by Contracting Parties during the 15th COP (2008),
- Decision IG.20/4: "Implementing MAP ecosystem approach roadmap: Mediterranean Ecological and Operational Objectives, Indicators and Timetable for implementing the ecosystem approach roadmap", adopted during the 17th COP (2012),
- Decision IG.21/3: "The Ecosystems Approach including adopting definitions of Good Environmental Status (GES) and targets" adopted during the 18th COP (2013),
- Decision IG.22/7: "Integrated Monitoring and Assessment Program of the Mediterranean Sea and Coast and related assessment criteria (IMAP)" adopted during the 19th COP (2016).

The 19th Meeting of the Contracting Parties to the Barcelona Convention adopted the Integrated *Monitoring and Assessment Program* (IMAP), through a participatory process involving Contracting Parties and the scientific community in line with the Decision IG. 21/3.

In order to implement the EcAp in synergy with the Marine Strategy Framework Directive (MSFD), the European Union (EU) is supporting the Southern Mediterranean Contracting Parties to the Barcelona Convention through financing the EcAp-MED II project (Mediterranean implementation of the Ecosystem Approach, in coherence with the EU MSFD).

In light of this, SPA/RAC is committed to assist the Southern Mediterranean countries in the development of national monitoring programs related to biodiversity (EO1) and NIS (EO2), in line with the IMAP requirements.

Objective of the assignment

The objective of this assignment is to develop the national monitoring program for biodiversity (EO1) and non-indigenous species (EO2) in Egypt.

The national monitoring program must include at least the following sections:

- Representative areas/sites to be monitored
- National reference list of habitats, species and invasive alien species to be monitored
- Monitoring program by common indicator:
  a) Habitat distributional range
  b) Condition of the habitat‘s typical species and communities
  c) Species distributional range:
     - Marine mammals
     - Seabirds
     - Marine reptiles
  d) Population abundance:
     - Marine mammals
     - Seabirds
     - Marine reptiles
  e) Population demographic:
     - Marine mammals
     - Seabirds
     - Marine reptiles
  f) Trends in abundance, temporal occurrence and spatial distribution of non-indigenous species (NIS)

In order to ease the task on elaborating the national monitoring program, SPA/RAC will provide the following documents to the selected expert:

- Guidelines for the development of the national monitoring program,
- Table of contents of the national monitoring program.

Tasks to be undertaken

The consultant should work in close collaboration with the SPA/RAC Focal Point as well as the EcAp-MED II project officer and the national project coordinator.

Regular communication and briefings on project progress are recommended.

The consultant is required to:

- Develop a first draft of the “National monitoring program for biodiversity and non-indigenous species in Egypt”, according to the documents provided by SPA/RAC and including the sections described in paragraph 2;
- Provide an intermediate draft of the ”National monitoring program for Biodiversity and Non-

Indigenous Species in Egypt" based on comments made on the first draft by the National IMAP Committee2 and the EcAp-MED II project officer;

- Present the intermediate draft of the "National monitoring program for Biodiversity and Non-Indigenous Species in Egypt" during a national consultation workshop.
- Elaborate the final version of the "National monitoring program for biodiversity and non-indigenous species in Egypt" taking into consideration the comments made during the national consultation workshop on the intermediate draft.

Deliverables

1. First draft of "National monitoring program for biodiversity and non-indigenous species in Egypt";
2. Intermediate draft of the "National monitoring program for Biodiversity and Non-Indigenous Species in Egypt";
3. Final version of the "National monitoring program for biodiversity and non-indigenous species in Egypt".

Duration of the assignment

The elaboration of 'National monitoring program for biodiversity and non-indigenous species in Egypt' will be conducted for a fixed period of fifteen (15) working days. It will start immediately after signing the contract, and long until the provision of the final version based on the comments made on the first draft of the document.

Approach

The Integrated Monitoring and Assessment Program (IMAP) of the Mediterranean Sea and Coast and related Assessment Criteria was carefully studied to develop the national monitoring program for marine biodiversity and non-indigenous species in Egypt. Similarly, all relevant decisions (IG.1716; IG.2014; IG.21/3 and IG.22.7) that were adopted by the contracting parties to the Barcelona Convention (2008 – 2016) were examined to achieve more effective ecosystems-based management in the Mediterranean. Marine monitoring programs of several countries and regions were reviewed to be considered in the Egyptian monitoring programs. Furthermore, personal contacts with marine monitoring experts were made to provide advice on the Egyptian monitoring program. This has led to a better understanding of the requirements for the monitoring program in terms of what is needed to be done, consultation with different stakeholders (academics, institutions, managers and others), available literature on monitoring of marine and coastal biodiversity, both regionally and internationally.

Current state of knowledge of marine biodiversity in Egypt was collected from numerous sources such as SAPBIO, national reports to biodiversity related conventions such as CBD, RAMSAR, CMS, CITES, annual reports of Nature Conservation Sector (NCS) of the Egyptian Environmental Affairs Agency (EEAA), recent relevant literature on the marine and coastal biodiversity in the Egyptian Mediterranean.

The national monitoring program for biodiversity (EQ1) and non-indigenous species (EQ2) in Egypt is based on guidelines for the development of the national monitoring program provided by RAC/SPA, published works of RAC/SPA for habitat distribution range, species distribution range, population abundance and population demographics of marine mammals, seabirds and marine

reptiles, as well as trends in abundance, temporal occurrence and spatial distribution of non-indigenous species (NIS). It was modified, when possible, based on monitoring programs of some countries and regions.

After preparing the draft monitoring programme, a workshop was held in Cairo in October 2017, and attended by representatives of the main national institutions. Participants's comments were included in the final monitoring programme.

This report has followed table of contents of the national monitoring program provided by RAC/SPA secretariat.

CHAPTER 1
Introduction

The Mediterranean Basin is one of the most highly valued seas in the world. The region comprises a vast set of coastal and marine ecosystems that deliver valuable benefits to all its coastal inhabitants, including brackish water lagoons, estuaries, or transitional areas; coastal plains; wetlands; rocky shores and near shore coastal areas; sea grass meadows; coralligenous communities; frontal systems and upwellings; seamounts; and pelagic systems (State of the Mediterranean Marine and Coastal Environment, UNEP/MAP.2012)

The Mediterranean Sea occupies a basin of almost 2.6 million km2. The coastline is 46 000km long, and the basin itself about 3 800 km from east to west and 900 km from north to south at its maximum between France and Algeria. The average water depth is approximately 1 500 m with a maximum depth of 5 121 m off southwestern Greece. The shallowest part of the Mediterranean Sea is the northern Adriatic, where the average depth does not exceed 50 m. The Mediterranean Sea can be divided into two sub-basins, the Western and the Eastern Mediterranean, which in turn are composed of a series of varied small basins (Amblas et al. 2004). The Mediterranean drainage basin extends over an area of more than 5 million km2 . The estimated residence time of Mediterranean waters is quite high, around 50 – 100 years (Millot and Taupier-Letage 2005), which has important implications for the cycling and eventually export of contaminants.

Mediterranean coastal and marine biodiversity is high by all measures. The basin supports some of the richest fauna and flora in the world and the habitat-level diversity is extraordinary. It is recognized as one of the world‘s 25 top biodiversity hotspots, defined as areas with rich biodiversity, a large number of endemic species (species unique to the region), and critical levels of habitat loss (Meyers et al. 2000). There are an estimated 10 000-12 000 marine species in the Mediterranean, compromising approximately 8 500 macroscopic fauna, over 1 300 plant species, and 2 500 species from other taxonomic groups (UNEP/MAP 2012). This represents 4 – 18 percent of the world‘s known marine species, depending on the taxonomic group (from 4.1 per cent of the bony fishes to 18.4 per cent of the marine mammals), in an area covering less than one per cent of the world‘s oceans and less than 0.3 per cent of its volume (UNEP/MAP 2012; Bianchi and Morri, 2000).

The level of endemism in the Mediterranean is high compared with other seas and oceans, including the Atlantic Ocean. Fifty to seventy-seven per cent of Mediterranean marine species are Atlantic species (found also in the Atlantic Ocean). Here to ten per cent are pan-tropical species from the world‘s warm seas. Five per cent are Lessepsian species (species that have entered the Mediterranean from the Red Sea). The remaining 20 – 30 percent is endemic species: that is, species native only to the Mediterranean Sea (UNEP/MAP 2012).

The percentage of endemism is very high for sessile or sedentary groups, including ascidians (50.4 percent), sponges (42.4 percent), hydroids (27.1 percent), and echinoderms (24.3 percent). Endemism is also considerable for the other groups, such as decapods crustaceans (13.2 percent) and fish 10.9 percent).

Species diversity in the Mediterranean Basin tends to increase from east to west with 43 per cent of known species occurring in the Eastern Mediterranean, 49 per cent in the Adriatic, and 87 per cent in the Western Mediterranean (UNEP/MAP 2012). The Western Mediterranean also has more endemic species than other regions of the sea. In addition, its proximity to the Atlantic Ocean and its seasonal

frontal and upwelling systems provide nutrients. The Western basin also supports the greatest diversity of marine mammal, sea turtle, and seabird life of the Mediterranean (UNEP/MAP 2012). The southeast corner of the Mediterranean, the Levantine Basin, is the most biologically impoverished area. While there is an ecological basis for lower diversity in the Eastern Mediterranean, this area has also not been as well studied as other parts of the sea (UNEP/MAP 2012).

Species distribution also varies according to depth, with most flora and fauna being concentrated in shallow waters up to 50 m in depth. Although this zone accounts for only five per cent of Mediterranean waters, 90 per cent of the known benthic plant species are found here, as are some 75 per cent of the fish species (UNEP/MAP/RAC/SPA 2010). The high seas of the Mediterranean also support a great variety f marine life in areas of high productivity (gyres, upwelling, and fronts)

The total population of the Mediterranean countries grew from 276 million in 1970 to 412 million in 2000 (a 1.35 per cent increase per year) and to 466 million in 2010. The population is predicted to reach 529 million by 2025. Four countries account for about 60 per cent of the total population: Turkey (81 million), Egypt (90 million), France (62 million), and Italy (60 million) (Plan Bleu computations based on UNDESA 2011). Overall, more than half the population lives in southern shores of the Mediterranean, and this proportion is expected to grow to three-quarters by 2025 (UNEP/MAP/MEDPOL 2005). The Mediterranean region‘s population is concentrated neat the coasts. More than a third live in coastal administrative entities totaling less than 12 per cent of the surface area of the Mediterranean countries. The population of the coastal regions grew from 95 million in 1979 to 143 million in 2000. It could reach 174 million by 2025 (UN/MAP/BP/RAC2005).

Despite compelling evidence of the importance of services delivered by Mediterranean coastal and marine systems, the ecosystem degradation continues. The UNEP/MAP Barcelona Convention Initial Integrated Assessment, (2011) identified pressures and impacts, which vary in severity from region to region, include coastal development and sprawl, driven by urbanization and tourism development, leading to habitat loss and degradation, and erosion/shoreline destabilization; overfishing, and incidental or by-catch, affecting community structure, ecological processes, and delivery of ecosystem services; destructive fishing, including bottom trawling and other fishing methods that result in benthic disturbance; contamination of sediments and biota by pollution, primarily from urbanization and industry, but also from antifoulants and atmospheric inputs of hazardous compounds; nutrient over-enrichment, leading sometimes to eutrophication and hypoxia, but more regularly to ecological imbalances (reduced water quality and growth of algae); disturbance and pollution caused by maritime industries, including fisheries, shipping, energy, aquaculture, and desalination (operational as well as accident-related). Invasive species spread, in many cases mediated by climate change; and, degradation of transitional or estuarine areas, which serve as critical nursery areas for commercial fisheries and also support unique assemblages of species.

Changes in conditions are apparent in the last decade such as improvements in water quality being discernible in many places, thanks to strategic efforts to reduce pollutant loading, and declining quantities of hazardous substances such as DDT and heavy metals in most areas. Nevertheless, new issues are emerging which warrant attention, such as desalination and its negative effects; aquaculture, including the grow out operations for blue fin tuna; and, cumulative risks due to reduced access and availability of space of multiple conflictive uses.

The main regulatory instrument aimed at the protection of the Mediterranean marine and coastal environment is the ― Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean‖ (Barcelona Convention) which entered into force in 2004 replacing the 1976 ― Convention for the Protection of the Mediterranean Sea Against Pollution. It is the first regional sea agreement concluded and administered by UNEP. The Convention has 7 protocols for the prevention of pollution by dumping from ships and aircraft or incineration at sea; and, by trans-boundary movements of hazardous movements of hazardous wastes and their disposal; combating pollution in cases of emergency; protection against pollution from land-based sources and activities, as well as exploration and exploitation of the continental shelf and the seabed and its subsoil; specially protected areas and biological diversity; and, integrated coastal zone management. Today all 21 countries surrounding the Mediterranean Sea, as well as the European Union, are parties to the Convention.

Strategic Action Programme for the conservation of Biological Diversity (SAP BIO) in the Mediterranean Region

Confronted with the complexity and size of the pressure on marine and coastal biological diversity, the Contracting Parties judged that they needed a concerted strategy. In 2004, RAC/SPA launched the implementation of the Strategic Action Programme for the Conservation of Biological Diversity in the Mediterranean (SAP BIO).

This was a process of diagnosis, consultation and assessment at national and regional level, backed by the GEF. It was designed as twin-track:

- The first track analyses the state of biodiversity in the Mediterranean and stresses the main problems, lacuna and activities to plan for.
- The second track involves 30 concrete strategic actions to guide countries over the fifteen following years in planning and implementing protection activities.

The strategic actions aim to:

- Protecting species and habitats,
- Improving knowledge about marine and coastal biodiversity,
- Reducing negative impacts on biological diversity ,
- Promoting sector-based policies that encourage biodiversity (tourism, agriculture, etc.),
- Adopting institutional and legal measures ,
- Coordinating the biodiversity activities of the MAP centers.

Adopted by the Contracting Parties on 2003, these actions should guide countries over the following fifteen years in planning and implementing protection activities; this will have repercussions for the whole of the Mediterranean.SAP BIO project was revised in 2014 and adopted by National Focal Points of RAC/SPA in Rabaat, Moracco, 2014

The Ecosystem Approach (EcAp)

The Convention on Biological Diversity (CBD) defines the ecosystem approach as ―a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way". It goes beyond examining single issues, species, or ecosystem functions in isolation. Instead, it recognizes ecological systems for what they are: rich mixes of elements that interact with each other continuously. This understanding is particularly important for coasts and seas, where the nature of water keeps systems and functions connected. The Ecosystem Approach is also a way of making decisions in order to manage human activities sustainably. It recognizes that human's activities both affect the ecosystem and depend on it. Thus, it aims to improve the way human activities are managed for the protection of the marine environment.

At their 15th meeting, held in January 2008 in Almeria (Spain), the Contracting Parties to the Barcelona Convention have adopted the Ecosystem Approach and agreed a road map for its implementation. Thus the EcAp becomes a specific process under the UNEP/ MAP Barcelona Convention, as its Contracting Parties have committed to implement it in the Mediterranean with the ultimate objective of achieving the Good Environmental Status (GES) of the Mediterranean Sea. The main valued added of the Ecosystems Approach in the context of the Barcelona Convention is a renewed emphasis on implementation and integration that will strengthen our ability to understand and address cumulative risks and effects as well as to better focus our actions on priority targets. Simply put, the EcAp brings MAP‘s many sectoral analyses and management measures into a single integrated framework which will results in an adaptive management strategy that will be periodically monitored, evaluated and revised through a rigorous 2012-2018 Six-year first Management Cycle.

Decision IG.17/6 on ―Implementation of the ecosystem approach to the management of human activities that may affect the Mediterranean marine and coastal environment‖, Decision IG.20/4 on―Implementing MAP ecosystem approach roadmap: Mediterranean Ecological and Operational Objectives, Indicators and Timetable for implementing the ecosystem approach roadmap adopted by the Contracting parties to the Barcelona Convention‖, Decision IG. 21/3 on "The Ecosystem Approach including adopting definitions of Good Environmental Status (GES) and targets" and Decision IG.22/7 on "Integrated Monitoring and Assessment Program of the Mediterranean Sea and Coast and Related Assessment Criteria", respectively in COP 15 (2008), COP17 (2012), COP 18 (2013) and COP 19 (2016) articulate a systematic process for moving forward towards more effective ecosystems-based management in the Mediterranean. They also contain the agreement reached on the progress achieved and define priorities on the way forward.

Interactive EcAp Roadmap and Implementation

Definition of an Ecological Vision for the Mediterranean

"A healthy Mediterranean with marine and coastal ecosystems that is productive and biologically diverse for the benefit of present and future generations".

Setting common Mediterranean strategic goals

Contracting Parties agreed *that the ecological vision of the Ecosystem Approach to be realized through the following strategic goals:*

- *To protect, allow recovery and, where practicable, restore the structure and function of marine and coastal ecosystems thus also protecting biodiversity, in order to achieve and maintain good ecological status and allow for their sustainable use*
- *To reduce pollution in the marine and coastal environment so as to minimize impacts on and risks to human and/or ecosystem health and/or uses of the sea and the coasts*
- *To prevent, reduce and manage the vulnerability of the sea and the coasts to risks induced by human activities and natural events*

Identification of an important ecosystem properties and assessment of ecological status and pressures

The UNEP/MAP Barcelona Convention Initial Integrated Assessment contains information on the overall nature of the ecosystems in the Mediterranean, including physical and ecological characteristics, pressures that affect the state of the marine environment, conditions or state of the coastal and marine ecosystems, and expected response of ecosystem if trends continue. It also identifies existing pressures and impacts affecting the Mediterranean region as well as emerging ones. It has also been useful in highlighting information availability and needs going into the future Development of a set of ecological objectives corresponding to the Vision and strategic goals Ecological Objectives associated to RAC/SPA activities:

- *Ecological objective 1: Biological diversity is maintained or enhanced*
- *Ecological objective 2: Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem.*
- *Ecological objective 3: Populations of selected commercially exploited fish and shellfish are within biologically safe limits, exhibiting a population age and size distribution that is indicative of a healthy stock.*
- *Ecological objective 4: Alterations to components of marine food webs caused by resource extraction or human-induced environmental changes do not have long-term adverse effects on food web dynamics and related viability.*
- *Ecological objective 6: Sea-floor integrity is maintained, especially in priority benthic habitats.*

Derivation of operational objectives with indicators and target levels

This step includes the preparation of the integrated monitoring and Assessment Program.

The elaboration of the IMAP was carried out by the Correspondence Group on Monitoring (CORMON) and was adopted at the 19th meeting of the Contracting Parties, Athens, 9-12 February 2016.

The IMAP aims to lay down the principles for the update of the existing national monitoring and assessment programs, following the agreed common indicators. It provides to Contracting Parties guidance on methodologies, monitoring and assessment techniques, specifics, for each common indicator and analyses key outstanding issues also in an integrated manner. It will also be a common basis for the development of the national integrated monitoring and assessment programs that are the subject of this request.

The two Ecological objectives relevant to this study are: Biodiversity and Non-Indigenous species.

Objective (1): Biological Diversity is maintained or enhanced

The quality and occurrence of coastal and marine habitat and the distribution and abundance of coastal and marine species are in line with prevailing physiograpic, hydrographic, geographic, and climatic conditions

The term ―maintained‖ is key to the quantification of GES for EO1. This condition has three determining factors:

1. no further loss of the diversity within species, between species and of habitats / communities and ecosystems at ecologically relevant scales;
2. any deteriorated attributes of biological diversity are restored to and maintained at or above target levels, where intrinsic allow;
3. Where the use of the marine environment is sustainable.

Objective (2): Non-indigenous species

Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem.

Non-indigenous species are species, subspecies or lower taxa introduced outside of their natural range and outside of their natural dispersal potential. This includes any part, gamete or propagule of such species that might survive and subsequently reproduce. Their presence in the given region is due to intentional or unintentional introduction resulting from human activities.

In the Mediterranean, marine invasive species are regarded as one of the main causes of biodiversity loss potentially modifying all aspects of marine and other aquatic ecosystems.

Integrated Monitoring and Assessment Programme (IMAP) of the Mediterranean Sea and Coast and Related Assessment Criteria

Monitoring and assessment, based on scientific knowledge, of the sea and coast is the indispensable basis for the management of human activities, in view of promoting sustainable use of the seas and coasts and conserving marine ecosystems and their sustainable development. The Integrated Monitoring and Assessment Program of the Mediterranean Sea and Coast and Related Assessment Criteria (IMAP) describes the strategy, themes, and products that the Barcelona Convention Contracting Parties are aiming to deliver, through collaborative efforts inside the UNEP/MAP Barcelona Convention, over the second cycle of the implementation of the Ecosystem Approach Process (EcAp process), i.e. over 2016-2021, in order to assess the status of the Mediterranean sea and coast, as a basis for further and/or strengthened measures.

IMAP builds on the monitoring and assessment related provisions of the Barcelona Convention and its Protocols, previous Decisions of the Contracting Parties related to monitoring and assessment, and to the EcAp process, including on Decision IG. 21/3 and the expert level discussions mobilized based on this Decision, such as the ones taking place in the Correspondence Groups on Good Environmental Status (COR GEST) and Monitoring (CORMON), as well as the 4th and 5th EcAp Coordination Group.

In addition, the development of IMAP took due account of the Contracting Parties‘ existing monitoring and assessment programs, practices of other Regional Sea Conventions and other

Regional bodies.

IMAP is aiming to deliver over 2016-2021 its objectives as described above. It is introduced first however in an initial phase (in line with Decision IG. 21/3, in between 2016-2019), during which the existing national monitoring and assessment programs will be integrated, in line with the IMAP structure and principles and based on the agreed common indicators. This implies in practice that the existing national monitoring and assessment programs will be reviewed and revised as appropriate so that national implementation of IMAP can be fulfilled in a sufficient manner.

The main outputs during the initial phase of IMAP will include the update of GES definitions, further refinement of assessment criteria and development of national level integrated monitoring and assessment programs.

Furthermore, the Quality Status Report in 2017 and the State of Environment and Development Report in 2019 will build on the structure, objectives and data collected under IMAP.

The validity of the IMAP should be reviewed once at the end of every EcAp six year cycle, and in addition it should be updated and revised as necessary on a biennial basis, based on lessons learnt of the implementation of the IMAP and on new scientific and policy developments.

New events that took place after Barcelona Convention COP21 (Feb. 2016)

After COP21 several important events took place and are relevant to the proposed monitoring program. These are:

1- Monitoring of marine environment (April 2016)

A technical workshop on the monitoring of marine and coastal biodiversity was held on 24 April 2016, in Montreal. The workshop was convened by the CBD Secretariat, the Australian Commonwealth Scientific and Industrial Research Organization (CSIRO), the International Ocean Commission through the Global Ocean Observing System (GOOS) Biology and Ecosystems Panel, and GEOBON through the Marine Biodiversity Observing Network (MBON). The workshop was chaired by Mr. Moustafa Fouda (Ministerial Advisor on Biodiversity, Egypt) and Mr. Nic Bax (CSIRO, Australia). It brought together representatives of some of the major marine global reporting initiatives: the UN First World Ocean Assessment, the Large Marine Ecosystem program, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), and a recent joint FAO/CBD Expert Meeting on Improving Progress Reporting and Working towards Implementation of Aichi Biodiversity Target 6. Matching these reporting obligations were representatives of some of the major marine scientific monitoring groups: the GOOS Biology and Ecosystems Panel, the MBON Pole to Pole initiative, the Global Coral Reef Monitoring Network, UNEP, IUCN, the Global Ocean Biodiversity Initiative (GOBI), and the Ocean Biodiversity Information Network (OBIS). Parties from South America, the Middle East, Southeast Asia, North America and Europe presented their opportunities and requirements for marine monitoring and reporting. Over 70 people from 31 countries and 17 organizations attended the workshop.

Fruitful discussions ensued, with workshop participants noting that it was rare for such a diverse group interested in sustainable fisheries, marine ecosystems and marine biodiversity to come together – in fact this may have been the first time. Summary conclusions from the workshop were:

1. Participants recognized that existing marine global assessments lacked quantitative data on

trends in the marine environment or even consensus on how they should be monitored. Information on trends in human use and impacts were especially poor making it difficult to evaluate how livelihoods are affected by the many ocean uses and their cumulative impact.

2. Participants therefore recognized the need for baselines, sustained standardized monitoring and improved data availability and access to meet ongoing and future reporting requirements, especially Aichi targets and SDG goals, and to provide a long-term perspective on the changing marine environment.
3. Participants also recognized that there were many existing monitoring programs and data series and that there are further opportunities to work together with governments, academic institutions and the private sector to coordinate and extend these initiatives.
4. Participants recognized that several areas of marine biodiversity science had reached a level of maturity such that monitoring systems could be designed to respond to societal needs, especially with new technologies and communication opportunities coming online.
5. Participants recognized the existence of at least three knowledge systems which could inform marine assessments including scientific, local and traditional knowledge.
6. Participants recognized the need to link monitoring of biodiversity to ecosystem services and incorporate that valuation into jurisdictional accounting systems.
7. Participants recommended that monitoring needed to be driven from the bottom up by jurisdictional needs, within an agreed framework of global standards and interoperability. In other words monitoring should cross the science policy interface and address current and emerging management needs.
8. Monitoring data would need to be regularly reviewed for relevance, reliability and effectiveness.
9. However, despite the wealth of existing and potential marine monitoring, participants recognized that many individual Parties were currently unaware of, or lacked the capacity to access currently available information from global databases relevant to their own jurisdiction.
10. Therefore participants recommended that a series of regional workshops be initiated to support capacity transfer from resource rich to resource poor countries. This series of regional workshops could potentially be developed through the CBD‘s Marine Spatial Planning initiative.
11. Additional and more recent technology developments, including options like MOOCS (massive open online courses) should also be explored as an additional communication option.
12. Finally, participants recognized the rapidly changing marine environment including ocean acidification and the looming dates for reporting against Aichi targets and concluded that action need to be taken quickly if relevant monitoring and information are to be available to meet these needs.

A workshop report is being assembled and will be available to delegates before COP 13.

2- <u>Workshop on Biodiversity priorities for Targets 11 and 12 of the Strategic Plan of CBD (2011 – 2020)</u>

A CBD workshop was held in Uganda, 24 – 26 March 2016 where targets 11 (protected areas) and 12 (threatened species) were discussed in details. Prior the workshop a questionnaire regarding progress made in Egypt was prepared by a team of experts. Participants agreed on the future

priorities that will be presented at the next CBD COP13 which will be held in Cancun, Mexico in December 2016. Priorities of Egypt as road map were approved as the list of priorities focused actions to be undertaken in the next five years, and included the following:

Element of Targets 11 and 12	Priority Actions
Quantitative Aspects	• 14 Future PAs under review. • Possibility to increase the number of existing PAs (2000 km2). • Establish a new self-financed Agency for conservation of biodiversity and protected areas. • Amendment of the law of PAs. • Implement green economy instruments in PAs.
Improve Ecological representation	• The total conservation areas for IBAs are 34 sites are covering an area about 35,000 km2 which is equivalent to (3.5 %) of the total area of the Egypt. This will need update for available recent information. • A workshop will be held soon.
Areas important for biodiversity	• Identify and implement new conservation mechanisms to protect areas of high importance for the maintenance of ecological services. • Develop and implement unified Egyptian methodology for the identification and monitoring of priority of all components of biodiversity according to the international standards to ensure the maintenance or rehabilitation of 50% of our most threatened species focusing on mammals and reptiles to a favorable conservation status.
Management effectiveness and Equity	• Management effectiveness assessment for 10 PAs will be continued through the following years for improving performance. • Design and implement performance monitoring system to follow-up of the management activities in each PA. • Develop innovative schemes of equitable governance in selected PA.
Connectivity	Currently there is no a clear effort for establishing biological corridors, as 30% of PAs are connected.
Integration into wider land and seascapes	• Survey for identification of different alternatives for the integrated management of landscapes and seascapes in order to promote sustainable development and connectivity around Protected Areas. • Involve local community around Wadi El-Gemal National park in protected area activities.

Element of Targets 11 and 12	Priority Actions
Other effective area-based conservation measures	• Conserve and management of wild species under the pressures of illegal hunting. • Develop effective tools for combating illegal hunting of wild animals (e.g. illegal birds hunting). • Improve the licensing procedure for hunting of migratory birds. • Define hunting quotas for migratory birds and conduct studies on hunting. • Understand and implement the concept of sustainable legal hunting • Mainstreaming of biodiversity in energy and tourism sectors.(2 MOU)
Threatened species assessment	• Assess status of major endangered species and habitats to determine the requirements and priorities for conservation to protect these plants and animals by using the standards of the IUCN. • Ensure the conservation of 20% of threatened species and reintroduce critically endangered species as appropriate and feasible. • Ensure conservation and management of biodiversity hot spots located outside protected areas. • Promote more ex-situ conservation efforts • Practice and adopt a national policy on *ex-situ* conservation. • Inspire *ex situ* conservation through the establishment of natural history museum, gene banks, seed banks captive breeding centres, zoos and public gardens. • Develop guidelines and mechanism for collection, maintenance, reproduction and reintroduction of plants and animal species in ex-situ programmes
Conservation plan status	• Conservation action plans for endemic and endangered species, particularly those with restricted distribution in PA. This will include Sea Turtles, Dolphins, Whale Shark, Dugong, Deer, Coral Reefs, Mangrove trees, sooty falcon, and endemic medicinal plants in St. Catherine PA. • Threat analysis and threatened reduction and assessment of important plants.

Actions/ Measures	Operational goals	Activity	proportion	Comments
Integrated Policymaking	Implement sustainable development goals.	• Sustainable management of fisheries and aquatic resources		Develop and endorse a holistic and integrated approach that ensures the integration of social, environmental, and

		(80% or more) • Encourage sustainable cities for biodiversity conservation (20% or less) • Sustainable rural development around protected areas are encouraged (20% or less) • Water and waste management‘s are effectively implemented (80% or more) • Renewable energy projects in and around protected areas are encouraged (20% or less) • Develop and implement Strategic Environment Impact Assessment (20 – 80%)		economic dimensions in biodiversity conservation and within integrated sustainable communities.
	Apply principles of sustainable production and consumption.	• Undertake steps to achieve or have management plan for sustainable production and consumption resources		Undertake an assessment of existing regulatory & incentive measures & assess their impacts on the environment & resource efficiency with the objective of identifying measures & policies, including means of

		(80% or more)		implementation that promote SCP & consequently resource efficiency in the agriculture sector and fisheries.
	Develop action plan of biodiversity conservation.	• NBSAP adopted as policy instrument (100%)		Develop an Action Plan for the implementation of the proposed biodiversity strategy.
	Develop and adopt new legislation for biodiversity conservation.	• Biosafety and ABS (NAGOYA) protocols are operational (100%) • Incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed (20 – 80%)		Adopt new laws and regulations that promote conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. These include the approved law on protected areas, biosafety law and ABS law.
	Develop institutional reform for NCS.	• Develop legal and regulatory framework for NCS (80% or more)		Create an institutional set up that ensures public participation, involvement of relevant stakeholders, including the private sector and civil society, transparency, accountability, collaboration and coordination between various government entities, and between the public and private sector - through Public-Private-Partnership (PPP) - exchange of information

				on best available technologies and best environmental practices on sustainable Biodiversity practices.
	Implement green Economy in protected areas.	• Illegal wildlife trade are reduced significantly (80% or more) • Encourage ecotourism in protected areas (80% or more)		Promote the use of a number of tools and measures that facilities the adoption and implementation of green economy in protected areas.
Good governance and institutions	Institutional reform activities.	• Mainstreaming of biodiversity in all development sectors (100%)		Identify action needed to reform/restructure or create an institutional mechanism that will be entrusted with Coordinating action related to planning, implementation of biodiversity related activities in an efficient, transparent and accountable manner. A set-up that allows inter-ministerial coordination to avoid redundancy, conflict of interest and overlap of Responsibilities between different ministries. Moreover, in order to facilitate a transition to sustainable biodiversity and ecosystem services practices, policies related to energy, water, and land uses, which are under the jurisdiction of other sectoral ministries should be taken into

				account, thus necessitating close coordination with relevant ministries. Institution should function in a transparent, accountable, and in a participatory manner promotes efficiency and optimum use of Resources.
	State responsibilities of the Ministry of Environment in biodiversity conservation.			Clearly identify the responsibilities of the Ministry of Environment and the institutions affiliated with it in formulating policies, research, extension work, development of action plan, monitoring and follow up, data gathering, planning provision of necessary infrastructure for reclaimed land.
	State responsibilities of relevant agencies involved in biodiversity conservation.	• Enhance synergies between biodiversity conservation and land-use planning (20 – 80%)		Clearly identify the responsibilities of relevant entities involved in biodiversity related activities, integrating entities with similar responsibilities.
	Develop research plan related to biodiversity conservation.	• Encourage research and development for environment protection (20 – 80%)		Create an institutional set up that responsible for linking research centers with universities and Academy of Scientific Research and Technology.
	Identify relevant agencies involved			Closely link the development of the

	in implementation of NBSAP.			different strategies by the different related ministries, particularly the Ministry of Agriculture, Water, and Tourism should be closely linked and well Coordinated.
	Implement institutional reform of NCS.	• Implement institutional reform of NCS (100%)		Institutional reform of Nature Conservation Sector to meet changing socioeconomic conditions and in a way that they are supportive to sustainable biodiversity and Ecosystem services.
	Ensure good governance of protected areas.			Ensure public participation, involvement of relevant stakeholders, including the private sector and civil society, transparency, accountability, collaboration and coordination between various government entities, and between the public and private sector - through Public-Private-Partnership (PPP) - exchange of information on best available technologies and best environmental practices on sustainable biodiversity and Ecosystem services.
	Create a unit for green economy.			Create within the Ministry of Environment a Unit to be entrusted with the responsibility of

				providing guidance and technical support related to green economy.
	Identify government responsibility for natural capital account.			Identify a government body to be entrusted with data gathering, updating and analysis.
	Law enforcement in protected areas.			Emphasis should be laid on monitoring and enforcement of regulations including those related to land encroachment to protected areas with severe penalties as instituted in the law implemented.
Regulatory framework	Develop legal and regulatory framework for NCS.			Review biodiversity related legislation with a view to developing a package of regulatory supported by incentive measures and policies, that support sustainable biodiversity and ecosystem services.
	Enhance innovative approach in protected areas.			Include in law and implement a requirement for rangers and farmers in protected areas to introduce innovative water efficient techniques (drip irrigation) in newly reclaimed land and the improvement of the irrigation system in existing cultivated areas.
	Disseminate experience of St. Catherine PA in certification			Develop and launch a labeling and certification scheme for sustainable and organic

	scheme.			products such as already implemented in St. Catherine protected area.
	Enhance sustainable agriculture in PAs.			Introduce and implement strict regulatory measures and control mechanisms for the use of chemical fertilizers and pesticides in protected areas.
Economic instruments	Encourage incentives in protected areas with focus on sustainable agriculture.	• Sustainable management of agriculture and aquaculture (80% or more)		Design market incentives to encourage investments in protected areas as means to create a market niche for Egyptian products. Measures may include subsidies and tax rebates and exemptions for locals and visitors using energy and water saving equipment and measures, the introduction of water resistant crops and climate resilient crops.
	Encourage investment in protected areas with focus on sustainable mining.	• Encourage sustainable mining industry (20% or less)		Provide incentives to introduce sustainable mining industry in protected areas.
Economic analysis	Undertake socio-economic analysis of biodiversity and ecosystem services.	• Develop and implement resource mobilization strategy (100%) • Undertake socio-economic analysis of biodiversity and ecosystem		Undertake an economic analysis to assess the financial viability of the proposed plan to include costs and benefits. The latter should include the expected social and environmental benefits resulting from the proposed plan, including number of new jobs created. It should also

		services (100%) • Encourage investment in protected areas (green infrastructure) (100%)		identify budgetary requirements needed to finance the program and sources of funding.
Trade	Enhance trade policies in protected areas.	• Establish trade policies in protected areas (20 – 80%)		Design trade policies to support sustainable tourism, agriculture and fisheries in protected areas through a tariff system that encourages the import of environmentally friendly technologies and encouraging the export of locally produced technologies.
Funding	Establish a policy for different sources of funding.			Secure a stable and predictable source of funding for sustainable biodiversity and ecosystem services in order to ensure the continuity of services provided and meeting the set objectives of the program.
	Institutional support for financing mechanism.			Financial institutions should be requested to support financing investments in green economy in protected areas.
	Special funding mechanism for R & D.			Provide sufficient budgetary allocations for research and development and develop a long term R&D strategy to support the transitioning of

				biodiversity to a green and sustainable path.
	Establish new markets for biodiversity.			Direct investments to biodiversity related industrial activities to increase the value added of protected areas, diversify rural areas, and create new jobs for the local community.
Private sector	Establish and implement public – private partnership for biodiversity.	• Establish and implement public – private partnership for biodiversity conservation (20 – 80%)		Encourage the private sector to be engaged directly or through Public-Private-Partnership in investments in sustainable tourism, agriculture, and fisheries in protected areas.
	Clarify benefits of public – private partnership for biodiversity			Develop a package of incentives and measures to encourage and promote the engagement of the private sector in sustainable tourism, agriculture, and fisheries in protected areas.
Public Awareness	Develop and implement CEPA program.	• Implement CEPA Program in PAs (100%)		Develop and implement public awareness campaigns targeting different target groups highlighting the economic, social, health and environmental benefits of biodiversity and ecosystem services. The role of media can be significant in promoting this approach.
	Emphasis on media for biodiversity conservation.			Promoting the role of media is significant in demonstrating the economic and financial

				benefits of sustainable biodiversity and ecosystem services to different stakeholders.
	Implement CEPA program on T.V.			Designate a TV channel for promoting public awareness and education on sustainable biodiversity and ecosystem services.
Education	Develop and implement a national plan for human resource development for biodiversity conservation.			Investing in human resources in order to promote the integration of biodiversity in the national economy and provide the necessary calibers to support a sustainable biodiversity and ecosystem services within integrated sustainable communities.
	Mainstream higher education in sustainable development strategy.			Develop and implement a curriculum for green and sustainable communities and buildings to be offered at the Egyptian Universities. This can be at the undergraduate and the post graduate level.
	Invest in education system for biodiversity			Increase public investment in the education system for biodiversity, including training programmes for teachers and training the trainers, special programs for rangers, farmers, women, youth and the elderly.
Capacity Development	Develop and implement a	• Develop and implement a		Develop and implement a capacity building,

	national plan for capacity development of biodiversity.	national plan for capacity development (100%) • Develop and implement a national plan for human resource development (100%)		educational, and a research and technology development program that supports biodiversity conservation as well as tools and concepts that support this transition such as integrated assessment, green economy, and circular economy/closed loop economy.
	Implement extension program in protected areas.			Promote the role of extension programs to train rangers of the protected areas, raise their awareness and innovative environmentally friendly cultivation techniques and practices.
	Encourage innovative thinking			Assist rangers with innovative environmentally sound technologies, socio-economic analysis, invasive species and risk assessment.
Monitoring and assessment	Develop a framework for monitoring and assessment.	• Effective management of current and future of Protected Areas (PA network) (100%) • Develop and implement a framework for monitoring and assessment of biodiversity		Develop, for adaptation at the national level of a framework for the efficient monitoring, enforcement, assessment and implementation of a system that ensures compliance & adherence to sustainability principles in biodiversity, green & sustainable regulations, codes of practice & standards. The

		(100%) • Rate of biodiversity loss is reduced to halve (100%) • Invasive species and pathways are identified, and priority species are controlled (100%) • Develop and implement IUCN's Red list of threatened species, and species conservation program (100%) • All forms of pollution are reduced and not detrimental to ecosystem function and biodiversity (80% or more) • Pressures on vulnerable ecosystems are reduced (80% or more) • Genetic diversity are maintained (80% or more) • Ecosystems that provide essential		framework would also include the creation of a coordination mechanism to coordinate initiatives, programs, & funding.

		services (e.g. water) are restored and safeguarded (80% or more) • Ecosystems are restored and resilience enhanced to contribute to climate change mitigation and adaptation, and to combating desertification (80% or more)		
Research & development	Synergies between biodiversity and scientific research strategies.	• Synergies between biodiversity, scientific research and innovative green technology strategies (80% or more) • Scientific and traditional knowledge improved, shared and applied (100%) • Research on biodiversity in and around offshore oil and gas industries are encouraged (20% or less)		Design and implement a long-term R&D program in environmentally sound fisheries, agriculture, energy and water saving equipment and infrastructure, practices and new strains of crops that consumes less water and that are draught resistant and resilient to climate change. The development of this program to be developed by the Academy of Scientific Research in close consultation and collaboration with the Ministry of Environment, and other relevant ministries and research bodies and think tanks.
	Establish incentives for R & D.			Provide incentives for the private sector in the

				form of tax cuts and rebates and other incentives to invest in R&D and invest in green and sustainable biodiversity and ecosystem services.
Indicators	Follow up baseline of biodiversity indicators.			Monitor and assess the achievement of the objectives and targets and implementation of road map based on the identified set of indicators.
	Make intervention to stream indicators.			Review indicators and adjust as appropriate in order to ensure achieve the objectives of biodiversity strategy.
Regional & International Cooperation	Synergies of biodiversity related conventions.	• Synergies among biodiversity related conventions (100%)		Promote regional and international cooperation in the field of biodiversity by being an active member/partner in conventions and organizations such as CBD, RAMSAR, CMS, CITES, PERSGA, MAP, and Arab League.
	Establish a biodiversity national committee.			Create specialized committees to promote cooperation with countries with potential investment opportunities.

3- Ecosystem Profile update for the Mediterranean Basin:

National Consultation Workshop in Egypt (October 2016)

The Mediterranean Basin biodiversity hotspot is the second largest hotspot in the world and the largest of the world‘s five Mediterranean-climate regions. Many of the ecosystems reached equilibrium long ago with human activity dominating the landscapes. However, this delicate balance is in a precarious state as many local communities depend on remaining habitats for fresh water, food and a variety of other ecosystem services.

Critical Ecosystems Profile Fund (CEPF)'s niche is to work with all actors engaged in conservation and development activities in Mediterranean Basin countries to foster partnerships in priority corridors and sites. Such partnerships will seek to reduce impacts of these developments on natural resources and systems that communities are dependent on. The grants awarded to civil society organizations from CEPF will work towards safeguarding globally threatened species and critical sites in the Mediterranean Basin.

Responsibilities:

- Compile a short (max 5 page) national report based on a standard questionnaire as an input paper to the meeting (detailed guidance to be provided by BirdLife/IUCN), covering:
  - Socio-economic situation and implications for conservation;
  - Policy context as relevant to conservation;
  - Civil society context;
  - Assessment of current conservation investment.
  - Threat assessment
  - Prioritization of KBAs
- A consultation workshop was held in Cairo, attended by about 60 stakeholders to identify needs for critically ecosystems in the Egyptian Mediterranean basin. Results are summarized in the following tables:

KBA name (sorted from north-west to south-east) **NB Sites that overlap, potentially for amalgamation, are grouped by alternate shading. If amalgamation is agreed, please then complete fields for only the first row in such a group**	**KBA Source**	**Global KBA status**	Global KBA criteria met	**DEGREE OF THREAT**	**Top 3 threats** (following IUCN classification, see worksheet 4)	**FUNDING NEED**	**Current funding**	**MANAGEMENT NEED**	**What management is needed?**	**CIVIL SOCIETY CAPACITY**	**OPERATIONAL FEASIBILITY**	**ALIGNMENT WITH NATIONAL PRIORITIES**	**Name strategy(ies) where site is identified as a priority**	**OPPORTUNITY FOR LANDSCAPE-LEVEL CONSERVATION**
Sallum Gulf	KBA2010	confirmed	B1	low	Fishing/aquatic harvesting (intentional; subsistence/ small scale) Garbage/solid waste pollution Climate/weather (drought)	high	Annual government allocation	high	MP	medium	feasible	high	NBSAP 2016	low
Sallum Area	IPA2011	candidate		medium		high	no	high	monitoring conservaton planing	low	difficult	medium	IPA national inventory	low

Coastal Dune	KBA2010	confirmed	B1		Development (commercial/industrial areas) Development (tourism/recreation areas) Development (roads/railroads) Annual/perennial crops (small-holder) Livestock grazing/ranching/farming (nomadic)	high	no	high	MP development and implementation	low	very feasible	high	proposed PA	medium
Ras Elhekma (Showela Coastal Dune)	NEW KBA	proposed	B1		Development (commercial/industrial areas) Development (tourism/recreation areas) Development (roads/railroads) Annual/perennial crops (small-holder) Livestock grazing/ranching/farming (nomadic)	high	no	high	MP development and implementation	low	difficult	high	proposed PA	low
Western Mediterranean Coastal Dunes	IPA2011	candidate												
El Omayed (added to below)	KBA2010	confirmed	B1											
Omayed Biosphere Reserve	KBA2010 IPA2011	Confirmed	B1	high	Development (tourism/recreation areas) Development (roads/railroads) Annual/perennial crops (agro-industry) Livestock grazing/ranching/farming (nomadic)	high	Government funding	high	Update MP according to UNESCO	medium	very feasible	high	Biosphere reserve	low
Lake Maryut	IBA1999, KBA2010 IPA 2011	confirmed	B1	high	- Aquaculture - Euthrophication - Urbanisation (refer to pg. 46 of IPA Inventory)	high	World Bank Project - ICZM0 Alexandria Coast Line	high	Management plan that takes into account human use;	low	difficult	low	National Strategy for Wetlands - Identified as 4th priority;	low

Lake Mariut (added with above)	IPA2011	candidate												
Alexandria Coast (removed)	KBA2010	candidate												
Lake Edku	IBA1999, KBA2010 IPA 2011	candidate		very high	Aquaculture Eutrophication Urbanisation (refer to pg. 41 of IPA Inventory)	high		high	Address pollution from industries & aquaculture;	low	feasible	medium	National Strategy for Wetlands - Identified as 3rd priority;	medium
Lake Edku (added with above)	IPA2011	candidate												
Lake Burullus	IBA1999, KBA2010 IPA 2011	confirmed	B1, D1a	high	- Hunting (intentional) - Sewage - Agricultural & Industrial Pollution - Urban development - Unsustainable fishing - Aquaculture	High	- Gov. funding - Int. funding for hunting management & research through BLI	high	Implementation of general management plan + hunting management	medium	very feasible	high	National Strategy for Wetlands - Identified as 2nd priority; NCE's RHP identified it as hunting hotspot in need of conservation actions	low
Lake Burullus (added with above)	IPA2011	candidate												
Lake Burullus Protected Area - Marine (awaiting clarification)	IBA2012	candidate												
Wadi el Natrun (canceled from KBA)	KBA2010	candidate												
Lake Manzala & Malaha	IBA1999 KBA2010 IPA2011	confirmed	B1, D1a	very high	Aquaculture Eutrophication Urbanisation Hunting (intentional)	high		high	Waste treatment + Hunting management	low	feasible	high	National Strategy for Wetlands - Identified as 1st priority;	High
Lake Manzala (added to above)	IPA2011	candidate												
Manzala & Malaha - Marine (awaiting clarification)	IBA2012	candidate												
El Malaha (added to above)	IBA1999, KBA2010	confirmed	D1a											

Lake Bardawil & Zaranik	IBA1 999, KBA2 010 IPA 2011	con firm ed	B1, D1a	high	Overfishing Unsustainable fishing Hunting (persecution/ control)	med ium		high	* Sustainable develop ment; - Integrated manage ment plan - Species conserva tion plan	low	difficult	high	High priority accordin g to NBSAP	low
Lake Bardawil (added to above)	IPA2 011	can did ate												
Lake Bardawil - Marine (awaiting clarification)	IBA2 012	can did ate												
Zaranik Protected Area (added to Bardawil)	IBA1 999, KBA2 010	con firm ed	D1a											
[PROPOSED] North Sinai Mountains	-	Pro pos ed	-	medi um	Overgrazing Overcutting Drought stress	Hig h	-	High	Declarati on of protectio n for juniperus phenicea pop.	Low	Difficult/ Impossi ble	Low	-	Hig h

4- Contacts with experts

When the consultant was assigned to prepare the monitoring marine biodiversity program of Egypt, contacts were made with several experts from several countries. The following is an example of the Australian expert.

Dear Mostafa

Nice to hear from you. What you are asking for is a quite a large question and I have been given some thought to how I could be of assistance. One of the key challenges in monitoring national biodiversity is choosing what to monitor. There are typically many more choices than funds and determining which aspects that if monitored would actually make a difference to national policy or management requires a lot of thought. From my experience there are many monitoring programs that only document the decline of biodiversity and do not lead to any substantive change. This is an expensive approach to getting the public depressed and contributes to the impression that it is all too hard and we might as well give up! For monitoring to have an impact it needs to be tied into a strong governance framework. Recently when Australia‘s Great Barrier Reef World Heritage Area was in danger of being put on the WH properties at risk register, I led a project for the Australian government to develop an integrated framework that is now being put in place. What surprised me at the time was that despite spending $20M a year on 60+ monitoring projects and having the reputation as the best managed MPA in the world, there was very little coordination and no link between monitoring and managers (most monitoring to be fair was independent academic researchers). We developed quite an extensive report on the steps to set up an integrated monitoring framework that can be downloaded from this address:

http://www.environment.gov.au/sustainability/publications/integrated-monitoring-framework-great-barrier-reef-world-heritage-area

The second important point is that to provide effective national (and international) monitoring, it is important that wherever possible researchers (and these can be government researchers, academics or industry consultants) collect data using similar (or at least comparable methods) and that they are committed to sharing data in an agreed format and archived in a national data centre. Perhaps providing that data can be made a condition of research funding or licensing activities (although this never solves all the problems – it is an ongoing issue!). The Global Ocean Observing System is in the process of developing some standard protocols for Essential Ocean Variables that I can provide you access to once you reach that stage. I have a very draft paper on developing that approach to identifying essential ocean variables that I can send if it would be useful.

Lastly, some governments are interested in the broader concept of ecosystem health rather than the more direct species-based approaches to biodiversity. In this case it gets quite complicated. What is really meant by ecosystem health and how would you monitor its change. In Australia, the government developed a program (very much like the CBD EBSA process) where they identified areas of high biodiversity interest based primarily on their perceived species richness or productivity (although in many cases they were based on seafloor features that had never been sampled but were assumed to have high biodiversity). Given that the government had decided that these were important, it allowed us when developing an approach to monitor ecosystem health, to use these important areas, identify which pressure would be impacting them, and then determine which aspects of the features need to be monitored to determine how they were changing and what was causing the change. This is quite complicated and we are still determining how well it works, but I attach a paper that describes the approach – and incidentally points out some of the flaws in many monitoring approaches.

This might be enough to get you started. Best of Luck

Nic‖

5- Examining marine monitoring programs of several countries and regions

Several marine monitoring programs were reviewed to be considered in the Egyptian monitoring program. These include:

- An integrated framework for the Great Barrier Reef World Heritage Area
- Helcom (North sea) Monitoring and Assessment strategy
- UK monitoring program
- French monitoring program (plan d‘action pour le milieu marin)
- Dutch marine strategy (North sea)

Overview of Egypt Biodiversity

Egypt covers an area of about one million square kilometers and can be divided into four physiographic regions: the Nile Valley, Western Desert, Eastern Desert and Sinai. The arid desert covers 92% of the land, the remaining 8% of arable land being restricted to the Nile Valley, the Nile Delta and a few oases scattered in the Western Desert. The population is very unevenly distributed: 99% of Egyptians live on less than 4% of the land (Egypt Country Study on Biological Diversity). The country can also be divided into 4 bioclimatic zones: the eastern desert which is hyper arid with mild winters, hot summers and extremely rare rainfall; the southern Sinai region which is also hyper arid but has cool winters, hot summers, and less than 30mm/yr. of rainfall; the coastal belt along the Mediterranean Sea; and the sub-coastal belt and the wetlands (Nile Valley, Nile Delta).

Egypt lies at the northeast corner of Africa at the junction of four biogeographical regions: Irano-Turanian, Mediterranean, Saharo-Sindian and Afrotropical. At the same time it is at the center of the great Saharo-Sindian desert belt that runs from Morocco on the northwest corner of Africa to the high, cold deserts of central Asia. Egypt is bounded on the north and east by two largely enclosed seas, the Mediterranean Sea and the Red Sea. This unique position is enhanced by the circumstance that it is divided by the Nile, the longest river in the world. Despite being mostly arid or hyperarid, Egypt is home to a wide diversity of terrestrial habitats, fauna and flora due to its very varied eco-zones. Although relatively low in species numbers and with few endemics, it is extremely varied in composition.

Despite being dominated by desert and draught, Egypt‘s biodiversity is of global significance due to the fact that it is situated at the juncture of three continents: Europe, Africa and Asia. It is the home of at least 1500-2000 species of non-flowering plants, 2302 flowering species and subspecies (62 endemic species and 2 threatened), 116 mammal species (13 threatened), 447 bird species (14 threatened) 109 reptile species (6 threatened), 9 amphibians and more than 1000 fish species. Invertebrates are very diverse, for instance insect diversity varies between 5 and 10 thousand species, and there are more than 200 coral species, 800 mollusks, and more than 1000 crustaceans. The biodiversity of Egypt reflects its habitats, position and climate. The uniqueness of the Nile as a conduit from tropical Africa contributes greatly to the fauna and flora, and there are few places where the contrast between water and aridity is as stark.

From the terrestrial point of view, outside the Nile Valley, Egypt is one of the most hyper arid countries in the world, with large areas of completely barren desert where no rain having fallen for decades. There is slightly more rainfall in the north, close to the Mediterranean coast, in the mountains of Sinai, and in the extreme southeast where fog deposition in Gebel Elba produces the only Egyptian example of a officially (WWF) endangered habitat – a Red Sea Fog Woodland. In terms of terrestrial habitats, all of Egypt is classified into only two of the major habitats of Africa (desert and riverine vegetation (albeit greatly modified by man), and thus habitat diversity is low overall.

Because of the hyper aridity, the overall number of species in most taxa is low on a world scale. The Nile corridor has ameliorated this to an extent, providing a source of freshwater habitats and wetlands that is extremely important, especially to migrating and overwintering animals. Levels of endemicity are reasonably high because the drying of North Africa over the last 5000 years has fragmented and isolated the fauna and flora, allowing the evolution of many unique forms. Isolated pockets of biodiversity exist in the oases of the Western desert and on the mountaintops of Sinai. Probably the relatively rich biodiversity of Gebel Elba harbors many endemic forms, but more study

is needed to assess their uniqueness relative to other Red Sea fog woodlands further south in the Sudan.

Egypt is at the junction of three major biogeographical zones (Western Palaearctic, Eastern Palaearctic and Afrotropical,), and its biodiversity reflects the mixture of elements that this implies.

The fauna and flora change significantly on either side of the Suez Canal because of the bottleneck effect of the connection between Africa and Asia, augmenting Egypt‘s total biodiversity.

In the marine environment, biodiversity in Egypt benefits from having two completely independent elements – the Mediterranean and the Red Sea. Its Mediterranean fauna and flora are modest and shared with most of the countries of that region. It‘s very rich Red Sea equivalents are also probably shared with most of the countries bordering the Red Sea. Endemics are largely or wholly limited to Red Sea habitats, where Egypt has the most northerly coral and mangrove habitats of the world – possibly these will become even more important as climate change occurs. The shallow waters of the Suez Gulf are important areas for marine biodiversity, and the contrast with the abyssal depths of the Gulf of Aqaba creates a very important set of habitats.

Although the country‘s species diversity is relatively low owing to its general aridity, many species are very narrowly distributed or highly localized, making habitat conservation crucial. Threats to Egypt‘s biodiversity include demographic pressure, excessive hunting and cutting, globalization and its negative impacts on resource extraction, limited human and financial resources, and habitat degradation due to pollution from unsustainable agricultural and industrial use. Many species have been introduced in the last 2 centuries and became the backbone of Egypt‘s agriculture: cotton, fruit cultivars, animal races including fish and chicken. This has resulted in the neglect of local breeds, and therefore some have been badly degraded with others disappearing. It is noteworthy that many plant and animal species in Egypt are on the very edge of their geographical or ecological range, and have therefore very limited tolerance for ecological pressures. (e.g. coral reefs and mangroves).

CHAPTER 2

Institutional and regulatory aspects

Overview of the legislation and regulatory requirements to support the development and implementation of National IMAP Monitoring Plan

- Article 45 of the **Egyptian Constitution** of 2014 dictates that the state commits to protecting its seas, beaches, lakes, waterways, mineral water, and natural reserves. It is prohibited to encroach upon, pollute, or use them in a manner that contradicts their nature. Every citizen has the right to enjoy them as regulated by law. The state also commits to the protection and development of green space in urban areas; the protection of plants, livestock and fisheries; the protection of endangered species; and the prevention of cruelty to animals. All the foregoing takes place as regulated by law.
- As well as, Article 93 dictates that Egypt shall bound by all of the international conventions and agreements it has signed and ratified. This is the legal foreground for asserting Egypt‘s responsibility to uphold its duties and obligations under international law. Egypt is a signatory of all the major international agreements and conventions regarding the conservation of biodiversity, ensuring that it is under international duties to fulfill its obligations and take the necessary local measures to do so.
- Conservation of critical ecosystems and biodiversity is mandated by regional and international conventions. The Constitution of Egypt has the same power as Egyptian Law. The conventions obligate Egypt to establish and maintain a network of protected areas in order to protect and conserve ecosystems, representative habitats, threatened species, cultural heritage sites, and traditional knowledge which is of value to all mankind.
- International Conventions with provisions for biodiversity conservation signed by Egypt include:
    - African Convention on the Conservation of Nature and Natural Resources, Algiers 1968
    - Convention on Wetlands of International Importance Especially as Waterfowl Habitat, Ramsar 1971
    - Convention Concerning the Protection of World Cultural and Natural Heritage, Paris 1972
    - Convention on International Trade in Endangered Species (CITES) 1973
    - Convention on the Conservation of Migratory Species of Wild Animals, Bonn 1979
    - Protocol Concerning Mediterranean Specially Protected Areas, Geneva 1982
    - Convention on the protection of Marine Environment and the coastal region of the Mediterranean, known as Barcelona Convention 1995
    - Convention on Biological Diversity, Rio de Janeiro 1992
    - Agreement on the Conservation of African-Eurasian Migratory Waterbirds, The Hague 1995
    - ACCOBAMS agreement on conservation of Cetacea 2010
- Law for the Protection of Environment - Law 4/1994 (Amended by Law 9/2009) This is the main law that is specialized with matters of environmental protection, upon which the Egyptian Environmental Affairs Agency (EEAA) was established, it being the main governmental entity designated with jurisdiction over environmental matters. This law is the main legal framework for

the Ministry of Environment and its executive body, the EEAA. The first chapter of this law dictates that all institutions and projects submit an environmental impact assessment (EIA) that integrates the wellbeing of wildlife and biodiversity. This chapter goes on to address solid and liquid waste management, air and water pollution, use of chemicals, habitat degradation for mining, all in light of its effects on biodiversity health. The third chapter specifically refers to the protection of coasts and wetlands from pollution, in light of biodiversity concerns (that include birds).

- The law encourages the establishment of protected areas, in hope of protecting wildlife and other natural resources.
- Article 28 explicitly forbids the hunting, killing, catching or trading of species that are determined by the law‘s executive regulations: “It is forbidden to hunt, kill, or catch the species of wild birds and animals determined in the executive regulations of this Law or to possess, transport, circulate with, sell or offer to sell such birds and animals either dead or alive. It is also forbidden to damage the nests or eggs of these birds… The executive regulations of this Law shall determine the areas to which the provisions of this article apply and shall specify the conditions for a hunting license in these areas as well as the competent administrative authorities responsible for implementing the provisions of this article”.
- Article 84 specifies the legal consequences of violating the previous article (28) “Whoever violates the provisions of Article 28 of this Law shall be sentenced to jail and/or fined a sum of not less than five thousand Egyptian pounds and not more than fifty thousand Egyptian pounds. In addition, birds and animals seized as well as the machines and equipment used in the violation shall be confiscated”.
- Law for Protected Areas – Law 102/1983 (Appendix II): This law organizes the establishment and management of protected areas in Egypt. It was initially passed to promote the establishment of a network of protected areas to promote biodiversity conservation, providing safe spaces for birds and other wildlife from hunting, pollution and other forms of human disturbance. Article 2 of this law explicitly prohibits hunting, trafficking or disturbing all wildlife, alive or dead, located within the boundaries of the protected area. This law also prohibits any nearby activities taking place outside the boundaries of the protected area if such activities are damaging or harmful to the protected area and the creatures residing within it. Any provinces that contain a protected area are expected to integrate the wellbeing of this protected area into its development plans, to ensure the wellbeing of the nature residing within it. Park rangers and other administrative staff working in a protected area are vested with full authority to enforce the law and its executive regulations, to ensure the continued protection of the protected area‘s natural resources. Similar to the Law for the Protection of the Environment (4/1994), violating such laws can result in a jail sentence and/or a fine, as well as confiscation of equipment and machinery.
- The Ministry of State for Environmental Affairs (MSEA) and its executive arm, the Egyptian Environmental Affairs Agency (EEAA) consider nature conservation critical to the national environmental strategy.
- Egypt‘s strategic objective of environmental policy is to integrate environmental concerns to managing natural resources into all national policies, development plans, programs and projects. The medium-term objective is to preserve natural resources, biological diversity and national heritage within the context of sustainable development. The Nature Conservation Sector (NCS) of

the EEAA is responsible for nature conservation and management of Protected Areas. It is entrusted with implementing policies, programs, studies and other actions that ensure compliance with the nation‘s habitat and species protection legislation and the nation‘s commitment to international conventions for the conservation of nature.

During the last 10 years NCS has focused its work on preparing its vision, mission, mandate, and policies as the first step of mainstreaming biodiversity conservation into development sectors (tourism, agriculture, fisheries, mining).

Vision

To preserve the natural character of the Egyptian environment for future generations of Egyptians, while using it innovatively to enhance sustainable local productivity and alleviate poverty.

Mission

Egypt has exceptional wild resources (coral reefs, spectacular desert ecosystems, rich fossil deposits, and vast bird migrations) that underpin the economy and offer it a comparative economic advantage in the massive and growing nature based tourism industry. Recognizing the value of this biodiversity and its critical role in maintaining and enhancing the wellbeing of the country Government, in partnership with stakeholders, will maintain a healthy, well managed and ecologically representative system of Protectorates and will make them as financially self- supporting as possible. Furthermore, it will manage wild resources outside these areas sustainably for the benefit of the people living on the land with the resources.

Mandate

Government will fulfill its accountability to the people of Egypt for conserving their wild resources, through the Minister for the Environment approving an autonomous Nature Conservation Council, in consultation with affected local resource use right holders and other stakeholders. This Council will have full responsibility to undertake this task on the Minister‘s behalf and will report to him and through him to the Nation at least once a year. The Council may appoint specialist sub- committees to perform particular allotted tasks, and it will be serviced by a professional scientifically orientated Nature Conservation Authority, under the command and control of a Director General who shall be responsible for enacting and implementing a policy to:

1. Create and maintain an ecologically representative system of adequate terrestrial and marine areas as Protectorates at national provincial and local levels, to protect the nation‘s natural values, particularly its biological diversity and areas of natural scenic excellence, in an unspoiled state.
2. Ensure that Protectorates are properly governed (by the Nature Conservation Authority alone or in partnership with one or more private of public sector organizations) and are managed to preserve their asset value and used sustainably in support of the local and national economy, in terms of properly constituted resource management, business and tourism plans, agreed by the Council.
3. Council will endeavour to make Protectorates as financially self-supporting as possible by optimizing revenue generation from each area to the extent the market will bear and this can be achieved without threatening natural values. It will ensure that the first call on all revenue earned by a Protectorate is used for its own protection and management in terms of a system of financial controls that promotes the Authority‘s effectiveness. Where a Protectorate earns revenue surplus

to its needs Council may allocate a predetermined proportion of this surplus to nature conservation elsewhere in Egypt, to rural development in the area adjacent to the Protectorate, and finally to other environmental issues.

4. Promote the better long term conservation of all wild resources outside Protectorates through supportive regulatory mechanisms, services and pricing structures that offer local people incentives to conservation and manage wild resources more sustainably. This will include community based resource management programmes (like locally regulated fee paying hunting, the locally controlled sustainable collecting of wild animals or plants, or the rearing and growing of such organisms) that give the landholders in an area rights to use and trade freely in wild resources, so as to maximize the returns from using them sustainably.
5. Monitor the status and trends in wild resources throughout the country with a view to initiating appropriate action to prevent the dissipation or genetic contamination of valuable species, ecological processes or the despoiling of aesthetically attractive scenery. Where justified by careful investigation, to devise strategies to protect people from invasive species or wild organisms that are harmful to their health or livelihoods.
6. Promote awareness among decision makers and the public at large of the value of truly wild resources and the importance of managing them effectively to this end, without undervaluing them, and to develop a coordinated wildlife industry that conserves the resources and realizes their potential to generate increased national prosperity in the long term.
7. Ensure that the Egyptian Nature Conservation Authority is adequately staffed, equipped and financed to be an effective and efficient organization that the Council can hold accountable for fulfilling this mandate. In doing so the Authority should use internationally recognized best practices (such as those proposed by the World Conservation Union) to achieve the standards of excellence expected by the Convention on Biodiversity.
8. The Authority will ensure that Egypt fulfills its obligations in terms of international conventions and bilateral or regional agreements relating to nature conservation of which it is a signatory.

Policy for Managing Protected Areas or Cluster of Protected Areas

1. **Governance:**

National Protected Areas or clusters of Protected Areas will each be managed by a Board appointed by the Minister on the advice of the Nature Conservation Council which shall have representation on every such Board. The Director of the Nature Conservation Authority and a senior member of his staff will also be members of these boards on which the remaining four Members will be drawn from local communities in the area where a Protectorate or cluster of Protectorates is located. Local members will be selected to represent Local Government and local communities, with emphasis on stakeholders who have invested in services in the Protectorate, or who have traditional resource rights in the area it covers.

Protected Area Boards will meet at least once a year to guide management and ensure the ongoing protection of the natural values and sustainable use of Protected Areas. They will objectively evaluate past progress and guide future management, in terms of resource management, business and tourism plans for the area, setting clear objectives to be accomplished by the annual work plan applicable to the Board‘s area of responsibility. This information will be reported to the National Council for Nature Conservation.

The representatives from the Nature Conservation Council and Nature Conservation Authority on a Protectorate Board will ensure that all management actions in the Protectorate are undertaken in accordance with established national and area policy.

2. Planning

Natural Resource Protection and Management, Tourism and Business Plans will be prepared by the Nature Conservation Service for each Protectorate under the general supervision of the Director of NCS and in consultation with the local Members of a Protectorate Board. These Members should consult with their local constituencies to promote the generation of local benefits from the proper management of a Protectorate; the aim being to promote public acceptance of the area and its use.

These plans and any amendments to them will be submitted to the National Council for Nature Conservation for consideration and approval. Where development is desirable for any reason in a Protected Area, it will be subject to an environmental impact assessment to be considered first by the responsible local Board. If the Board agrees to the development it will submit its recommendation to Council and the Council‘s decision will be binding on the local Board and the Nature Conservation Authority.

3. Management

The physical management of a Protected Area will be undertaken by the Nature Conservation Authority, by the Area Manager and his staff with broad supervision from the Director General. It will be in terms of Natural Resource Protection and Management, Tourism, and Business Plans, recommended by the Protected Area Board and approved by the Nature Conservation Council.

Management of a Protected Areas (or cluster of Protected Areas) will be supported by a grant in aid from Government, or a donor, augmented by revenue the area generates from entry charges, concessions, licenses fees or the like, with the aim of using free market forces to first make the Area financially self-supporting and then profitable. Sporadic, unpredictable windfall earnings, such as those from fines for infractions or physical damage to the natural assets in a Protectorate shall not be treated as part of the regular income of a Protected Area or group of Protected Areas. It will be credited to a special fund and used by Council to rehabilitate natural resources in the Protected Areas or to further develop their use.

Any or all management activities in a Protected Area may be outsourced to public and private sector providers, on condition the local Board and the Director General are both satisfied that the provider can offer services of sufficient quality at a competitive price. All contracts to undertake a management function and all concessions to offer services to visitors to a Protected Area will consist of a well-crafted agreement of fixed duration, varying from one to twenty years, depending on the magnitude of the investment and the costs involved in undertaking the function or providing the service in question. These agreements will specify the standards to be achieved, payments to be made by either party to the agreement, the conditions under which it may be terminated, and will include a provision for the management authority to revise the terms and conditions of the agreement for sound technical or economic reasons.

Where it is possible to generate a flow of benefits from a Protected Area or cluster of Protected Areas for the benefit of members of the public, especially for neighbors of a Protected Area who can benefit, this will be in terms of ancillary Policy Documents that spell out the nature of the benefits,

how they will be realized sustainably and who may benefit. This Policy will also describe the terms and conditions of fixed term agreements to be entered into between a Protected Area and registered individuals, associations or companies permitted to realize such benefits and the fees, if any, that they may be required to pay annually to do so. Provision will also exist to cancel or suspend any such agreement where the holder is in breach of the conditions of his agreement.

No land in national Protectorates will be sold to the private sector but suitable sites identified in management plans may be leased, subject to an environmental impact assessment, for the development of important management activities or the provision of appropriate visitor services.

4. Monitoring Management Performance

The biological diversity and general health of wild populations of plants and animals in the various ecosystems in Protected Areas will be monitored annually, using indicator species, to ensure that resource management is achieving the aims of the management programme and is sustainable. Likewise, all developments, public services and authorised uses of an area or its recognisable ecological sub-divisions will be monitored to ensure that the uses permitted are sustainable and not detracting from the area‘s long term aesthetic attractiveness.

Monitoring of management performance will be based on objectively verifiable criteria for ascertaining the effectiveness of the management and whether it is accomplishing its stated objectives. It will be undertaken in terms of work plans that will require data to be evaluated to determine the cost effectiveness of management actions and permissible uses of the area. This will be on an annual basis and the results will be fully reported to higher authorities for consideration by the Director General and Council.

Data and analysis of data obtained from monitoring the effectiveness of management and cost effectiveness of the use of an area shall be lodged with the Data Base and shall become part of the permanent records of the Nature Conservation Authority.

One of the most important duties of EEAA is participation and execution of National Environmental Monitoring Program (article 5) and makes use of its results in the protection of the Egyptian environment. In addition, EEAA prepares regular reports on the main indicators of the status and trends of the environment in air, soil and water. These reports are submitted annually to the Egyptian Parliament, and published (online) by EEAA. Furthermore, EEAA is to coordinate with relevant agencies to the protection of Egyptian environment.

State of Environment report of Egypt include section I on air quality, section 2 on noise, section 3 on climate change, section 4 on ozone layer protection, section 5 on fresh water, section 6 on coastal and marine zones, section 7 on biodiversity, section 8 on green belts, and other sections on energy, industry, solid waste management, toxic / hazardous substances and EEAA ongoing projects.

The executive regulations of Law 4/1994 amended by law 9/009 contains an annex (4) with all protected species of birds (21), mammals (75), amphibians and reptiles (37), as well as all living aquatic species of fish (both cartilaginous and bony fish), coral reefs, aquatic invertebrates in the Egyptian waters. In addition, species of CITES (only appendix I) are also protected.

There are other laws which address the marine environment of Egypt. These are law for Development of Fisheries Resources (law 124/1983), law for establishment of the National Institute of Oceanography and Fisheries, Academy of Scientific Research and Technology, Egyptian Universities

and Research Centres, Ministry of Maritime, Ministry of Trade and Industry, and others.

Articles 21 and 22 of law 124/1983 deals with Scientific and Technical aquatic research committees in charge of collecting fisheries data to publish annual reports on fisheries statistics.

The National Institute of Oceanography and Fisheries aims to monitor and carry out scientific research on the marine environment, and publishes annual reports, after submission to the President of the Academy of Scientific Research and Technology and other relevant agencies in Egypt, including the Egyptian Parliament.

Many regional and international agreements and conventions were reviewed with focus on marine and coastal monitoring. Convention on Biological Diversity has several articles that deal with identification and monitoring of biodiversity (article 6), sustainable use of biological diversity (article 10), and reports (article 26).

5. **Article 6: Identification and Monitoring**

Each Contracting Party shall, as far as possible and as appropriate, in particular for the purposes of Articles 8 to 10:

(a) Identify components of biological diversity important for its conservation and sustainable use having regard to the indicative list of categories set down in Annex I:

(b) Monitor, through sampling and other techniques, the components of biological diversity identified pursuant to subparagraph (a) above, paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use;

(c) Identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects through sampling and other techniques; and

(d) Maintain and organize, by any mechanism data, derived from identification and monitoring activities pursuant to subparagraphs (a), (b) and (c) above.

6. **Article 10: Sustainable Use of Components of Biological Diversity**

Each Contracting Party shall, as far as possible and as appropriate:

(a) Integrate consideration of the conservation and sustainable use of biological resources into national decision-making;

(b) Adopt measures relating to the use of biological resources to avoid or minimize adverse impacts on biological diversity;

(c) Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements;

(d) Support local populations to develop and implement remedial action in degraded areas where biological diversity has been reduced; and

(e) Encourage cooperation between its governmental authorities and its private sector in developing methods for sustainable use of biological resources.

7. **Article 26: Reports**

Each Contracting Party shall, at intervals to be determined by the Conference of the Parties, present to the Conference of the Parties, reports on measures which it has taken for the implementation of the provisions of this Convention and their effectiveness in meeting the objectives of this Convention.

Convention of the protection of the Marine Environment and the Coastal Region of the

Mediterranean contains articles on Biological Diversity (article 10), and Monitoring (article 12).

8. **Article 10: Conservation of Biological Diversity**

The Contracting Parties shall, individually or jointly, take all appropriate measures to protect and preserve biological diversity, rare or fragile ecosystems, as well as species of wild fauna and flora which are rare, depleted, threatened or endangered and their habitats, in the area to which this Convention applies.

9. **Article 12: Monitoring**

1- The Contracting Parties shall endeavour to establish, in close cooperation with the international bodies which they consider competent, complementary or joint programs, including, as appropriate, programs at the bilateral or multilateral levels, for pollution monitoring in the Mediterranean Sea Area and shall endeavour to establish a pollution monitoring system for that Area.

2- For this purpose, the Contracting Parties shall designate the competent authorities responsible for pollution monitoring within areas under their national jurisdiction and shall participate as far as practicable in international arrangements for pollution monitoring in areas beyond national jurisdiction.

3- The Contracting Parties undertake to cooperate in the formulation, adoption and implementation of such annexes to this Convention as may be required to prescribe common procedures and standards for pollution monitoring.

The SPA/BD Protocol is the Mediterranean‘s main tool for implementing the 1992 Convention on Biological Diversity, as regards the in situ sustainable management of coastal and marine biodiversity. The Conference of Plenipotentiaries of the Barcelona Convention adopted the Protocol in 1995.

The Protocol envisages three main elements in order to ensure the safeguard of biological diversity in the Mediterranean:

1- The creation, protection and management of Specially Protected Areas (SPAs),

2- The establishment of a list of Specially Protected Areas of Mediterranean Importance (SPAMIs),

3- The protection and conservation of species

In order to meet these objectives, the following aspects are developed:

- Conservation of types of marine and coastal ecosystem that are typical of the Mediterranean;
- Protecting habitats that are in danger of disappearance or are necessary for the survival, reproduction and restoration of threatened or endemic species;
- Protecting sites of scientific, aesthetic, cultural or educational interest;
- Development and implementation of management plans ;
- Setting up and promoting Specially Protected Areas ;
- Conservation of species that are threatened of extinction, endangered, or to be managed;
- Sustainable use of biological resources

The SPA/BD Protocol recommends concrete protection measures to safeguard elements of biological diversity through Action Plans and technical tools for inventory. The Protocol recommends setting up Specially Protected Areas of Mediterranean Importance (SPAMIs), including trans-boundary areas, in areas where several states have sovereignty and in international waters.

The SAP/BD has article 3 dealing with General obligation where (3.3) parties shall identify and compile inventories of the components of biological diversity important for its conservation and sustainable use. Article 3.4 calls parties to adopt strategies, plan and programs for the conservation of biological diversity and sustainable use of marine and coastal biological resources, and shall integrate them into their relevant sectoral and intersectoral policies. Finally, article 3.5 calls parties to monitor the components of biological diversity, and shall identify processes and categories of activities which have or are likely to have a significant adverse impact on the conservation and sustainable use of biological diversity, and monitor their effects.

Other conventions such as Convention on International Trade on Endangered Species (CITES), Convention on Conservation of Migratory Species (CMS), RAMSAR (wetlands), MARPOL, and others have specific articles that deal with sustainable use of marine and coastal resources. The most significant ones are those related to reporting on the status and trends of coastal and marine resources. These conventions have specific programs and strategies, adopted by COPs, where specific species and habitats are to be protected and conserved. They contained in appendixes (such as appendix I and II of CITES) or in specific agreements such as ACCOBAMS for Marine Mammals, or in the form of Memorandum of Understanding (MOUs) such Marine Turtles.

Based on the above, it is clear that the national constitution and legislation, as well as national institutions all have regulatory requirements to support the development and implementation of National Integrated Monitoring Program, which are committed to regional and international agreements and conventions. However, enforcement of national legislation requires strengthening of capacity building, technical and financial assistance, bilateral, regional and international cooperation to implement proper IMAP plan in Egypt.

CHAPTER 3

Scientific Aspects

Summary of Egyptian Marine Biodiversity Knowledge

The Egyptian Mediterranean coastline is roughly divided into three geomorphologically distinct geomorphological sectors. The first sector extends from El-Salloum at the Egyptian – Libyan border to the city of Alexandria at the western margin of the Nile Delta. The second sector is the Mediterranean coast of the Nile Delta, which extends from Alexandria to Port Said. The third sector is the Sinai Mediterranean coast, which extends from the eastern margin of the Nile Delta to Rafah at the border between Egypt and Gaza strip. Along the coastline, sandy beaches predominate, and are occasionally interrupted by both hard and soft rock shores of limited length, associated with rocky cliffs where the Libyan plateau of the Egyptian Western Desert just into the Mediterranean plateau.

The biodiversity of the coastal and marine waters of the Egyptian Mediterranean Sea provide valuable services for humanity, as well as crucial nursery habitats for marine animals and sanctuaries for endangered species. These resources have traditionally supported livelihood through fisheries, agriculture and trading. Nowadays, the coastal areas are the focus of rapid urban an industrial growth, oil and gas development, industrial-scale, fisheries and tourism.

More than 20% of Egypt total population lives on the coasts where available food and raw material are required for economic development. More than 40% of industrial and developmental activities are concentrated on the coastal zone (ports, cities, infrastructure, petroleum and mining activities and tourism)

In the Egyptian coastal waters, as in the eastern Mediterranean in general, marine biological diversity is relatively impoverished, when compared to areas in the western Mediterranean (UNEP, 1999) and is dominated by species with smaller individuals and shorter life cycle (Bellani-Santini et al., 1994). Primary productivity in that area is characteristically rather low, with pelagic phytoplankton blooms being quite variable and largely associated with the seasonal variation in temperature and salinity gradients.

Habitats:

The Egyptian coastline of the Mediterranean is considered arid to hyper-arid. Consequently, the availability of water as the most critical resource, plays a decisive role in determining the types and distribution of natural habitats. Differences in rainfall as well as landform features which control the redistribution and availability of water from local to remote sources, are therefore of extreme importance in determining the nature, distribution and abundance of plant and animal life.

Two major groups of habitats are recognized in the Mediterranean coastal zone: the natural and the man-made / human modified habitats.

Natural Habitats

- Beaches (sandy or rocky) and coastal dunes,
- Coastal rocky cliffs and slopes,
- Compounded coastlines (beaches and rocky cliffs mixed)
- Coastal lagoons

- Salt pans and playas
- Swamps / marshes
- Seagrass meadows
- Coralligenous communities
- Continental shelf water
- Deep sea communities such as Nile Delta Fan

Man-made / man-modified Habitats

- Irrigated agriculture
- Dry / Rain-fed agriculture
- Urban

The Mediterranean coast of Egypt is one of the richest areas in biodiversity in the entire country. The milder climate and the higher rainfall support a more or less continuous vegetation cover of about 968 species and a wide variety of animal species.

Flora

Thirteen major habitats were identified in the northern Mediterranean (coastal dunes, sand formation, sallum plateau, salt marshes, saline depression, non-saline depression, inland ridges, inland plateau, wadis, cultivated lands, road sides, and summer resorts). Mediterranean elements were the most represented within the flora of the western Mediterranean desert and had the maximum relative occurrence in the salt marshes. Saharo-Arabian elements had the maximum relative occurrence in inland plateau; whereas Sudano-Zambezian elements are mostly in Sallum plateau.

Twenty endemics and 21 near endemic species are recorded in the western Mediterranean Desert. Most of endemic species were restricted to one habitat and were very rare; while near-endemic species were restricted to Egypt, Palestine and Libya, most of them have small phytogeographical distribution, restricted habitats and were very rare.

Forty two species were recorded as introduced species; some of them were invasive species such as *Paspalum distichum.* A total of 211 species were recorded as weeds, mostly in barely fields, figs farms, clover fields and wheat fields.

The medicinal species were mostly represented in Sallum Plateau and contributed by 14 poisonous species followed by the grazed and human edible species.

Fifty three species in the Western Mediterranean Desert were recorded in the Red data List of the vascular plants of Egypt (one extinct *Ceruana pratensis*), 20 endangered, 3 vulnerable, 20 rare, and 9 indeterminate). Most of these species were restricted to one habitat and were very rare.

There are a number of ecological units in the coastal land, each with its distinct plant life. The coastal dunes immediately on or near the shoreline are dominated by *Ammophila arenaria*, *Euphorbia paralias*, *Lotus polyphyllos* and *Thymelaaea hirsute.* Coastal ridges of consolidated oolitic sand are characterized by *Pituranthosturtuousus*. Away from the shore, the dune plant cover becomes dominated by *Urigina maritime* and*Thymeleaeahirsuta.*

The inland rocky ridges are characterized by a vegetation cover dominated by *Thymus Pitatus* and *Salvia lanigera*. Saline depressions between these ridges often support salt march plant communities dominated by *Arthrocenemumm acrostachyum* whereas non-saline depressions are dominated by Anabasis articulate, *Zygophylum album*, *Artemisia monsperma* and other species.

In the western region, *Capparisspinosa* and *Ephedra aphylla* grow on the *limestone escarpments*, whereas *Gymnocarposdecandrum* grow on the slopes of the wadi sides. In non-cultivated wadi courses, the dominant plants are *Zillaspinosa* and *Atriplexhalinus*. On the plateau top, *Artemisia monosperma* and *Scorzonera* alexandrine are the dominant plants.

Animal life

The Mediterranean coastal belt of the western sector possesses the richest herpatfauna (46 species of reptiles and two species of amphibian). The Egyptian tortoise *Testudo kleinmanni*, formerly a common and characteristic species of the Mediterranean coastal desert has been mostly eliminated from its natural habitats by commercial collectors and habitat alternation. It is listed in the IUCN Red list of threatened species.

There are around 170 resident and migratory bird species that occur in the Mediterranean coastal area and desert, 48 of them occur in the western coastal belt. Two resident species, the Barbary Partridge *Alectorisbarbara* and the Raven *CorrusCarax* are known only from the western coastal habitat.

A total of 57 species of mammals (62% of the Egyptian terrestrial mammalian fauna) have been recorded from the Mediterranean coastal terrestrial land, and 40 species from the western coastal land. They are mostly rodents. The dorcas gazelle *Gazelladorcasdorcas* used to be common, but their populations have been declined greatly due to hunting. The same is true for the slandered- horned gazelle that is found now only in Siwa region.

Marine Biodiversity

Mediterranean marine life is characterized by its low biomass and high diversity, and clearly reflects the prevailing abiotic, environmental features particularly the nutrient deficient water, low tidal amplitude and temperature regime. Biodiversity is dominated by smaller individuals and shorter life cycle. Primary productivity is relatively low, with pelagic phytoplankton blooms being quite variable and largely associated with seasonal variation in temperature and salinity gradient.

The richest marine biodiversity are phytoplankton (661 species), consisting mostly on diatom, dinoflagellates and to a much lesser extent chlorophytes and cyanophytes. Marine olgal and seagrasses are mostly *Posidoniaoceanica, Zosterasp., Sargassum sp,Caulepra prolifera*, *Halimeda sp* and other green algae.

Zooplanktons are represented by 184 species, mostly copepods, whereas macro benthic fauna (annelids, mollusks, echinoderms, arthropods, ascidians) are not abundant in biomass but high in species diversity. For example, a total of 51 sponge species, 126 polychaete species, 57 crustacean species, 7 bryozoa species, more than 100 mollusk species, and more than 300 fish species have been recorded from the coastal waters of the Mediterranean.

Posidonia seagrass meadows are found in a number of localities along the coast (e.g. The Alaam- El-Run, MersaMatrouh area, westwards of Sallum). Significant coastal lagoons are situated at El-

Alamein / Siddi Abdel Rahman. They are a mosaic of very shallow inundated areas and patches of sabkha.

Sea turtles are represented by loggerhead, green turtles and Leatherback turtles. These are endangered, and are very rare in the northern coastal waters. Similarly,9 species of marine mammals (dolphins and whales) are also known from the Egyptian waters (e.g. common dolphins, pilot whale, Risso's dolphins, striped dolphins, bottle-nosed dolphins). The monk seal *Moachusmonachus* used to be seen in rocky areas and caves disappeared 3 decades ago. However, only one alive individual was seen recently near MarsaMattrouh.

Continental shelf waters of the Mediterranean coast vary considerably in width. It is generally wider in the east than the west. This is due to the influence of the sea current, which moves from west to east carries coastal deposits with it.

However, our information on the coastal and marine biodiversity of the Egyptian Mediterranean is less than complete and quite old (more than 30 years). Considerable information on marine habitats and biota is available, but these data are far from being geographically comprehensive, mostly covering areas around Alexandria, Abu Qir and Arabs Bay. Little or no data covering the rest of the coastline are available. Furthermore, while species lists are available for most groups, accurate information on the distribution of these species among habitats along the coast is virtually unknown. Basic information on the conservation status of the great majority of the species is lacking.

One of the major difficulties facing the management and conservation of marine-biodiversity is the lack of detailed, geographically comprehensive database. In addition, information available on marine species, habitats and ecosystems are quite old. Meanwhile human activities in the coastal and marine environment have made considerable changes leading to depletion of fish stocks, pollution in all different forms (oil pollution, debris, plastics, noise), fragmentation of habitats, increase of number of invasive species, and the possible impacts of climate change.

Therefore, a detailed, geographically comprehensive database on marine habitats, ecosystems and biota is required to develop a sound management plan for marine biodiversity. This will require field surveys on marine biodiversity to gather information on the geographical distribution, status, and exploitation levels of marine habitats, ecosystems and species. The collected data will be assessed into a GIS database, which will be accessible to biodiversity managers and decision makers. Targets include: 1) establish a marine database on the basis of recent, geographically comprehensive field-collected data; 2) develop and implement an integrated marine biodiversity management plan.

Although many institutions hold knowledge on marine biodiversity, decision makers have difficulties to find the type of answers they need. This situation can be challenged by representing a one-entry for questions and collecting all available knowledge in the best possible manner (depending on means and timeframe). The network will integrate available knowledge and process it in a sound and reliable way to provide answers to decision makers in a format that they can readily use. Thus, creating better links between knowledge holders and users will bring significant changes to the way short and long-term impact on marine biodiversity changes are tackled.

There exists several marine biodiversity knowledge in Europe (15 countries and 18 leading institutions). North America and South East Asia. These are either initiativeson projects where they use all collaborative approaches in order to link researchers with stakeholders and decision makers to ensure efficient policy development and implementation as well as identifying best practices for the management of ecosystems and their services.

Biodiversity knowledge‘s activities will need to follow some basic principles to ensure openness, transparency and trustfulness. The following principles are first guidelines:

1. Ensuring broad collaboration, by enhancing good communication and teamwork with a multidisciplinary team of experts
2. Minimizing bias and maximizing objectivity, through a variety of approaches ensuring scientific rigor, transparency, broad participation, and by avoiding conflicts of interest
3. Striving for relevant and up-to-date information, by linking available knowledge with ongoing policy discussions on biodiversity and ecosystem services
4. Promoting access and enabling wide participation, through open communication of procedures as well as outputs of Biodiversity Knowledge, taking advantage of existing networks and strategic alliances in the area of biodiversity research and management
5. Ensuring quality, by developing transparent and objective quality criteria (including risk / confidence in results), responding to feedback applying advanced methodologies, and developing supporting (capacity building?) systems for quality improvement
6. Supporting international processes, by linking up with international organizations and bodies, including the Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES)
7. Building on the enthusiasm of individuals, by involving and supporting of different nationalities, expertise and backgrounds working on biodiversity
8. Avoiding duplication, by providing overview of existing knowledge, and by good management and coordination to maximize efficiency and minimize costs.

Despite the efforts made to conserve biodiversity in Egypt during the late twentieth century and early twenty-first century, there is need for more efforts to preserve biodiversity in Egypt on the basis of the increasing human pressure on natural resources and climate changes resulting from the global warming.

Information on biodiversity is mostly related to northern countries of the Mediterranean, whereas the north-African countries are limited and scattered.

The additional efforts require a continuous flow of data through the implementation of scientific research programs of high priority , especially in the areas of intensive human activity, mainly the Mediterranean coasts (northwestern coast - north Delta - north Sinai). Such zone is of regional interest (North Africa), and international importance (Mediterranean basin).

1- Assessment of Biodiversity in the Mediterranean Sea:

The natural aquatic and terrestrial fauna and flora in this region are subjected to the dangers of extinction, such as Juniper plants located in the hills of the northern sector of the Sinai Peninsula as well as many marine fishes, crustaceans, mollusks and echinoderms. These studies are recommended to include the followings:

- Field surveys on fauna and flora the natural aquatic and terrestrial species will be identified based on the available information at both in herbaria and in museums and review the related researches, studies and reports carried out in this concern.
- Studies to produce maps and biological atlas to show the distribution of the different species and the related physiographic and climatic features by use of Geographical Information Systems (GIS).
- Studies for the determination of the Red Data Listing and hotspots of those species and the impact of human activities on the existence and distribution of such species.
- Studies to improve the different means of the management and conservation of the important and threatened species in the different locations.
- Identification of genetic traits of the living organisms of special interest.
- Studies on the proper conservation of the genetic resources, whether in natural habitat or in a similar environment which can be controlled, as well as the conservation of such materials in the herbaria or in the gene bank.
- Studies on the application of biotechnological techniques for the conservation and use of species of special interest. The tissue culture and genetic engineering techniques are the most important tools that can be used in this regard.

2- BioNET for the Egyptian Mediterranean coast

The Biodiversity Monitoring and Assessment in Egypt resulted in the availability of about two million records of animal and plant species at different times and places. This has facilitated prediction of future distribution of biota in Egypt, preparation of Red (endangered) Black (invasive) species, indicators for biodiversity conservation, and enhancement of Public Awareness on biodiversity. The available data on biodiversity in Egypt, make it an ideal place for a centre of excellence on biodiversity for Southern Mediterranean countries.

The BioNET‘s main aims are two-folds:

- To make the National Biodiversity Database the Egyptian node of the Global Biodiversity Information Network, a worldwide Web-based collaboration of nations to create a modern transboundary information system for reporting on the 2010 CBD targets and all other obligations of conventions.
- To coordinate a regional network, the North African network of BioNET International, and work with other Mediterranean countries to encourage the implementation of our system and experiences across North Africa from Egypt to Morocco.

3- Development and Management of Protected Areas along the Mediterranean Sea countries

Considerable efforts have been made to develop and manage the existing Protected Areas (PAs) along the Mediterranean coast. (e.g. Zaranik, Brullus, Ashtoum Al-Gamil, Omayed). However, the existing PAs are not well representing the different marine ecosystems. In addition, local communities need to be developed for better and good governance of PAs. Emphasis will be focused on the role of women and NGOs. Application of the ecosystem approach will be implemented. More protected areas especially along the western coast at Salloum, will be declared, developed and well-managed with emphasis on the marine environment, fisheries and ecotourism, and with support

of local communities and NGOs. There is also need for exchange of experience between the different countries, through twinning between protected areas (e.g. Wadi El Rayan in Egypt and Grand Sasso in Italy).

4- Impacts of Climate change on biodiversity in the Egyptian Mediterranean Sea

The Mediterranean is one of the regions most sensitive to climate change and shelters 4 – 18% of the world marine biodiversity. A warming trend of about 1°c in the last 30 years, and a rise in the frequency of extreme events are provided by scientific institutions. So far, none establishment of a model tries to assess Mediterranean Biodiversity. A debate still exists on the possible adaptation measures to restrict the negative impacts by reducing the ecosystem‘s vulnerability, and to exploit the positive aspects or opportunities in the best possible way.

Most research on the impacts of climate change in the Egyptian Mediterranean is fragmented and is concentrated on the Nile Delta system. Therefore, there is a need to establish a virtual centre that deals with this important issue, and includes all interested scientific institutions and individuals. Data already exist, but need to be verified, modeled, and impacts on biodiversity are properly addressed.

New policies are needed to integrate options for meeting biodiversity, climate and sustainable development objectives at the national level. This will require scientific and technical expertise, and understanding of socio-economic and ethical considerations. For example, climate change policies must, as a priority, identify the protection of biodiversity and healthy ecosystems as highly relevant to climate change mitigation and adaptation.

A significant new research effort is required to improve understanding the role of biodiversity in the Mediterranean sea and climate systems, the impact of climate change on biodiversity and human populations, and their inter-linkages, feedback mechanisms and cross-scale effects.

5- Biodiversity study in the exclusive economic zone of the Mediterranean deep water

Studies indicate that the biodiversity in seas and oceans is richer than on land. Such biodiversity is subjected to degradation as a result of limited plankton, high temperature of the earth, as well as over fishing and prospecting for oil and gas ... etc. So that study of biodiversity in the exclusive economic zone in the Mediterranean, especially in northern Nile Delta and north-western coastal zone, is one of the priorities in the maintenance of marine biodiversity. These studies include:

1- Survey of the marine organisms in some areas of environmental sensitivity (North Delta - Salloum - Marsa Matrouh ... etc).
2- Mapping of the environmental specifications of those places using techniques of GIS and remote sensing. This activity includes the monitoring of water temperature - the wind - the degree of water transparency - depths of water - soil quality of the beaches etc..
3- Atlas preparation for the distribution of marine species and conduct studies to predict the presence and distribution of species by use of environmental maps which have been prepared.
4- Identify the impact of human activities on marine biodiversity (prospect for oil and gas in the north Delta), as well as overfishing ... etc.
5- Identification of species at risk.
6- Recording and conservation of genetic origins of these organisms by use of technological means.

7- Study the rehabilitation of degraded areas ... etc.

The availed facilities to implement these studies include:

1- The presence of scientific institutions with experience in these studies perhaps the most important is the Institute of Marine Sciences in Alexandria.
2- Availability of qualified personnel to perform these studies i.e. EEAA and the University of Alexandria and other scientific institutions in Egypt.
3- The availability of the main equipment that can be used in these studies (well equipped ship for researches in the deep water).

6- Marine Invasive species program in th Mediterranean region Background

The Mediterranean is a sea of the Atlantic Ocean surrounded by the Mediterranean region and almost completely enclosed by land: on the north by Europe, on the south by Africa, and on the east by Asia. It covers an approximate area of 2.5 million km² (965,000 sq mi), but its connection to the Atlantic (the Strait of Gibraltar) is only 14 km (9 mi) wide. In oceanography, it is sometimes called the Eurafrican Mediterranean Sea or the European Mediterranean Sea to distinguish it from Mediterranean seas elsewhere.

Invasive species originating from the Red Sea and introduced into the Mediterranean by the construction of the canal have become a major component of the Mediterranean ecosystem and have impacts on the Mediterranean ecology, endangering many local and endemic Mediterranean species. Up to this day, about 300 species native to the Red Sea have already been identified in the Mediterranean Sea, and there are probably others yet unidentified.

The marine biological invasion in the Mediterranean Sea caused due to:-

- **Suez Canal**

The opening of the Suez Canal in 1869 created the first salt-water passage between the Mediterranean and Red Sea. Red Sea species invade the Mediterranean biota, and not vice versa; this phenomenon is known as the Lessepsian migration (after Ferdinand de Lesseps, the French engineer) or Erythrean invasion. The construction of the Aswan High Dam across the Nile River in the 1960s reduced the inflow of freshwater and nutrient-rich silt from the Nile into the Eastern Mediterranean, making conditions there even more like the Red Sea and worsening the impact of the invasive species.

- **Ballast water and Bio-fouling**

Hundreds of marine species have been moved from their native ranges to non-native areas through shipping. Ocean-going ships depend on ballast water for stabilization while crossing the open ocean. This water (along with the organisms it contains) is taken on in one port and is discharged at the next port. The organisms that survived transport are released into this new, often non-native, location. If the receiving environment is similar enough to the donor region, these species may survive and proliferate, and sometimes become invasive. In addition to ballast water, ships also transport organisms on their hulls. Bio-fouling organisms can form colonies on the hulls of ships or in internal compartments and be released or spawn in non- native areas.

- **Marine aquaculture**

The other factor for moving organisms in marine environments is stocking. We often grow non-native species in aquaculture as food products. Sometimes these species escape into the wild. But often when we bring these species in for culture, they bring with them a whole suit of hitch hikers that we overlook.

- **Example for Invasion**

Caulerpa taxifolia is a marine, green algae, a certain strain of which is invading sectors of the western coasts of the Mediterranean Sea where it grows much more robustly than it does in its native range. In the Mediterranean it has spread into thousands of hectares where it fills the water column with hundreds of tons of plant biomass per hectare. It is protected from sea urchins, fish and other herbivores by its toxicity. *Caulerpa taxifolia* is native to the Caribbean and other tropical seas where it grows in small patches and does not present problems. However, it was reported in 2000 that the Mediterranean Sea strain of the alga was discovered in California waters, where it is not native, and where it may spread as it has in the Mediterranean.

- **The Current Situation in Egypt**

In Egypt, the Suez Canal is an open gate for Red Sea water to run into the Mediterranean. Every year, five to ten new species from the Red Sea, and even the Indian Ocean, are discovered in the Mediterranean. So far, at least 10% of all fauna found in the Levant basin are of Indo-Pacific origin.

There is a great lack of information about existing marine invasive species in Egypt. There are weaknesses in the political and institutional environment, coastal and port authorities have only limited knowledge of current biological invasion problems and the Communication between sectors and institutes is poor because there is no established body for coordinating invasive alien species activities. The taxonomic information or even the taxonomic resolution is still insufficient.

Achievements:

During the last 10 years, Egypt, through the Nature Conservation Sector (NCS), had made considerable program for invasive species and took many steps at both national and international level. NCS has worked to achieve certain goals, including:

- A list of Alien Invasive Species was developed, with 152 invasive species include 43 marine invasive species; belong to the various taxonomic groups of organisms.
- Co-operated with international bodies and organizations. E.g. responded to the questionnaires from the Global Invasive Species Program (GISP) and the Regional Activity Centre for Specially Protected Areas (RAC / SPA).
- A workshop about "the Management of Marine and Coastal Invasive Species" was held by the co-operation with the Regional Activity Centre for Specially Protected Areas (RAC/SPA), United Nations Environment Program - UNEP and Mediterranean Action Plan-MAP, the workshop was held at the Natural Conservation Training Centre- NCTC at Sharm El-Sheikh, 3- 6 February 2008.
- When the suez canal was developed and widened, an EIA was prepared and approved with focus on non-indiguons species, recommendates are being implemented by Suez Canal

Authiority which commisioned NIOF to monitor invasive species in both suez canal and the Mediterranean sea.

Present state of Biodiversity knowledge

Our present state of knowledge of the biodiversity of Egypt is reasonably adequate. Species lists covering most animal and plant groups are available (see appendix 3 on species and habitats). Numerous publications covering taxonomic, distributional and ecological aspects of the biodiversity of the country have been published during the past two hundred years. A review and assessment of Egypt‘s biodiversity has been published by the National Biodiversity Unit (NBU, 1995) and by (RAC/ SPA, 2003). The levels of available information vary considerably among taxonomic groups, geographical areas and types of habitat.

Available information on the biodiversity of coastal and marine areas of the Egyptian Mediterranean very well covers most taxonomic groups on the terrestrial side. Habitat types, as well as species taxonomic lists, geographical and ecological distribution are well known for most biotic groups. The status of most species of at least vascular plant and vertebrate of the area is known with reasonable accuracy.

Our information on biodiversity of the Mediterranean marine environment is less than complete. Considerable information on marine habitats and biota is available, but these data are far from being geographically comprehensive, mostly covering areas around Alexandria, Abu Qir and Arabs Bay. Little or no data covering the rest of the coastline are available. Furthermore, while species lists are available for most groups, accurate information on the distribution of these species among available habitats along the coast is virtually unknown. Basic information on the conservation status of the great majority of the species is lacking.

Recent information during the last 10 years based on the fifth national report submited to CBD in 2014 as well as recent literature about marine biodiversity in Egypt

The Egyptian coastal and marine environment is distinguished by specific habitats and threatened species, such as marine mammals (17 species), marine turtles (4 species), sharks (more than 20 species), sea cucumber, special bivalves (clams), coral reefs, mangrove trees and many birds (white eyed gulls , sooty falcons, ospreys). This is in addition to great biodiversity (more than 5000 species), including 800 species of seaweeds and sea grasses, 209 species of coral reefs, more than 800 species of molluscs, 600 species of crustacea, 350 species of echinodermata, and many others yet to be discovered in the Exclusive Economic Zone in the Red Sea and the Mediterranean.

CHAPTER 4
Development of monitoring program

Introduction

Status of Mediterranean Sea Local Species

The conservation status of species found in the Mediterranean Sea, between southern Europe and northern Africa is Critical/Endangered. A total of 19 species of cetaceans can be found in the Mediterranean, with eight of them considered common to the Mediterranean (Fin Whale, Sperm Whale, Striped Dolphin, Risso's dolphin, Long Finned Pilot Whale, Bottlenose dolphin, Common dolphin, Cuvier's beaked whale), four considered occasional (Minke Whale, Killer Whale, False Killer Whale, Rough Toothed Dolphin) and 6 considered alien to the Mediterranean, but have been occasionally sighted in the last 120 years (the Humpback Whale among them).

A few of the species that are endangered include the Mediterranean Monk Seal (Monachus *monachus*), Mediterranean Mussel (*Mytilus galloprovincialis*), Mullet (*Mugilidae*), Gilthead Sea Bream (*Sparus aurata*), Sea Bass (*Dicentrarchus labrax*) and the Greater Flamingo (*Phoenicopterus roseus*). Also found in this ecosystem are Loggerhead Sea Turtles (*Caretta caretta*), Green Sea Turtles (*Chelonia mydas*), and Leatherback Sea Turtles (*Dermochelys coriacea*).

Although the Mediterranean Basin is high in biodiversity, many of its species are threatened by a range of human activities. Among the most endangered marine vertebrate species are: the Mediterranean Monk Seal, Common Bottlenose Dolphin (*Tursiops truncates*), Short-beaked Common Dolphin (Delphinus delphis), and Striped Dolphin (*Stenella coeruleoalba*), Sperm Whale (*Physeter macrocephalus*), Green Turtle, Leatherback Turtle and Loggerhead Turtle and cartilaginous fishes (sharks, rays, and chimaeras) (UNEP/MAP/MED POL 2005). Sea turtles are vulnerable to human activities throughout their life cycle.

Loggerhead and Green Turtles have been listed as Endangered by the IUCN while the Leatherback Turtle is listed as Critically Endangered (UNEP/MAP 2012). While the Loggerhead remains relatively abundant, it seems to have almost deserted the Western Basin. The Leatherback and Green Turtle are becoming increasingly rare. Nesting sites for the herbivorous and migratory Green Turtle are in Cyprus, Turkey, Syria, Egypt, Lebanon and Israel. There are a total of only 2,000 nesting females at these sites, and this number is declining. Important nesting sites for the Loggerhead Turtle are on the coasts of Greece and Turkey, on a number of Mediterranean islands, and in Tunisia, Libya and Egypt along the North African coast. The Leatherback Turtle is rarer in the Mediterranean and has no permanent nesting sites, although there are some breeding records for Israel and Sicily.

Of all five sea turtle species found in the world's oceans, three frequent the Egyptian Mediterranean shores for foraging and wintering grounds. The most commonly-found turtle on this coast is the Loggerhead, followed by the Green and the Leatherback, the latter being just an occasional visitor. They nest in low numbers during the summer on the outer sandy Mediterranean shores of Lake Bardawil.

The Loggerhead has rarely been sighted in Lake Bardawil in North Sinai, a semi-enclosed water body listed among the RAMSAR Wetlands of International Importance. However, recent changes in the biodiversity of the saline lake have led to growth in their numbers. Newer fishing practices, like bottom trawling, have reduced the sea bass population of Lake Bardawil, because fine mesh nets trap both adult and juvenile fish. This is despite the fact that by law, fishermen are forbidden to use nets

with meshes smaller than 40 mm. In Bardawil, they fish with 8 mm nets. The declining sea bass population, combined with increased water salinity has attracted shrimps and crabs – the sea turtle‘s favorite food. Additionally, the Lake has become an attractive wintering ground for sea turtles. In order to gather fish and crustaceans in certain areas of the lake, some fishermen dump tires and other large objects into the water to create a sort of shelter for them and thus increase the populations of shrimp and crab. However, the turtles are found to frequent these shelters to feed on shrimp and crab, becoming a nuisance to fishermen.

In October 2012, over 90 sea turtles were found dead and in various stages of decomposition on the shores of Lake Bardawil, suggesting that their deaths may have been occurring for several months (Sarant, 2012; Yahia, 2012). Lake Bardawil is one of the less polluted bodies of water in the country, so pollution seems improbable as a major source of mortality. In addition, the dead turtles were counted in a single small area and not found dead randomly across the lake. Of the 96 dead turtles found, only 74 could be clearly identified through photographic evidence. The vast majority found were Loggerheads. However, a few Green Sea Turtlesand one Leatherback were also identified. Four turtles had been decapitated and one died from a head trauma caused by a blunt object. The conclusion reached was that turtles interfered with the catch of fishermen, driving fishermen to eliminate their competition.

Turtle Mortality

The lack of a coordinated and integrated approach between environmental policies and fisheries policies to protect marine biodiversity further exacerbates the problem. The conflict witnessed in Lake Bardawil is an indication that the lake should be designated a marine protected area, with an integrated management approach to accommodate fishing activities, in order to ensure sea turtles‘ survival in the long term. Further research and field surveys should be conducted to fully document the of the wetland as a feeding, wintering and development habitat for sea turtles in the Mediterranean, their interaction with the lake's fisheries, as well as monitor mortality rates and causes.

IUCN Red List 2013

At the global level, a total of 71,576 species have been assessed by the IUCN in 2013. Of these, 21,286 species are threatened with extinction. The IUCN assigns a species to one of eight categories of threat based on whether or not they meet criteria linked to population trends, population size, structure and geographic range. Species listed as critically endangered, endangered or vulnerable are collectively described by the IUCN as threatened.

The number of threatened species in Egypt according to the IUCN Red List 2013 shows the figures for these groups should be interpreted as the number of species known to be threatened within those species that have been assessed to date, and not as the overall total number of threatened species for each group.

Threatened Species in Egypt by Taxonomic Group show the total number of bird species recorded in Egypt and the number of threatened bird species, respectively, according to the IUCN Red List 2013. The numbers in brackets refer to the country's rank when compared to other countries and territories globally.

Taxonomic group	Number of Threatened species
Mammals	18
Birds	10
Reptiles	12
Amphibians	0
Fishes	40
Molluscs	0
Other Invertebrates	53
Plants	2
Total	135

Bird Species Recorded in Egypt

TOTAL	379 (97th)	Breeding Endemic	0
Landbirds	241	Seabirds	39
Migratory	299	Waterbirds	129

IUCN 2013 Red List of Bird Species

Extinct (EX)	0
Extinct in the Wild (EW)	0
Globally Threatened (VU, EN,CR)	10 (134th)
% threatened	3% (166th)
Critically Endangered (CR)	0
Endangered (EN)	2
Vulnerable (VU)	8
Near Threatened (NT)	16
Least Concern (LC)	353
Data Deficient (DD)	0

National Red List

The national preliminary Red Data List of threatened species of various taxonomic groups in 2010. Number and Percentage of Threatened Species of Various Taxonomic Groups:

Taxonomic group	Known Species Number	Threatened Number and %
Mammals	111	72 (65.5%)
Birds	475	43 (9.6%)
Reptiles	112	47 (24.0%)
Amphibians	9	2 (22.2%)
Fish	1200	52 (04.3%)
Invertebrates	12000	205 (01.7%)
Vascular plants	2145	457 (20.0%)

At the national level, several attempts have been made to provide a conservation assessment for different taxonomic groups in Egypt and in its protected areas. By the end of 2013, the conservation status of only the following taxonomic groups is available: mammals (111 species), insects (mainly butterflies: 63 species and Odonata: 40 species), four plant families (Apocyanaceae: 22 species, Euphorbiaceae: 51 species, Primulaceaa: 9 species and Amaranthaceae: 25 species) and birds (43 species), which indicate a continuing increase in the risk of extinction.

Important Bird Areas (IBAs)

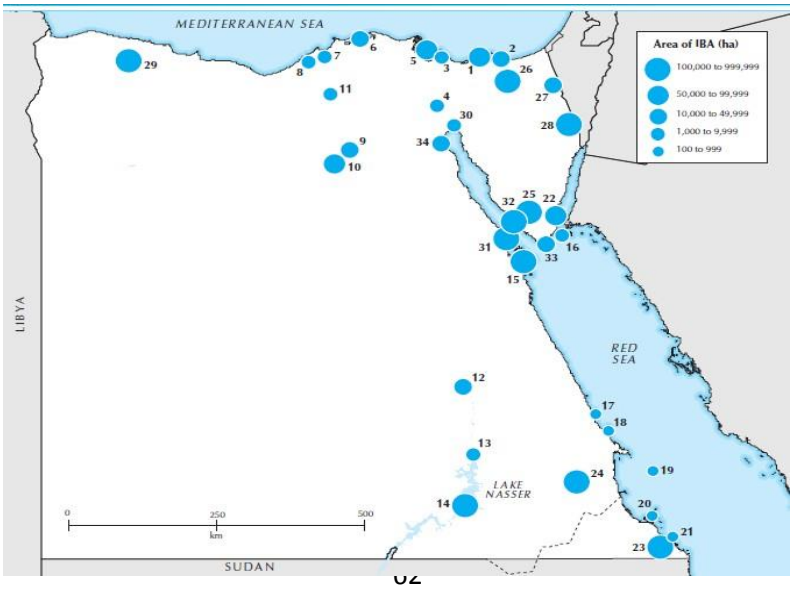
There are a total of 34 Important Bird Areas (IBAs) in Egypt, comprising a wide range of habitats critical for birds, such as wetlands, high altitude mountains, desert wadis, coastal plains and marine islands. They cover an area of 35,000 km^2 or some 4 % of Egypt's territory. Fifteen IBAs, approximately 44%, fall entirely within the existing protected area network. All of Egypt‘s avian habitats are represented within the identified network of IBAs, although not equally so.

Total number of IBAs in Egypt	34
Globally threatened species	21
Biome-restricted species*	9
Congregatory species**	24

*Species whose entire global distributions are largely or wholly confined to one biome.

**Species that gather in globally significant numbers at a particular site and at a particular time in their life cycle for feeding, breeding or resting (during migration).

Map of Important Bird Areas in Egypt



Four of the 34 IBAs in Egypt are also designated RAMSAR sites, while eight IBAs have the potential to qualify for designationbased on the waterbird populations they host.

Important Bird Areas Designated and Potentially Qualifying as RAMSAR Sites

Number of Potential RAMSAR Sites	8
Fully Recognized as RAMSAR Sites	4
Partially Recognized	0
Not Recognized	4

Threats to Biodiversity

The main threats to biodiversity were identified as habitat loss, habitat degradation, overexploitation, unsustainable use, pollution, the spread of invasive alien species and climate change. These pressures are continuing to increase and are themselves driven by a range of socio-economic drivers, chiefly the growing human population and the associated increase in the consumption of resources. Furthermore, globalization and its negative impacts on resource extraction, along with limited human and financial resources, have also contributed to the loss of biodiversity. Threats are accentuated by increases in the level of desertification due to climate change, as well as human population growth.

Major threats to marine ecosystems are unregulated tourism, exploitation of marine resources, overfishing and fishing in illegal areas (e.g. breeding grounds) and coastal pollution. At present, 20% of Egyptians live in coastal areas, which are also visited annually by 11 million tourists. In addition, more than 40% of industrial activity occurs in the coastal zone.

Pollution causes deterioration of critical habitats and species loss. A concrete example is the Delta wetlands. Excessive use and misapplication of pesticides also causes loss of rare species including those that act as pollinators and natural biological control agents.

Overgrazing and over-fishing contribute to biological degradation. Wildlife utilization is, for the most part, unregulated in Egypt and excessive hunting is endangering a number of wild animals (e.g. gazelles) as well as several species of resident and migratory birds.

Many plant and animal species are located at the limits of their geographical or ecological distribution ranges. Under such conditions, these species have limited tolerance for ecological pressures, as is exemplified by corals in the Red Sea, the Gulf of Suez and the Gulf of Aqaba.

The lack of a sustainable and effective system to address natural heritage management issues is hampering the nation‘s ability to conserve and manage its unique and critical resources. Poorly regulated marine tourism, coupled with inadequate infrastructure to protect natural resources and insufficient regulations for desert tourism are causing the destruction and degradation of natural habitats, landscapes, cultural heritage sites and other resources. In addition, there is a lack of coordination and cooperation between all relevant stakeholders in regards to data collection, storage and analysis of biodiversity data and the absence of comprehensive legal protection for natural heritage resources outside protected areas. This lack of coherence threatens future sustainable returns from natural resources. All of the aforementioned issues are compounded by the fact that few economic incentives are for biodiversity conservation (National Environmental Action Plan (2002 - 2017)).

Habitat Loss and Degradation

Destruction of habitat is a major cause of biodiversity loss in Egypt. Direct habitat loss is a major threat to terrestrial, marine and coastal ecosystems, and freshwater ecosystems are particularly

severely affected by fragmentation. Land reclamation, urbanization and industrial activities destroy and alter critical natural habitats along with their plant and animal life. There are a range of factors, economic and social, that lead to land-use changes and development pressures, raising serious concern for the integrity of ecosystems in Egypt.

Threats to Wetlands

Egypt's wetlands are subject to a variety of human induced threats, which are leading to the degradation of this valuable national resource. There are multiple threats to wetlands and river ecosystems in Egypt. One of the major threats to wetlands, in the northern coastal lakes in particular, in Egypt is the drainage of water bodies for their conversion into agricultural and settlement developments, ultimately destroying habitat and reducing their areas. Other threats to wetlands include water withdrawal for irrigation, coastal erosion, invasive species, water pollution and overfishing.

The severity of pollution varies from lake to lake, but they all share the same cause of pollution - the discharge of untreated or partially treated industrial and household waste water (mainly sewage) and the dumping of agricultural drainage loaded with fertilizer, pesticide and herbicide residues. The severity of pollution in these lakes can be as follows: Lake Maryout> Lake Manzala> Lake Edku> Lake Burullus. Excess agricultural runoff and domestic wastewater discharge into these water bodies causes an increase in the levels of nitrogen and phosphorous, a process known as eutrophication, causing harm to other forms of life inhabiting these waters. Such malpractices can be traced back to a rapidly growing population and the increased human activity that comes with it. Applied fishing techniques also have adverse impacts on fish production. They have affected the aquatic environment in many ways. Fishermen use inappropriate techniques to increase their catch. This has caused the killing of the small traits and hence, decreased production. The use of huge fishing nets causes the death of large numbers of non-target species through habitat destruction and being accidentally engulfed by the fishing nets.

Threats to Coastal and Marine Ecosystems

Direct habitat loss is a major threat to coastal and marine ecosystems and is driven by a number of factors: i) the rapid unplanned development of areas such as the north coast and the coast of the Suez Canal; ii) the unsustainable exploitation (ex. bottom trawlers) of marine resources; iii) deterioration of breeding and nursery sites in many areas, especially in the Mediterranean Sea(less in the Red Sea due to the declaration of some protected areas along coasts and islands); iii) commercial ship trafficking in the Suez Canal and oil leakage from some oil fields in the Red Sea;

sanitation discharge in the Mediterranean Sea and coastal lakes; v) social pressures on the government to meet the needs of a growing population (unemployment, introduction of new patterns of development, competition for exploiting available resources, lack of public awareness with the importance of inherited culture associated with unorganized development plans and threat of investments due to beach erosion).

Coastal development, intensive tourism and land reclamation for agriculture put pressure on key wildlife habitats in the Mediterranean. Contributing factors to the decline of wildlife habitat in the Mediterranean include historical overexploitation, degradation of beach nesting habitat due to sand extraction, entanglement in fishing gear, loss of sea grass meadows, pollution and increased ship traffic. In the eastern Mediterranean, seabirds are threatened by habitat loss due to drainage, water diversion, changes in annual water regime, eutrophication, reed cutting, landfills, chemical pollution and hunting (UNEP/MAP 2012). For example, the vast tracts of what might have been suitable habitat for the Egyptian Tortoise (Testudo kleinmanni) in the North Coast are now uninhabitable for the species. Perhaps the most serious threat to T. kleinmanni is the complete (and possibly irreversible) destruction of habitat caused by agricultural activities. Local and regional

problems related to pollution, specifically effluents from domestic and industrial sources, oil transportation, refineries and agricultural runoff are also beginning to have serious impacts on wildlife.

Implications of Biodiversity Changes for Ecosystem Services and Human Well-being

The relationship between biodiversity and ecosystem services is complex. The role of biodiversity in the supply of ecosystem goods and services has been categorized as provisioning, regulating, cultural and supporting; and, biodiversity may play multiple roles in the supply of these types of services. For example, in agriculture, biodiversity is the basis for a provisioning service (food, fuel or fiber is the end product), a supporting service (such as microorganisms cycling nutrients and soil formation), a regulatory service (such as through pollination and pollution control), and potentially, a cultural service in terms of spiritual or aesthetic benefits, education or cultural identity. The loss and degradation of biodiversity will therefore have serious social, economic, cultural and ecological implications.

As mentioned earlier, Egypt has unique biodiversity that contributes to the economy and supports human wellbeing. Biodiversity in Egypt is deteriorating at the level of ecosystems, species and populations; and, genetic diversity is also declining. Climate change is likely to exacerbate many of the risks associated with other stressors, by further taxing the already compromised resilience of natural systems, and reducing the choices open to individuals and policy makers.

The impact of biodiversity loss is difficult to determine precisely due to the complexity of the processes involved. The loss of biodiversity will impact severely on the livelihoods of the many people who directly or indirectly depend on natural resources. Egypt, like many other countries, has not carried out a systematic quantitative assessment of how changes in biodiversity have impacted the provision of ecosystem services, or how the production of ecosystem services has impacted biodiversity. Some examples of the impacts of major threats on biodiversity and associated effects on ecosystem services and human well-being are summarized in the sections below.

Biodiversity and Climate Change

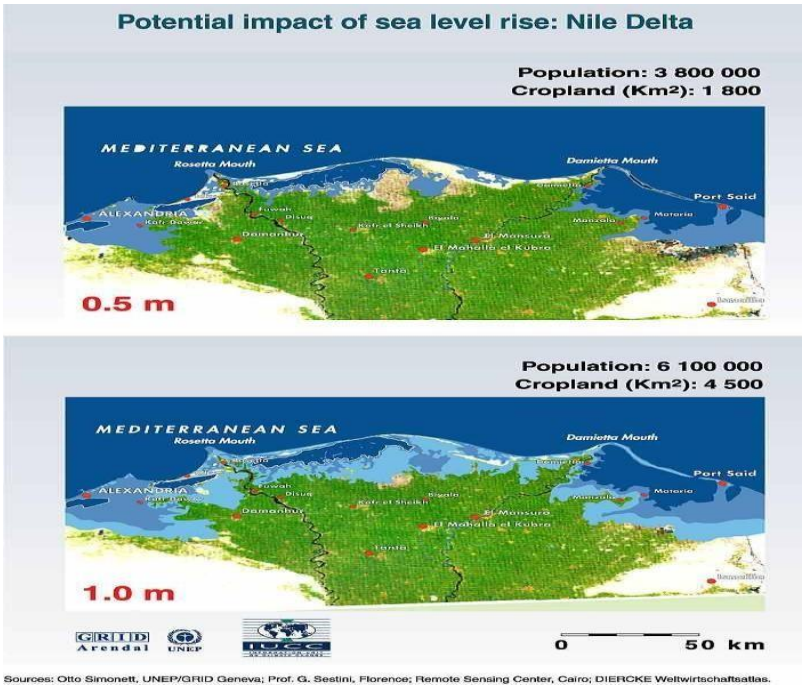
The 5th IPCC assessment report (Nov. 2014) confirmed that it is extremely likely that human influence has been the dominant course of the observed warming of the atmosphere and the ocean since the mid-20th century. The report documented both observed impacts of climate change on biodiversity and human well-being, as well as the projected impacts according to a number of scenarios. It also set options for mitigation actions (Fouda, 2015).

However, the fourth Global Biodiversity Outlook (GBO4) (October 2014) shows that it is possible to limit climate change, protect biodiversity, and attain food security. This will require political coherence: a clear policy and legal framework, incentives, monitoring and public support. These are extremely relevant to Africa and MENA countries to draw strategies for adaptation to climate change, and to the conservation and sustainable use of biodiversity.

Climate change, and its impacts on ecosystems and people, will likely be the biggest threat to biodiversity conservation in Africa and MENA region in the future. The expected impacts of climate change include shifting rainfall patterns, rising temperatures, shifts in seasons, and sea level rise. The most vulnerable sectors to climate change include agriculture, water, and health; coastal areas and islands are expected to be heavily impacted.

Biodiversity impacts of climate change include shifts in species distribution and range, and the impacts of mitigation activities. There is also concern that existing protected area networks may not be adequate for biodiversity conservation in a time of changing climate. Moreover, the Mediterranean Sea is becoming warmer; its salinity is increasing, and the rise in sea level is accelerating. The Nile Delta is considered one of the most vulnerable sites in the world due to

climate change inputs.



Rising sea level would destroy weak parts of the sand belt, which is essential for the protection of lagoons and the low-lying reclaimed lands. The impacts would be very serious: One third of Egypt‘s fish catches are made in the lagoons. Sea level rise would change the water quality and affect most fresh water fish. Valuable agricultural land would be innundated. Vital, low-lying installations in Alexandria and Port Said would be threatened. Recreational tourism beach facilities would be endangered and essential groundwater would be salinated. Dykes and protective measurements would probably prevent the worst flooding up to a 50 cm sea level rise. However, it would cause serious groundwater salination and the impact of increasing wave action would be serious.

- Mediterranean Sea
  - 1°c ↑ in 30 years frequency of extreme events.
  - No model to assess biodiversity
  - Debate on adaptation measures
- Climate change impact is becoming increasingly evident in the Mediterranean. In its recent Fifth Assessment Report (2014), the Intergovernmental Panel on Climate Change considered the Mediterranean region as ‒highly vulnerable to climate change‖ and stated that it would suffer multiple stresses and systemic failures due to climate changes‖. According to the conclusions from the project on ‒Climate change and impact research: the Mediterranean environment funded by the European Union:
  - In the course of the twenty-first century, the Mediterranean region might experience substantial warming, which in summer might be of the order of 0.6°C/decade.
  - The warming appears to be accompanied by a reduction in precipitation (projected annual mean precipitation in the period 2021–2050 will decrease by about 5 per cent compared with the mean for the period 1961–1990) over the entire region, more pronounced in the southern and western part of the basin during summer.
  - Inter-annual variability of temperature and precipitation in the Mediterranean basin is projected to generally increase, especially in summer, as is the occurrence of extreme

heat and drought events.

- The sea level of the Mediterranean might increase, causing adverse impacts on coastal areas. The projected mean sea-level rise in the period 2021–2050, owing to thermal expansion and salinity-density compensation of sea water, might be in the range of about +6/+11 cm.
- It is expected that there will be an increase in the number of very hot days and nights and longer heat waves. The projections also indicate an earlier onset and a longer duration of droughts.
- Overall, there will be an increase in the intensity of heavy precipitation events over most of the Mediterranean region in all seasons.

- Four strategic directions, each has national and regional actions, owners, time frame and indicators. These are:
  1. Develop scientific knowledge and technical capacities to deal with climate change and ensure informed decision – making at all levels (8 actions).
  2. Accelerate the uptake of climate-smart technologies (6 actions)
  3. Leverage existing and emerging climate financing – mechanisms (international, national, private sector (4 actions)
  4. Encourage institutional, policy and legal reforms for effective mainstreaming of climate change responses into national and local development frameworks.

- CBD addressed the relationship between biodiversity and climate change.

Within the framework of the expected climate agreement by end of last year (Paris 21, there exist tools, guidance and information related to biodiversity and climate change.

According to GBO 4 (October 2014), mitigating climate change is a key long term priority and urgent action to reduce emissions is essential to limit climate change to 2°c warming while halting biodiversity loss, and achieving other SDGs can be accomplished if coherent and strategic action is taken (e.g. Effective management of protected areas).

Ecosystem – based approaches for adaptation include sustainable management, conservation and restoration of ecosystem, as part of an overall adaptation strategy that take into account the multiple social, economic and cultural co-benefits for local communities.

What is needed?

- Assessment of climate change impacts, mitigation and adaptation measures on relevant ecosystems
- Most vulnerable components of biodiversity
- Risks and consequences for ecosystem services and human well-being
- Monitoring threats and impacts on biodiversity
- Impacts of mitigation and adaptation activities on biodiversity, and opportunities provide for biodiversity conservation and sustainable use.
- Critical knowledge needed to support implementation (scientific research, data availability, appropriate measurements and monitoring techniques, technology, traditional knowledge)
- The current information and expertise available can contribute understanding :
  - ***First****: the nature of the threat* – the impact of climate change on biodiversity, how biodiversity influences the vulnerability or resilience of ecosystems to climate change,

techniques to assess extinction risks across species and communities, how human activities may exacerbate the impacts of climate change and the technologies available to measure and report these changes.

- ***Second****: solutions* that enhance carbon stocks, conserve biodiversity and improve human well-being through ecosystem restoration community-level approaches to conservation, incentives to promote sustainable land-use practices and coherent policy frameworks.

Threats to biodiversity in Egypt

	Threats	Egyptian Mediterranean
Direct Threats		
1-	Tourism Development	+++
2-	Unsustainable activities	+++
3-	Solid waste	+++
4-	Unsustainable surface / ground water	+++
5-	Effluent change	+++
Indirect Threat		
6-	Increase access to road development	+++
7-	Over exploitation of natural resources	+++
8-	Displacement of local populations	++
Other Threats		
9-	Invasive species	+++
10-	Climate change	+++
11-	Over grazing	+++
12-	Over collection of wild plants	+++
13-	Over collection of wild animals	+++
14-	Illegal bird hunting	+++
15-	Mines	+++
16-	Nuclear power station	+++
17-	Unsustainable Quarrying and mining	+++
18-	Pollution	+++
19-	Land ownership	+++

Degree of threat + low; ++ medium; +++ high

Threats to biodiversity in Egypt are either directly or indirectly related to human impacts, with the former including excessive hunting, clear-cutting and deforestation, and the latter linked to habitat destruction for developmental purposes and all pollution types, including refuse from industry and human settlements. Excessive hunting is endangering several species of resident and migratory birds as well as a number of hoofed animals (e.g. gazelles). Pollutants in the air, water and soil (especially in rural areas) are also threatening a large number of plants and animals as well as leading to a substantial increase in other harmful exotic ones (e.g. species of rats and birds, red spider, American cotton worm). A famous example is the detrimental effect of the introduction of the water hyacinth (*Eichhorniacrassipes*) on life in the Nile River. Major threats to marine

ecosystems are unregulated tourism, exploitation of marine resources, overfishing and fishing in illegal areas (e.g. breeding grounds) and coastal pollution. At present, 20% of Egyptians live in coastal areas which are also visited annually by 11 million tourists. In addition, more than 40% of industrial activity occurs in the coastal zone. Threats are accentuated by increases in the level of desertification due to climate change as well as in human populations. Many plant and animal species are located at the limits of their geographical or ecological distribution ranges. Under such conditions, these species have limited tolerance for ecological pressures, as is exemplified by corals in the Red Sea, the Gulf of Suez and the Gulf of Aqaba.

Implementation of the NBSAP:

The Egyptian NBSAP (1998) aims to establish a sound basis for the sustainable development of natural resources for meeting the needs of present and future generations and harmonize conservation and development plans in relevant sectors (e.g. agriculture, industry, mining, housing, tourism). Three main issues are prioritized, namely: the development and management of existing protected areas with a view toward the creation of new ones; biodiversity assessment through monitoring and databases updating; institutional development, capacity-building, partnership-building, outreach, securing sustainable financing of projects from donor states and organizations. It is believed that eeffective NBSAP implementation should be based on a highly participatory process, and adherence to the principle of social equity which affirms that benefits which arise from the sustainable use of biodiversity should be shared among all people, especially women and children. Work on revising the NBSAP began in March 2013.

Actions taken to achieve the 2020 Aichi Biodiversity Targets:

A network of protected areas, representing the principal ecosystem types of scientific importance, has been established throughout the country and currently comprises up to 15% of the territory. Egypt intends to increase this figure to 20% by 2017. Programs have also been established for the conservation and management of important and sensitive ecosystems and habitats outside the natural protected areas network, especially in marine and coastal environments and arid lands. In situ programs for conserving restricted ranges and globally threatened species of plants and animals (e.g. sea turtles) have been elaborated. Ex situ conservation is provided through national germplasm banks as well as through captive breeding centres for breeding and reintroducing rare, endemic, threatened and extinct plant and animal species.

Egypt‘s proposed Natural History Museum promotes research and training in biodiversity and also has a large capacity for conducting educational and awareness-raising activities. Management programs for hunting, fisheries and rangelands have been introduced. Particular attention has been given to the development of ecological tourism along the warm coasts of the Red Sea, the Gulf of Suez and the Gulf of Aqaba.

Support mechanisms for national implementation (legislation, funding, capacity-building, coordination, mainstreaming, etc.):

Egypt is among the first countries in the world to have taken an active interest in biodiversity conservation and the preservation of natural resources and heritage at the international and regional levels. Egypt became a Party to the Convention Relative to the Preservation of Fauna and Flora in their Natural State in 1936 and to the Agreement for the Establishment of a General Fisheries

Council for the Mediterranean Sea in 1952, and has become a Party to several other related agreements since. At the national level, strategies were approved for wetlands (2005), ecotourism (2006) and the maintenance of natural habitats (2007), involving various institutions, such as the National Commission for Sustainability, the National Committee for the Integrated Management of Coastal Areas, the National Committee on Climate Change and the National Committee on Wetlands and Sub-Humid Areas, with a view to aligning political strategies and work plans. As well, programs have been introduced for enhancing the effectiveness of relevant government agencies, as have studies on the need for new institutions at the central and local government levels. Finally, programs for mobilizing financial resources from national and international sources have been launched in support of projects favoring biodiversity conservation.

Mechanisms for monitoring and reviewing implementation:

As part of a major biodiversity data management program, the National Biodiversity Unit (NBU) has established a biodiversity database containing information available on representatives of the various taxonomic groups in the country. This database is the nucleus of a national network connecting scientific establishments and referral collections (e.g. herbaria, botanic gardens, zoos) in universities, research centers and scientific societies (e.g. Entomological Society of Egypt). The country intends to make the database globally available via the web. The following reports have been produced by national experts: Ecosystems as seen from a geographical perspective; Guide to the Mammals of Natural Protected Areas in Egypt; Reptiles of Egypt; Natural Protected Areas of Egypt; Marine Algae of Alexandria; Checklist of the Flora of Egypt; Fungal Biota in Egypt; Birds known to occur in Egypt; Freshwater Fishes of Egypt.

In addition to information provided above the following is more information on Egyptian marine biodiversity published recently.

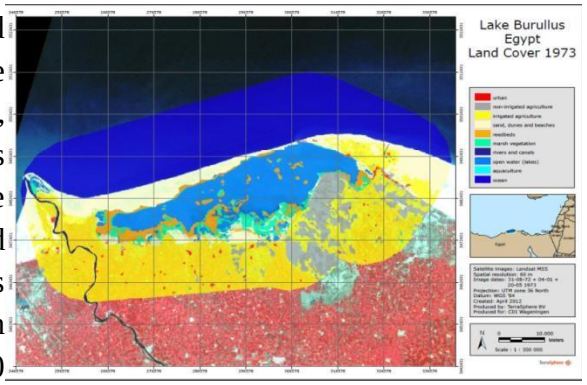
Assessment of fisheries and marine biodiversity of Sallum Gulf, Egypt

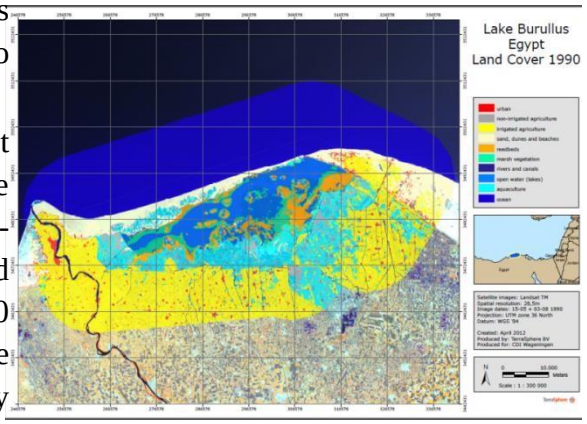
A research cruise was carried out to assess the fisheries and marine biodiversity of the Gulf of Sallum, with a view for the protection, conservation, and management of its resources (Elhaweet *et al*., 2011). To achieve this aim, the Egyptian Research Vessel ‒Salsabil‖ was used, deploying otter bottom trawl for fisheries data, CTD for collecting environmental parameters, and a bottom grab sampler for obtaining samples of benthos fauna. Moreover, diving was used to survey the under-water sea grass beds. The Gulf of Sallum supports a wide range of ecosystems, from the rich sea grass meadows and rocky reefs of the coastal zone, to the little seamounts. It is thus considered as a great resource for many economic fish species. Seagrass plants were found forming from scattered small areas to dense vegetation that covered extended areas of the sea floor. The macrobenthic community in the investigated area consisted from 57 species belong to seven groups, while fish populations contained more than 90 species. Species Richness was closely correlated to depth, organic matter concentrations and sediment characteristics. Some invasive polychaete and introduced fish species were recorded in the present study, moreover few considered as threatened species. Using GIS analysis to the survey result showed that diversity of seagrass beds, benthic fauna and fish species in the Gulf could be divided into two sections. First section lies to the west of 25º 30‘E longitude; contains the highest species composition, while second section (eastward of 25º 30‘E) contains the lowest species composition. It was highly recommended, therefore, to declare

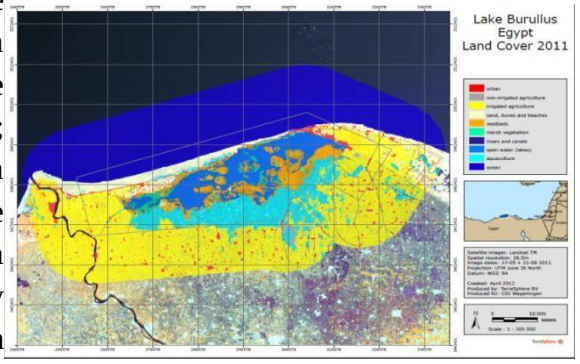
the first section as a marine protected area (MPA). As the results of this study, the Gulf of Sallum was declared as the first marine Egyptian protected area in the Mediterranean Sea by the Egyptian Prime Minister's decision No. 533 for the year 2010.

Changes in Land Use in Lake Burullus

Lake Burulus is an important coastal wetland and RAMSAR site on the northern coast of Egypt. Despite the status of Protectorate under Egyptian legislation, the environmental condition of Lake Burullus has dramatically changed over the past 40 years. Three processes can be held accountable; the unprecedented growth of aqua culture ponds (from close to 0 hectares in 1978 to over 40,000 hectares 12 years later in 1990), the expansion of urban area from nearly 2,000 hectares in 1973 to 8,500 hectares in 2011, and loss of open water from over 45,000 hectares in 1973 to about 25,000 hectares in 2011.







The aqua culture ponds have predominantly been built in the fringes of the Lake at the account of shore line vegetation (marsh vegetation and reed) and non-irrigated agricultural lands. The loss of marsh land (from 8,000 hectares in 1978 to a bit more than 3,000 hectares in 2011) in the fringes of the Lake due to the construction of aqua ponds is partly compensated by the development of new marsh land vegetation in the Lake. The surface of reed vegetation increased even despite the fact that reed vegetation along the shore lines was massively replaced by aqua culture ponds; due to the inflow of nutrients from upstream agricultural lands and untreated waste water from the new urban areas reed invaded the open water. As a result the surface of reed beds increased from nearly 11,000 hectares in 1978 to nearly 17,000 hectares in 2011 (Zingstra, 2013).

The loss of open water, combined with the deteriorating water quality has had a damaging impact on the biodiversity (seven valuable fish species disappeared) and the livelihoods of about 50,000 fishermen living around the Lake.

The fish composition of Lake Burullus has also changed over the years due to the change in the environmental conditions of the lake.

Reproductive biology of Argyrosomus regius (Asso, 1801) inhabiting the south eastern Mediterranean Sea, Egypt

A study the reproductive biology of *Argyrosomus regius* (Asso, 1801) collected from the wild catch of Egyptian Mediterranean coast was made by (Abou Shabana *et al*., 2012). This is to give a clear

image about the spawning season, length at first sexual maturity, and to identify gonadal maturation using histological analysis in respect to steroid hormone concentration throughout 1 year period. The present results revealed that wild meagre has a protracted spawning season starting in April and ending in July. The length at first sexual maturity of female fishes started at larger lengths than males 47 cm for females and 45 cm for males. By comparing calculated gonadosomatic index (GSI) to histological analysis it is clear that male fishes started gonadal maturation before female fishes. Plasma steroid level showed fluctuations in its mean concentration as Testosterone showed massive increase during male gonadal maturation and ripening stages. Plasma Progesterone and Estradiol levels displayed different patterns in their mean concentration during developmental stages throughout the maturation period of ovaries and testes. They showed significant declination in mature fish plasma followed by an insignificant increase during nearly ripe and ripening periods. The current data showed that wild meagre displays a gonochoristic group-synchronous oocyte maturation pattern. More investigation on this important fish species is recommended to establish a breeding protocol for aquaculture purpose.

Genetic and nutritional characterization of some macrophytes, inhabiting the Bardawil Lagoon, Sinai, Egypt

The ecological and economical significances of macrophytes, in habiting the Mediterranean Lagoon, Bardawil, northern Sinai, Egypt, are still ambiguous, due to lack of knowledge (Elsaied *et al*., 2015). This study focused on genetic and nutritional characterization of three dominant macrophyte species at Bardawil Lagoon. Genetic identifications were done through genomic DNA extraction, followed by PCR amplifications and sequencing of 18S rRNA genes of the studied species. Phylogenetic analyses indicated that two of the recorded species showed homologies with the seagrass species, Posidonia oceanica and Halophila ovalis, with nucleotide identities 94.5% and 96.8%, respectively. The third species showed a unique phylogenetic lineage, representing nucleotide identity average, 86.5%, among the brown seaweeds, Heterokontophyta. Nutritional analyses indicated that the recorded seaweed-like macrophyte had the highest recommended nutritional contents, crude protein, 24.67%, with a total amino acid composition of 6.64 g/100 g protein, and carbohydrate, 38.16%, besides a calorific value of 3.063 K cal/g, among the studied macrophytes. To the best of our knowledge, this is the first attempt to characterize macrophyte community in Bardawil Lagoon, using both genetic and biochemical approaches.

Phylogenetic characterization of two echinoid species of the southeastern Mediterranean, off Egypt

Soliman *et al*. (2015), investigated the phylogenetics of two sea urchin species, Arbacia lixula and Paracentrotus lividus from the Mediterranean Sea. Specimens were collected from the east coast of Alexandria City, Egypt. Pigmentation examination showed four sympatric color morphotypes (black, purple, reddish brown, and olive green). Mitochondrial DNA was extracted from specimens and mitochondrial cytochrome oxidase subunit I (COI) and 16S ribosomal RNA (16S) were sequenced. The results showed that all black specimens constituted the species A. lixula. All other colors belonged to P. lividus, with no apparent differentiation between color morphotypes. Moreover, P. lividus showed high haplotype diversity (COI; H =0.9500 and 16S; H =0.8580) and low values of nucleotide diversity (COI; p =0.0075 and 16S; p =0.0049), indicating a high degree of polymorphism within this species. This study represents the first attempt at DNA barcoding of

echinoid species in the southeast Mediterranean off the Egyptian coast, and will provide a base for future phylogenetic analyses.

Reproductive biology spermatogenesis and biochemical characteristics of male sparid fish *Dentex dentex* from the south eastern Mediterranean coast

Assem *et al*. (2016) study focused on reproductive biology parameters and histological and fine structure investigations of testes maturation, in respect to steroid hormones and fatty acids' profile. All males over 30 cm in length were found to be mature. Gonadosomatic index (GSI) of males increased progressively to reach a peak value in May and June. In Dentex dentex, the spermatogonia were detected throughout the year in the peripheral zone of the testes. Spermatocytes are characterized by large nuclei with higher electron density and a layer of cytoplasm. The nuclei of spermatids were characterized by a condensed chromatin material. The early spermatid had a central nucleus and a large number of mitochondria. One big mitochondrion lies beneath the head of the sperm. The seasonal change of serum testosterone correlates with gonadal development. The presence of nearly ripe and ripe male D. dentex coincides with the surge of testosterone and the decrease in estradiol continues throughout the spawning periods. In males, higher GSI was accompanied by the highest lipid content of the testis. The high concentration of polyunsaturated fatty acids n-3 (PUFA) for testis, liver and muscles was as follows: docosahexaenoic (DHA, 22: 6 n-3) and eicosapentaenoic (EPA, 20:5 n-3) acids. The higher concentration of polyunsaturated fatty acids n-6 (PUFA) for testis, liver and muscles was as follows: linoleic (18:2 n-6) and arachidonic acids (20:4 n-6) with significant differences in relation to maturation stages at ($P < 0.001$).

Abundance, size composition and benthic assemblages of two Mediterranean echinoids off the Egyptian coasts: *Paracentrotus lividus* and *Arbacia lixula*

Elmasry *et al*. (2015), studied the variability in abundance, size composition and benthic assemblages of two echinoid species, the common sea urchin *Paracentrotus lividus* (Lamarck, 1816) and black urchin *Arbacia lixula* (Linnaeus, 1758) in the Southeastern Mediterranean (SEM) along the coast of Alexandria, Egypt. Four seasonal trips were made during the years 2014–2015 covering 55 km of the shore with depths ranging between 3 and 9 m. The sea urchin species composition, density and size structure and distribution were compared. The associated macrobenthic invertebrates with prominent presence and biomass were observed as well as other benthic fauna and flora associations. The present results showed that *P. lividus* was the dominant echinoid spatially and temporally. *A. lixula* showed frequent occurrence in Sidi Bishr and Sidi Gaber stations in the spring season. The most dominant size class was the medium to large-sized classes for P. lividus and largesized classes *for A. lixula*. The commercial size for the edible *P. lividus* represented 33% of the sampled population. Furthermore, the most dominant macrobenthic assemblages beside the echinoid population were primarily oysters, sea cucumbers, and mussels. Beside these, assemblage of seaweeds (red, green, brown and crustose algae), Porifera, Cnidaria, Crustacea, other Echinodermata, Bivalvia, Gastropoda, Tunicata, Bryozoa and Annelida were found. The present study shows that the investigated area represents stable habitats for the echinoid population with rich and diversified algal assemblages as well as other potential food resources.

Reproductive biology, steroid and biochemical profiles of *Dentex dentex* ovaries in the Eastern Mediterranean in relation to histological structure

Ismail *et al*. (2016), studied the reproductive biology in female Dentex dentex, which is a summer multiple spawner with the spawning period extending from late April to June. Females with body length over 35 cm were mature. The GSI value had peak values during May and June. The ova diameter ranged over nine groups (50–700 lm). The relative fecundity ranged from 510 to 1276 eggs per g gutted weight and from 20,409 to 22,595 eggs per 1 cm total length. The histological appearance of the ovarian cycle was divided into five periods. The histological structure of the maturing and ripe oocyte wall shows the presence of five different layers. Baseline of testosterone and estradiol levels was found during the immature and spent, whereas the peak value was found in prespawning and ripe-spawning period. While the maximum total lipid content was in the maturing ovary, the minimum was in muscles of prespawning female. The main polyunsaturated fatty acids n-3 (PUFA) for ovary, liver and muscles were docosahexaenoic (DHA, 22:6 n-3) and eicosapentaenoic (EPA, 20:5 n-3) acids, whereas n-6 (PUFA) were linoleic (18:2 n-6) and arachidonic (20:4 n-6). All together, the present observations gave basic data of the reproductive cycle of female *D. dentex* required for its successful spawning.

Genetic and morphological identification of some crabs from the Gulf of Suez, Northern Red Sea, Egypt

Most crab species inhabiting the Red Sea have not been characterized morphologically and genetically. Five different crab species were collected from the northern part of the Egyptian Red Sea, and were morphologically identified through description of colors, dentations of the carapace and shapes of chelipeds and pereiopods (Abbas et al., 2016). They were also genetically characterized by the partial sequencing of the barcode region in the mitochondrial cytochrome oxidase subunit I (COI) gene, which is known to be hypervariable among different crab species. Morphological and genetic characterization identified the crab species as: *Charybdis* (*Charybdis*) *hellerii* (A. Milne-Edwards, 1867), *Charybdis* (Charybdis) *natator* (Herbst, 1794), *Portunus* (Portunus) *pelagicus* (Linnaeus, 1758), *Liocarcinus corrugatus* (Pennant, 1777), and *Atergatis roseus* (Ru¨ ppell, 1830). This is the first record of *L. corrugatus* in the Egyptian Red Sea, despite being previously recorded in the Indian and Atlantic Ocean as well as in the Mediterranean Sea. DNA barcoding with precise morphological identification was effective in characterizing the crab species collected from the Egyptian Red Sea water.

Aliens in Egyptian waters. A checklist of ascidians of the Suez Canal and the adjacent Mediterranean waters

Checklists of the alien ascidian fauna of Egyptian waters are provided covering the Suez Canal, the adjacent Mediterranean waters and the Gulf of Suez (Halim and Abdel Messeih, 2016). Enrichment in ascidian species of the Suez Canal seems to have been on the increase since 1927. The distinctly uneven distribution pattern in the Canal appears to be directly related to the ship traffic system. Earlier reports on alien ascidian species in the Mediterranean are compared and discussed. Of 65 species recorded from the Mediterranean waters of Egypt in all, four are Erythrean migrants and four potentially so. Polyclinum constellatum Savigny, 1816 is a new record for the Mediterranean Sea.

Risk probability due to heavy metals in bivalve from Egyptian Mediterranean coast

An assessment of marine contamination by eight heavy metals (Al, Cd, Co, Cr, Cu, Ni, Pb, and Zn) made along the Egyptian Mediterranean coast) (El nemr *et al*., 2012). Also, risk probability due to heavy metals contamination in bivalve was investigated. The bivalve samples collected in April 2007 from nine hot spot locations started at El-Mex and ended at Port-Said along Mediterranean coast. The recorded average concentrations of Al, Cd, Co, Cr, Cu, Ni, Pb, and Zn were 137.8± 147.4, 0.09 ± 0.04, 2.45 ± 1.29, 8.49 ± 5.19, 3.82± 2.21, 10.28± 4.09, 0.24 ±0.15, and 21.87 ± 21.38 lg g_1 dry weight, respectively. In spite of the mollusks species, El-Mex exhibited the highest metal pollution index (MPI), which is expected due to the presence of industrials and agriculture drain near El-Mex location, followed by Port-Said and Abu-Qir stations that suffer from many industrials, marine transportation, fisheries and human activities. Western Harbor and Damietta stations recorded the lowest MPI. Principal component analysis (PCA) and cluster analysis were applied to highlight the relationships between metals. The dendrograms of the cluster analysis confirm the results obtained with PCA. Indeed, depending on the statistical analysis, the studied metals were grouped into two groups, the first group contains Co, Pb, Zn, Cu, Cd and Ni, and the second group includes the remaining two studied metals (Al and Cr). Risk probability study showed that the risk quotients for Cd, Cu, Ni, Pb, and Zn in both the best-case and worst-case scenarios do not cause adverse effect for either low or high consumption groups. Only chromium recorded a risk quotient three times greater than the worst-case scenarios, which may associate health problem for the heavy shellfish consumers groups.

Metal pollution in surface sediments of Abu-Qir Bay and Eastern Harbour of Alexandria, Egypt

Concentrations of major constituents (Na, K, Ca, Mg, CO_2 3 , SiO_2 3) and some metals (Fe, Al, Mn, Sn, Zn, V, Cu, Pb, As, Cd and Se) in surface sediments from Abu-Qir Bay and the Eastern Harbour of Alexandria were investigated (Abdel Ghani *et al*., 2013). Assessment of pollution was performed using several pollution indices. The adverse effects on aquatic organisms were determined by classifying the sediments according to sediment quality guidelines. Enrichment factors (EFs) revealed anthropogenic sources for Sn and Cd in Abu-Qir Bay; while in the Eastern Harbour Sn and Cd possessed high EF values (>30). High contamination factor (CF) for Sn and Cu (>6) was obtained. Concentrations of Sn and Se in sediments of most studied sites can regularly and occasionally affect sediment-dwelling organisms. Low concentrations of Se strongly affect the variance in surface sediment composition in both studied areas. Pollution load index (PLI) indicated that most stations in both areas are polluted.

Determination of metals in tuna species and bivalves from Alexandria, Egypt

The concentration levels of eight heavy metals (Cd, Cr, Cu, Fe, Mn, Ni, Pb and Zn) were measured in the liver, gills, and muscle tissues of tuna fish (Thunnus thynnus) collected from the El-Mex Bay, the Eastern Harbour and Abu-Qir Bay as well as two bivalves (Pinctada radiate and Paphia textile) from the Abu-Qir Bay (Hussein and Khaled, 2014). Generally, the liver and gills exhibited higher metal concentrations than the muscle. Among the analysed fish species, the average concentrations of heavy metals were as follows: Cd (0.052, 0.243, 0.177), Cr (0.817, 1.503, 1.196), Cu (1.251, 4.368, 2.711), Fe (165.476, 263.557, 186.405), Mn (1.004, 1.509, 3.031), Ni (0.370, 0.624, 0.708), Pb (0.832, 1.113, 1.372), Zn (18.715, 118.308, 78.421) mg/kg wet weight in the muscle, liver and

gill tissues, respectively. The average concentrations of trace metals in mussels decreased in the order Fe (296.655) >Zn (88.222) >Mn (5.497) > Cu (1.299) P Pb (1.135) P Cr (1.072) > Ni (0.659) > Cd (0.347) mg/kg wet weight. The concentrations of the studied heavy metals in all species were found to be within the safe limits suggested by various authorities and thus gave no indication of pollution. The target hazard quotients (THQs) values of Cd, Cr, Cu, Mn, Pb, and Zn for the investigated fish and mussels are much smaller than one, which may indicate that there is no health risk from consuming the investigated fish and mussels.

Tolerance of benthic foraminifera to anthropogenic stressors from three sites of the Egyptian coasts

Surely the coupling of natural and anthropogenic stressors combined with a lack of regulation resulted in the current threat to a large part of coastal marine biodiversity as well as coastal human societies, particularly in highly populated regions (Badawi and El-Menhawey, 2016). The distribution pattern of benthic foraminifera as sensitive bio-indicator is utilized to assess human-induced impact on the coastal area, at Alexandria, Port Said and Suez cites of Egypt. Twenty-two benthic foraminiferal genera were identified and complied by principal component analysis into four factors through cluster analysis. Cross correlation of the generic composition, distribution and relative abundance of common genera in the three investigated cores revealed three different coastal environments entities. The categorized environment ranged from light human impact as Alexandria site to heavily impacted by human activities as Port Said and Suez sites. Fauna of Alexandria site reflects an increase in unpolluted water activity revealing high-energy erosive environment. The second entity involves Port Said site, which represents a highly stressed coastal environment, corresponding to high-energy transport conditions influenced by fresh water flush from local Manzala Lake via Bougaz El Gamel outlet while Suez site is influenced by marine hypersaline water coupling with intensified levels of industrial and domestic pollution, attributed to the anthropogenic impact.

In addition to national recent information, there are numerious regional literatures that arerelevent to marine monitoring.The followings are some examples from the Mediterannean region:

Med PAN (2013) is implementing its strategy (2013 – 2017) which include a directory of ecological monitoring protocols to improve the knowledge of the marine environment, and to guide conservation and management action in marine protected areas. Many of these protocols are scattered among MPAs and scientific organizations. MedPAN is implementing a project aiming at:

- Inventory of existing ecological monitoring
- Facilitate access to these protocols
- Capture the overview of monitoring actions.

These projects will result in clear objectives, targets (e.g. species, habitats) and what parameter (s) are measured on this target, equipment, MPA, Program, language, and legal framework.

Dose of truth—monitoring marine non-indigenous species to serve legislative requirements

Non-indigenous species (NIS) are recognized as a global threat to biodiversity and monitoring their presence and impacts is considered a prerequisite for marine environmental management and sustainable development (Lehtiniemi *et al*., 2015). However, monitoring for NIS seldom takes

place except for a few baseline surveys. With the goal of serving the requirements of the EU Marine Strategy Frame work Directive and the EU Regulation on the prevention and management of the introduction and spread of invasive alien species, the paper highlights the importance of early detection of NIS in dispersal hubs for a rapid management response, and of long term monitoring for tracking the effects of NIS within recipient ecosystems, including coastal systems especially vulnerable to introductions. The conceptual frame work also demonstrates the need for port monitoring, which should serve the above mentioned requirements but also provide the required information for implementation of the International Convention for the Control and Management of Ships Ballast Water and Sediments. Large scale monitoring of native, cryptogenic and NIS in natural and manmade habitats will collectively lead to meeting international requirements. Cost-efficient rapid assessments of target species may provide timely information for managers and policy-advisers focusing on particular NIS at particular localities, but this cannot replace long-term monitoring. To support legislative requirements, collected data should be verified and stored in a publicly accessible and routinely up dated database/information system. Public involvement should be encouraged as part of monitoring programs where feasible.

Monitoring and surveillance for non-indigenous species in UK marine waters

Stebbing *et al*. (2014), stated that the threat non-indigenous species (NIS) pose to global biodiversity loss is considered to be second only to habitat destruction since NIS have devastated terrestrial, freshwater and marine ecosystems across all continents. Marine systems are particularly vulnerable to the introduction of NIS due to their exposure to multiple transport pathways along which new species can be either accidentally or intentionally introduced. There has been a steady rise in the number of NIS becoming established in UK waters, increasing the level of impact and cost to the environment and economy.

In recognition of the increasing issues resulting from the introduction of NIS on the marine environment the European Union adopted the Marine Strategy Framework Directive 2008/56/EC (MSFD) in 2008, specifically descriptor 2. The MSFD provides a legislative framework for an ecosystem based approach to the management of human activities which supports the sustainable use of marine goods and services. The over arching aim of the Directive is to achieve Good Environmental Status (GES) by 2020 in Europe‘s marine waters.

In order to assess GES there is a need to gather information on the status of NIS in marine waters in comparison to environmental targets. In addition, monitoring and surveillance is required to determine the effectiveness of a programme of measures (re: bio-security) in reducing the risk of introduction.

Ten recommendations for advancing the assessment and management of non-indigenous species in marine ecosystems

Henn Ojaveer, *et al*. (2013) reported that the main objective of recent international legislative measures and policies concerning marine ecosystems is to ensure sustainable environmental management to maintain a good status for marine waters, habitats and resources, with the ultimate target of achieving an integrated ecosystem-based approach to management. Because bio invasions pose significant threats to marine ecosystems and the goods andservicestheseprovide, non-indigenousspecies (NIS) are included in the more recent legislative documents. A major challenge for the scientific community is to translate the principles of the legislative directives into a realistic,

integrated ecosystem-based approach and at the same time provide stakeholders with best practices for managing NIS. The aim of this paper, prepared by members of the Working Group on Introductions and Transfers of Marine Organisms (WGITMO) of the International Council for the Exploration of the Sea (ICES), is to provide guidance for the application of NIS related management in the European Union Marine Strategy Framework Directive (MSFD). Ten recommendations, including NIS identification, standardization of sampling and data, indicators, propagule pressure and management issues are considered in this paper. While most of these suggestions were developed to improve the implementation of the MSFD, several may be more widely applicable.

Long-term trends in small pelagic and bottom fisheries in the Mediterranean: 1950-2008

In its programme of work, Plan Bleu has undertaken an economic analysis of the ecosystems of the Mediterranean Large Marine Ecosystem, in the general framework of implementation of the Ecosystem Approach in this Sea promoted by the Mediterranean Action Plan Garcia (2011). To that effect, Plan Bleu has undertaken an assessment of the sustainability of maritime economic activities in the Mediterranean (MedSEA Project) The present report is a contribution to the project. Its purpose of this study is to provide the Mediterranean Blue Plan project with a synoptic view of the state of fisheries development in the Mediterranean and therefore indirectly of the likely state of the underlying resources. The study is particularly timely as the concern has been growing in international instances about the state of the resources and the GFCM has been stressing repeatedly the concerns about the resources (based on scientific assessments) and the need to start seriously regulating capacity, effort and catches.

The study analyses the state of the fisheries looking at trends in landings and landing growth rates for the key resources of the Mediterranean. It does so at the level of the Mediterranean, the different GFCM statistical areas, and the countries (Home Areas). It could not do it using the recently management areas adapted by the GFCM (the GSAs) because there are still no time series available (at least publicly) for that purpose.

The data is taken from the FAO Fishstat databases for the FAO Fishing Area 37 – Mediterranean and Black Sea 1950-2008 (taking out the Black Sea data) and the GFCM data set for 1970-2008. From this data, key groups of species were selected using the ISSCAAP categories to reflect the fisheries on bottom fish (on the shelf and the slope) as well as small pelagic species. Sharks and rays, lobsters, shrimps and prawns as well as squids, cuttlefish and octopus were included. Tunas and tuna-like species as well as species such as coral, turtles, cetaceans, tunicates, etc. were not analysed. The methodology rests on the use of the fishery development cycle (sensu Garcia 2009) already used for the World Bank review of the state of world fisheries. This cycle analyses the landings in terms of progression in the development cycle from Development to Maturity and eventually to Senescence and, sometimes, to Recovery. The main assumption is that the trends in landings, despite all the alledged and real problems with their quality, reflects mainly the impact of the fishing fleets, particularly during the main fishery development phase between 1960 and 1990. The method compares the landing variable with the Long Term Maximum Average Yield (LTMAY) to identify the periods of growth (Development), stagnation (Maturity) and decline (Senescence). The numerous graphs produced with the time series are analysed one by one and then summarised in a synaptic representation that gives a global perception of the development

processes, allowing fruitful comparisons of the empirical between resources, areas and countries, looking for contrasts or coherence and overall diagnosis.

At Mediterranean-wide level, the data show an overall stagnation for 2.5 decades of the aggregated production (about 800,000 tonnes). The pelagic low value species show the same pattern (and are stable at 500,000 tonnes) while the bottom high value fish increase until 1990 to close to 300,000 tonnes and decline rapidly until 2008.

At regional level, the 8 GFCM sub-areas show different behaviour. The different resources increase in some areas, stagnate in others and decrease still in others. There are some general patterns:

1) The fisheries appear generally in more advanced stage of development (and unfortunately of senescence) in the western and northern Mediterranean than in its southern and eastern parts.
2) In general, pelagics resources appear less pressurized than demersal ones as one would expect considering the higher economic value of the second. Also, among the high value resources, lobsters appear more pressurized and less able to sustain maturity situations. Similarly, sharks and rays appear extremely pressurized for the entire period, probably with a collapse of all targeted fisheries in the 1960 and repeated cycles of development-maturity-senescence. Shrimp resources are in a better shape and are still increasing and perhaps reaching their maximum. The same seem to be happening with cephalopods. For all these resources the entry in "Maturity" and senescence happens earlier in the North and West and maturity stages tend to be shorter also in these regions. At national level, the same general pattern prevails with some intriguing differences. The overall trend in development pressure from West to East is clear. However, the pelagics seem to have started reaching maturity earlier than the demersals even if the latter have reached a high percentage of country fisheries in senescence in recent times.

Although the study was not planned to make a full comparative analysis of the study results with conventional assessments made in the ambit of GFCM, a few comparisons with recent reviews indicate a general coherence (e.g. in the degree of overfishing in demersal and pelagic stocks) and there is evidence that the landing trends analysis reflect the underlying fisheries dynamics and their interaction with the resources.

This indicates that the approach can be useful, particularly but not only, where more scientific data is scarce. Having a more complete coverage in time and space, if carefully used, it can provide a useful backdrop to more sophisticated assessments. In area with limited scientific capacity, it can be used to promote a dialogue between the scientists, the policy-makers and the sector with the view to better understand the fisheries sector past history, and present likely state.

Med-ESCWET project: Regional workshop on ecosystem services provided by Mediterranean wetlands, Mercure Hôtel, Valbonne - Sophia-Antipolis, France September 19th, 2016

The role of green infrastructure in climate change adaptation was illustrated through case studies, by the variety of situations and wetlands encountered. This emphasizes the importance of better regulating human usage of these fragile environments in order to limit greenhouse gas releases, of allowing transit areas for coastal systems that provide a storm barrier while promoting sedimentary circulation, and the relevance of conserving large, well-connected floodplains in a coherent manner

across borders, in order to ensure flood protection for local populations.

The Med-ESCWET project has also reaffirmed the need to ensure all local biophysical assessments and economic valuations are understood in their context, in order to ensure that the ensuing results and recommendations are properly interpreted.

The economic valuation of climate change adaptation and mitigation services considered here represents the start of an approach that has not been widely developed in the Mediterranean region and could feed into subsequent broader valuation studies. While bearing in mind the hazards of improper generalisation, as mentioned above, estimates of the TEV of wetlands could help ensure a better understanding of environmental management, via cost-benefit studies for site managers and policymakers, for instance. This last point highlights one of the majors difficulties encountered in many combined science/public policy projects such as Med-ESCWET - it is very rare and difficult to get scientists engaged with such strategies.

In concrete terms, the results of this study could also help in the development of impact indicators focused on ecosystem services provided by Mediterranean wetlands, as initiated by Tour du Valat. Developing such indicators (e.g. role of wetlands in water supply, drought and flood reduction, or water purification) would help provide an inventory of the various, sometimes poorly understood, environmental protection roles played by Mediterranean wetlands.

Setting Priorities for Regional Conservation Planning in the Mediterranean Sea

Spatial prioritization in conservation is required to direct limited resources to where actions are most urgently needed and most likely to produce effective conservation outcomes. In an effort to advance the protection of a highly threatened hotspot of marine biodiversity, the Mediterranean Sea, multiple spatial conservation plans have been developed in recent years (Micheli *et al*., 2013). Here, we review and integrate these different plans with the goal of identifying priority conservation areas that represent the current consensus among the different initiatives. A review of six existing and twelve proposed conservation initiatives highlights gaps in conservation and management planning, particularly within the southern and eastern regions of the Mediterranean and for offshore and deep sea habitats. The eighteen initiatives vary substantially in their extent (covering 0.1–58.5% of the Mediterranean Sea) and in the location of additional proposed conservation and management areas. Differences in the criteria, approaches and data used explain such variation. Despite the diversity among proposals, our analyses identified ten areas, encompassing 10% of the Mediterranean Sea, that are consistently identified among the existing proposals, with an additional 10% selected by at least five proposals. These areas represent top priorities for immediate conservation action. Despite the plethora of initiatives, major challenges face Mediterranean biodiversity and conservation. These include the need for spatial prioritization within a comprehensive framework for regional conservation planning, the acquisition of additional information from data-poor areas, species or habitats, and addressing the challenges of establishing trans-boundary governance and collaboration in socially, culturally and politically complex conditions.

Collective prioritised action, not new conservation plans, is needed for the north, western, and high seas of the Mediterranean, while developing initial information-based plans for the south and eastern Mediterranean is an urgent requirement for true regional conservation planning.

At the global level, there arerelevent information on monitoring marine environment. The following

are examples:

Global Marine Biodiversity Trends

Marine biodiversity encompasses all levels of complexity of life in the sea, from within species to across ecosystems. At all levels, marine biodiversity has naturally exhibited a general, slow trajectory of increase, punctuated by mass extinctions at the evolutionary scale and by disturbances at the ecological scale (Sala and Knowlton, 2006). In historical times, a synergy of human threats, including overfishing, global warming, biological introductions, and pollution, has caused a rapid decline in global marine biodiversity, as measured by species extinctions, population depletions, and community homogenization.

The consequences of this biodiversity loss include changes in ecosystem function and a reduction in the provision of ecosystem services. Global biodiversity loss will continue and likely accelerate in the future, with potentially more frequent ecological collapses and community-wide shifts. However, the timing and magnitude of these catastrophic events are probably unpredictable.

Marine biodiversity: patterns, threats and conservation needs

Marine biodiversity is higher in benthic rather than pelagic systems and in coasts rather than the open ocean since there is a greater range of habitats near the coast. The highest species diversity occurs in the Indonesian archipelago and decreases radially from there (Gray, 1997). The terrestrial pattern of increasing diversity from poles to tropics occurs from the Arctic to the tropics but does not seem to occur in the southern hemisphere where diversity is high at high latitides. Losses of marine diversity are highest in coastal areas largely as a result of conflicting uses of coastal habitats. The best way to conserve marine diversity is to conserve habitat and landscape diversity in the coastal area. Marine protected areas are only a part of the conservation strategy needed. It is suggested that a framework for coastal conservation is integrated coastal area management where one of the primary goals is sustainable use of coastal biodiversity.

Biodiversity monitoring for decision-making

Biodiversity monitoring provides guidelines for decisions on how to manage biological diversity in terms of production and conservation. Monitoring determines the status of biological diversity at one or more ecological levels and assesses changes over time and space (Niemelä, 2000). Monitoring at the global level is needed to compare trends caused by the increasing homogenisation of the world's landscapes. Bioindicators are routinely used, but each indicator's potential to determine changes in the overall biodiversity should be rigorously tested. Monitoring is a vital feedback link between human actions and the environment, but incorporation of monitoring results into decision making is hampered by poor communication between ecologists and decision-makers. A global network for assessing biodiversity changes (GLOBENET) is described as an example of an initiative that attempts to address the above issues by using a simple field protocol with the aim to develop tools for assessment and prediction of the ecological effects of human-caused changes in the landscape.

An Integrated Monitoring Framework for the Great Barrier Reef World Heritage Area

Monitoring provides important feedback on how social and environmental systems are tracking and

whether or not human activities, including management activities, are having an impact. Hedge et al. (2013), described an approach applied to develop an integrated monitoring framework to inform adaptive management of the Great Barrier Reef World Heritage Area, a complex, multi-jurisdictional, multi-sectoral marine system of international ecological, social and economic importance. The monitoring framework provides the agreed basis for developing a monitoring program in this complex space. It identifies the gaps and opportunities to integrate the existing long-term, short-term and compliance-related monitoring and reporting initiatives to provide the information for more effective and efficient (adaptive) management of the GBRWHA. And as importantly it aligns expectations among different agencies about how monitoring will inform management. An integrated monitoring framework was developed through a series of reviews, multi-stakeholder workshops and subsequent meetings in 2012 and 2013. Fifty two high priority values, processes and pressures for management were identified along with 65 existing monitoring programs. Applying the structured guidance process to develop the monitoring framework was useful in several ways. First it brought together scientists, policy-makers, managers, and other interested stakeholders with slightly different agendas, philosophies and incentives and established a common purpose, lexicon and language for an integrated monitoring program. Second, it highlighted the importance and usefulness of qualitative conceptual models as a framework for discussing and setting questions. Third, the process started an important conversation about defining and setting priorities for management. Finally, it has established a comprehensive framework that is being used in developing an integrated monitoring program for this globally significant world heritage area.

Adaptive management is a cornerstone of modern environmental management but examples of truly adaptive management are rare (Westgate et al. 2014). This parlous outlook is challenging Australia‘s policy makers and scientists to develop a more effective approach to adaptive management for the Great Barrier Reef World Heritage Area, a complex system with multiple pressures and management responses – a scenario that is likely to impose itself on other World Heritage Areas.

In an adaptive management approach, monitoring is used to update system models with data and management responses in a process of continuous improvement (e.g. Lyons et al 2008). Monitoring provides important feedback on how social and environmental systems are changing and whether or not human activities, including management responses, are having an impact. For a large and complex system such as the GBR with multiple management objectives, the question of what, where and how to monitor to support adaptive management is a challenge. Prioritising one form of monitoring over another requires agreement on the question(s) to be addressed by monitoring and on how the results are to be used and communicated. Monitoring and management thus need to be tightly integrated.

Integrated monitoring has been described as _the systematic, consistent, and simultaneous measurement of physical, chemical, biological and socio-economic variables of different ecosystem compartments, over time and specified locations‘ (Parr et al. 2002). On the surface, this definition suggests that the art of integrated monitoring lies in integrating the measurement of variables from different scientific disciplines over time and space — primarily a technical exercise. However, Parr and colleagues‘ elaboration of integrated monitoring based on their experience of integrated terrestrial and freshwater monitoring program in Europe, clearly indicate that a range of interests, skills, resources and data need to be combined to develop an effective integrated monitoring

program. A similar set of requirements has been identified for effective adaptive monitoring (Lindenmayer and Likens 2009), ecological monitoring (Field et al. 2007, Fancy et al. 2009), biodiversity monitoring (Lindenmayer et al. 2012) and adaptive marine spatial planning (Douvere and Ehler 2011). For the purposes of this paper we extend the definition of integrated monitoring of Parr et al. (2002) to:

The objective and systematic alignment of priorities, data and knowledge across management, research, industry and community to monitor, analyse and report on the effectiveness of management for maintaining and enhancing clearly defined *values.*

Integrated monitoring, when planned and implemented effectively, should provide two primary benefits; firstly, a better understanding of the cause-and-effect relationships within coupled socio-economic and ecological systems, and the response of these systems to management actions (represented by a Driver-Pressure-State-Impact-Response [DPSIR] model; Antunes and Santos 1999); and secondly, the cost-effective use of available resources for monitoring priority values.

While the benefits are logical and attractive, the challenges of integrated monitoring need to be recognised and understood. The need to identify clear priorities fis paramount because it is unlikely that all existing monitoring programs within a region will need to be included, offering the potential for redirecting limited resources. Integrated monitoring has the potential to be resource intensive if not focused. Building constructively on the existing monitoring legacy is a key challenge for integrated monitoring (Parr et al. 2002). In this paper we describe a recently developed approach to integrated monitoring being used to support adaptive management of the Great Barrier Reef World Heritage Area, a complex, multi-jurisdictional, multi-sectoral marine system of great ecological, social and economic importance regionally, nationally and internationally.

Disturbance to Marine Benthic Habitats by Trawling and Dredging: Implications for Marine Biodiversity

The direct effects of marine habitat disturbance by commercial fishing have been well documented. However, the potential ramifications to the ecological function of seafloor communities and ecosystems have yet to be considered (Thrush and Dayton, 2002). Soft-sediment organisms create much of their habitat's structure and also have crucial roles in many population, community, and ecosystem processes. Many of these roles are filled by species that are sensitive to habitat disturbance. Functional extinction refers to the situation in which species become so rare that they do not fulfill the ecosystem roles that have evolved in the system. This loss to the ecosystem occurs when there are restrictions in the size, density, and distribution of organisms that threaten the biodiversity, resilience, or provision of ecosystem services. Once the functionally important components of an ecosystem are missing, it is extremely difficult to identify and understand ecological thresholds. The extent and intensity of human disturbance to oceanic ecosystems is a significant threat to both structural and functional biodiversity and in many cases this has virtually eliminated natural systems that might serve as baselines to evaluate these impacts.

Indicators for Monitoring Biodiversity: A Hierarchical Approach

Biodiversity is presently a minor consideration in environmental policy. It has been regarded as too broad and vague a concept to be applied to real-world regulatory and management problems. This problem can be corrected if biodiversity is recognized as an end in itself, and if measurable indicators can be selected to assess the status of biodiversity over time (Noss, 1990). Biodiversity,

as presently understood, encompasses multiple levels of biological organization. In this paper, I expand the three primary attributes of biodiversity recognized by Jerry Franklin — composition, structure, and function—into a nested hierarchy that incorporates elements of each attribute at four levels of organization: regional landscape, community-ecosystem, population-species, and genetic. Indicators of each attribute in terrestrial ecosystems, at the four levels of organization, are identified for environmental monitoring purposes. Projects to monitor biodiversity will benefit from a direct linkage to long-term ecological research and a commitment to test hypotheses relevant to biodiversity conservation. A general guideline is to proceed from the top down, beginning with a coarse-scale inventory of landscape pattern, vegetation, habitat structure, and species distributions, then overlaying data on stress levels to identify biologically significant areas at high risk of impoverishment. Intensive research and monitoring can be directed to high-risk ecosystems and elements of biodiversity, while less intensive monitoring is directed to the total landscape (or samples thereof). In any monitoring program, particular attention should be paid to specifying the questions that monitoring is intended to answer and validating the relationships between indicators and the components of biodiversity they represent.

Identifying indicators and essential variables for marine ecosystems

Identifying essential biological variables in marine ecosystems is harder than essential ocean variablesbecause choices about the latter are guided by the needs of global oceanic models, and the number ofcandidate variables to choose from is much smaller. Hayes *et al*. (2015) presented a process designed to assist managersidentify biological indicators and essential variables for marine ecosystems, and demonstrate its appli-cation to Australia‘s Exclusive Economic Zone. The process begins with a spatially explicit description ofkey ecological systems and predicts how these systems are impacted by anthropogenic pressures. Theprocess does not require experts to agree on the system‘s structure or the activities that threaten theecosystem. Rather it defines a suite of pressure scenarios that accommodate uncertainty in these aspects,and seeks to identify indicators that are predicted to respond in a consistent fashion across these scenar-ios. When the process is applied at national or regional scales, essential biological variables emerge asthe set of consistent indicators that are common to similar but spatially distinct systems.

GEO BON (2015) with its partners introduced a new generation of indicators integrating biodiversity observations, remote sensing data, and models for assessing progress towards the CBD strategic plan 2011-2020, and Aichi Targets 5, 11, 12, 14, 15 and 19. The new set of indicators is characterized by the vigorous use of open access large global data sets, state of art remote-sensing based information, model-based integration of multiple data sources and types, including in situ (ground based) observations, and online infrastructure enabling unexpensive and dynamic updates, with full transparency. Data are integrated from 3 essential biodiversity variables: species distribution, taxonomy diversity and ecosystem extent. The resulting indicators offer some important benefits such as filling geographical and taxonomic gaps, habitat loss and degradation, relationships between species distribution and patters of habitat loss and protection. These indicators are:

- Species Habitat Indices (SHIs)

The Species Habitat (SHIs) quantify changes in the suitable habitats of single species to provide aggregate estimates of potential population losses and extinction risk increases in a region or

worldwide.

- Biodiversity Habitat Index (BHI)

The Biodiversity Habitat Index uses biologically-scaled environmental mapping and modeling to estimate impacts of habitat loss, degradation and fragmentation on retention of terrestrial biodiversity globally, from remotely-sensed forest change and land-cover change datasets.

- Species Protection Index (SPI)

The Species Protection Index (SPI) measures how much suitable habitat for single species is under protection and estimates the regional or global biodiversity representativeness of terrestrial protected areas.

- Protected Area Representativeness and Connectedness (PARC) Indices

The Protected Area Representativeness & Connectedness Indices use biologically-scaled environmental mapping and modeling globally to assess the extent to which terrestrial protected areas are ecologically representatives and well connected.

- Local Biodiversity Intactness Index (LBII)

The Local Biodiversity Intactness Index (LBII) is based on a purpose-built global data-base of local biodiversity surveys combined with high resolution global land-use data. The index provides estimates of human impacts on the intactness of local biodiversity worldwide, and how this may change overtime.

- Global Ecosystem Restoration Index (GERI)

The Global ecosystem restoration index (GERI) is a composite index that integrates structural and functional aspects of the ecosystem restoration process. These elements are evaluated through a window that looks into a baseline for degraded ecosystems with the objective to assess restoration or declines in a more integrated manner.

- Species status Index (SSI)

The Species Status Information Index (SSII) measures the adequacy of data on the distribution of single species and on the make-up of species assemblages in a location or region.

Each indicator is well defined; its purpose, coverage and methods for calculation are provided.

Nature-based Solutions to address global societal challenges.

Nature-based Solutions (NbS) are defined by IUCN as actions to protect, sustainably manage and restore natural or modified ecosystems, which address societal challenges (e.g. climate change, food and water security or natural disasters) effectively and adaptively, while simultaneously providing human well-being and biodiversity benefits. The NbS concept, as used in environmental sciences and nature conservation contexts, has emerged within the last decade or so, as international organisations search for ways to work with ecosystems – rather than relying on conventional engineering solutions (such as seawalls) – to adapt to and mitigate climate change effects, while improving sustainable livelihoods and protecting natural ecosystems and biodiversity (Cohen-Shacham, 2015).

NbS is a relatively young concept, still in the process of being framed. There is a need now to deepen our understanding of NbS and confirm the principles upon which NbS is based, in order to move towards an operational framework that can guide applications of the NbS concept. The following set of NbS principles is proposed.

Nature-based Solutions:

1) Embrace nature conservation norms (and principles);
2) Can be implemented alone or in an integrated manner with other solutions to societal challenges (e.g. technological and engineering solutions);
3) Are determined by site-specific natural and cultural contexts that include traditional, local and scientific knowledge;
4) Produce societal benefits in a fair and equitable way, in a manner that promotes transparency and broad participation;
5) maintain biological and cultural diversity and the ability of ecosystems to evolve over time; 6- Are applied at the scale at a landscape;
6) Recognise and address the trade-offs between the production of a few immediate economic benefits for development, and future options for the production of the full range of ecosystems services;
7) Is an integral part of the overall design of policies, and measures or actions, to address a specific challenge?

NbS is best considered an umbrella concept that covers a range of different approaches. These approaches have emerged from a variety of spheres (some from the scientific research domain, others from practice or policy contexts) but share a common focus on ecosystem services and aim to address societal challenges.

These NbS approaches can be classified into:

i. Ecosystem restoration approaches (e.g. ecological restoration, ecological engineering and forest landscape restoration);
ii. Issue specific ecosystem-related approaches (e.g. ecosystem-based adaptation, ecosystem-based mitigation, and ecosystem-based disaster risk reduction);
iii. Infrastructure-related approaches (e.g. natural infrastructure and green infrastructure approaches);
iv. Ecosystem based management approaches (e.g. integrated coastal zone management and integrated water resources management); and
v. Ecosystem protection approaches (e.g. area-based conservation approaches including protected area management).

A lack of operational clarity presents a major obstacle to the credibility and applicability of new concepts in the fields of conservation and development. Several parallel exercises are currently underway to develop operational parameters for specific NbS approaches (such as Ecosystem-based Adaptation and REDD+), each proposing its own set of criteria. Many of these criteria could be relevant for other approaches within the NbS ‗family' and there is likely an overarching set of parameters, or ‗standards', that can guide implementation of all types of NbS interventions. To help in this endeavour, five preliminary parameters are proposed: ecological complexity, long-term stability, scale of ecological organisation, direct societal benefits and adaptive governance.

By unifying NbS approaches under a single operational framework, it becomes possible to scale up their implementation and strengthen their impact in mitigating the world's most pressing challenges.

Ocean Assessment

The Open Ocean Assessment provides a baseline review of issues linking human well-being with the status of the open ocean through the themes of governance, climate change, ocean ecosystems, fisheries, pollution, and integrated assessment of the human-ocean nexus. It uses indices and indicators where data exist, in many cases with future projections due to global climate change, complemented by expert scientific assessment of numerous low certainties but potentially high impact issues where global ocean monitoring is inadequate (Fouda, 2015).

Key Messages and Recommendations

1- **Urgent attention is needed to sustainably manage the open ocean ecosystems and their services.**

The open ocean is the largest trans-boundary water space on Earth, covering about half of the entire surface of the planet, but also has impact on the entire global ocean. The open ocean‘s physical, chemical and biological characteristics are directly and indirectly threatened by human activity, especially via the effects of climate change. Damage to the open ocean will have severe consequences for marine ecosystems and services, and in turn human wellbeing.

2- **Understanding the impact of climate-ocean-human interconnections will help inform and improve sustainable development decisions.**

The state of the open ocean is influenced by climate. Likewise, climate is influenced by the ocean. This feedback loop is out of balance, with stressors from human activities causing a decline in the health of marine ecosystems and negatively affecting ecosystem services and human wellbeing.

3- **Improving human development is a key way to reduce human risk to sea level rise at the coast.**

By reducing vulnerability and boosting adaptive capacity. The risk comes from the hazard of sea level rise which will continue under all emissions scenarios, and human exposure and vulnerability.

4- **Unabated greenhouse gas emissions require immediate regulation to avoid severe consequences.**

If greenhouse gas emissions continue unabated, IPCC projections from now to 2050 indicate a continued decline in the health of marine ecosystems and their associated services. This will have negative consequences for human wellbeing.

5- **The sustained and incrementally improved monitoring of key ocean and climate variables within the Framework for Ocean Observations, GOOS and GCOS is critical.**

It is important that the open ocean‘s physical, chemical and biological characteristics are regularly monitored. This will provide essential trend data to properly inform decisions to manage the health of the open ocean ecosystems, with a view to maintaining viable ecosystem services and being able to measure and project human risk.

6- **Improved regulation is essential in reducing the over-exploitation of fish stocks and the impacts of climate change on them.**

Fish stocks in the open ocean are vulnerable to over-exploitation from direct human impact. In addition, the indirect human impacts of climate change lead to declining fish stock health and shifting migratory patterns.

7- **Improved regulation is required to minimize the sources and impact of pollution on marine ecosystem health and human wellbeing.**

There are multiple sources of pollution in the open ocean (including land, shipping and atmospheric) which have potentially massive impact on the health of marine ecosystems, and in turn, humans.

8- **Improved global trans-boundary ocean governance is needed to mitigate even local damage to ocean ecosystems within national waters.**

Stressors such as climate change, whose mitigation solutions require global and regional governance and cannot be addressed by national action alone, dominate cumulative human impact on these local and coastal ecosystems.

9- **Governance arrangements for the open ocean should connect to those for areas under national jurisdiction at the regional level.**

Numerous governance arrangements (ranging from local, to regional, to global) exist for the Open Ocean and areas beyond national jurisdiction. These are often complex, with many gaps (especially for biodiversity) and/or regulations are not enforced. There is no co-ordination body actively addressing these challenges at global and regional levels. These arrangements should work on common principles.

10- **The TWAP Open Ocean assessment method provides a holistic overview of the state of open ocean ecosystems and their inter-connections with human wellbeing. It can be used to create a system of monitoring goals within the Sustainable Development Goals (SDG) framework and to support future rounds of the World Ocean Assessment.**

This assessment is the first to look at the state of open ocean ecosystems and inter-connections with human wellbeing holistically using a method describing the relationship between human and natural systems from the point of view of ecosystem services. This has allowed an identification of data sources and gaps, and natural points of intervention for management. The methodology compliments the UN Regular Process, and the results also corroborate with World Ocean Assessment Summary (2015).

11- **An ongoing and robust scientific support enterprise is essential in providing confidence to policy and decision-makers that resources are being appropriately allocated.**

The open ocean is under-observed and under-explored, and there is still more to be understood about its immediate and future impact on human society. However, a lack of certainty cannot prevent policy and decision-makers from acting. The results of this assessment reveal key issues that require immediate attention and action. As research and monitoring improve, strategies for managing these issues can then be refined in the light of increased scientific understanding.

Inventory, monitoring and impact assessment of marine biodiversity in the Seri Indian territory, Gulf of California, Mexico

The conservation of marine ecosystems is at least 20 years behind terrestrial and freshwater ecosystems due to the difficulties in studying and monitoring these dynamic and complex environments. Furthermore, marine environment receive less attention because human impacts are less visible in the sea, and oceans are viewed as global commons. Jorge (2002) study contributed to

the knowledge of marine conservation through the development of three components in natural resources management: inventory, monitoring, and assessment of impacts. I elaborate a multi-taxa inventory, identify key species to monitor, characterize one of the key species, and assess the impacts of the most important fishery in the community-based controlled marine area of the Seri Indians along the Sonoran desert coast of Mexico. A total 657 species of mollusks, echinoderms, sharks, rays, bony fish, sea turtles, sea snake, aquatic birds and marine mammals were recorded in the Seri territory through review of 30 scientific collections housed in museums and universities, literature, and field collections. The fish information was improved through the analysis of 151 traditional Seri names. Fifty species were identified for monitoring ecosystem health. They represent species with a legal status, rare, commercially important, taxa that dominate or characterize entire communities, common taxa, and species recognized in the Seri culture. The annual eelgrass (Zostera marina atam) was selected as a key species inside the Canal de Infiernillo in the Seri territory. Coverage of the eelgrass beds was estimated using aerial photographs, field mapping, and Seri traditional ecological knowledge. The total extent of the eelgrass beds was approximately 6687 ha, which regrew in the same areas during the three-year study, maintaining the same general shapes and sizes. Twenty-six percent of the eelgrass beds overlap with the swimming crab (Callinectes bellicosus) fishing zones. Major impact on this fishery are caused by "ghost" fishing traps, which continue to capture crabs and animals and modify the substrate as they are moved around by currents and accumulate on the sea bottom. Efforts to standardize the use of traps will reduce these impacts on this fishery in the long term.

Marine Biodiversity in South Africa: An Evaluation of Current States of Knowledge

Continental South Africa has a coastline of some 3,650 km and an Exclusive Economic Zone (EEZ) of just over 1 million km2. Waters in the EEZ extend to a depth of 5,700 m, with more than 65% deeper than 2,000 m. Despite its status as a developing nation, South Africa has a relatively strong history of marine taxonomic research and maintains comprehensive and wellcurated museum collections totaling over 291,000 records (Griffiths, 2010). Over 3 million locality records from more than 23,000 species have been lodged in the regional AfrOBIS (African Ocean Biogeographic Information System) data center (which stores data from a wider African region). A large number of regional guides to the marine fauna and flora are also available and are listed. The currently recorded marine biota of South Africa numbers at least 12,914 species, although many taxa, particularly those of Small body size, remain poorly documented. The coastal zone is relatively well sampled with some 2,500 samples of benthic invertebrate communities have been taken by grab, dredge, or trawl. Almost none of these samples, however, were collected after 1980, and over 99% of existing samples are from depths shallower than 1,000 m—indeed 83% are from less than 100 m. The abyssal zone thus remains almost completely unexplored.

South Africa has a fairly large industrial fishing industry, of which the largest fisheries are the pelagic (pilchard and anchovy) and demersal (hake) sectors, both focused on the west and south coasts. The east coast has fewer, smaller commercial fisheries, but a high coastal population density, resulting in intense exploitation of inshore resources by recreational and subsistence fishers, and this has resulted in the overexploitation of many coastal fish and invertebrate stocks. South Africa has a small aquaculture industry rearing mussels, oysters, prawns, and abalone—the latter two in land-based facilities.

Compared with many other developing countries, South Africa has a well-conserved coastline, 23% of which is under formal protection; however deeper waters are almost entirely excluded from conservation areas. Marine pollution is confined mainly to the densely populated KwaZulu-Natal coast and the urban centers of Cape Town and Port Elizabeth. Over 120 introduced or cryptogenic marine species have been recorded, but most of these are confined to the few harbors and sheltered sites along the coast.

Marine biodiversity, ecosystem functioning, and carbon cycles

Although recent studies suggest that climate change may substantially accelerate the rate of species loss in the biosphere, only a few studies have focused on the potential consequences f a spatial reorganization of biodiversity with global warming. Here, we show a pronounced latitudinal increase in phytoplanktonic and zooplanktonic biodiversity in the extratropical North Atlantic Ocean in recent decades. We also show that this rise in biodiversity aralleled a decrease in the mean size of zooplanktonic copepods and that the reorganization of the lanktonic ecosystem toward dominance by smaller organisms may influence the networks in which carbon flows, with negative effects on the downward biological carbon pump and demersal Atlantic cod (*Gadus morhua*). Our study suggests that, contrary to the usual interpretation of increasing biodiversity being a positive emergent property promoting the stability/resilience of ecosystems, the parallel decrease in sizes of planktonic organisms could be viewed in the North Atlantic as reducing some of the services provided by marine ecosystems to humans (Beaugrand *et al*., 2010).

CHAPTER 5

Existing Monitoring Program in Egypt

The interest of Egypt in marine science dates back to the 18th century; different departments carried out occasional marine investigations, leading to considerable contribution to our knowledge on the marine environment. These included biological oceanography, littoral macrobenthic communities, macrobenthos, epifauna, macro-algae, fish biology and fisheries, physical and chemical oceanography and geological investigations. There is existing a national Oceanographyic Data Centre (NODC) in Alexandria. A historical review of general oceanography of Egypt is published at the Egyptian Journal Aquatic Research (volume 40, 2014)

National Institute of Oceanography and Fisheries (NIOF) was established in 1973 by law 69, where all monitoring and research on aquatic institution (Mediterranean sea, Red sea, Inlands were combined together in one institute. NIOF has many resources including researchers, research boats, laboratories, libraries, and other infrastructure in Cairo (Headquarter), Alexandria, Suez, Aswan, Hughada, and Nile Delta.

NIOF carries out monitoring program on water quality since 1998 along the coasts of the Mediterranean and Red sea. This program is commissioned by the Ministry of Environment. The Suez Canal Authority commissioned NIOF, last year, to monitor Non-Indigenous species in the Suez Canal and the Mediterranean Sea. When resources are available, NIOF can implement monitoring program, as the case in 2008 when IUCN funded a project to establish a marine protected area at El-Sallum along the western coast of the Egyptian Mediterranean Sea. NIOF also carry out irregular surveys along the Mediterranean sea to monitor plankton, benthos, fish and fisheries. Its researchers publish their work in both national and international journals that deal with aquatic taxonomy, biology, ecology, fisheries, aquaculture geology, oceanography, pollution, and to some extent genetics.

Nature Conservation Sector (NCS) of EEAA has monitoring programs related to birds (particularly migratory birds), marine turtles, and has made a recent survey on marine mammals. The result of NCS works are published in the annual report (online) of EEAA (State of Environmental Report).

The General Authority for Development of Fish Resources (GADFR) publishes annual report on fish statistics. It includes information on fish landed at many places along the Mediterranean sea, Red sea, Nile River. Considerable information exist on fisheries in terms of fish species, catch, price, cooperatives, fishing gear, fish boats and other aspects of fisheries.

Researchers at Universities and research centers have carried extensive research, where results were either M.SC or Ph.D thesis; many of them have published their work in scientific journals related to phytoplankton, zooplankton, benthic ecology, fish and fisheries and to some extent on marine turtles. Resources available for those researchers are very limited, where many departments of marine sciences in Alexandria, Suez Canal and Al-Azhar Universities do not have proper facilities such as research vessels. This has led many researchers to have small fishing boats to obtain samples for further studies. Laboratories in most Egyptian Universities are quite adequate for analysis of water, sediments, plankton and fishes. Reasonable experience on taxonomy of marine life exists, where several reference collections exist in Alexandria, Cairo and Suez.

Based on the above, and inspite of marine research that goes back to 200 years, our information on marine biodiversity in the Egyptian Mediterranean sea is less than complete. Considerable

information on marine habitats and biota is available, but these data are far from being geographically comprehensive, mostly covering areas around Alexandria, Abu Qir, Arabs Bay, Suez Canal and Salloum. The situation is better in the Red sea where considerable knowledge have been generated from monitoring surveys on sea birds, marine mammals, turtles, fishes, coral reefs and mangroves.

The existing marine monitoring program in Egypt is scattered; data exist in many institutions, and cannot be used to implement Ecological Approach and objectives. In addition, most data are quite old, and cannot be used to know the current level of marine environment health, good or bad. The marine environment is changing rapidly due to numerous human activities such land-based sources, coastal urbanization, pollution of all forms, underwater cables used for communication and internet, and offshore activities.

There is a need to develop a successful marine monitoring program based on the existing ones at the NCS (turtles, migratory birds, marine mammals in the Red sea and started recently in the Mediterranean sea), NIOF (water quality, plankton, benthic fauna and flora, fish and fisheries0, GADFR (only fish statistics), and other marine research aspects at the Universities and research centers. There exist reasonable human resources, adequate laboratories and infrastructure; however, these resources need to be managed effectively. It is suggested to hold a workshop attended by participants of all governmental institutions, universities, and research centers, to discuss the proposed integrated marine biodiversity monitoring and agreed on standards use for sampling, data sharing and governance, and also to agree on implementing ECAP approach and its Ecological objectives and common indicators.

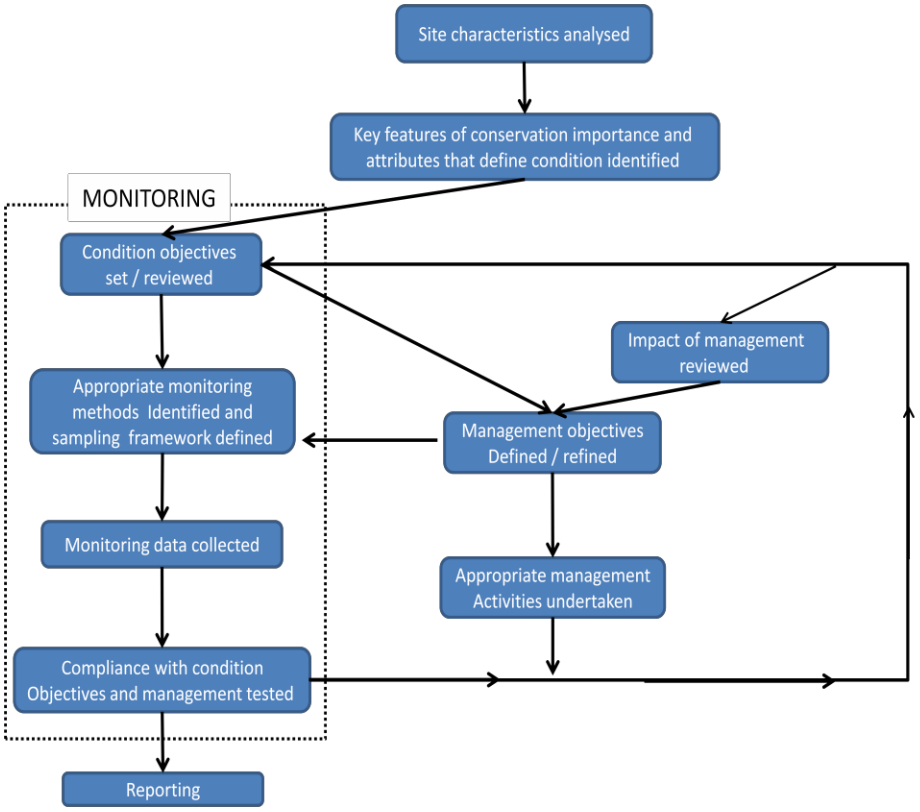
Planning and development of a marine monitoring program

The development of a successful monitoring program is dependent upon being clear about what you want to do and why (objectives). It is therefore important to define what monitoring is and how surveys relate to monitoring.

Monitoring is often loosely regarded as a program of repeated surveys in which qualitative or quantitative observations are made, usually by means of a standardized procedures. Monitoring can be more rigorously defined as –intermittent (regular or irregular) surveillance undertaken to determine the extent of compliance with a predetermined standard or the degree of deviation from an expected norm. In this context, a standard can be a baseline position (e.g. maintenance of the existing area of a particular habitat or population of a particular species), or a position set of an objective (e.g. maintenance of a specific area / habitat or a desired species.

A monitoring program has a specific purpose that requires the standard to be defined or formulated in advance. This requires the identification of interest features (e.g. various habitats and species), their attributes (e.g. area, number, structure and reproductive success) and their target state, i.e. the standard that is to be monitored.

Monitoring for conservation purposes should be clearly linked to site management, and should test whether conservation and management objective have been achieved.



Management adjustment requires knowledge of the dynamic situation, i.e. whether the feature is moving towards or away from the standard, from which direction, and whether the change is expected, acceptable or otherwise.

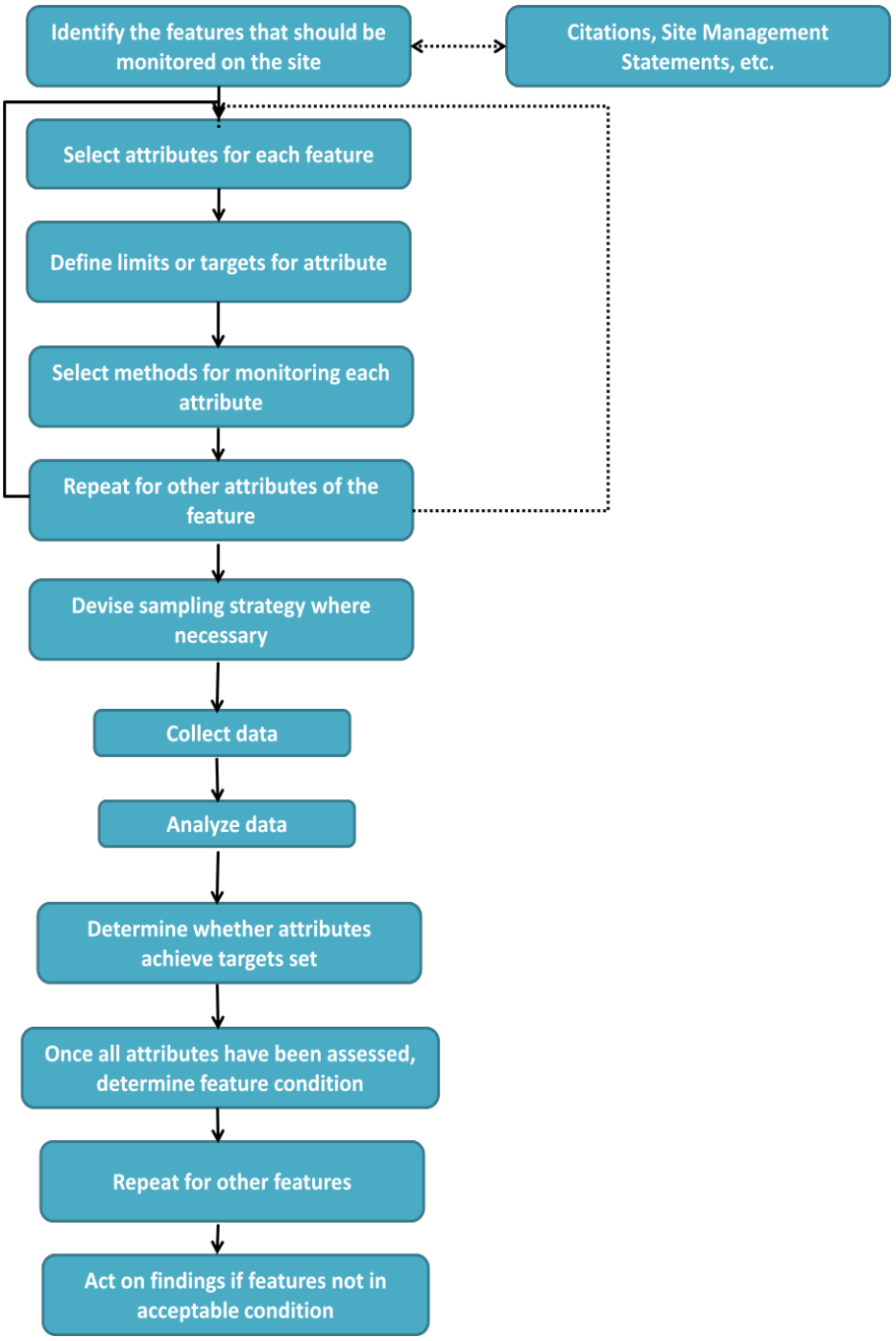
Monitoring should not be confused with research aimed at investigating ecological processes. Nevertheless, data collected for monitoring purposes can sometimes also be used to examine possible causes of change and to investigate the relationship between features of interest and

environmental variables and pressures. Such information can then be used to formulate appropriate responses.

Thus, monitoring can:

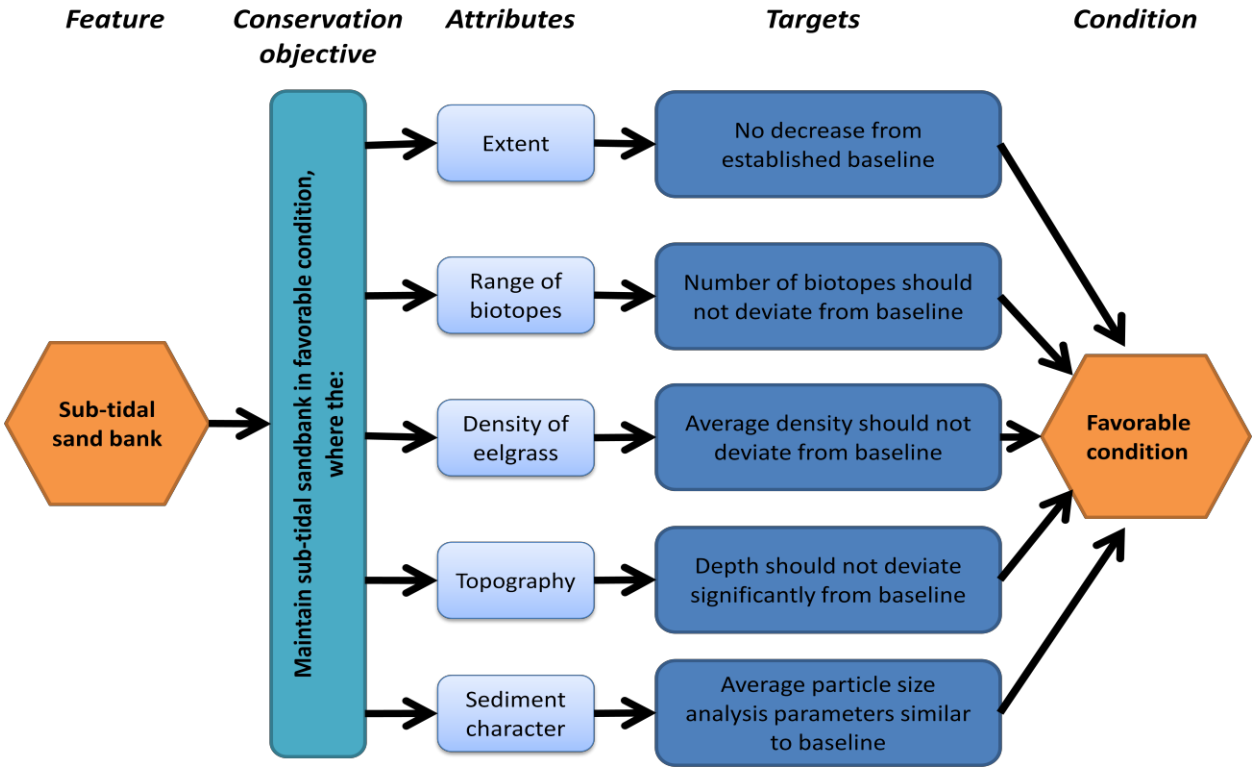
- Establish whether standard are being met;
- Detect changes and trigger responses if any of the changes are undesirable;
- Contribute to the diagnosis of the causes of changes; and
- Assess the success of actions taken to maintain standard or to reverse undesirable changes, and, where necessary, contribute to their improvement.

The major steps involved in planning and executing a monitoring program are illustrated in the following fig.

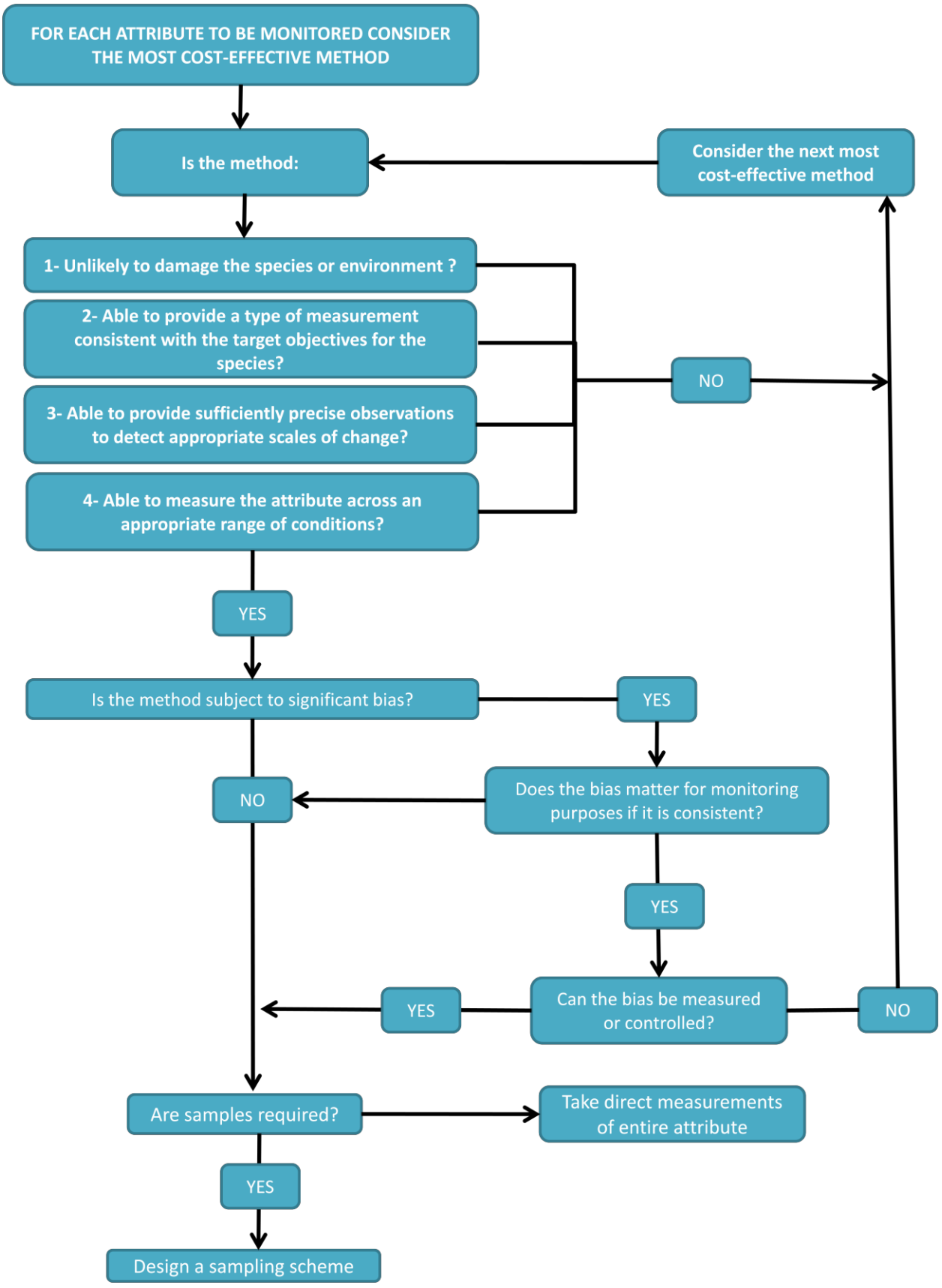


A schematic diagram of the steps involved in a monitoring programme.

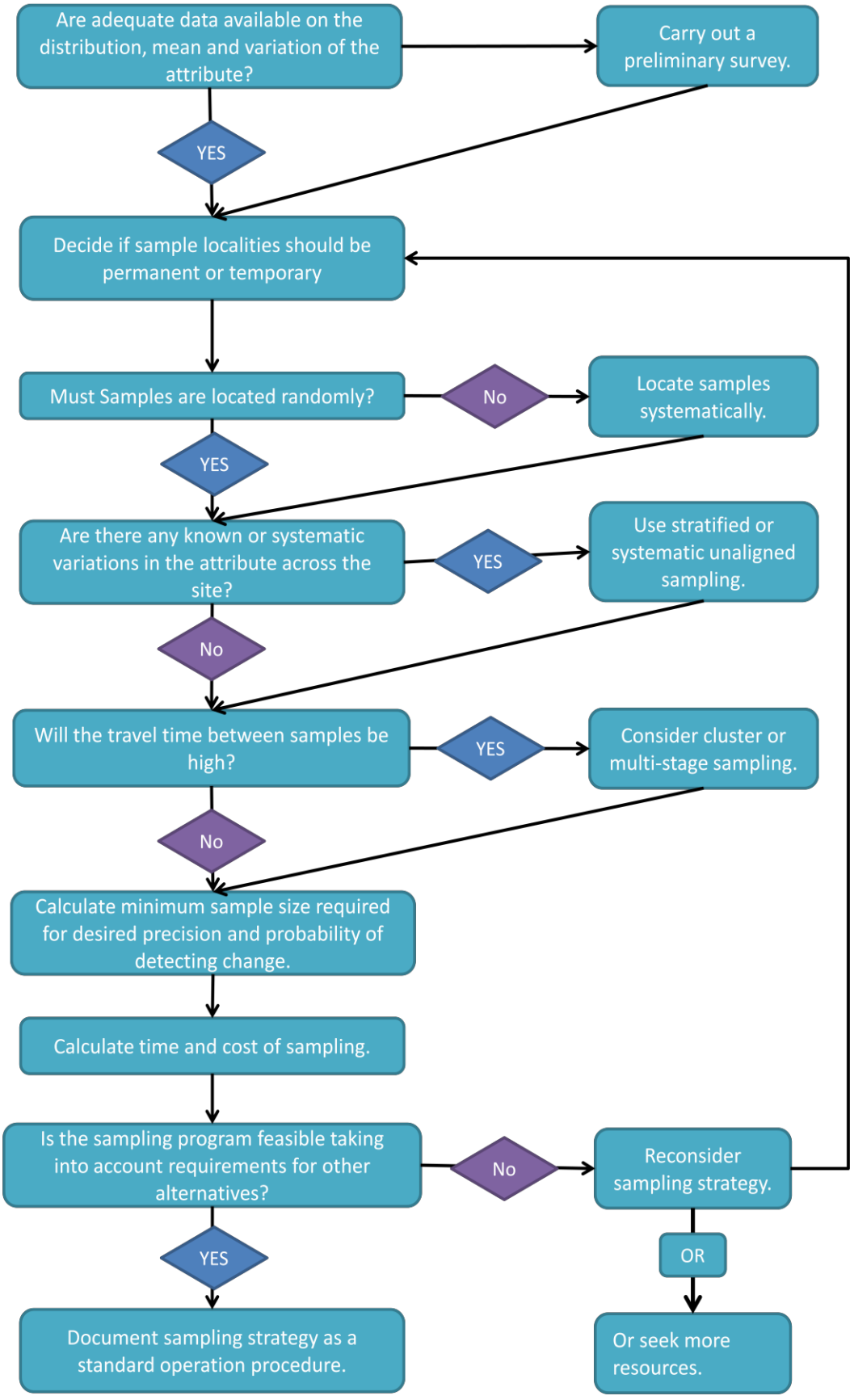
They involve setting the objectives for the monitoring program (what features of conservation interest are to be monitored? what objective for each feature? how often should monitoring be carried out? what are the management objectives for the site? Are there external factors that may have significant impacts on the site? What monitoring has been undertaken and are the baseline surveys required? Should the site be subdivided into monitoring units?); Methods for monitoring each attribute. (Is the method likely to damage the environment?, Are samples required?, Will the method provide the appropriate type of measurement?, Can method measure the attribute across an appropriate range of conditions?, Is the method prone to substantial measurement error?); Designing a sampling strategy (has the habitat been thoroughly tested and are preliminary field trials necessary?, Will the appropriate level of precision be achieved?, Should sample location be permanent or not?, Should the samples be located randomly, systematically or by judgment?, How many samples will be required?, When should date be collected? How will consistency be assured?); Reviewing the monitoring program (Are there sufficient long-term resources available?, Are personnel sufficiently trained and experienced?, Are licenses required?, Is specialist equipment required and available?, Are there health and safety issues to consider?); Data recording and storage (how will data be recorded in the field?, How will the data be stored?, Who will hold and manage the data?, Will the data be integrated with other data sets, and if so, how?); Data analysis, interpretation and review (who will carry out the analysis and when?, What are the steps in analyzing data?, description and presentation of data, making inferences about the site or population, interpretation and presentation of findings, and what statistical software is available for the analysis of data). Details of all of these steps are provided by Hill et al. (2005).

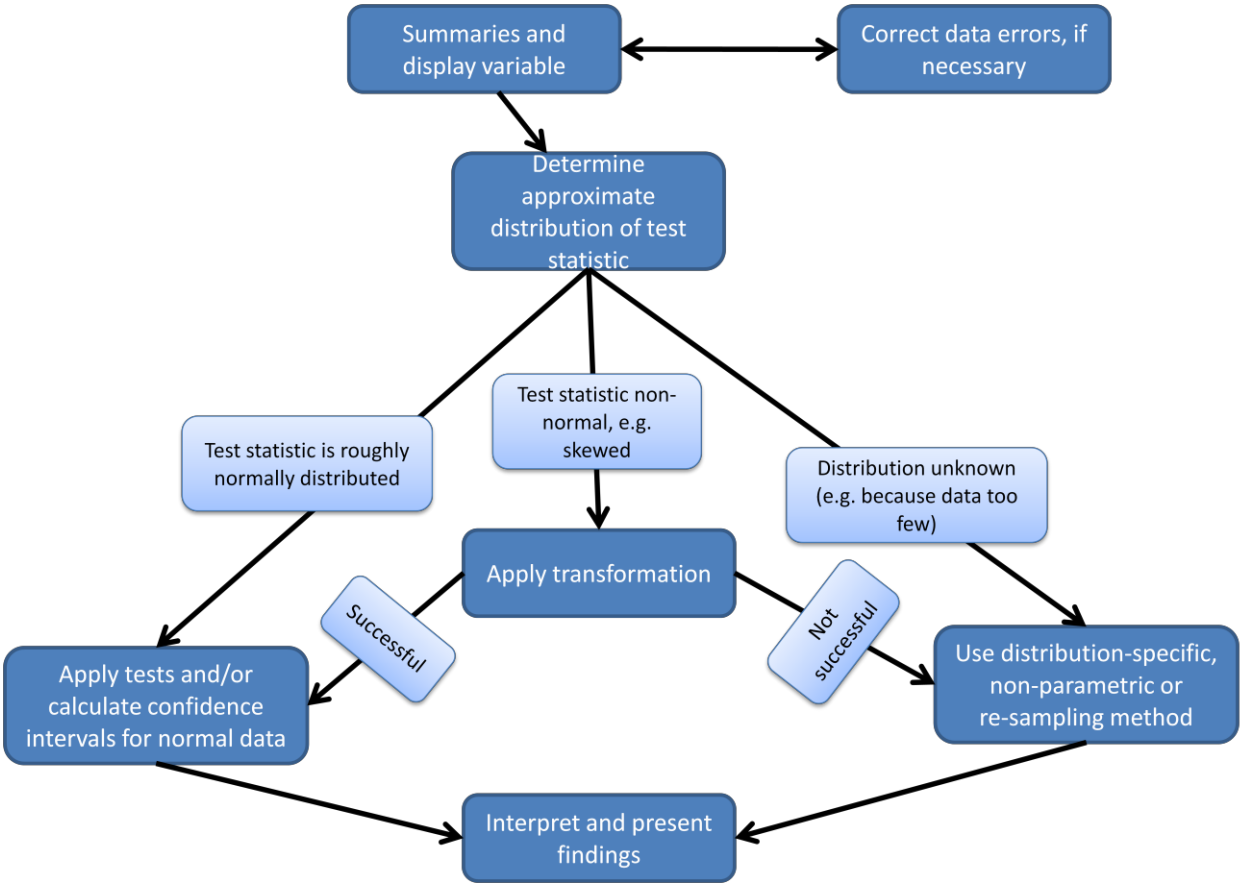


Diagrammatic representation of the proposed approach to setting a conservation objective for a marine feature.

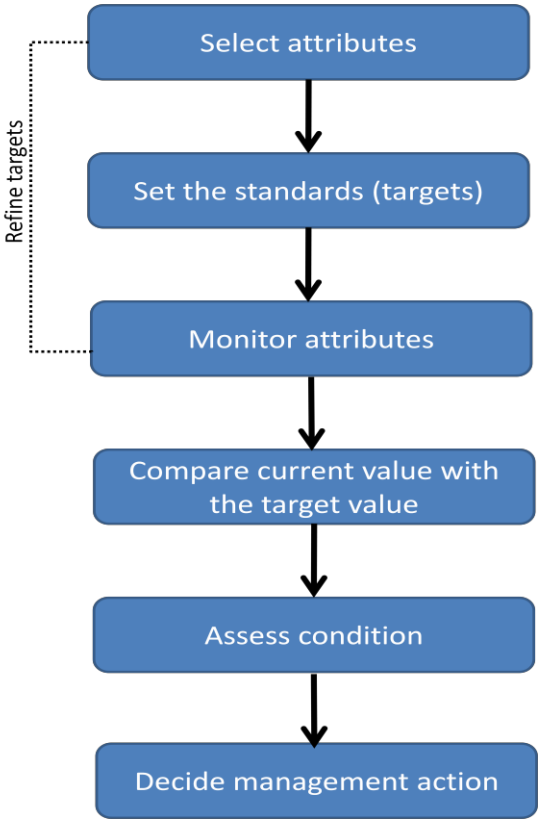


Selection of methods for monitoring each attribute


Are adequate data available on the distribution, mean and variation of the attribute?
Carry out a preliminary survey.
YES
Decide if sample localities should be permanent or temporary
Must Samples are located randomly?
No
Locate samples systematically.
YES
Are there any known or systematic variations in the attribute across the site?
YES
Use stratified or systematic unaligned sampling.
No
Will the travel time between samples be high?
YES
Consider cluster or multi-stage sampling.
No
Calculate minimum sample size required for desired precision and probability of detecting change.
Calculate time and cost of sampling.
Is the sampling program feasible taking into account requirements for other alternatives?
No
Reconsider sampling strategy.
OR
Or seek more resources.
YES
Document sampling strategy as a standard operation procedure.



Flow diagram outlining the steps involved in data analysis, for each variable of interest



Summary of the SAC monitoring process

Summary of Indicators for Biodiversity Monitoring in the Mediterranean

In the context of the Barcelona Convention, a common indicator is a measure that summarizes data into a simple standardized and communicable figure, and is ideally applicable in the whole Mediterranean basin, aiming at deliverable valuable information to decision makers. In particular, indicators should contribute to assess effects of measures taken to achieve or maintain GES. Integrated (Ecosystem) Assessment means both a process and a product. As a process, an assessment is a procedure by which information is collected and evaluated following agreed methods, rules and guidance. It is carried out from time to time to determine the level of available knowledge and to evaluate the environmental state. As a product, an assessment is a report which synthesizes and documents their information, presenting the findings of the assessment process, typically according to a defined methodology, and leading to a classification of environmental status in relation to GES.

There will be need to assess the characteristics, pressures and impacts and evaluate the current environmental state in relation to GES, and thereby assess the distance between the current state and GES. This is the basis for identifying appropriate environmental targets in relation to state, impact or pressure in order to bridge the gap between the current status and GES in order to improve status or to ensure that good status is maintained.

Monitoring program refers to all substantive arrangement for carrying out monitoring per each Ecological objective. The ecosystem approach monitoring includes a number of scheduled and coordinated activities to provide all the data needed for the on-going assessment of environmental status and related targets in relation to the achievement of GES.

Key principles for the Integrated Monitoring and Assessment Program are:

1. Adequacy
2. Coordination and coherence
3. Data architecture and interoperability
4. Adaptive monitoring program
5. A risk-based approach (priorities)
6. Precautionary principle

It is recommended to focus on ―representative sites‖ with the criteria for the selection as the following:

- Where the pressures to and risks to / effects on biodiversity are strongly associated?
- Where most information / historic data are available?
- Where well established monitoring is undertaken?
- Sites of high biodiversity importance and conservation interest.
- Expert opinion.

The common indicators in relation to biodiversity and NIS monitoring are as follows:

1. Habitat distribution range.
2. Condition of the habitat defining species and communities.
3. Species distribution range (related to marine mammals, seabirds, marine reptiles).
4. Population abundance of selected species.

5. Population demographic characteristics (e.g. body size or age class structure, sex ratio, fecundity rate, mortality rate, etc).
6. Trends in abundance, temporal occurrence and spatial distribution of non-indigenous (NIS).

1- Habitat distribution range

- Locating and assessing benthic habitats.
- Evaluating the status of habitat a real extent.
- Assessment (Generate maps / vulnerability)
- Cost-effectiveness

2- Condition of habitats's typical species and communities

- Benthic species condition
- Assessment
- Cost-efficiency
- Special consideration.
- Plankton life forms

3- Species distribution range

Information on the Mediterranean marine species is uneven, particularly southern region. Gaps exist for marine mammals, seabirds and to some extent marine turtles.

It is therefore necessary to establish minimum information standards, using different methods (location of species using standardized 30x30 nautical grids, dedicated ships or aerial surveys, opportunistic data from fisheries sightings, tagging, accoustic data collection, specific breeding and wintering areas). Assessment will be based on annual comparison.

4- Population abundance of selected species

- Population size (number of individuals)
- Population density (number of individuals / unit area)
- Breeding areas census
- Wintering areas census
- Foraging census
- Coordinated census from land
- Migration monitoring
- Ship and a real surveys
- Tagging
- Satellite tracking

5- Population demographic characteristics

- Body size
- Age structure
- Sex ratio
- Fecundity

- Mortality

6- Non-Indigenous species

- Selection of monitoring locations
- Pathways of introduction
  - Commercial shipping
  - Recreational boating
  - Aquaculture
  - Natural dispersal
  - Combined methods.

There are needs for:

- Create / update database
- Collection of socioeconomic information
- Collection methods
- Inventory
- Rapid assessment surveys
- At least 3 years of data per location to calculate the trend indicator, and to define the reference level for NIS.

Resources needed

- Research vessel
- Scuba diving
- Adequate equipment (core samplers, grabs, dredges…)
- Laboratory infrastructure
- Qualified personnel for data processing, analysis and interpretation
- Good taxonomy skills

Conclusions

Biodiversity monitoring provides guidelines for decisions on how to manage biological diversity in terms of production and conservation. Monitoring determines the status of biodiversity at one or more ecological levels and assesses changes over time and space. Therefore, it is a vital feedback link between human action and the environment.

It should be used to determine the ability of the area to continue to add value to society over time, and be the main driver of research, by highlighting where more social, ecological, economic, commercial or operational information and knowledge is desirable.

For monitoring have an impact, its needs to be tied into a strong governance framework. To provide effective monitoring, it is important that researchers collect data using similar methods and that they are committed to sharing data in an agreed format and archived in a national data centre.

Monitoring provides important feedback on how social and environmental systems are tracking, and whether or not human activities are having an impact.

Monitoring framework provides the agreed basis, identifies the gaps and opportunities to integrate the existing long-term, short-term and compliance – related monitoring and reporting initiatives to provide the information for more effective and efficient management of the marine environment.

However, the existing marine monitoring program lacks quantitative data on trends in the marine environment in Egypt. Information on trends in human use and impacts are especially poor making it difficult to evaluate how livelihoods are affected by the many marine uses and their cumulative impacts.

There are needs for baseline sustained standardized monitoring and improved data availability and access to meet ongoing and future reporting requirements, especially Aishi targets and SDG goals, and to provide a long-term perspective on the changing marine environment.

There are many existing monitoring programs and data series and that there are further opportunities to work together with academic institutions and the private sector to coordinate the initiatives.

Monitoring systems should respond to societal needs, and be integrated components of the management. There are need to link biodiversity monitoring to ecosystem services, and incorporate the valuation into national accounting systems.

Monitoring should be driven from bottom-up by national existing and emerging management needs, within agreed framework of standards.

Monitoring data need to regularly be reviewed for relevance, reliability and effectiveness. Monitoring program personals are lack the capacity to access currently available information from global databases relevant to their own jurisdiction. It is recommended that a series of workshops be held to support capacity development.

The rapidly changing marine environment needs actions to be taken quickly.

Priority action for monitoring include identification of conservation areas (MPAs), and mechanisms to protect areas of high importance for the maintenance of ecological services, methodologies and priority of biodiversity components, rehabilitation of threatened habitats and species, MPAs effectiveness, identification of biological coordinators, different alternatives for the integrated management of seascape, to promote SDG, developing effective tools for combating illegal hunting of wild animals, assess status of threatened species, conservation action plan for endemic species, and many other actions.

This will require integrated policy making for sustainable development (e.g. fisheries), good governance and institutions, regulatory framework, implementation of economic instruments and economic analysis, biodiversity and trade, funding, cooperation with private sector, public awareness, education, capacity development, research and development, use of indicators, regional and international cooperation.

Key Biodiversity areas within the Egyptian Mediterranean Sea were identified, and included: Sallum Gulf, coastal dune, northern lakes, Bardawil lake and Zaranik PA, Nile Delta fan.

Regarding invasive species the followings should be considered:

- Importance of early detection of NIS in dispersal hubs for a rapid management response, and of long-term monitoring for tracking effects of NIS within the marine environment.
- Ports and marinas monitoring will provide the required information for implementation of the Biodiversity monitoring from ships ballast waters.
- Cost-efficient rapid assessments of target species may provide timely information for managers and policy-advisors focusing on particular NIS at particular localities.
- Collected data should be verified and stored in a publicly accessible and routinely updated database / information system.
- Public involvement should be encouraged as part of monitoring programs when feasible.

Suggested Monitoring Program

It is suggested that monitoring program should have a vision similar to EcAp program agreed upon by parties which is:

"A healthy Mediterranean with marine and coastal ecosystems that is productive and biologically diverse for the benefit of present and future generations"

The main goals are:

Contracting Parties agreed that the ecological vision of the Ecosystem Approach to be realized through the following strategic goals:

- *To protect, allow recovery and, where practicable, restore the structure and function of marine and coastal ecosystems thus also protecting biodiversity, in order to achieve and maintain good ecological status and allow for their sustainable use.*
- *To reduce pollution in the marine and coastal environment so as to minimize impacts on and risks to human and/or ecosystem health and/or uses of the sea and the coasts.*
- *To prevent, reduce and manage the vulnerability of the sea and the coasts to risks induced by human activities and natural events.*

The Two Ecological Objectives relevant to this study are: Biodiversity and Non-Indigenous species.

Objective 1

Biological Diversity is maintained or enhanced. The quality and occurrence of coastal and marine habitat and the distribution and abundance of coastal and marine species are in line with prevailing physiograpic, hydrographic, geographic, and climatic conditions. The term ―maintained‖ is key to the quantification of GES for EO1.

This condition has three determining factors:

1. No further loss of the diversity within species, between species and of habitats /

communities and ecosystems at ecologically relevant scales;
2. Any deteriorated attributes of biological diversity are restored to and maintained at or above target levels, where intrinsic allow;
3. Where the use of the marine environment is sustainable.

Objective 2

Non-indigenous species introduced by human activities are at levels that do not adversely alter the ecosystem.

Non-indigenous species are species, subspecies or lower taxa introduced outside of their natural range and outside of their natural dispersal potential. This includes any part, gamete or propagule of such species that might survive and subsequently reproduce. Their presence in the given region is due to intentional or unintentional introduction resulting from human activities. In the Mediterranean, marine invasive species are regarded as one of the main causes of biodiversity loss potentially modifying all aspects of marine and other aquatic ecosystems.

1-Monitoring program for habitat mapping

General Goal:

Preparation of integrated maps for marine and coastal habitats including their socio, economic and ecological importances.

Specific objectives:

1- Coordination will be undertaken with all relevant agencies and stakeholders for targeted habitats.
2- Create complete components and characteristic overview including biological, ecological, etc. for the targeted habitats.
3- Study ecological changes at artificial (man made) habitats.

Natural Habitats in the Egyptian Mediterranean Sea include the followings:

- Beaches (sandy or rocky) and coastal dunes
- Coastal rocky cliffs and slopes
- Compounded coastlines (beaches and rocky cliffs mixed)
- Coastal lagoons
- Salt pans and playas
- Swamps / marshes
- Sea grass meadows
- Coralligenous communities
- Continental shelf water
- Deep sea communities such as Nile Delta Fan.

To match the recommended reference of habitats in the IMAP, it is suggested to consider mapping marine algae in both littoral and sub-littoral areas, sea grass beds, sandy and rocky shores, underwater soft and hard bottom habitats as well as small islands, open sea and deep sea habitats. These habitats exist in Egypt, and there are considerable information on them, some are quite old and have witnessed dramatic changes in their benthic communities such as coastal

areas around Alexandria and coastal wetlands along the Nile Delta coast, and still there are areas that have been made recently in 2008 where proper mapping were made for Posidonia meadows, hence there exist reference to compare with the current trends and status for specific habitats such as in El Salloun marine protected area. There are also some marine sites where no information is available such as small islands around Alexandria, Sinai coast, and western areas close to Mattrouh.

habitats to be mapped:

1- Sallum MPA,
2- Nile Delta,
3- Zaranik habitats (north Saini), when possible,
4- West Nile Delta; extended area between Alexandria to Sidi Brani.

Notes:

- The survey will be carried out to maximum point vertically and horizontally (surface and depth) according to available facilities.
- Chemical and physical characters will be recorded (water quality).
- Key species is a first priority to be monitored.

The following are examples of coastal and marine habitats suggested to be mapped:

1- Sallum area (example of shallow sea grass meadows)

A research cruise was carried out to assess the fisheries and marine biodiversity of the Gulf of Sallum, with a view for the protection, conservation, and management of its resources. To achieve this aim, the Egyptian Research Vessel "Salsabil" was used, deploying otter bottom trawl for fisheries data, CTD for collecting environmental parameters, and a bottom grab sampler for obtaining samples of benthos fauna. Moreover, diving was used to survey the under-water sea grass beds. The Gulf of Sallum supports a wide range of ecosystems, from the rich sea grass meadows and rocky reefs of the coastal zone, to the little seamounts. It is thus considered as a great resource for many economic fish species. Seagrass meadows were found forming from scattered small areas to dense vegetation that covered extended areas of the sea floor. The macrobenthic community in the investigated area consisted from 57 species belong to seven groups, while fish populations contained more than 90 species. Species Richness was closely correlated to depth, organic matter concentrations and sediment characteristics. Some invasive polychaete and introduced fish species were recorded in the present study, moreover few considered as threatened species. Using GIS analysis to the survey result showed that diversity of seagrass beds, benthic fauna and fish species in the Gulf could be divided into two sections. First section lies to the west of 25º 30'E longitude; contains the highest species composition, while second section (eastward of 25º 30' E) contains the lowest species composition. It was highly recommended, therefore, to declare the first section as a marine protected area (MPA). As the results of this study, the Gulf of Sallum was declared as the first marine Egyptian protected area in the Mediterranean Sea by the Egyptian Prime Minister's decision No. 533 for the year 2010.

2- Nile Delta Fan (example of deep sea habitats)

The ecological and biological significance of the Nile Delta Fan (NDF) in the Eastern Mediterranean Sea stems the geological features and natural phenomena (Nile silt sedimentation, physical and biological oceanographic and climatic characteristics). NDF belong

to the Levantine Sea where important geomorphological features are located including highly active mud volcanoes, canyons (Alexandria canyon), fan, escarpment, continental shelf. Deep-sea benthic habitats knowledge is scarce however significant and peculiar habitats related to gas hydrocarbon chemsymbiotic communities are known. It includes of mollusks and polychaete endemic species which represent vulnerable ecosystems. In addition, deep-sea corals communities are predicted in the area. Biodiversity index in the region is quite high (38 out of 50) with a major components of pelagic and benthic communities. Small pelagic fisheries are very important and Blue Fin Tuna (BFT) fishery as well, furthermore the NDF is known as one of the few spawning grounds in the Mediterranean Sea for BFT. Also, regarding pelagic species, marine turtles aggregate in feeding grounds in the shelf which is equally used as breeding areas for birds.

3- Marine algae

Collection of benthic marine algae made over a period of 5 decades in Alexandria revealed the presence of 242 taxa belonging to 140 genera. Over 50 % of the taxa identified are considered as new records to the region. The distribution and ecology of taxa in different localities are made. On the whole the algal flora has decreased in quantity and quality over the years due to increase in organic and inorganic pollutants in coastal water, as a result of growth of human population and industrial development. The area investigated covered about 40 km of coastline, extending to the east and west of Alexandria. A total of 14 collected stations have shown considerable variety of algal habitats, ranging from protected to very exposed localities. The rocly susbstratum is mainly composed of sandstone. Thus, the algal zones and algal communities include the littoral zone, tidal pools (transects), rocky crevices and guillies, andintralittoral zone.

Goal for habitat monitoring program

Since this indicator will be considerable to other indicators for marine mammals, seabirds, marine turtles and non-indigenous species, it is recommended to have a general goal; to develop habitat mapping for specific areas of biodiversity importance, as well as economic and social importance. Specific goals would include:

- Prepare an inventory for all biological components in each site.
- Mapping will be effective, easy to use, fairly cheap and reliable.
- Agree on standardize methods of mapping.
- Integrate habitat mapping indicator with other common indicators.

Implementation of habitat mapping indicator

1- Habitat distribution range

The Egyptian Mediterranean is roughly divided into 3 geomorphically distinct sectors. The first sector extends from El-Salloum to Alexandria at the western margin of the Nile Delta. The second sector extends from Alexandria to Port Said, and the third sector is the Sinai Mediterranean coast, extending from the eastern margin of the Nile Delta to Rafah. The coastal and marine environment of each sector vary greatly due to the different environmental, oceanographically, geological and geomorphical characteristics of each sector. Along the coastline, sandy beaches predominate, and are occasionally interrupted by both hard and soft stones of limited length, associated with rocky cliffs. The coastal area of the northern Nile

Delta is characterized by very narrow sand strips supporting the sea from the northern lakes. However, the Nile River is connected with the sea through Damietta and Rashid (Rosetta) branches, as well as passages (Boughazes) connecting the lakes with the sea. This is not the case for Sinai Mediterranean coast which is geomorphically distinct by sandy shores. The marine environment is so varied, depending on the width of the continental shelf, which is mostly narrow, leading to deep sea habitats of biological importance (e.g. Nile Delta Fan).

Based on the above, it is suggested 3 sites be mapped for each sector of the coastal and marine habitats. The first site will be at El-Salloum marine protected area and the surrounding areas, where extensive sea grass meadows exist with high biodiversity index. It is also less vulnerable compared with the other sites. The second site will be along the Nile Delta coast with a focus around Alexandria where intensive human pressures exist. The third site will be Zaranik, with less human pressures, and high significant biological importance.

In each site, benthic and pelogic habitats will be mapped using different methods such as DGPS, a single-band ech-sounder CTD, hydroplane techniques, side scan sonar for mapping sea beds, and remote operational vehicles (ROVs) for deep sea habitats.

In each site, habitats will be mapped and evaluated in terms of habitat areal extent. Human activities will be monitored to generate maps of vulnerable site. Efforts will be made to be cost-effective as the same site will be used for other common indicators.

2- Condition of habitats' typical species and communities

The condition of benthic and pelagic habitats for each site will be complemented with environmental data as well as human pressures. There exist several guides that will be used, depending on the habitat types. For example, RAC/SPA has published recently a guide on the environmental monitoring of rocky sea beds in the Mediterranean marine protected and surrounding zones (MedMAPAnet project, edited by Garcia-Gomez, 2015). Similar other monitoring techniques will be implemented for different habitats such as Salloum.

3- Species distribution range

A minimum information standards, using different methods (location of each species using standardized grids, boat surveys, data from fisheries sightings, acoustic data collection, special breeding grounds for fish and invertebrates). Assessment will be based on annual comparison, as well as older data collected from similar habitats.

4- Population abundance of selected species

The first step will be preparing an inventory of all fauna and flora, and the occurrence of each species in each site to prepare species composition. This will be followed by selected dominant species of sea-grasses, algae, sponges, coelontrates, polychaetes, crustaceans, echinoderms, bony fishes and cartigenous fishes.

For the selected species identified, population size (number of individuals), population density (number of individuals / unit area), breeding season, migration patterns, and other biological parameters will be determined. Species recommended by IMAP will be considered.

5- Population demographic characteristics

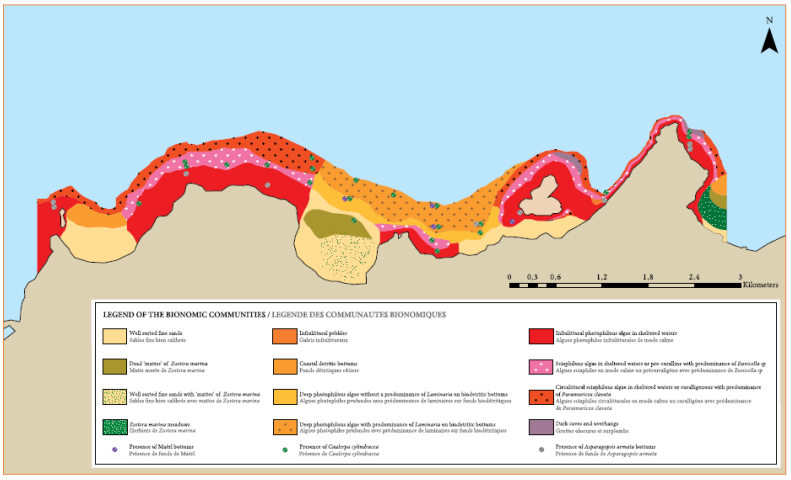
Selected habitats and species will be used to determine body size, age structure, sex ratio, fecundity and mortality.

Mapping of Key Marine Habitats in the Mediterranean and Promoting their Conservation through the establishment of SPA (MKH/UNEP/MAP/RAC/SPA 2016) was consulted

and examples provided for Morocco, Algeria, Tunisia, and Montenegro were found to be useful, and can be used in this monitoring program for habitat mapping, and hope results will follow these examples which will include:

Methodology

- Depth limit of the study area ;
- Characterization of the species and habitats:
  a. Sampling using grab,
  b. Visual counting of fish using transects,
  c. Identification of species and biocenoses using underwater photos and videos.
- Mapping of marine habitats:
  a. Bathymetric survey by single band echo-sounder,
  b. Elaboration of images of the seabed using side sonar,
  c. Interpretation of the results using data from underwater exploration,
  d. Hydroplane to locate and estimate the extent of the various habitat,
  e. Visual observation using a bathyscope to trace the upper edges of the meadows,
  f. Remotely Operated Vehicle (ROV) and towed camera.
- Sitting up monitoring system for key habitats:
  a. Monitoring of *Posidonia oceanica* meadows,
  b. Monitoring of coralligenous assemblages.
- Number Crunching:
  a. Field survey days,
  b. Total surface area,
  c. Number of species inventoried,
  d. Species listed within international conventions,
  e. Number of habitats of conservation interset,
  f. Surface area of key habitats



<u>Resources needed</u>

- Research vessel
- Scuba diving
- Adequate equipment for habitat mapping and characteristics of species and habitats, as well as monitoring of sea grass meadows and coralligenous assemblages. These will include DGPS, long line transects, Quadrates, making edge of meadows, visual counting of fish, underwater photos and videos, core samplers, and other equipment available at NIOF and NCS.
- Laboratory infrastructure

- Qualified personnel for field work, data processing, analysis, and interpretation.
- Good taxonomy skills for marine fauna and flora.

2-Marine MAMMALS monitoring program

Background

Marine mammals are represented in the Egyptian Mediterranean Waters (EMW) by two major taxonomic groups: the Order Cetacea (whales, dolphins and porpoises) and the Order Carnivora, Superfamily Pinnipedia, Family Phocidae.

There is no certainty about what and where species of Cetacean occur in the Egyptian Mediterranean. Of the 11 cetacean species represented by populations regularly occurring in the Mediterranean Sea, only eight can be presumed to be regularly occurring in the coastal and pelagic waters adjacent to the Egyptian Mediterranean coasts (Notarbartolo di Sciara and Birkun 2010). These include one Mysticete species, the fin whale Balaenoptera physalus, and seven Odontocetes: the sperm whale Physeter macrocephalus, the Cuvier's beaked whale Ziphius cavirostris, the Risso's dolphin Grampus griseus, the common bottlenose dolphin Tursiops truncatus, the rough-toothed dolphin Steno bredanensis, the striped dolphin Stenella coeruleoalba, and the short-beaked common dolphin Delphinus delphis. The three remaining species which regularly occur in parts of the Mediterranean (the killer whale Orcinus orca, the long-finned pilot whale Globicephala meals, and the harbour porpoise Phocoena phocoena) are unlikely to be regularly found in EMW. The first is being limited to Gibraltar Strait waters, the second to the western basin, and the third to the Northern Aegean Sea. The regular presence in EMW of most of the eight cetacean species mentioned above, as well as the extent of their occurrence, perhaps with the exception of common bottlenose dolphins, still considered hypothetical due to lack of sufficient knowledge.

The monk seal Monachus monachus, the only pinniped found in the Mediterranean Sea, once regular throughout most of the region's coasts, until very recently was considered extinct in Egypt, at least since the 20th century (Anon. 2006). It was only in early 2011 that proof of its occurrence in Egypt, in the vicinity of the city of Marsa Matrouh, was evident.

The Egyptian Action Plan for Conservation of Marine mammals in the Mediterranean Sea which was prepared in corporation with RAC/ SPA aimed to "Achieving and maintaining the favourable conservation status of marine mammals living in the Egyptian Mediterranean waters". One of its objectives is "Collect and expand knowledge on the status of marine mammal populations in the Egyptian Mediterranean". This objective targeted to: Collect basic information about population ecology (abundance, distribution and structure) of marine mammal species present in the EMW, in addition to Collect basic information on existing anthropogenic pressures in the EMW known to potentially impact on marine mammal populations.

However, till now there is no monitoring program already existing except some cases to implement the Cetacean survey and record the recent cases of stranded animals along Egyptian Mediterranean coast. For example, the first cetacean field survey at Egyptian Mediterranean water conducted during April 2016, as well as a sperm whale which was found stranded close to Cleopatra beach shoreline at Matrouh governorate in the western Egyptian Mediterranean coast during May 2016.

Marine Mammals Monitoring Program:

Aim of the program:

It is to provide data to assess the status, abundance, trends, distribution and health of marine mammal species and their habitats present in the Egyptian Mediterranean Sea.

Methods:

The abundance and distribution of the marine mammals species present or visitors to the Egyptian Mediterranean Sea will be implemented using the following appropriate methods provided by Franzsoni et al, 2013, RAC/SPA UNEP MAP MedPAN ACCOBAMS:

1- Incidental sightings and stranding

As a first step, the collection of incidental sightings and stranding information can enable initial insights and construction of a species list. This may often be a preliminary way of collecting information and to plan more rigorous data collection later on. Sightings of cetaceans by MPA personnel, volunteers, visitors, fishermen or other members of the public can provide an inexpensive way of gathering information. MPA managers can (and probably should) actively promote the reporting of sightings by visitors and other MPA users. basic data such as date, time and location of the sighting are very straightforward to record by anyone. Group size and species identification are slightly more complicated, but represent additional useful data that can often be collected. Photographs or video footage can corroborate the reported data. This type of information can provide a rough measure of which species are most common, and potentially detect gross seasonal differences (or long-term trends) in occurrence. This type of information is also often the only available information for rare species. However, caution is needed in interpreting results from such records, because the information provided by non-experts may not always be reliable, and seasonal peaks in sightings may reflect seasonal peaks in the number of visitors to the area. This method of monitoring provides no quantitative measure for assessing population change. Information can also be gathered from fishermen, who often observe dolphins during fishing, as well as tourists during their vacations as happened during last summer where baby whale was observed in the Marine lagoon. In addition, many stranded animals have been recorded suring the last few years along the Egyptian Mediterranean coast.

2- Land-based monitoring

Some cetaceans permanently live close to land, or they frequently occur alongshore. Some make repeated near shore migrations each year. These can readily be observed from the coast, using high vantage points and binoculars. This makes surveying for cetaceans relatively easy and inexpensive. Theodolite tracking can provide additional information on the movements of the animals. If sufficient survey effort is maintained, such monitoring can provide an assessment of the frequency of occurrence and the associated inter-seasonal or inter-annual variation, and even some level of habitat use. Moreover, this method often allows interactions between boats and cetaceans to be studied and monitored. If MPA is located on a path of a near shore seasonal migration corridor, land-based watches can be used for counts of migrating animals, which can in turn provide information on abundance. However, the drawback is that land-based surveying provides limited area coverage and in most cases does not provide

accurate information on abundance or trends. Based on information gathered, fin whale was recorded close to shore last summer.

3- Platforms of opportunity

Platforms of opportunity such as fishing boats, oceanographic research vessels, etc. are often used to survey areas at low cost. These often allow repeated observations over time, but with little or no control over where the vessel goes. This again limits the area coverage and is usually not appropriate for abundance estimation. However, it can provide a year-round monitoring opportunity, and if coupled with photo-identification, it can provide a range of other useful information. Offshore platforms can be used to monitoring purposes

4- Boat surveys

Surveys using a dedicated boat allow wider area coverage and a wider range of information to be collected. The choice of a boat will depend on resources available, the size of the MPA to be monitored and the types of questions that need to be answered. Boats can be used for photo-identification surveys or line transects surveys. They can also be used to conduct acoustic surveys. Photo-identification of coastal cetaceans can often be done with relatively small boats (5–6 m), powered by outboard engines. Rigid inflatable boats are commonly used. Line transect surveys require a higher platform (at least 5 m, ideally much more) and therefore, especially if we want to cover larger areas, a much larger ship. One vital piece of equipment in any boat survey is the GPS (Global Positioning System), which allows us to pinpoint sighting locations as well as record where the survey took place. Small hand-held GPS devices are inexpensive and can be used for that. In most cases, some quantification of survey effort is desirable, either in hours spent surveying or even better, the distance travelled on effort.

5- Photo-identification

Photo-identification (or photo-ID) is a very common method of monitoring cetacean populations and is often the most suitable and simple way to monitor coastal cetaceans. In several species, individual animals can readily be recognized by natural markings, such as scars and notches on the dorsal fins or tail flukes, pigmentation patterns, body scarring, callosity patterns, etc. Animals are photographed to facilitate mark recognition. This method is noninvasive and can provide information on a range of aspects of cetacean biology and ecology. It provides information on site fidelity, i.e. how often individual animals use a given area. Because individual animals can be identified, this also provides information on how many animals use the MPA. Photo-ID data can be applied to mark-recapture techniques in order to estimate absolute abundance and survival, to assess reproduction rates and to monitor trends.

Photo-ID requires a fast, high resolution camera (Canon EOS 60D is a good example of that, but numerous other cameras of the same and other brands are equally appropriate) with a telephoto or zoom lens (usually 70-200 or 300 mm). Nowadays the market provides numerous options that satisfy such needs at fairly low cost. However, not all species of cetaceans carry sufficient amount of markings to enable photo-ID. It is vital that good (sharp, big enough, right angle) photographs of as many animals in the group as possible are obtained. This means we need to get fairly close to the animals (the exact range will depend on the species and the photographic lens used) and take photographs perpendicularly to the identifying feature, e.g. a dorsal fin. For example, when photographing common bottlenose dolphins with a 200 mm lens,

the boat should ideally be completely parallel to the animal at about 10-20 m distance. An attempt should be made to photograph all animals in the group, regardless of their level of marking. Obviously, the welfare of the animals should be a priority and every care should be taken to prevent undue disturbance. Many training courses have been obtained to several marine environmental researchers at EEAA on this technique.

6- Acoustic monitoring

Static passive acoustic monitoring utilizes hydrophones (underwater microphones) that can record cetacean vocalizations. Acoustic devices can be deployed at sea and retrieved at a later stage. For example, C-POD loggers are commonly used for acoustic monitoring of porpoises and dolphins, but there are also other types of devices that can be used. Being autonomous, they can collect data when visual surveys are not possible, i.e. at night, during bad weather, etc. They can provide information on long-term trends in patterns of habitat use and frequency of occurrence. Such methods require the animals to vocalize in order to detect them, which may not always be the case. The choice of acoustic equipment will depend on the target species (cetaceans have very diverse vocalization repertoires) and the research questions. Furthermore, in areas with several species, some might be difficult to tell apart acoustically. Static passive acoustic monitoring does not currently enable estimation of abundance, but there has been a lot of research progress in that field lately, which is likely to change that. Acoustic surveys can also be carried out 'on the go', by towing a hydrophone array behind the ship. This is used in acoustic line transect sampling and for some species such as sperm whales and porpoises, it can provide estimates of abundance. Existing research vessels at the NIOF and NCS has reasonable equipment for acoustic survey.

7- Biopsy sampling

Tissue samples (skin and blubber) of free-ranging cetaceans can be obtained using biopsy sampling. Such samples can provide information on toxicology (i.e. pollutant levels), stable isotopes (feeding habits and trophic levels) and genetics (kinship and genetic population structure). It can even provide information on pregnancy. Biopsy samples can be obtained with a biopsy pole (to sample bowriding animals) or via remote sampling using crossbows or rifles.
These methods are semi-invasive, so every care needs to be taken to minimise stress and potential risk to the animals. This means proper training is needed before undertaking biopsy sampling.

8- Spatial modeling

Spatial modeling of habitat use is increasingly being used in the study and conservation of cetaceans. This approach uses environmental data to help explain animal distribution and predict important areas. Such models can be used to inform conservation and management decisions. Model predictions can inform MPA design and information on negative anthropogenic effects on cetaceans. This approach is analytically complex and requires rigorous data collection scheme.

Application of the common indicators for marine mammals monitoring:

1- Habitat distribution

Different techniques will be used to estimate habitat distribution. These will include land based monitoring, boats surveys, off shore platforms and acoustic monitoring. This will require using the existing research vessels at NIOF and NCS of EEAA. Meanwhile, cooperation with personal in charge of off shore platforms will be encouraged to report on the presence of marine mammals. The same will be applied to public and tourist to report on marine mammals observed from the shore.

Information available on marine mammals vary greatly, from only one site (monk seal close to Marsa Matrouh) to several sites at tourst resort areas along the northern coast (fin and sperm whales were observed), to numerous sighting around Damietta , Alexandria and Port Said (mostly dolphins). No information is available along the north Sinai coast; however, fin whale was sighted last summer along the coast of Israel.

Based on the above, it is suggested that locating main habitats will focus on 3 sites representing the geomorphological sectors of the Egyptian coast: 1) from El-Sallum to Alexandria; 2) along the coast of Nile Delta which extend from Alexandria to Port Said, and 3) Sinai Mediterranean coast.

Habitats will be assessed based on the data obtained from mapping of main habitats along the coast and open sea. Maps for the occurrence of marine mammals will also be prepared, as well as the vulnerability of each site based on human pressures.

2- Condition of marine mammals habitats

All human activities in the suggested 3 sites will be monitored to assess marine mammal habitats. These will include fisheries activities, maritime, off shore platforms, underwater cables for communication, oil pollution areas, marine litter (debris) and touristic development along the coast which has changed dramatically in recent years leading to marine mammals are easily observed from the shore. In addition, observation will be made on the presence of iconic species of fish particularly sharks, sea birds and marine turtles. The cumulative maps generated of human impacts on the EMW, and overlap between marine mammal critical habitat and significant impacts outlined and analyzed will be prepared. A special emphasis to be placed on overlap between marine mammal critical habitat and the presence of human activities involving the production of underwater noise (e.g., naval exercises, seismic surveys, maritime traffic).

3- Species distribution range

It will be determined using different methods; Incidental sightings and stranding, Photo-identification, Land-based monitoring, Boat surveys, Photo-identification, Acoustic monitoring, Spatial modeling. These techniques will facilitate species identification, public and personal of off shore platforms, acoustic data. Cetacean species distribution and abundance data will be generated. Therefore, if data density allows, predictive habitat maps of the main species generated, and possible hotspots will be determined. Data on abundance, distribution, movements, behavior and threats collected. Regular surveys for monk seal presence conducted within Sallum MPA will be implemented.

4- Population of abundance of selected species

Indicators 3 will be applied to identify species population size (number of individuals), population density (number of individuals/ unit area), foraging census, Coordinated census from land, Migration monitoring and Ship surveys.

5- Demographic characteristics

This indicator will be implemented using biopsy sampling (necropsies) and Incidental sightings stranding when possible. It is hoped that information collected will help to enable us to identify body size, age (frequency and distribution), sex (male or female), and cause of mortality. The national stranding database created, data also contributed to MEDACES will also be consulted. It is suggested that 2 surveys per each sector will be made annually conditioned by availability of resources and occurrence of stranded marine mammals along the coast.

Frequency: double surveys will be carried out annually during covering the entire area of distribution. As the next table:

	Short term monitoring	Medium term monitoring	Long term monitoring
Activities	• Stranding Network Along coast. • Coastal species monitoring (Bottlenose) by sharing fishermen boats.	• Seismic Marine Mammals Observation (MMO). • By catch monitoring.	• Seismic Marine Mammals Observation (MMO). • Longitudinal survey. • Arial Survey.
Areas	• Damietta, • Port Said, • Gamasa, • Matrouh.	• Damietta offshore, • Economic Exclusive Zone (EEZ) including deep sea habitats. • Maine Landing Sites.	• Damietta offshore, • Economic Exclusive Zone (EEZ) including deep sea habitats.

Resources needed/ tools

- Qualified personnel for data processing, analysis and interpretation.
- Research vessel/ boats.
- Adequate equipment (Cameras, Binoculars, GPS, Acoustic, ETC…).
- Laboratory infrastructure for necropsies.
- Manual on taxonomy guides for marine mammals in the Mediterranean.
- Public/ citizen scientist engagement in field observation.
- Permissions.
- Financial resources.

3-Marine Turtles Monitoring Program

Background

Marine turtles in the Egyptian Mediterranean Sea are represented by 3 species: Loggerhead *Caretta caretta*, Green *Chelonia mydas* and Leatherback *Dermochelys coriaca*. These are endangered, and are very rare in the northern coastal waters. While the loggerhead remains relatively abundant, it seems to have almost deserted in the western northern coast. The leatherback and green turtles are becoming increasingly rare. Nesting sites for both species exist along the Sinai coast in Zaranik Protected area.

Recent changes in the biodiversity of the Bardawil hypersaline lake have led recently to growth in numbers of loggerhead turtles, perhaps because of the increase of their favorite food (shrimps and crabs). Additionally, the Bardawil lake has become an attractive wintering ground for turtles due to the closed fishing season (January – April). In October 2012, over 90 sea turtles were found dead, and in various stages of decomposition on the shores of lake Bardawil. The majority found were loggerhead. However, a few green turtles and only one leatherback were identified. The conclusion reached was that the recent abundance of sea turtles interfered with the catch of fishermen, driving them to eliminate sea turtles from the lake.

The lack of a coordinated and integrated approach between environmental policies and fisheries policies to protect marine turtles further exacerbates the problem.

Main Goal:

Integrated Monitoring programs for Marine Turtles along Egyptian Mediterranean Coast.

Specific objectives:

1. Establish a tagging marine turtles program in the proposed sites (when possible).
2. Establish a long-term monitoring program for nesting beaches and standardization of monitoring methods.
3. Mapping known nesting sites on national land use map (spatial planning).
4. Study ecology, biology and behavior of marine turtles.
5. Carrying out genetic analysis (when possible).
6. Establish data collection methods on stranding.
7. Setting up a stranding network.
8. Agree on standardization of methodologies to estimate demographic parameters for population dynamics analysis, such as modeling.

Sites

Based on the above, the proper sites for monitoring marine turtles in the Egyptian Mediterranean Sea are along the northern Sinai, particularly at Bardawil Lake and Zaranik protected area. The representative sites criteria and the basic questions mentioned in indicator monitoring apply to Bardawil and Zaranik, such as these sites suffering from human pressures (fisherman), historic data are available, the sites have biodiversity importance and conservation interest, as well as the presume of experts on marine turtles. Other sites along the Egyptian coast will be explored.

There exist considerable experiences in turtle monitoring in Egypt, where Rangers of Protected Areas in both the Red Sea and Mediterranean Sea have been involved in marine turtles for more

than 10 years particularly in the Red Sea. Rangers can work together in monitoring of the 3 marine turtle species Loggerhead *Caretta caretta*, Green *Chelonian mydas* and Leatherback *Dermochelys coriaca*. They will need basic equipment including a differential GPS (DGPS), and tagging equipment.

Frequency:
Double surveys will be carried out annually as:
- Form 1st May to 15th July, first priority, and
- From 1st August to 15th October.

1- Habitat distribution range

1.1 Locating and assessing habitats of marine turtles

Monitoring program will focus on only Bardawil and Zaranik Protected Areas.Visits will be alsomade tothe fish markets in Alexnadriaand Port Said where marineturtles are frquently sold to public for superstitous reseaon (e.g. women bleive they can be pregenent if they drink turtle blood)

1.2 Evaluating the status of habitat areal extent

Efforts will be made to identify and assess all human pressures in the two sites, as well as the surrounding coastal and marine areas. Areal extent will be calculated based on the pressure of turtles, by using a differential GPS to generate maps. Methods used for habitat mapping will be used

1.3 Assessment (Generate maps and vulnerability)

Maps will be generated based on the pressure on every site, based on the results of habitat mapping.

2- Conditions of habitat's typical species and communities

This will be done by examining the overall biota (benthic fauna and flora, and fishes) with a focus on the favorite food of sea turtles. Information gathered will be assessed to be able to report on the condition of the turtle habitats.

3- Species distribution range

A minimum information standards will be made using different methods such as location of each of the 3 species of turtles per unit areas using boats, data from fishermen sighting, specific known breeding and wintering areas. Assessment will be based on annual comparison.

4- Population abundance

Parameters used to estimate population abundance are population size (number of individuals), population density (number of individuals / unit area), breeding are census, wintering area census, foraging census (when possible), migration monitoring, tagging, and satellite tracking (when possible).

5- Population demographic characteristics

Parameters use will include body size, age structure (when possible), sex ratio, fecundity and mortality.

Resources needed

- Research / or fishing boats
- Adequate equipment needed for condition of habitats (e.g. DGPS, Cameras, core samplers, grabs, dredges, etc).
- Basic laboratory infrastructure for turtles.
- Qualified personnel for field work, data processing and interpretation.
- Human resources.
- Permissions,
- Tagging system,
- Capacity building.

4-Monitoring Program for Seabirds

Background

Birds have played a major role in the Egyptian life throughout its history. The depictions of birds on the walls of tombs and temples are a testimony to their great importance in Pharaonic times. Some species were considered sacred and many others provided food. Birds continue today to play a symbolic, as well as an economic role in Egyptian society. Birds have proved to be excellent indicators of biodiversity and flagships for conservation, because they are relatively well known and carry popular support. Birdlife International fostered the production of a comprehensive national directory of critical sites for birds in Egypt to promote their conservation (Baha El-Din, 1999). It seeks to identify, evaluate and publish information on sites of global importance.

More than 480 bird species are known from Egypt. Most of bird species are non-breeding migrant, which pass through the country or spend only the winter, and are of Palearctic origin. The wintering and transit bird populations, although not present in Egypt, all or most of the time, are important component of the country's biodiversity. Only about 150 species can be considered resident breeding birds, although some of these also migrate further south during winter.

There are a total of 34 Important Bird Areas (IBAs) in Egypt, comprising a wide range of habitats critical for birds, such as wetlands, coastal plains and marine islands. Of these 34 areas, there exist 8 areas along the Egyptian Mediterranean coast and habitats. The number of threatened bird species in Egypt is 43 (9.6%) of all birds. Migratory birds are about 300 species, seabirds are 39 and waterbirds are 129. There are also 16 globally-threatened species occuring in Egypt.

The 25 bird species listed in annex II (list of endangered or threatened species) were examined carefully by ornitholgists in Egypt. Almost all of them are present, some are common such as Pied Kingfisher and stender-billed Gull, little term; others are rare such as Mediterranean shape, and still some very rare such as scopolis shearwater, and Yelkouan shearwater.

N	Scientfic name	English name	Status
1	*Calonectris diomedea*	Scopoli's Shearwater	migrant, very rare
2	*Puffinus yelkouan*	Yelkouan Shearwater	migrant, very rare
3	*Puffinus mauretanicus*	Balearic Shearwater	migrant, very rare
4	*Hydrobates pelagicus melitensis*	Mediterranean Storm-petrel	migrant, rare
5	*Phalacrocorax aristotelis desmarestii*	Mediterranean Shag	WV, rare
6	*Phalacrocorax pygmeus (Microcarbo pygmaeus)*	Pygmy Cormorant	migrant, rare
7	*Pelecanus onocrotalus*	White Pelican	WV, rare
8	*Pelecanus crispus*	Dalmatian Pelican	WV,very very rare
9	*Phoenicopterus roseus*	Greater Flamingo	WV & FB, uncommon
10	*Pandion haliaetus*	Osprey	WV & FB, uncommon
11	*Charadrius leschenaultii columbinus*	Greater Sand Plover	WV & could be MB
12	*Charadrius alexandrinus*	Kentish Plover	RB & WV, common
13	*Numenius tenuirostris*	Slender-billed Curlew	WV, very rare

14	*Sterna albifrons (Sternula albifrons)*	Little Tern	MB & WV, common
15	*Sterna nilotica (Gelochelidon nilotica)*	Gull-billed Tern	RB & WV , common
16	*Sterna caspia (Hydroprogne caspia)*	Caspian Tern	WV, common
17	*Sterna sandvicensis (Thalasseus sandvicensis)*	Sandwich Tern	WW, common
18	*Sterna bengalensis emigrata (Thalasseus bengalensis)*	Lesser Crested Tern	PV, rare
19	*Larus genei*	Slender-billed Gull	RB & WV ,common
20	*Larus melanocephalus*	Mediterranean Gull	WV, , uncommon
21	*Larus audouinii*	Audouin's Gull	PV,rare
22	*Larus armenicus*	Armenian Gull	WV, uncommon
23	*Halcyon smyrnensis*	White-throated Kingfisher	RB & WV , common
24	*Ceryle rudis*	Pied Kingfisher	RB & WV, very common
25	*Falco eleonorae*	Eleonora's Falcon	PV, rare
Status of bird at Egyptian Mediteranain coast is based on persoanl suervey from 2009 till 2016			

Abreviations

RB, Resendent breeder

WV, winter visitor

PV, passage visitor

MB, migrant breeder

FB, former breeder

The most important problems facing resident and migratory birds in Egypt are:

- Increasing rate of unregulated hunting, whether using nets across the migration route or weapon for hunting aquatic birds.
- Destruction of natural habitats and bird nests (e.g. solid waste disposal, mining and quarrying).
- Excessive use of pesticides in agriculture.
- High rate of pollution.
- Open sewage areas that attract birds during migration.
- Habitat loss (e.g. land reclamation, urban encroachment, and tourist development.

Objective for the Seabird monitoring program

It is suggested that the same objective of the action plan for the conservation of bird species listed in the annex II of the Protocol concerning Specially Protected Areas (SPAs) and Biological Diversity in the Mediterranean (RAC / SPA 2009) be the sameobjectove of the monitoring program. It is to maintain and / or restore the population levels of bird species in SPA Protocol's Annex II to a favorable conservation status.

Bird monitoring program will be the first important priority in the national action plan, where it is intended to:

a. Identify important areas at sea for species.
b. Prepare an inventory and map critical habitats supporting bird colonies.
c. Monitor and warden bird colonies under threat disturbance.

d. Investigate whether local fisheries impact on breeding success.
e. Establish population size and trends.
f. preparation of reports to be used nationally and internationally (RAMSAR, CMS, AEWA).
g. Raise public awareness.
h. Capacity Building.

Priority PAs (Sites) for potential indicator species monitoring program

Species	Selected PAs for monitoring	Methodology and field techniques	Time table
ter Bird Census, Breeding sea birds and Breeding herons	Ashtum El-Gamel, Zaranik, El-Salloum	Shore line transect, visual census, and Point Count	- During Breeding and migratory seasons, - The rest of the year is disc work for preparation and analysis of the collected data.

Application of the common indicators for bird monitoring

1- <u>Habitat distribution range</u>

There exist good experience about ornithology of Egypt in terms of human resources and availability of good information on bird species and habitats. There are numerous habitats suitable for the 25 bird species listed in the appendix II of SPA protocol. Some of these sites are of global importance for birds such as wetlands (RAMSAR), protected areas along the Mediterranean coast such as El-Salloum, and still small islands infront of Alexandria city where almost nothing is known about bird species and their habitats.

Based on above, it is suggested that the appropriate 3 sites for bird monitoring will be Zaranik Protected Area / Bardawil Lake, northern lakes (with focus on small islands close to the shore), and El-Salloum Protected Area.

Zaranik PA and Bardawil lake are significant for cost-effectiveness where several combined monitoring programs will be implemented such as seabirds, sea turtles and habitat monitoring will be carried at the same place, with perhaps more or less same people with expertise on birds, turtles and habitats. Zaranik is a shallow lagoon, with numerous small islets scattered throughout, most of which are covered with dense halophytic vegetation. Extensive mudflats and salt marshes are found at the lagoon shores. Zaranik's importance is primarily as a bottleneck area for migrant Palearctic waterbirds; many of them pass through the area, others either land or rest and feed before resuming their journey southwards across Sinai or westwards to the Nile valley. Some 270 bird species have been reported in Zaranik; of these 10 species are known to breed in the protected area, such as Little Tern and Kentish Plover.

The other 2 sites will be at El-Salloum Marine Protected Area and Nile Delta coast where a focus will be on small islands close to the shore. This will be cost-effective as there will be no need for using boats for bird surveys.

Status of each habitat will be assessed in terms of its vulnerability, as well as habitat areal extents, using DGP to generate maps for each habitat.

2- Conditions of habitat's typical species and communities

This indicator will be implemented using results of habitat monitoring where the recommended habitats of IMAP (reference list of species and habitats) will be tried, and a list of priority habitats will be selected, assessed in terms of human pressures, and be cost effective (combined monitoring programs).

3- Species distribution range

It is planned to establish minimum information standards, using different methods (location of species using grids, boat survey (when possible), data fisheries sightings, specific breeding and wintering areas. Based on information gathered using different methodologies, it will be possible to establish species distribution range for bird species listed in the annex II of SPA protocol. Focus will be given to predators, intertidal benthic, inshore and offshore feeders.

4- Population abundance of selected species

Emphasis will be made on the bird species listed in SPA protocol where population size (number of individuals of observed species), population density (number of individuals / unit area), breeding area census, wintering area census, foraging census, coordinated census from land, and migration monitoring.

This indicator will be implemented using the existing bird monitoring where a project is being funded by Bird Life International on the Mediterranean coast.

5- Population demographic characteristics

This indicator will be implemented using different methods at the 3 main sites, and will be based on the existing bird monitoring program. All birds captured by nets which are scattered over most of the Mediterranean coast will be collected and species identified. In addition, visits will be made to bird markets at Port Said, and Alexandria where bird species listed in SPA protocol will be bought, and examined.

Size and weight of each individual species will be determined, when possible, followed by examining the food content and reproductive status of each individual bird will be determined.

Size frequency distribution for each species will be established where body size and age composition of each species will be established. Status of reproductive organs will help to identify sex ratio, number of eggs, and population dynamics of species collected will assist in developing models for survival / mortality rate.

Expected outcome of bird monitoring:

- National Reports on sea bird species & their habitat.
- Update threatened species list.
- Distribution of sea bird species.
- Identify the threats and pressures on sea bird sites.
- Increase Public awareness on sea bird species.

Resources needed

- Research vessel / boat
- Adequate equipment (e.g. Binoculars, Telescope, GPS, Professional Camera, and Guide Book).
- Laboratory infrastructure for ornithological work.

- Qualified personnel for species identification; data processing, analysis and interpretation.
- Safari Boat (when possible).

5-Non-Indigenous Species Monitoring Program

Background

Invasive alien species, which include a vast, and rapidly increasing, range of mainly non-native terrestrial and freshwater and marine aquatic vertebrates, invertebrates, plants and disease organisms, constitute one of the most serious, rapidly growing and hard-to-address threats to biodiversity, ecosystem services and food, health and livelihood security. Invasive alien species have been responsible for the extinction of native plants and animals , degradation of rare and threatened ecosystems and ecological communities, crop failure and declining agricultural productivity, loss of cultivar and animal breed diversity and damage to property, infrastructure, native fisheries, tourism and outdoor recreation. The threats to native biodiversity from marine invasive alien species, either from deliberate or accidental introductions (e.g., in contaminated ballast water or as encrusting organisms on ships), are increasingly serious and very poorly understood. A high percentage of globally and locally threatened species and ecosystems are at risk owing to competition with or predation or infection by invasive alien species. The cost in loss to biodiversity and human well-being due to invasive alien species, including alien mammals, birds, reptiles, amphibians, fishes, crabs, molluscs, insects, echinoderms, terrestrial and water weeds, seaweeds and a vast array of plant and animal infectious and zoonotic diseases, is difficult to measure. Worldwide, it has been estimated that the cost of damage from invasive alien species exceeds $1.4 trillion annually, amounting to 5 per cent of the global economy.

According to Article 8(h) of the CBD, each party shall prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species. The guiding principles for the Prevention, Introduction and Mitigation of Impacts of Aliens Species, provide all Governments and organizations with the guidance for developing effective strategies to minimize the spread and impact of invasive alien species. In particular, the Guiding Principles highlight the importance of identifying pathways of introduction of invasive species in order to minimize such introductions, and call for the risks associated with such pathways. The Guiding Principles (15) include application of precautionary approach; ecosystem approach; the roles of states; research and monitoring; education and public awareness; border control and quarantine measures; exchange of information; cooperation, including capacity building; intentional introduction; mitigation of impacts; eradication; containment; and control. In addition, there exist relevant standards and tools applied by other conventions and organizations such as FAO, WHO, IMO, and IPPC. Although considerable efforts made by parties, the number of invasive alien species continues to increase globally, and still pose a serious hazard to biodiversity, human health and sustainable development. It poses the highest threat to biodiversity after habitat destruction. Therefore, the Strategic Plan of CBD (2011-2020) included a Target for invasive species (9) which specifies: ‘By 2020, invasive species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introductions and establishment’’. Thus, with the relation to pathways, the target contains three elements to identify, prioritize and manage pathways. However, the fifth national reports submitted to CBD suggest that actions tend to be concentrated on control and eradication, with relatively few examples of actions to identify, prioritize and manage the pathways of introduction. Cost-benefit strategies are starting to be

implemented to prioritize control and eradication of invasive species. Based on the future climate and land-use changes, the risk of invasion is likely to increase in the future as evidence suggests species shift its climatic niche after it was introduced to new environment in different regions. The Mediterranean Sea is an example where a considerable number of alien species from the Red Sea and other regions have crossed the Suez Canal via ships (ballast water and fouling), active swimming, and have been adapted particularly in the eastern Mediterranean Sea. It is expected that the global warming, growing international trade and tourism will increase the likely impacts of invasive species on biodiversity, human health and sustainable development.

Invasive species continue to be a major threat to all types of ecosystems and species in Egypt. There are no signs of reduction of this pressure on biodiversity, and there are indications that it is increasing. Several attempts have been made to record different taxonomic groups of alien and invasive species in Egypt. However, most of these did not apply or acknowledge the appropriate international criteria used to evaluate invasive species status. Currently available information about invasive species in Egypt is still insufficient and exerted efforts are still limited in spite of the fact that invasive species represent real threat to Egyptian ecosystems, the economy and human health. The recorded species included aquatic plants (44), terrestrial plants (40), crustaceans (16), insects (26), spiders (1), fish (29), mammals (3), birds (5), reptiles (1), amphibians (1), viruses (17), fungi (8), bacteria (6), nematodes (5), mollusks (5), echinoderms (1), coelenterates (1) and polychaetes (2). Among the invasive species recorded (211) in Egypt, 21 species were included in the world list of the worst 100 invasive species (Black List) developed by The World Program of Invasive Species (2010). This indicator reflects the extent and spread of invasive species and the measures necessary to be taken to limit their spread.

It is important to note the upward trend in the numbers of invasive species arriving in Egypt and the uncertainty of their number. More expert studies are needed to ascertain the accuracy of recorded invasive species over the years and additional studies are required to record the changes in the extent of widely established invasive species in freshwater, marine and terrestrial environments. Such information is important for setting eradication priorities, decision making and formulating and implementing credible invasive species programs and action plans.

The number of non-iniginous species (NIS) is substantially greater in the Mediterranean than for other seas-coastal habitats comprising native species alone are now a rare occurrence. With increased shipping, recreational boating, aquaculture, and the Suez Canal, the number of NIS is expected to substantially grow in the region. The individual and synergistic impacts of the majority of the known invasions have already adversely affected the conservation status of many native species, critical habitats,the structure and function of ecosystems and the availability of natural resources.Some NIS are noxious, poisonous, or venoumous and pose clear threats to human health.

Analytical review on alien species in the Mediterranean Sea

Before the start of the Suez Canal Expansion Project starts, EEAA made a study on the possible impact of Suez Canal on biodiversity of the Mediterranean Sea.

The following is a summary of a very lengthy study:

The Mediterranean Sea in particular has seen successive waves of introductions. Its biota consists of a mosaic of formally alien species of different biogeography affinities, reflecting its eventual geological history.

It is impossible to prevent movement of marine creatures, but manage them in accordance with international and regional conventions (tools and guidance include relevant guiding principles of CBD, relevant guidelines under the Ballast water convention of IMO, relevant guidelines for control and management of ships Bio fouling, relevant standards by FAO on applying risk analysis in aquaculture, recreational fisheries).
Species migration is a global phenomenon, not restricted to the Suez Canal. A very small number of marine ecosystems in the world are free of alien species. Climate change plays the main role in this process.

Terminology being used on migratory species over time (e.g. lesspsian migration 50 years ago, invasive species in 1993, non-indigenous species, accidental or causal species, tropical species, circum-tropical and the new concept of adapted species to new environment is being discussed in various scientific communities.
Species migration via Suez Canal occurs from the Red Sea to the Mediterranean and vice versa from the Mediterranean to Gulf of Suez. (at least 60 species).
The terminology used by invasion ecologist reflects their pre-conceived options, ranging from neutral to quasi-hostile, sometimes emotionally charged attitudes. The spread of new species to new habitats is and has always been a natural and continuous process over the ages. Man has only accelerated this process.

Invasive species is associated with adverse effects, threatening native biological diversity, the ecological stability of the invaded ecosystems, and the resulting economic and health consequences.
Many authors ignore other potential impacts such as over harvesting of resources, destruction of habitats or the introduction of harmful pollutants.
By 1970, most species were established and adapted at the Suez Canal ecosystems, and many have reached eastern Mediterranean, reaching 140 species of plants and animals. However, this number has increased dramatically to more than 300 species in eastern Mediterranean, due to the considerable changes in environmental conditions.

In 2014, the number of alien species in the Mediterranean is close to 900 species (representing 5% of the marine species in the entire Mediterranean), 13.5% of them are classified as invasive species (47). The dominant group in the western Mediterranean and Adriatic Sea are macrophytes (macroalgae and sea grasses), whereas polychaetes, crustaceans, mollusks and fishes dominate eastern and central Mediterranean. The vast majority of alien species occur in the eastern Mediterranean; some are located exclusively in the south-eastern basin, others are restricted to the western basin, whereas others have colonized the entire Mediterranean. Alien species occur in warm waters.

The number of alien species continues to increase globally. In Europe, north America, and China, the number has increased dramatically during the last 4 decades by 50 – 70% due to the rapid increase in global trade, marine transportation, tourism. This is similar to what happened in the eastern Mediterranean.
The main dispersal routes include shipping (ballast waters and fouling that represent 70% of alien species), active swimming (fishes), intentional release (aquaculture and aquaria), natural

dispersal, through currents and tides, adaptation through Suez Canal, trade, tourism (recreational boats), dumping in the marine environment, ports and marina.
Alien species pattern is not influenced by water volume or current speed, but rather with high salinity that acts as natural barrier.

Globally, alien species were identified in terms of more than tens of thousands species, and invasive species by few thousands. However, many problems still exist, including species trait, time lag in species introduction, settlement and adaptation, and the risk assessment of invasive species.
Out of 47 species claimed to be invasive, only 28 species of Indo-Pacific origin were recorded in the eastern Mediterranean, mostly fishes, crustaceans and mollusks. The dispersal of these species is though shipping (14 species in ballast water and fouling), Suez Canal (21 species), and aquaculture (10 species), and one from Monaco aquarium.

Main goal:
Monitor trends in abundance, temporal occurrence and spatial distribution of non-indigenous species (NIS).

Specific objectives:
1) Assess the impact of invasive species on biodiversity, human health and sustainable development in Egypt, with focus on invasive species in the marine environment;
2) Develop decision-support tools for assessing and evaluating the social, economic and ecological consequences of invasive alien species;
3) Take appropriate actions by making use of the full range of measures for early detection, control, and/or eradication, with appropriate risk analysis;
4) Raising awareness at all levels (policy makers and general public) on the impacts of invasive species, including the possible social, economic and ecological costs and the benefits of taking action to prevent their introduction or to mitigate their impacts.

Selection of monitoring program
The proposed monitoring program will be based on the existing program being carried at the Suez Canal and the Mediterranean Sea. It is based on collecting specimens using the research boat of NIOF, using different methods to collect plankton, benthic fauna and flora, as well as fishes. This program is ongoing for two years.
In addition to the existing program, it is proposed to monitor the shores and shallow areas around Port Said and Alexandria where previous information were obtained. Fish markets will be visited regularly to collect NIS, meanwhile shores at selected sites around Port Said and Alexandria will be surveyed using visual observation and seine net to collect small fishes, invertebrates, algae and sea grasses. Special consideration will be given to survey ports and marinas to collect fouling specimens, and when possible ballast waters from commercial ships. Furthermore, underwater surveys will be carried out using the standard monitoring protocol of RAC/SPA for MPAs as follow:

Standard monitoring protocols for marine invasive alien species

There is a variety of monitoring methods and program, but few of them are specifically designed to monitor alien species and marine invasive alien species, based on IUCN guidelines for MPAs, published in 2013. Monitoring the abundance and distribution patterns of alien species, particularly those that are invasive in nature, will help us to detect problems early, understand the relative risk of invasions by different species into environments, identify the potential patterns of invasions and see how to target management efforts so as to reduce further risks. The spatial and habitat distribution of a given IAS can further provide useful information to help identify which areas are most at risk of being invaded in the future.

A monitoring program must cover all stages of assessment, be simple, and record the presence and status of different species, through a science-based approach. It can also take advantage of existing programs in which specialist teams monitor native species diversity, and it can also use trained volunteers (such as recreational diving club members) specially to report sightings in new areas or of new species.

1- Underwater visual surveys

To monitor the occurrence and spatial distribution of invasive species, a series of sampling stations should be selected beforehand. These stations should be chosen to be representative of all the habitats, depth ranges, substrates and wave exposure conditions found in each individual MPA. The number of sampling stations will therefore be variable and will depend on the MPA's size and habitat heterogeneity as well as the logistical and financial facilities available.

The monitoring, conducted by two scuba divers, should follow linear transects perpendicular to the shore and it should be run twice a year in summer and winter to detect the presence of alien species of seasonal occurrence. If that is not possible due to logistical or financial constraints, the monitoring should be run at least once a year, preferably in summer, and at the same time each year. Perennial plant species display their greatest growth over summer making them easier to detect at this time.

On vertical walls and steep slopes, monitoring can be undertaken in two stages The first stage (during the descent) will serve to identify the main topographic and bathymetric features and the succession of habitats at different depths from the surface to the deepest zone reached in each transect. In the second stage (during the ascent), the divers will carefully examine each of the benthic communities found for approximately ten minutes to detect the presence or absence of possible invasive and/or alien species. If an alien species is found, its relative abundance should be estimated.

A similar procedure could be followed when an invasive species is detected. If it is feasible during the same dive, its abundance should be recorded in each habitat. Taking photographs of unidentifiable species or potential biological invaders can be a valuable aid to confirm identification. On more level substrates, monitoring can be performed along transects 25 m long and 5 m wide at each station. Along each transect, the divers should swim in one direction at constant speed, identifying and recording the presence of each alien species encountered. To record the spatial distribution and density of different taxonomic groups, a variety of standard methodologies can be used. This work can be conducted during a second visit to the area.

2- Monitoring invasive algae

For each different habitat, the coverage of invasive algae may be quantified by using 25 cm x 25 cm quadrats, each subdivided into 25 subquadrats of 5 cm x 5 cm (Cebrian *et al.*, 2000). In each habitat type, divers position 20 quadrats (covering a total area of 1.25 m2) randomly over the substrate and record the number of subquadrats in which the specific invasive alga occurs.

3- Monitoring sessile invertebrates and species with scattered distribution

Bathymetric transects performed in different habitats at each sampling station may firstly identify the depth at which other invasive species are most abundant. At each depth, two transects (50 m x 1 m) located randomly should be monitored by a scuba-diving team. In those cases where invasive species may be of a considerable size (e.g. the invasive coral *Oculina patagonica*), only colonies or individuals with at least 50% of their surface area lying within the belt transect should be considered and counted to avoid bias in the sampling (Nugues and Roberts, 2003).

4- Monitoring invasive fishes

At each sampling station, the abundance and size of any invasive fish should be recorded along transects. An observer should dive at an approximately constant speed along three 25 m x 5 m transects at each sampling station and at a fixed depth (where invasive fishes are most abundant).

Along each transect the observer will identify the species, count the number of individuals observed and estimate the approximate size of all individuals (in 2 cm increments of total length, TL). Fish biomass (g wet weight m-2) can be estimated from size data using length-weight relationships from the available literature and databases (Froese and Pauly, 2009).

In addition to monitor landing sites, implement fishermen awareness events and design data collection form (photos, location, depth, time)

Geographical areas:

1. Al-Areesh - Port Said (2 collection points),
2. Damietta – Maadia (4 collection points),
3. Abu Qir- El Dabaa (3 collection points),
4. El Dabaa – Sallum (2 collection points).

Sites:

Ports and surrounding areas, docks, marinas, aquaculture installations, heated power plant effluents sites, inshore and offshore structures.

Frequency:

- Plankton, benthic and fouling: use standard monitoring methods traditionally being used for marine biological surveys. However, specific approaches may be required to ensure that alien species are likely to be found (e.g. rocky shores) in refereeing with the monitoring programme of EEAA/ NIOF.
- Fisheries: monthly visits to landing sites to collect data and fishers forms.

Data Needed for Reporting Sightings

- Contact information (name and e-mail address)
- Monitoring location:
- Latitude and longitude in decimal degrees
  a. MPA name
  b. City, country
  c. Habitat type (e.g. bay, pier, marina, rocky shore, seagrass bed, intertidal)
- Observation details:

Date, time

a. Species observations:
b. Scientific name of species: (optional)
c. Abundance (e.g. on Braun Blanquet scale) per depth
d. Range of depth(s) where it occurs
e. Additional material (e.g. photos)

Monitoring programs conducted by volunteers

Marine monitoring is expensive and labour intensive, but training volunteers to conduct marine surveys can significantly enhance both prevention and the early detection of invasive species, as well as helping with limited funding constraints. In some Mediterranean MPAs and in other coastal areas, local volunteer organizations, fishermen and wildlife enthusiasts can assist in monitoring the coastal waters and gather new information to aid the early identification of new invasive species. More importantly, the involvement of local volunteers can have other benefits for the MPA, such as facilitating a sense of ownership and appreciation for the local marine environment.

Pathways of introduction

These will include (when possible) the followings:

1) Commercial shipping
2) Recreational boating
3) Aquaculture facilities, and
4) Natural dispersal
5) Combined methods

There are needs for:

- Create / update database
- Collection of socioeconomic information
- Collection methods
- Inventory
- Rapid assessment surveys
- At least 3 years of data per location to calculate the trend indicator, and to define the reference level for NIS.

Regarding NIS the followings will be considered:

- Importance of early detection of NIS in dispersal hubs for a rapid management response, and of long-term monitoring for tracking effects of NIS within the marine environment.

- Ports and marinas monitoring will provide the required information for implementation of the Biodiversity monitoring from ships ballast waters.
- Cost-efficient rapid assessments of target species may provide timely information for managers and policy-advisors focusing on particular NIS at particular localities.
- Collected data should be verified and stored in a publicly accessible and routinely updated database / information system.
- Public involvement will be encouraged as part of monitoring programs when feasible.

Preparatory tasks for biodiversity monitoring under the EcAP
- Collate human activity and environmental data
- Identify biodiversity components present in the region
- Define ecologically – relevant assessment areas
- Define reference state (condition).

Reference list of species and habitats

Predominant habitat, habitat, functional group (of species), regional importance, rarity, key functional role, sensitivity, vulnerability, declining or threatened, feasibility (for monitoring), monitoring, priority and monitoring scale. These are available in the annexes of this report, based on IMAP as well as the reference list of habitats and species in Egypt. These will be considered carefully in selecting habitats and species to be monitored.

CHAPTER 6

Implementation / Operational Plan

It is suggested that the proposed marine biodiversity monitoring in Egypt be discussed with concerned personnel interested in research and monitoring, from Ministry of Environment/ EEAA/ NCS, NIOF, GAFRD, Universities, and research centers. Once it is approved and modified based on needs for IMAP requirment, all methods, data analysis, and reporting formats will documented in fact sheets, and archived in a national data center, perhaps at NCS or NIOF, based on what shall we agreed up in the future.

Once every thing is finalized, a major workshop be held for participates of all personnel who will be involved in the field, laboratory work, data storage, data analysis and interpretation, where a proper capacity building, perhaps with foreign experts. Where the agreed biodiversity monitoring program will be presented and agreed, this will be followed by dividing participants into the following groups:

- Habitat mapping,
- Marine mammals,
- Marine turtles,
- Sebrids,
- Non- Indigenous species (NIS)

Each group will be accompaired by experts of data collection, data analysis, interpretation and reporting. Groups will meet together once again to a gree on the monitoring program, and provied modification needed for IMAP requirment.

Operational Management

- Logistics**:**
  a. Permits for security in the field
  b. Research vessel/ boat depending on the existing and condition of vessels at NIOF; if not proper, it may be possible to have a boat.
- Equipment:
  1- Need for each program, take into consider cost effective approach, meaning the same equipment can be used by more then one progrm.
  2- Work spaces with secretariat equipped with computers, printers, photocopier, internet, cameras and reprinting needs.
  3- Laboratory infrastructure for each program. This will be need for coordination for cost effective and ensure qulity control
  4- Organizing workshops for capacity building, meetings with personnel in charge of implementing monitoring program, meeting for NGOs and public awareness.
- Human Resources (30 - 35 personnel):
- Program coordinator and secretariat,
- GIS specialist,
- Skilled taxonomist,
- Field technicians,
- Laboratory specialists,
- Data collection, analysis and interpretations,

- Administrator and accountant,
- Specialists on habitat mapping, marine mammals, seabrids, marine turtles and NIS.

Data sharing and access principles, including format

To provide effective national monitoring, it is important that researchers collect data using similar methods or comparable methods, and that they are committed to sharing data in an agreed format and archived in a a national data center.

Participants should recognize the need to link monitoring of biodivesity to ecosystem services and incorporate that valuation into accounting system (when possible).

Participants should recognize the need for baselines, sustained standardized monitoring and improved data availability and access to meet ongoing and future reporting format, especially requirements for Aichi targets and SDG goals, and to provide a long-term prespective on the changing marine environment.

A standard can be a baseline position (e.g. maintenance of existing area of particular habitat or population of a particulae species) or a position set of an objective (e.g. maintenance of a specific area/ habitat or desired species).

Monitoring data would need to be regularly reviewed for reliability, relevance and effectiveness. These also need for capacity to access currently available information from global database relevant to Egypt. This could be achieved through several workshops or could be developed through the CBD's Marine Spatial Planing Initiative.

Since operational IAMP will be based on existing monitoring programmes or activities,it will be necessary it will be nenecessary to present these in a systemamtic format,under each relevent indicator. Name of existing programs will be given,each with duration (start date and financing), and modifications needed for IMAP requiremets. It is recommended that this will be done during the prposed workshop of all interested personnels involved inexisting monitoring marine programs in the Egyptian Mediterranean Sea, from:

Ministry of Environment EEAA/ NCS/ NIOF/ GADFR/ Uninversities and research institutions.

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ANNEXES

Annex I

A Historical Overview: Decisions of the Contracting Parties to the Barcelona Convention on the Ecosystem Approach

Decision IG. 17/6	Implementation of the ecosystem approach to the management of human activities that may affect the Mediterranean marine and coastal environment

- The Contracting Parties to the Barcelona Convention have committed to progressively apply EcAp to the management of human activities with the goal of effecting real change in the Mediterranean marine and coastal environment ;

- This Decision outlined a roadmap for the implementation of EcAp, consisting of several subsequent steps:
  - *i) Definition of an ecological Vision for the Mediterranean*
  - *ii) Setting of common Mediterranean strategic goals*
  - *iii) Identification of important ecosystem properties and assessment of ecological status and pressures*
  - *iv) Development of a set of ecological objectives corresponding to the Vision and strategic goals*
  - *v) Derivation of operational objectives with indicators and target levels*
  - *vi) Revision of existing monitoring programmes for ongoing assessment and regular updating of targets*
  - *vii) Development and review of relevant action plans and programmes;*

Decision IG.20/4	Implementing the Ecosystem Approach Roadmap

- It validated the work done so far regarding the 11 ecological objectives, operational objectives and indicators for the Mediterranean;

- It also mandated the Secretariat to prepare an EcAp Monitoring Programme, to determine GES and targets and to prepare an in-depth socio-economic analysis of human activities that impact on, or benefit from, the quality and ecological healthof coastal and marine ecosystems;

- It asked to integrate EcAp in the overall work of UNEP/MAP Barcelona Convention and mandated the Secretariat to establish an EcAp governance framework.

Decision IG.21/3	The Ecosystems Approach including adopting definitions of Good Environmental Status (GES) and targets
- It expresses the agreement on regionally common targets, lists of indicators to achieve GES in the Mediterranean, and an integrated list of Mediterranean GES, targets and indicators; - A specific timeline was adopted in this EcAp Decision on how to develop and implement an Integrated Mediterranean Monitoring and Assessment Programme by the 19th Meetingf the Contracting; - It was also agreed, that after the initial phase of implementation of the Integrated Monitoring and Assessment Programme (2016-2019), the draft Integrated Mediterranean Monitoring and Assessment Programme will be reviewed and in case necessary amended, in light of lessons learnt during the first years of its implementation; - This decision welcomed the work done on the socio-economic assessment, endorsed the EcAp governance framework with the key governing role of the EcAp Coordination Group, and reiterated the importance of EcAp as the guiding principle for the work of	
Decision IG.21/17	MAP Programme of Work and Budget for the 2014-2015 biennium
It approved that the Mediterranean Trust Fund also supports the implementation of the EcAp process since 2014, with almost forth of its activities budget devoted to EcAp during the period of 2014-2015 (444 000 EUR).	

Annex II

Decision IG 17/6: Implementation of the ecosystem approach to the management of human activities that may affect the Mediterranean marine and coastal environment
The 15th Meeting of the Contracting Parties,

Recalling decision V/6 of the Conference of the Parties to the Convention on Biological Diversity regarding the description and the application of the ecosystem approach,

Recalling *paragraph 30(d) of the Johannesburg Plan of Implementation encouraging the application of the ecosystem approach by 2010,*

Recalling also its decision, adopted at its 14th Meeting held in Portoroz, Slovenia, to follow the initiative of the European Commission relating to a project on the ecosystem approach, with a view to the possible application of the ecosystem approach by the whole MAP system,

Acknowledging with satisfaction the work accomplished in the framework of the joint EC/MAP project on the application of the ecosystem approach,

Noting with appreciation the conclusions and recommendations of the Government designated Experts' Meeting held in Athens in February 2007,

Decides to progressively apply the ecosystem approach to the management of human activities that may affect the Mediterranean marine and coastal environment for the promotion of sustainable development;
Decides to initiate a process, involving scientists and policy makers, and when appropriate, other competent bodies/organizations/authorities, aiming at the gradual application of the ecosystem approach which would include the following steps:

i) Definition of an ecological Vision for the Mediterranean.
ii) Setting of common Mediterranean strategic goals.
iii) Identification of important ecosystem properties and assessment of ecological status and pressures.
iv) Development of a set of ecological objectives corresponding to the Vision and strategic goals.
v) Derivation of operational objectives with indicators and target levels.
vi) Revision of existing monitoring programs for ongoing assessment and regular updating of targets.
vii) Development and review of relevant action plans and programs;

Agrees, as far as the first step of the process is concerned, on the following ecological vision for the Mediterranean:

"A healthy Mediterranean with marine and coastal ecosystems that are productive and biologically diverse for the benefit of present and future generations";

Agrees, as far as the second step of the process is concerned, on the following strategic goals for marine and coastal areas, on the basis of the relevant priority field of action of the MSSD and the experience gained by other international and regional bodies:

a) To protect, allow recovery and, where practicable, restore the structure and function of marine and coastal ecosystems thus also protecting biodiversity, in order to achieve and maintain good ecological status and allow for their sustainable use.

b) To reduce pollution in the marine and coastal environment so as to minimize impacts on and risks to human and/or ecosystem health and/or uses of the sea and the coasts.

c) To prevent, reduce and manage the vulnerability of the sea and the coasts to risks induced by human activities and natural events;

Requests the Secretariat to continue work on the basis of the road map specified above, taking into consideration relevant work undertaken by other regional and international organizations and initiatives and enhancing cooperation with them.

Annex III

Decision IG.20/4: Implementing MAP ecosystem approach roadmap: Mediterranean Ecological and Operational Objectives, Indicators and Timetable for implementing
the ecosystem approach roadmap

The 17th Meeting of the Contracting Parties,

Recalling the objective of the Barcelona Convention to prevent, abate, combat and to the fullest possible extent eliminate pollution of the Mediterranean Sea and its coastal areas; to protect and preserve biological diversity, rare or fragile ecosystems, as well as species of wild fauna and flora which are rare, depleted, threatened or endangered and their habitats and to protect and enhance the marine environment so as to contribute towards its sustainable development;

Recalling the vision and the goals for the implementation of the ecosystem approach to the management of human activities adopted in decision IG. 17/6 of its 15th meeting held in Almeria, Spain (2008) providing for *"A healthy Mediterranean with marine and coastal ecosystems that are productive and biologically diverse for the benefit of present and future generations"* and the seven step road-map for implementing the ecosystem approach by Mediterranean Action Plan also adopted during that meeting;

Recalling also the decisions taken by the Conference of the Parties to the Convention on Biological Diversity (CBD) regarding the ecosystem approach and the Aichi targets of the Strategic Plan for Biodiversity 2011-2020 adopted at the COP 10 of the CBD (Nagoya, 2010);

Considering the initiatives undertaken within the framework of the General Fisheries Commission for the Mediterranean (GFCM) to develop principles for and implement the Ecosystem Approach to Fisheries (EAF);

Recalling also the four objectives of the Mediterranean Strategy for Sustainable Development and the UNEP/MAP Five Year Strategic Program of Work adopted in Marrakech in 2009 that highlighted the ecosystem approach as the Program's overarching principle and several decisions of the Contracting Parties to ensure the necessary synergies and harmonization to the extent possible in terms of common understanding, tools used, reporting and timetable with the implementation of the EU Marine Strategy Directive;

Acknowledging the need for synergy to the extent possible with relevant global and regional processes, such as those under the UN regular Process for Global reporting and assessment of the state of the marine environment and the UNEP Regional seas programs;

Recognizing the special importance of MAP work related to ecosystem approach for those Contracting Parties that are EU members states in view of implementing the EU Marine Strategy Framework Directive (MSFD) that provides for building on relevant existing programs and

activities developed in the framework of structures stemming from international agreements such as Regional Sea Conventions;

Acknowledging with satisfaction the progress achieved and work carried out in the Mediterranean with respect to the implementation of the ecosystem approach roadmap by the Government-designated Experts Group (GDE) supported by the Secretariat during the biennium 2010-2011;

Thanking the Secretariat including MEDPOL, SPA/RAC and BP/RAC for the successful preparation of the integrated assessment report of the status of the Mediterranean Sea using ecosystem approach and ecosystem services analysis;

Appreciating the conclusions and recommendations of the Government-designated Experts' Meeting held in Durres, Albania in June 2011;

Recognizing the necessity for the Contracting Parties to fully support the implementation of the ecosystem approach roadmap and the need for substantive financial resources to support the process at regional and national levels;

Recognizing the need to focus the PoW on ECAP amongst other priorities.

Recognizing also, the importance of moving forward towards establishing InfoMAP following the principles of a Shared Environmental Information System (SEIS) for the purposes of the implementation of future phases of the ecosystems approach in the Mediterranean thus ensuring synergy and harmonization with national efforts by contracting parties with regards to the establishment of environmental information systems that support decision-making and enhance public information as well as recent global and regional developments in this field;

Considering the need to establish an effective governance of the knowledge and information generated through an appropriate data sharing policy which takes fully into account the GEOSS Data Sharing Action Plan for the implementation of the GEOSS Data Sharing Principles which was adopted by the GEO-VII Plenary of 3-4 November 2010 and which have been ratified by nearly all Contracting Parties to the Barcelona Convention;

Decides:

To re-affirm the commitment of the Contracting Parties to continue to apply the ecosystem-based approach to the management of human activities while enabling a sustainable use of marine goods and services with the view to achieving or maintaining good environmental status of the Mediterranean sea and its coastal region; their protection and preservation, as well as preventing their subsequent deterioration as an integrated operational approach for the successful implementation of the Barcelona Convention and its protocols while enhancing sustainable development in the region;

To endorse the Summary for decision-makers (attached as Annex I to this decision) that provides the main findings and priorities highlighted in the Initial Integrated Assessment Report (UNEP(DEPI)/MED WG.363/Inf.21) prepared by the Secretariat based on the available knowledge and information and with the precious contribution of the Contracting Parties, partners, as well as with the expertise of MEDPOL, SPA/RAC and Blue Plan and which has been peer reviewed by GESAMP;

To adopt based on Article 18 of the Barcelona Convention the Mediterranean Ecological Objectives associated with Operational Objectives and Indicators presented in Annex II to the present decision;

To adopt the timeline and projected outputs of the Ecosystem Approach roadmap implementation presented in Annex III to this decision for the next two years and on an indicative basis until 2017, as well as to update it on biannual basis to take into account progress achieved as need be;

To adopt the establishment of a review cycle for the integrated assessment of ecosystem approach roadmap implementation on a 6 year basis;

To establish an ECAP Coordination Group consisting of MAP focal points, the Coordinating Unit, the MAP components and MAP partners to oversee the implementation of the ecosystem approach, identifying progress gaps in the implementation of the road map and find feasible solutions for the advancement of the ECAP agenda. This Coordination Group will inform the Bureau about the results and the MAP components on the action they need to take;

To request the Secretariat to:

1. Prepare an integrated monitoring program based on the agreed ecosystem approach indicators with the participation of and contribution from all MAP components and with a leadership role by MED POL and in cooperation with other regional competent organizations such as the Secretariats of GFCM, ICAT and ACCOBAMS;

2. Work on the determination of Mediterranean Good Environmental Status (GES) and targets during the next biennium through a participatory process involving MAP components, contracting parties and scientific community, with the leadership role by the Coordinating Unit with the view of submitting the proposed GES and targets by the meeting of the Contracting Parties in 2013;

3. Prepare in cooperation with Contracting Parties, MAP components and competent partner organizations and with a leadership role by Blue Plan an in-depth socio-economic analysis developed through a common methodology for the consideration of the Contracting Parties meeting at its 18th meeting;

4. Develop a MAP-Barcelona Convention policy on assessments in the framework of the implementation of the ECAP

5. Work in 2012-2013, with SPA/RAC, with the national authorities and the relevant organizations to (i) evaluate the progress made so far in the implementation of the Strategic Action Program for the conservation of Biodiversity in the Mediterranean (SAPBIO) adopted by the 13th Meeting of the Contracting Parties (Catania, 2003); (ii) to define the orientations of SAPBIO at national and regional levels for the coming years, in accordance with the Mediterranean Ecological Objectives and the Aichi targets; and, (iii) to investigate options for ensuring appropriate financial support for the implementation of SAPBIO at national and regional levels;

6. Establish and make operational, through INFO/RAC, by 2013, at the latest, an information system to support the implementation of ecosystem approach and MAP integrated monitoring system;

7. Develop with the participation of and contribution from all MAP components and with a leadership role by INFO/RAC a MAP/Barcelona Convention data sharing policy taking into account the SEIS data sharing principles and with due consideration of access rights and confidentiality for the consideration of MAP Focal Points and 18th Contracting Parties meeting;

8. Ensure the implementation of this decision through the operational activities of MAP/Barcelona Convention and its integration in the next Strategic and 2-year Program of work;

9. Ensure that MAP/Barcelona Convention regional policies become coherent with the ecosystem approach progress and outcome and in particular to consider systematically the ECAP indicators when coordinating work of the various MAP components, or evaluating efficiency of MAP actions;

10. Consider the work carried out for the implementation of the Ecosystem Approach by all MAP components where appropriate;

11. Undertake under the guidance of the Bureau of the Contracting Parties the necessary analysis to enhance MAP/Barcelona Convention governance structure with the view to implementing the ecosystem approach for the consideration of the 18th meeting of the Contracting Parties;

12. Continue supporting the Contracting Parties in their efforts to implement the other steps of the road map according to the agreed timeline and enhance cooperation with partners and stakeholders and other global and regional process in particular with the EU common MSFD implementation strategy;

13. Mobilize resources for supporting financially the application of ecosystem approach by MAP as a means to effectively achieve the objectives of the MAP/Barcelona Convention.

Annex IV

A. Table of Contents for a National Integrated Monitoring Program

Following the adoption of Decision IG.22/7, on ―*Integrated Monitoring and Assessment Program of the Mediterranean Sea and Coast and Related Assessment Criteria*‖ (IMAP) by the 19th Meeting of the Contracting Parties in 2016, the Contracting Parties are to update their national monitoring programs in light of the new elements of IMAP.

The following outline is proposed to guide discussions on development of a possible structure for National IMAP Monitoring Plans, which countries can use to bring together information for all the IMAP Ecological Objectives and Common Indicators. It is based on the ―Draft Integrated Monitoring and Assessment Guidance‖ (WG.420/4), as well as monitoring plans or programs developed by EU Member States under the MSFD.

A. Institutional and regulatory aspects

Overview of the legislation and regulatory requirements to support the development and implementation of National IMAP Monitoring Plan, which may include:

- National legislation transposing the Barcelona Convention and its Protocols into national law;
- Explicit marine/coastal monitoring legislation for any of the Ecological Objectives, which is available to build on;
- Other legislation which may contain elements of marine monitoring. For example:
    - Biodiversity and marine protection legislation, implementing e.g. CBD or MARPOL
    - Chemicals and waste regimes – may include monitoring of POPs or other groups of chemicals such as heavy metals
    - Planning/ licensing regime / EIA – may include baseline assessments and follow up monitoring of NIS or hydrographical processes for coastal development
- Regulatory arrangements underpinning State of Environment Reports, and other processes which collect and compile marine environmental data;
- Rules and regulations related to data and information sharing in relation to the marine/coastal environment;
- Coordination, management and financing of monitoring activities – e.g. allocated responsibility, technical meetings, consultation with relevant stakeholders,
    - National coordination
    - Regional coordination

B. Scientific aspects

For each Common Indicator or theme, the monitoring program is structured around the following elements:

i. Parameters or elements to monitor (e.g. species or chemicals or physical parameters)
ii. Methods and protocols including quality assurance/ quality control
iii. Monitoring sites & use of a risk-based approach to select these
iv. Frequency and time series of monitoring data

The proposed Table of Contents for IMAP Monitoring Programs follows this structure, so under each of the IMAP topics/ Common Indicators, the four points i-iv) are to be addressed.

Biodiversity (EO1, EO2, EO3)

- Biodiversity - habitats
- Biodiversity - marine mammals
- Biodiversity - seabirds
- Biodiversity - turtles
- Non indigenous species
- Fisheries

C. Implementation/ operational plan

In addition the monitoring program should also define the implementation aspects which may be set out in an accompanying document. These include:

- Operational arrangements (logistics, human resources, and financial resources)
- Responsibility for implementation
- Data sharing and access principles, including reporting formats

Since operationally, the countries will want to build on existing monitoring programs or activities, it will be necessary to present these in a systematic format, under each relevant indicator. This may take a form similar to the one adopted by the French MSFD plan:

Existing programme name	
Duration (start date) & financing	
Modifications needed for IMAP requirements	

Annex V

Guideline on a procedure towards a national Integrated Monitoring Programme

Recommended Steps for the development of national integrated monitoring programs

Step 1: Establish a National IMAP Committee (optional step)

To ensure coherence and coordination of the monitoring activities to be undertaken as part of IMAP at national level, in case there no such coordinating body exists yet, on marine and coastal monitoring, it is highly recommended to establish a national committee (IMAP National Committee). Taking into account the specific context prevailing in the country, the IMAP National Committee could coordinate the elaboration of the country-specific EcAp monitoring plan and act as a steering committee for the implementation phases, including data compilation and reporting. Considering the wide range of expertise required, the IMAP National Committee may establish thematic working groups mirroring, as appropriate, the 3 CORMON clusters (Pollution and litter, Biodiversity and Fisheries and Coast and Hydrography). The number of National IMAP Committee and the working groups could be adapted to the national context of each Contracting Party.

Step 2: Inventory of existing monitoring activities and available human and technical resources

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

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

Step3: Development of a Monitoring strategy

Based on the IMAP objectives and the common indicators, a strategy should be defined to guide the elaboration of the concrete monitoring plan at national level. During this stage, the IMAP Committee (or in absence of, the coordinating key monitoring national body, or bodies) should agree on the proposed structure (table of contents) of the National Monitoring Program and on the key implementation bodies for the monitoring.

Step 4: Development of a National Integrated Monitoring Program

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

Based on the eleven Ecological Objectives and the related indicators they adopted under Decision IG.20/4, the Contracting Parties decided to focus the monitoring effort under the IMAP initial phase on a set of common indicators, set out in the Decision IG.22/7 on IMAP.

Next to available monitoring practices and needs of the country (outcomes of step2 and 3), the IMAP Decision, together with the Common Indicator Fact Sheets can assist the countries to fill in the agreed Table of Contents of the National Integrated Monitoring Program.

It is highly recommended during this step, that the draft National Integrated Monitoring Program will be consulted with the key national stakeholders.

Furthermore, while the aim of this Guideline is to set out a procedure towards a well-founded Integrated Monitoring Program, it is also important to note, that after the adoption of such a Program, it is key, also to establish a national IMAP Data Repository and undertake further consultations with neighboring countries, to exchange best practices and ensure synergies. In addition, to ensure the highest quality of monitoring, the elaboration of monitoring manuals and quality control procedures is also highly recommended.

Proposed timeline for the elaboration of national Integrated Monitoring Programs

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

Annex VI

I. IMAP common principles and structure

1- Overarching principles and the overall IMAP structure

6. The overarching principles guiding the development of the IMAP include (i) adequacy; (ii) coordination and coherence; (iii) data architecture and interoperability based on common parameters; (iv) concept of adaptive monitoring; (v) risk-based approach to monitoring and assessment, and (v) the precautionary principle, in addition to the overall aim of integration.

In line with the above overarching principles, data and information is gathered through integrated monitoring activities on the national level and shared in a manner that creates a compatible, shared regional pool of data, usable by each Contracting Party, as described under at point 4.

7. The IMAP information system will ensure the establishment of the regional pool of data based on SEIS principles that will allow the production of common indicator assessment reports in an integrated manner, following the monitoring specifics and data provided, which ensures comparability across the Mediterranean region.

8. In line with the above, integration is achieved through IMAP both at monitoring level, through an integrated monitoring system, following common principles and undertaken in a coordinated manner and at assessment level, with the overall aim to assess the overall status of the marine and coastal environment.

2- IMAP integrated monitoring

9. The IMAP monitoring requirements focus on, based on agreed common indicators, parameters that are indicative of the state of the environment, the prevailing anthropogenic pressures and their impacts, and the progress towards the good environmental status (ecological objectives and targets). The monitoring is carried out in such a way that an assessment with adequate confidence and precision is achieved.

10. The IMAP sets out the basis for how the Contracting Parties should design and carry out their national integrated monitoring programs and work together in the framework of the UNEP/MAP Barcelona Convention to produce and update common indicator based regional assessments on the status of the Mediterranean Sea and coast.

11. During the initial phase of IMAP (2016-2019), Contracting Parties will:

- During 2016-2017, update their existing monitoring programs in order to cover the IMAP areas, common indicators in line with the IMAP, and, based on the Integrated Monitoring and Assessment Guidance, Common Indicator Fact Sheets. It has to be noted that a number of Contracting Partied have already developed integrated national monitoring programs;

- Continue reporting based on their existing national monitoring programs until they are updated into a national Integrated Monitoring Program;

- Following the update of their existing monitoring programs, report quality assured data following a common regional monitoring reporting template (please see more on this under point 4);

12. During national implementation, the Contracting Parties are encouraged to coordinate within and between each other in order to use resources in an efficient way. Shared monitoring stations and activities, information, and data could be steps towards this direction.

3- IMAP integrated assessment

13. The IMAP assessment products, produced by the UNAP/MAP Secretariat, including the Common Indicator Assessment Fact Sheets, and the planned integrated assessments (2017 Status Quality Report, 2019 State of Environment and Development Report, 2023 State of Environment Report), should be mainly based on the common indicators and monitoring data provided by Contracting Parties.
14. In areas of scientific and/or data gaps, the assessment products can also build on relevant scientific projects, pilot outcomes, and comparable data of other regional organizations and in case these are not available, on scientific literature. In addition, they will analyze trends, drivers and will build on available socio-economic data.
15. The common indicator assessment fact sheets provide information on the status of the environment and information needed to evaluate the severity of environmental problems and distance from EcAp targets, ecological objectives and Good Environmental Status (GES) description.

The common indicator assessment fact sheets are linked to specific Ecological Objectives (EOs) and together they indicate whether the GES related to the specific EO is met or not. Following the EO level assessment, the integrated assessment takes place on the state of the Mediterranean Sea and Coast.

16. The 2017 Status Quality Report will be based on the common indicators, and common indicator assessment fact sheets established for them, following a model to be developed by the Secretariat in cooperation with the Contracting Parties through CORMONs by the end of 2016, and will consider the data from the most recent national monitoring and relevant scientific projects and pilots undertaken relevant to the IMAP.

17. During the development of the above an integrated approach for determining and assessing GES will be used, considering the Integrated Monitoring and Assessment Guidance, describing state-based common indicators and explicitly relating them to the pressure-based indicators.

4- UNEP/MAP Strategy towards an Integrated Data and Information System

18. Assessments arising from monitoring data are critically dependent upon practical mechanisms for handling data from different activities that ensure that documents, data, and products are managed consistently and are easily available to users. This will support integrated assessments, for example from integrated biological and chemical programs, or linking the observed changes in spatial distribution and temporal trends in substances or their effects to inputs into the UNEP/MAP Barcelona Convention maritime area.

19. Data storage and handling processes are therefore central, and it is important that the role of the various components in this is clear and continuously developed and strengthened.

20. The IMAP thus requires an updated and integrated data and information system for UNEP/MAP Barcelona Convention with clear set roles for data handling and assessment for the various components and with a user-friendly reporting platform for Contracting Parties, based on the following strategic points:

- The UNEP/MAP Barcelona Convention data and information activities aim to achieve a reliable, quantitative assessment of the status of the Mediterranean Sea and Coast;
- The UNEP/MAP Barcelona Convention data and information activities should facilitate access and knowledge of the general public to environmental information.

21. Basic activities, core elements of the UNEP/MAP Barcelona Convention integrated data and information system should include:

- Based on the structure of the Common Indicator Fact Sheets, develop region-wide, electronic, common indicator based monitoring reporting formats and up-to-date tools for data exchange;
- implement relevant quality control and validation procedures;
- make assessment products available in an integrated manner, on a common platform;
- make data and information available using harmonized standards and practices, following the UNEP access-to-information policy (UNEP/EA. 1/INF/23).

5. Cooperation with other relevant regional bodies in the context of IMAP

22. The current IMAP covers with agreed common indicators the ecological objectives related to biodiversity (EO1), non-indigenous species (EO2), eutrophication (EO5), hydrography (EO7), coast (EO8), contaminants (EO9), and marine litter (EO10).

23. In addition, regarding marine noise (EO11), IMAP includes candidate common indicators, with the intention for these candidate common indicators to be further developed, based on pilot monitoring activities, additional expert knowledge, and scientific developments, during the initial phase of IMAP.

24. While some of the elements of fisheries (EO3) and marine food webs (EO4) are partly covered by the monitoring and assessment of EO1 and EO2 and the Contracting Parties have agreed on the GFCM developed list of common indicators, the monitoring and assessment specifics of EO3 are still being developed by the GFCM, in close cooperation with UNEP/MAP. During the initial phase of IMAP implementation, a clear roadmap will be developed by the Secretariat in collaboration with GFCM and other relevant partners on the monitoring program and assessment for EO4 and EO6.

25. In light of the above, it is an absolute necessity for UNEP/MAP to strengthen its cooperation with the relevant regional bodies, especially in relation to:

- EO1, both with the General Fisheries Commission for the Mediterranean (GFCM) for commercial species of fish and shellfish and the Secretariat of the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS), noting that the ACCOBAMS Survey Initiative, to be undertaken during 2016- 2019, will provide important inputs (in terms of monitoring methodologies, capacity building and reliable data on abundance and distribution of cetaceans);
- EO3, with the GFCM, noting that the EO3 related common indicators will be further developed and assessed by GFCM (with assessment results provided to UNEP/MAP in order to undertake the 2017 and following integrated assessments);
- EO11, with ACCOBAMS, noting that further development of the candidate common indicators will need to be carried out in a close cooperation between UNEP/MAP and ACCOBAMS in light of pilot monitoring activities, additional expert knowledge, and scientific developments, during the initial phase of IMAP, and considering that ACCOBAMS is undertaking an identification of noise hot spots in the Mediterranean.

26. In addition, cooperation with other regional and international bodies will be key for the successful implementation of IMAP, to ensure that no double obligation is created for those Contracting Parties, which are Parties to various Regional Seas Conventions and/or members of the European Union and undertake monitoring activities under other specific frames.

27. Cooperation with other regional and international bodies can also strengthen the cost-efficiency and scientific adequacy of IMAP. Exchange of best practices and information is encouraged during the IMAP implementation, both in between Contracting Parties participating in various monitoring programs and in between UNEP/MAP and other relevant regional, international bodies.

II. Key elements of IMAP

1. Common Indicators

28. The common indicators are the backbone of IMAP.

29. In the context of the Barcelona Convention, a common indicator is an indicator that summarizes data into a simple, standardized, and communicable figure and is ideally applicable in the whole Mediterranean basin, or at least on the level of sub-regions, and is monitored by all Contracting Parties. A common indicator is able to give an indication of the degree of threat or change in the marine ecosystem and can deliver valuable information to decision makers.
30. Candidate indicators are indicators which still have many outstanding issues regarding their monitoring and assessment and therefore are recommended to be monitored in the initial phase of IMAP on a pilot and voluntary basis.

The Common and candidate indicators agreed upon, which are at the core of IMAP, include:

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

2. Condition of the habitat‘s typical species and communities (EO1);

3. Species distributional range (EO1 related to marine mammals, seabirds, marine reptiles);

4. Population abundance of selected species (EO1, related to marine mammals, seabirds, marine reptiles);

5. Population demographic characteristics (EO1, e.g. body size or age class structure, sex ratio, fecundity rates, survival/mortality rates related to marine mammals, seabirds, marine reptiles);

6. Trends in abundance, temporal occurrence, and spatial distribution of non-indigenous species, particularly invasive, non-indigenous species, notably in risk areas (EO2, in relation to the main vectors and pathways of spreading of such species);

7. Spawning stock Biomass (EO3);

8. Total landings (EO3);

9. Fishing Mortality (EO3);

10. Fishing effort (EO3);

11. Catch per unit of effort (CPUE) or Landing per unit of effort (LPUE) as a proxy (EO3);

12. By catch of vulnerable and non-target species (EO1 and EO3)

13. Concentration of key nutrients in water column (EO5);

14. Chlorophyll-a concentration in water column (EO5);

15. Location and extent of the habitats impacted directly by hydrographic alterations (EO7) to also feed the assessment of EO1 on habitat extent;

16. Length of coastline subject to physical disturbance due to the influence of man-made structures (EO8) to also feed the assessment of EO1 on habitat extent;

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

18. Level of pollution effects of key contaminants where a cause and effect relationship has been established (EO9);

19. Occurrence, origin (where possible), and extent of acute pollution events (e.g. slicks from oil, oil products and hazardous substances) and their impact on biota affected by this pollution (EO9);

20. Actual levels of contaminants that have been detected and number of contaminants which have exceeded maximum regulatory levels in commonly consumed seafood (EO9);

21. Percentage of intestinal enterococci concentration measurements within established standards (EO9);

22. Trends in the amount of litter washed ashore and/or deposited on coastlines (including analysis of its composition, spatial distribution and, where possible, source.) (EO10);

23. Trends in the amount of litter in the water column including microplastics and on the seafloor (EO10);

24. Candidate Indicator: Trends in the amount of litter ingested by or entangling marine organisms focusing on selected mammals, marine birds and marine turtles (EO10);

25. Candidate Indicator: Land use change (EO8)

26. Candidate indicator: Proportion of days and geographical distribution where loud, low, and mid-frequency impulsive sounds exceed levels that are likely to entail significant impact on marine animals (EO11)

27. Candidate Indicator: Levels of continuous low frequency sounds with the use of

models as appropriate (EO11)

31. During the implementation of the initial phase of IMAP, the CORMONs will further develop the candidate indicators towards common indicators as well as to further refine the specifics of agreed common indicators, in particular on geographical scale, in light of the ongoing implementation experience of IMAP.

Note on geographic reporting scales

32. A scale of reporting units' needs to be defined during the initial phase of IMAP taking into account both ecological considerations and management purposes, following a nested approach.

The nested approach aims to accommodate the needs of the above is to take into account 4 main reporting scales:

(1) Whole region (i.e. Mediterranean Sea);

(2) Mediterranean sub-regions, as presented in the Initial Assessment of the Mediterranean Sea, UNEP(DEPI)/MED IG.20/Inf.8;

(3) Coastal waters and other marine waters;

(4) Subdivisions of coastal waters provided by Contracting Parties

29. The work shall be undertaken to further develop reporting geographical scales of the nested approach.

2. Monitoring and assessment of biodiversity and NIS related common indicators

Biodiversity (EO1)

30. Biological diversity is the –variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems‖.

The common indicators to be monitored and assessed in relation to biodiversity are as following:

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

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

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

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

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)

31. As it is not possible or even necessary to monitor all attributes and components of biological diversity throughout the region, the IMAP monitoring is focusing, in line with the risk-based approach, on some representative sites and species, which can showcase the relationship between environmental pressures and their main impacts on the marine environment.

33. In light of the above, a reference list of species and habitats to be monitored is presented in Appendix 1, noting that those Contracting Parties who have the necessary means and are willing to do so can go beyond the monitoring requirements of this reference list.

34. The Contracting Parties while updating their national monitoring programs need to include at least the monitoring of the reference list species and habitats with at least two monitoring areas, one in a low pressure area (e.g. marine protected area/ Specially Protected Area of Mediterranean Importance (SPAMI)) and one in a high pressure area from human activity.

35. The few species of cetaceans regularly present in the Mediterranean Sea should all be considered when developing the national monitoring programs. The Contracting Parties shall make every effort to identify a minimum of two species to be included in their national monitoring program, based on the specificity of their marine environment and biodiversity, and taking account that these species should belong to at least two different functional groups, where possible (Baleen whales / Deep-diving toothed whales / Shallow-diving toothed whales). As far as possible the choice of monitored species should be coordinated at sub regional scale to ensure coherence with cetacean population distribution in the Mediterranean Sea.

36. The methodologies and quality control and quality assurance measures available for Contracting Parties to consider during the update of their national monitoring programs are described in the Integrated Monitoring and Assessment Guidance.

37. Regarding the assessment of biodiversity, it has to be noted that the quantitative definition of GES is difficult, considering the variety of assessment elements. The conceptual approach for a quantitative GES setting can be framed in a way that the resilience of the ecosystem is suited to accommodate the quantified biodiversity, or, in other words, it will be accounted in the determination of the GES boundaries as the –acceptable deviation from a reference state which reflects conditions largely free from anthropogenic pressures.

38. The scale of monitoring is of specific importance for biodiversity, due to the nature of the

biodiversity related common indicators.

39. For the high quality of assessment, baselines and thresholds will need to be agreed on in line with the possible methods for this set out in the Integrated Monitoring and Assessment Guidance document, following the agreed scales of assessment, during the initial phase of IMAP implementation.\

Non-Indigenous Species (EO2)

40. Non-indigenous species (NIS; synonyms: alien, exotic, non-native, allochthonous) are species, subspecies, or lower taxa introduced outside of their natural range (past or present) and outside of their natural dispersal potential.

41. Invasive alien species (IAS) are a subset of established NIS which have spread, are spreading, or have demonstrated their potential to spread elsewhere, and which have an effect on biological diversity and ecosystem functioning (by competing with and on some occasions replacing native species), socio-economic values, and/or human health in invaded regions.

The common indicator in relation to NIS is:

42. Common Indicator 6: Trends in abundance, temporal occurrence, and spatial distribution of non- indigenous species, particularly invasive, non-indigenous species, notably in risk areas (EO2, in relation to the main vectors and pathways of spreading of such species in the water column and seabed, as appropriate);

43. Non-indigenous species monitoring in the Mediterranean is a trend monitoring, where it is key to establish reliable, long-term data-sets as a first step of monitoring.

44. In addition, monitoring of non-indigenous species (NIS), following the risk based approach, needs to be focused on the invasive alien species (IAS) in IAS introduction ‒hot spots‖ (e.g. ports and their surrounding areas, docks, marinas, aquaculture installations, heated power plant effluents sites, offshore structures). In addition, areas of special interest such as marine protected areas or lagoons may be selected on a case by case basis, as appropriate, depending on the proximity to alien species introduction hot spots.

45. With the application of the risk based approach as stated above, it is possible to obtain an overview of the non-indigenous species present at a large spatial scope while only monitoring a relatively small number of locations.

46. Based on existing regional databases, such as the Marine Mediterranean Invasive Alien Species database, (MAMIAS), the ‒Andromeda‖ invasive species database for the Mediterranean and Black Sea, and the European Alien Species Information Network (EASIN), each Contracting Party will determine the list of IAS to be monitored in its

national monitoring program during the initial phase of the IMAP and start collecting data regarding these species. Guidance on developing IAS national lists and a regional and or sub regional reference list will be developed by 2017.

47. The methodologies and quality control and quality assurance measures available for Contracting Parties to consider during the update of their national monitoring programs, is described in the Integrated Monitoring and Assessment Guidance.

48. As the most effective monitoring method a Rapid Assessment Survey (RAS) will be carried out, at least yearly by the Contracting Parties in hot-spot areas (e.g. ports and their surrounding areas, docks, marinas, aquaculture installations, heated power plant effluents sites, offshore structures).

49. In addition, UNEP/MAP will develop during the initial phase of IMAP citizen survey guidance for NIS, to enable Contracting Parties to use this additional cost-efficient methodology, which also strengthens public awareness and participation.

50. Regarding the assessment of EO2, to be able to specify further GES, it is important to understand which NIS are present within the marine region and sub-regions. A baseline assessment of the extant NIS would provide a reference point against which the success of future actions could be measured. After this baseline data has been gathered during the initial phase of IMAP, it will be possible to set reference levels, following the assessment criteria set out in the Integrated Monitoring and Assessment Guidance.

Annex VII

Reference list of species and habitats

UNEP(DEPI)/MED IG.22/L.3/Add.7– Appendix 1 - Page 1

Explanatory Note/Glossary for parameters, criteria and prioritization used here:

EN Term	EN definition	FR Terme	FR définition
Predominant habitat:	Widely occurring and broadly defined habitat types by abiotic characteristics (e.g. EUNIS level 3), referred to in Table 1 of Annex III to	Habitats principaux:	Types d'habitats à un haut niveau typologique, définis par des caractéristiques abiotiques (e.g. EUNIS level 3), cités dans le tableau 1 de l'annexe III de la Directive
Habitat:	This term addresses (as defined in EC Decision 2010/477/UE) both the abiotic characteristics and the associated biological community, treating both elements together (e.g. EUNIS level 5 or 6). This term may also refer to a number of habitat complexes (which means assessing, where appropriate, the composition, extent and relative proportions of habitats within such complexes) and to some functional habitats (such as spawning, breeding, resting, feeding areas and migration routes)	Habitat:	Ce terme (tel que défini dans la Décision CE 2010/477/UE), se réfère à la fois aux caractéristiques abiotiques et à la communauté biologique associée, de façon indissociables (e.g. EUNIS level 5 ou 6). Ce terme peut également se référer à certains complexes d'habitats (impliquant, si approprié, dévaluer la composition, l'étendue et les proportions relatives des habitats composant ce complexe) et à certains habitats fonctionnels (tels que les frayères, les zones de reproduction, de repos, d'alimentation, et les couloirs migratoires)
Functional group (of species):	An ecologically relevant set of species, applied here in particular to the following (highly) mobile species groups: birds, reptiles, marine mammals, fish and cephalopods. Each functional group represents a predominant ecological role (e.g. offshore surface- feeding birds, demersal fish) within the species group. This term is referred to in the EC Decision 2010/477/UE (Part B, species)	Groupe fonctionnel (d'espèces):	Un ensemble écologiquement cohérent d'espèces, appliqué ici en particulier aux espèces (largement) mobiles suivantes : oiseaux, reptiles, mammifères marins, poissons et céphalopodes. Chaque groupe fonctionnel représente un rôle écologique majeur (e.g. oiseaux se nourrissant au large en sub-surface, poissons démersaux) au sein du groupe d'espèces. Ce terme est cité dans la Décision CE 2010/477/UE (Partie B, espèces)

Texel-Faial Criteria	Cf. document downloadable at: http://www.google.fr/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CCYQFjAA&url=http%3A%2F%2Fwww.ospar.org%2Fdocuments%2Fdbase%2Fdecrecs%2Fagreements%2F03-13e_texel_faial%2520criteria.doc&ei=r1MQVPP7GYvuaPm7gBA&usg=AFQjCNFFBqKlpeixMYiLZD1JqGJC_rAwTw&sig2=wG6kTCw1ZQvZJwazTNX7iw&bv m=bv.74649129,d.d2s	Critères de Texel- Faial:	Cf. document téléchargeable à: http://www.google.fr/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0CCIQFjAAahUKEwjzto-7punGAhWIPxQKHYo0B1k&url=http%3A%2F%2Fwww.ospar.org%2Fdocuments%2Fdbase%2Fdecrecs%2Fagreements%2F03-13f_criterestexel-faial.doc&ei=i7KsVbPFKYj_UIrpnMgF&usg=AFQjCNEVmunt g7oEq-C4n4tbGPpuM3B_0w&sig2=eVctr-Vg5--1LEVuFv97- A&bvm=bv.98197061,d.d24
(sub)regional importance (Texel-Faial Criteria)	A high proportion of the habitat or species population (at any time of its life cycle) occurs within a specific biogeographic region and/or (sub)region of national responsibility, within the Mediterranean Sea	importance (sous-) régionale (critère Texel-Faial):	Une grande proportion de l'habitat ou de la population de l'espèce (quel que soit les stades de vie considéré) est situé dans une zone biogéographique spécifique et/ou une (sous-)région relevant d'une responsabilité nationale, en Méditerranée
Rarity (Texel- Faial Criteria)	A habitat is assessed as being rare if it is restricted to a limited number of locations or to small, few and scattered locations in the Mediterranean Sea. A species is rare if the total population size is small. In case of a species that is sessile or of restricted mobility at any time of its life	Rareté (critère Texel-Faial):	Un habitat est dit rare s'il est restreint à un nombre limité de sites ou à quelques petits sites dispersés en Méditerranée, Une espèce est rare si sa population totale est faible. Dans le cas d'une espèce sessile ou à mobilité restreinte, quel que soit le stade de vie considéré, cette espèce est rare si son occurrence est limitée à

	cycle, a species is rare if it occurs in a limited number of locations in the Mediterranean Sea, and in relatively low numbers. In case of a		nombre réduit de sites en Méditerranée, et en faibles abondances. Dans le cas d'espèces largement mobiles, la taille de la population détermine sa rareté éventuelle
Key functional role (from Texel- Faial Criteria)	A species (population) or habitat, which function(s) as a key role to support ecosystem processes and interactions. These key functions may be associated to natural	Rôle fonctionnel clé (d'après critère Texel-Faial):	Une espèce (population) ou un habitat, dont la(es) fonction(s) ont un rôle clé dans les processus et interactions de l'écosystème. Ces fonctions clés peuvent être associées à une productivité naturelle, un
Sensitivity (Texel-Faial Criteria):	A species (population) or habitat is ―sensitive‖ when: a. it has low resistance (that is, it is easily adversely affected by human	Sensibilité (critère Texel-Faial):	Une espèce (population) ou un habitat est "sensible" si: a. il a une faible résistance (c'est-à-dire qu'il est facilement impacté par les
Vulnerability:	A species (population) or habitat is "vulnerable" when it is exposed to a pressure,	Vulnérabilité:	Une espèce (population) ou un habitat est "vulnérable" s'il est exposé à une pression, à laquelle il est sensible
Declining or threatening (from Texel-Faial Criteria):	A "declining" species (population) or habitat means an observed or indicated significant decline in numbers, extent or quality (quality refers for a species to its life history parameters). The decline may be historic, recent or current. The decline can occur in the whole Mediterranean Sea area or (sub) regionally. Where the decline is ―clear and present‖, and can be linked directly or indirectly to human activity, the species (population) or habitat is also considered to be ―currently threatened‖. Where there is a high probability of significant decline linked directly or indirectly to human activity, the species (population) or habitat is considered to be ―potentially threatened‖	En déclin ou menacé (d'après critère Texel-Faial) :	Une espèce (population) ou un habitat en "déclin" implique une diminution, observée ou mesurée de façon significative, en abondance, étendue ou qualité (qualité se réfère pour une espèce à ses paramètres démographiques). Le déclin peut être historique, récent ou actuel. Le déclin peut avoir lieu sur toute la Méditerranée ou une (sous-)région. Quand le déclin est "clair et avéré", et peut être lié directement ou indirectement à une activité humaine, l'espèce (population) ou l'habitat est aussi considéré comme "actuellement menacé". Quand il y a une forte probabilité de déclin significatif, lié directement ou indirectement à une activité humaine, l'espèce (population) ou l'habitat est considéré comme "potentiellement menacé"

Feasability (for monitoring):	Existence of methods and protocols to monitor a species (population) or habitat. Resources needed (logistic, technical and human) and actually existing monitoring are detailed in column W to AG	Faisabilité (pour la surveillance):	Existance de méthodes et protocoles pour réaliser le suivi d'une espèce (population) ou d'un habitat. Les ressources nécessaires (logistiques, techniques et humaines) et les suivis actuellement existant sont détaillés dans les colonnes W à AG
Priority:	If a species or habitat meet at least 1 of the Texel-Faial criteria AND is vulnerable AND then it's monitoring is technically feasible, its monitoring should be highly prioritized. Besides, redundancies in selected species or habitats representing specific functional groups/predominant habitats, should be considered.	Priorité:	Si une espèce ou habitat réponds à au moins 1 des critères de Texel- Faial ET est vulnérable ET que son suivi est techniquement faisable, son suivi doit être hautement prioritaire. Par ailleurs, la redondance entre les espèces ou habitats sélectionnés, représentatifs d'un groupe fonctionnel ou habitat principal spécifique, doit être considérée. La priorité haute signifie que des
	Priority mean than sufficient resources (national and/or joint at (sub) regional scale) should be dedicated to acquire relevant data at sufficient spatial and temporal resolution. Low prioritized species or habitats should also be monitored, but data could be acquired at a minimum relevant spatial and temporal resolution, according to available resources (cf. pragmatic approach for assessment scale)		ressources suffisantes (nationales et/ou jointes à l'échelle de la (sous-)région) devraient être dédiées pour acquérir des données pertinentes à une résolution spatiale et temporelle suffisante. Les espèces et habitats moins prioritaires devraient aussi être suivis, mais les données pourraient être acquises à une résolution spatiale et temporelle minimale, mais pertinente, en fonction des ressources disponibles (cf. approche pragmatique pour l'échelle d'évaluation)

Assessment monitoring scale:	For monitoring issue, assessment scale is expressed as the relevant spatial and temporal resolution of required data. These resolutions (number and location of sampling stations, accuracy of remote detection, sampling frequencies, etc.) are likely to be a compromise (cost- efficiency) between "high resolution" (which enable a very accurate and complete assessment, but more expensive assessment) and a more pragmatic approach, identifying a resolution and sampling design in accordance with available resources (less expensive, but which could lead to an incomplete or partial assessment)	Échelle d'évaluation pour la surveillance :	Pour la surveillance, l'échelle d'évaluation correspond au plan d'échantillonnage et aux résolutions spatiale et temporelle pertinentes pour acquérir les données requises. Ces résolutions (nombre et position des stations d'échantillonnage, précision de la télédétection, fréquence d'échantillonnage, etc.) devraient être définies selon un compromis (coût/efficacité) entre une "haute résolution" (permettant une grande précision et une évaluation complète, mais à un coût supérieur), et une approche plus pragmatique, adaptant la résolution et/ou le plan d'échantillonnage, selon les ressources disponibles (moins couteux, mais pouvant conduire à une évaluation partielle ou incomplète)
Mediolittoral:	Bathymetric level, corresponding to the intertidal benthic area (from higher to lower tide levels); organisms are in there submitted to alternating immersion and emersion	Mediolittoral:	Étage bathymétrique correspondant à la zone benthique intertidale (comprise entre les niveaux des plus hautes et des plus basses mers) ; les peuplements y sont régulièrement soumis aux alternances d'émersion et immersion

Infralittoral:	Bathymetric level, associated to preferential benthic distribution area of photophilic organisms (approximatively, for Mediterranean Sea, from 0 to -50 meters depth, on official marine bathymetric maps)	Infralittoral:	Étage bathymétrique correspondant à la zone benthique de répartition préférentielle des organismes photophiles (approximativement, en Méditerranée, de 0 à -50 mètres, sur les cartes marines bathymétriques officielles)
Circalittoral:	Bathymetric level, associated to preferential benthic distribution area of sciaphilic organisms (approximatively, for Mediterranean Sea, from -50 to - 200 meters depth, on official marine bathymetric maps)	Circalittoral:	Étage bathymétrique correspondant à la zone benthique de répartition préférentielle des organismes sciaphiles (approximativement, en Méditerranée, de -50 à -200 mètres, sur les cartes marines bathymétriques officielles)
Bathyal:	Bathymetric level, associated to darkness and continental slope (approximatively from -200 to -2000 meters depth, on official marine bathymetric maps)	Bathyal:	Étage bathymétrique correspondant à la zone aphotique et la pente continentale (approximativement de -200 à -2000 mètres, sur les cartes marines bathymétriques officielles)
Abyssal:	Last bathymetric level, associated to darkness and plains after the continental slope (approximatively below -2000 meters depth, on official marine bathymetric maps)	Abyssal:	Dernier étage bathymétrique correspondant à la zone aphotique et des plaines au bas de la pente continentale (approximativement sous -2000 mètres, sur les cartes marines bathymétriques officielles)

Coastal waters:	This term of "coastal waters" addresses here, for pelagic habitats, relatively low depth marine waters, directly influenced by terrigeneous and freshwaters inputs (approximatively from the coast to the beginning of the continental shelf)	Eaux côtières:	douces (approximativement de la côte au début du plateau continental)
Shelf and Oceanic waters:	This term of "shelf and oceanic waters" addresses here, for pelagic habitat, offshore marine waters (shell, bathyal and abyss), less directly influenced by terrigeneous and freshwaters inputs. They are characterized by specific physico-chemical conditions and biological communities	Eaux du plateau et océaniques:	Les "eaux du plateau et océaniques" se réfère ici, pour les habitats pélagiques, aux eaux marines situées au large (plateau, bathyal et abysses), moins soumises directement à l'influence des apports terrigènes et des eaux douces. Elles sont caractérisées par des conditions physico-chimiques et des communautés biologiques spécifiques

Species class	Species functional	
	CE/OSPAR	FR experts proposal (subdivision of toothed whales)
Marine mammals / Mammifères marins	Baleen whales	baleines à fanons (Mysticètes)
	toothed wales	Odontocètes épipélagiques stricts (alimentation entre 0 à -200 m)
		Odontocètes épi- et méso-bathy-pélagiques (alimentation de 0 à >-200 m)
	Seals	Phoques (pinnipèdes)
Reptiles	Turtles	Tortues marines
Birds/Oiseaux	Coastal top predators	Prédateur supérieur côtier
	intertidal benthic-feeders	à alimentation benthique littoral, côtier (côtier)
	inshore benthic feeders	à alimentation benthique subtidale, côtier (eaux côtières)
	inshore surface-feeders	à alimentation pélagique de surface, côtier (eaux côtières)
	inshore pelagic feeders	à alimentation pélagique de sub-surface, côtier (eaux côtières)
	offshore surface feeders	à alimentation pélagique de surface, au large (eaux du plateau et océaniques)
	offshore pelagic feeders	à alimentation pélagique de sub-surface, au large (eaux du plateau et océaniques)
Fish/Poissons	Diadromous bony fish	Poissons diadromes
	Demersal coastal bony fish	Poissons osseux démersaux côtiers (eaux côtières)
	Demersal coastal elasmobranch	Elasmobranches démersaux côtiers (eaux côtières)
	Pelagic coastal bony fish	Poissons osseux pélagiques côtiers (eaux côtières)
	Pelagic coastal elasmobranchs	elasmobranches pélagiques côtiers (eaux côtières)
	Demersal offshore bony fish	Poissons osseux démersaux du large (eaux du plateau et océaniques)
	Demersal offshore	elasmobranches démersaux du large (eaux du plateau et océaniques)
	Pelagic offshore bony fish	Poissons osseux pélagiques du large (eaux du plateau et océaniques)
	Pelagic offshore elasmobranchs	elasmobranches pélagiques du large (eaux du plateau et océaniques)
Cephalopods /Céphalopodes	Coastal cephalopods	Céphalopodes côtiers (eaux côtières)
	Offshore cephalopods	Céphalopodes du large (plateau et océaniques)

Annex VIII

Minimu			Texel- aial								Typology/ listed	
Predominant habitat or "Functional" group of species	Specific habitat type or species to be monitored	ADDITIONAL INFORMATION (to be further discussed): specific representatives species or habitats (Invertebrates associated with habitats)	(sub)regional importance	Rarity	Key functional role	Declining or threatening	Sensitivity/Vulnerability (exposure to pressures): cf. column N to V	feasability (for monitoring): cf. column W to AG	Priority (estimated from column D to I)	Assessment monitoring scale	EUNIS 2015	Habitats Directive
Seabed - mediolittoral - infralittoral rock	Communities in the mediolittoral and infralittoral that are based on bio-construction	(e.g. vermetid reefs, e.g. Dendropoma paetreum, Cladocora, Astroides calicularis, ; some C*ystoseira* spp. belts, ...)	Subregional distribution in Southern Mediterranean (Chemmelo & Silenzi, 2011)	Patchiness of subregional distribution	Biodiversity, keystone/habitat formers, sediment transport , carbon flux, protection from coastal erosion		high sensitivity and vulnerability	1. (ship/video/photo/quadrats/di ving)	*1*	fine scale assessment = community level (EUNIS 5)		1170 Reefs

Seabed - infralittoral rock	Hard beds (bottoms, substrates, reefs) associated with communities of photophilic algae	e.g. facies with *Cystoseira amentacea, Mytilus galloprovincialis, Corallina elongata/Herposiphonia secunda, Dasycladus vermisularis, Alsidium helminthochorton, Gelidium spinosum, Lobophora variegata, Cladocora caespitosa, Cystoseira brachycarpa, Cystoseira crinita, Cystoseira crinitophylla, Cystoseira sauvageauana, Cystoseira spinosa, Sargassum vulgare, Dictyopteris polydioides, Calpomenia sinuosa, Stypocaulon scoparium, Cystoseira compressa, Pterothamnion crispum/Compsothamnion thuyoides, Schottera nicaeensis, Rhodymenia ardissonei/Rhodophyllis divaricata* or facies with big hydrozoans	Wide regional distribution	Patchiness of wide regional distribution	Biodiversity, keystone, Carbonate flux, nutrient fluxes		high sensitivity and vulnerability	1. (ship/video/photo/quadrats/diving)	*1*	fine scale assessment = community level (EUNIS 5)		1170 Reefs

Seabed - mediolittoral-infralittoral sediment	Seagrass meadows	*Posidonia oceanica, Cymodocea nodosa, Zostera* sp	Wide regional distribution (Giannoulaki et al., 2013; Giakoumi et al, 2013)	Patchiness of wide regional distribution	Biodiversity, keystone/habitat formers, carbon sink, spawning and nursery grounds, critical food resources, water quality and transparency, water		high sensitivity and vulnerability	1. (ship/sonar/video/photo/diving)	*1*	fine scale assessment = community level (EUNIS 5)		1120 Posidonia beds, 1110
Seabed - mediolittoral-infralittoral sediment	Infrallitoral sands or muddy sands	e.g. facies with *Pinna nobilis, Asterina pancerii, Callianassa tyrrhena/Kellia corbuloides, Cerastoderma glaucum, Cyathura carinata, Loripes lacteus* or *Tapes* spp.	Wide regional distribution	Patchiness of wide regional repartition	Biodiversity, sediment properties, organic, nutrient fluxes		lower sensitivity and vulnerability	1. (ship/sonar/video/photo/grabs)	*2*	fine scale assessment = community level (EUNIS 5)		1140, 1110
Seabed - circalittoral rock	Hard bottom habitats associated with coralligenous communities, sciaphillic algae and semi dark caves, deep reefs (dominated by sponges and other filter feeders)	e.g. facies with *Cystoseira zosteroides, Mesophyllum lichenoides, Lithophyllum frondosum/Halimeda tuna, Rodriguezella strafforelli, Eunicella* spp., *Lophogorgia, Paramuricea, Parazoanthus* spp. or facies of *Corallium rubrum, Leptosammia* spp.	Wide regional distribution (Giakoumi et al, 2013)	Patchiness of wide regional distribution	Biodiversity, keystone species/habitat formers, carbonate flux		high sensitivity and vulnerability	1. (ship/sonar/video/photo)	*1*	fine scale assessment = community level (EUNIS 5)		1170 +8330 Submerged or partially submerged sea caves

Seabed - circalittoral sediment	Communities of the coastal detritic bottom	e.g. facies with *Laminaria rodriguezii, Osmundaria and Peysonnelia, Ophiothrix quinquemaculata, Neolampas rostellata* or *Leptometra phalangium*	Wide regional distribution	Patchiness of regional distribution	Biodiversity, sediment properties and fluxes		lower sensitivity and vulnerability	1. (ship/sonar/video/photo/grab)	2	fine scale assessment = community level (EUNIS 5)		1110?
Seabed - circalittoral sediment	Maerl communities	e.g. *Lithothamnion corallioides, Phymatolithon calcareum*	Wide Regional repartition (cf. Martin et al., 2014; DOI: 10.1038/srep 06646)	Patchiness of wide regional repartition	1 (biodiversity, Carbonate flux)		(high sensitivity and vulnerability)	1. (ship/sonar/video/photo/grab)	1	fine scale assessment = community level (EUNIS 5)		1160 (L. coralli oides), 1110 (*P. Calcar eum*)
Seabed - circalittoral sediment	Biocoenosis of coastal terrigenous muds	e.g. facies with *Turritella tricarinata communis, Virgularia mirabilis /Pennatula phosphorea* or *Alcyonium palmatum /Stichopus regalis*	regional	Patchiness of wide regional repartition	Biodiversity, sediment properties and fluxes		lower sensitivity and vulnerability	1. (ship/sonar/video/photo/grab)	2	fine scale assessment = community level (EUNIS 5)		
Seabed - circalittoral sediment	Communities of shelf-edge detritic bottoms	e.g. facies with *Leptometra phalangium*	regional		Biodiversity		lower sensitivity and vulnerability	1. (ship/sonar/video/photo/grab)	2	fine scale assessment = community level (EUNIS 5)		1110

Seabed - bathyal-abyssal	Communities of deep-sea corals	e.g. facies with *Lophelia pertusa* or *Madrepora oculata*	regional / not yet comprehensive mapping of the populations (Bo et al., 2015)	rare	Biodiversity, habitat formers		Extremely vulnerable species but less exposed to pressures	(ship/sonar/video/photo/grab)	*2*	fine scale assessment = community level (EUNIS 5)		1170 reefs
Seabed - bathyal-abyssal	Seeps and communities associated with bathyal muds	e.g. facies with *Isidella elongata, Funiculina quadrangularis, Thenea muricata, Brissopsis lyrifera , Apporhais seressianus* or *Pheronema carpenteri*	regional		Biodiversity / keystone /		lower sensitivity and vulnerability	(ship/sonar/video/photo/grab)	*2*	fine scale assessment = community level (EUNIS 5)		1180?
Seabed - bathyal-abyssal	Communities associated with seamounts	(cf. mediterranean deep sea experts)?	regional		Biodiversity		lower sensitivity and vulnerability	(ship/sonar/video/photo/grab)	*2*	fine scale assessment = community level (EUNIS 5)		1170 reefs; 1180 ? Submarine structures
Water column - coastal waters	Coastal waters phytoplankton communities	HABs	wide regional repartition	No but depends of the level of taxonomy considered (can be true at the species level)	biodiversity, food webs, fluxes and nutrient recycling		high sensitivity and vulnerability		*1*	national/regional		

Water column - coastal waters	Coastal waters zooplankton communities	cf. jellyfish population dynamics and blooms; Jellyfish species : Phyllorhiza punctata and Mnemiopsis leidyi. Secondary Cassiopea andromeda Catostylus tagi Geryonia proboscidalis Marivagia stellata Pelagia benovici Rhopilema nomadic, Beroe ovate	wide regional repartition	No but depends of the level of taxonomy considered (can be true at the species level)	biodiversity, food webs, fluxes and nutrient recycling		high sensitivity and vulnerability		*1*	national/subregional		
Water column - shelf and oceanic waters	Shelf and oceanic waters phytoplankton communities		wide regional repartition	No but depends of the level of taxonomy considered (can be true at the species level)	biodiversity, food webs, fluxes and nutrient recycling				*to define*	subregional		

Minimum list			Texel- Faial Criteria								Typology/ listed	
Predominant habitat or "Functional" group of species	Specific habitat type or species to be monitored	ADDITIONAL INFORMATION (to be further discussed): specific representatives species or habitats (Invertebrates associated with habitats)	(sub)regional importance	Rarity	Key functional role	Declining or threatening	Sensitivity/Vulnerability (exposure to pressures): cf. column N to V	feasability (for monitoring): cf. column W to AG	Priority (estimated from column D to I)	Assessment monitoring scale	EUNIS 2015	Habitats Directive
Water column - shelf and oceanic waters	Shelf and Oceanic waters zooplankton communities	cf. jellyfish population dynamics and blooms; HABs	wide regional repartition	No but depends of the level of taxonomy considered (can be true at the species level)	biodiversity, food webs, fluxes and nutrient recycling				*to define*	subregional		
Seabirds -												
Seabirds -												
Seabirds -	*Phalacrocorax*		regi	*wide*					*1*	regio		
Seabirds -	*Larus*		subregion	*wide*					*1*	subre		
Seabirds - inshore surface-feeders	*Sterna* spp.	*Sterna albifrons* (Pallas, 1764) *or Sterna nilotica* (Gmelin, JF, 1789) *or Sterna sandvicensis* (Latham, 1878)	regional						*1*	regional		
Seabirds - offshore (surface or pelagic ?)	*Puffinus* spp.	*Puffinus mauretanicus* (Lowe, PR, 1921), *Puffinus yelkouan* (Brünnich, 1764)	regional						*1*	regional		
Mammals -	*Monachus*		subregion						*1*	subre		pri
Mammals -	*Balaenoptera*		subregion						*1*	subre		
Mammals -	*Physeter*		subregion						*1*	subre		
Mammals -	*Ziphius*		subregion						*2*	subre		
Mammals -	*Delphinus*		subregion						*1*	subre		

Mammals -	*Tursiops*		regi						*1*	regio		pri
Mammals -	*Stenella*		regi						*2*	regio		
Mammals -	*Globicephala*		subregion						*2*	subre		
Mammals -	*Grampus griseus*		subregion						*2*	subre		
Reptiles -	*Caretta caretta*		regi						*1*	subre		pri
Reptiles -	*Chelonia mydas*		subregional						*1*	subre		pri
Fish -												
Fish - Demersal	*Solea solea*		subregion						*2*	subre		
Fish - Demersal	*Mullus barbatus*		subregion						*1*	subre		
Fish -	*Pagellus*		subregion						*1*	subre		
Fish -	*Pagellus*		subregion						*2*	subre		
Fish - marine,	*Epinephelus*		subregion						*2*			Endang
Fish -												
Fish - Pelagic	*Spicara smaris*		subregion						*2*	subre		
Fish - pelagic-	*Engraulis*		subregion						*1*	subre		
Fish - pelagic-	*Sardina*		subregion						*1*	subre		
Fish - demersal	*Boops boops*		subregion						*2*	subre		
Fish -	*Merluccius*		subregion						*1*	subre		
Fish -												
Fish - Pelagic												
Fish -	*Mullus*		subregion						*1*	subre		
Fish - Demersal												
Crustacean	*Aristaeomorpha*		subregion						*1*	subre		
Crustacean	*Aristeus*		subregion						*1*	subre		
Crustacean	*Nephrops*		subregion						*2*	subre		
Crustacean	*Parapenaeus*		subregion						*1*	subre		
	epinephelus											

Minimum list		Main pressures (binary=occurring or not: to be prioritized (ranked) for each specific representatives species or									Feasibility										
Predominant habitat or "Functional" group of species	Specific habitat type or species to be monitored	Physical loss of habitat (construction ports, marinas)	Physical damage to habitat	Nutrient enrichment	Contaminants	Removal by fishing (target, non-target)	Hydrological changes (thermal, salinity regime)	Other disturbances to species (e.g. litter, visual disturbance)	UW noise	NIS	Vessel	Lab facilities, equipment, consumables	Taxonomic expertise (technicians, scientists)	Monitoring techniques developed	Aerial	Land-based	In-water	Indicators established	Existing observatory stations / long term monitoring programmes	Satellite / Remote Sensing / aerial platforms	Oceanographic platforms
Seabed -	Communities in the										No	Yes	Low	Diving, ROVs,							No
Seabed -	Hard beds (bottoms,										No	Yes	High	Diving, ROVs,				WFD	WFD mon		No
Seabed -	Seagrass meadows				?						Yes	Yes	Moder	Diving, ROVs,				WFD	WFD mon		No
Seabed	Infrallitor			?	?	?					Ye	Ye	Hig	Grabs,				WFD	WFD		
Seabed - circalit	Hard bottom habitats				?	?					Yes	Yes	Moderate	Diving, ROVs, drop				For corall igeno	?		
Seabed -	Communities of				?						Yes	Yes	High	Grabs, corers;				For the soft	partly cover		
Seabed -	Maerl communiti				?						Yes	Yes	High	Grabs, corers;				For the soft			
Seabed	Biocoenos			?	?	?				?	Ye	Ye	Hig	Grabs,				WFD?	partly		
Seabed	Communit				?					?	Ye	Ye	Hig	Grabs,				No			
Seabe	Commu				?						Ye	Ye	Hig	ROVs,				No			
Seabe	Seeps and				?						Ye	Ye	Hig	ROVs,				No			
Seabe	Communi				?						Ye	Ye	Hig	ROVs,							

Wate r	Coastal waters										Ye s	Ye s	High to low	Niskin bottles				yes /chl-a	yes (to	sea surfa	Buo ys
Water column	Coastal waters				?						Ye s	Ye s	High to low	Plankton nets,				No	yes (to	N o	Buo ys
Water column	Shelf and oceanic				?						Ye s	dep ends	High to low	Niskin bottles				yes /chl-a	yes (to	sea surfa	Buoy s,
Water column	Shelf and Oceanic										Ye s	dep ends	High to low	Plankton nets,				No	yes (to	N o	Buoy s,
Seabi											No	No		Birdwatch					Yes	teled	No
Seabir											No	No		Birdwatch					Yes	teled	No
Seabir	*Phalacroc*											No	Mo	Shipboard						Tel	
Seabir	*Larus*											No	Mo	Shipboard						Tel	
Seabir	*Sterna*											No	Mo	Shipboard						Tel	
Seabir	*Puffinus*											No	Mo	Shipboard						Tel	
Mamm	*Monachus*										Ye	Ye	Mo	Quadrat				Yes	Yes	Tel	
Mamm	*Balaenopt*										Ye	Ye	Mo	Shipboard				Yes	Yes	Tel	
Mamm als -	*Physeter macrocep*										Ye s	Ye s	Mo der	Shipboard surveys;A				Yes	Yes	Tel ede	
Mamm als -	*Ziphius cavirostri*										Ye s	Ye s	Mo der	Shipboard surveys,				Yes	Yes	Tel ede	
Mam	*Delphinus*										Ye	Ye	Mo	Shipboa				Yes	Yes	Tel	

Minimum list		Main pressures (binary=occuring or not: to be prioritized (ranked) for each specific representatives species or									Feasibility										
Predominant habitat or "Functional" group of species	Specific habitat type or species to be monitored	Physical loss of habitat (construction ports, marinas)	Physical damage to habitat	Nutrient enrichment	Contaminants	Removal by fishing (target, non-target)	Hydrological changes (thermal, salinity regime)	Other disturbances to species (e.g. litter, visual disturbance)		NIS	Vessel	Lab facilities, equipment, consumables	Taxonomic expertise (technicians, scientists)	Monitoring techniques developed	Aerial	Land-based	In-water	Indicators established	Existing observatory stations / long term monitoring programmes	Satellite / Remote Sensing / aerial platforms	Oceanographic platforms
Mamm	*Tursiops*										Ye	Yes	Mo	Shipboard,				Yes	Y	Tele	
Mamm	*Stenella*										Ye	Yes	Mo	Shipboar				Yes	Y	Tele	
Mamm	*Globiceph*										Ye	Yes	Mo	Shipboard,				Yes	Y	Tele	
Mamm	*Grampus*										Ye	Yes	Mo	Shipboard,				Yes	Y	Tele	
Reptiles - turtles	*Caretta caretta* (Linnaeus,										Yes,transects	Yes	Moderate	Other monitoring techniques	Yes, transects	Yes, nesting monitor	Yes, diving/snorkeling			Yes, during	No
Reptiles - turtles	*Chelonia mydas* (Linnaeus,										Yes,transects	Yes	Moderate	Other monitoring techniques	Yes, transects	Yes, nesting monitor	Yes, diving/snorkeling			Yes, during	No
Fish -											Ye	Yes	Mo								
Fish -	*Solea solea*										Ye	Yes	Hig	Surveys at				yes	y		
Fish -	*Mullus*										Ye	Yes	Hig	Surveys at				yes	y		
Fish -	*Pagellus*										Ye	Yes	Hig	Surveys at				yes	y		
Fish -	*Pagellus*										Ye	Yes	Hig	Surveys at				yes	y		
Fish -	*Epinephelu*																				
Fish -											Ye	Yes	Hig								
Fish -	*Spicara*										Ye	Yes	Hig	Surveys at				yes	y		
Fish -	*Engraulis*										Ye	Yes	Hig	Surveys at				yes	y		

Fish	*Sardina*										Ye	Yes	Hig	Surveys at				yes	y		
Fish	*Boops*										Ye	Yes	Hig	Surveys at				yes	y		
Fish	*Merluccius*										Ye	Yes	Hig	Surveys at				yes	y		
Fish											Ye	Yes	Hig								
Fish											Ye	Yes	Hig								
Fish	*Mullus*										Ye	Yes	Hig	Surveys at				yes	y		
Fish											Ye	Yes	Hig								
Cru	*Aristaeomo*										Ye	Yes	Hig	Surveys at				yes	y		
Cru	*Aristeus*										Ye	Yes	Hig	Surveys at				yes	y		
Cru	*Nephrops*										Ye	Yes	Hig	Surveys at				yes	y		
Crustacean (shellfis	*Parapenaeus longirostris*										Yes	Yes	High	Surveys at sea, data collection programmes, stock				yes	yes		
	epinephelus																				

Annex IX

Reference habitats and species in the Egyptian Mediterranean Marine biodiversity

Mediterranean marine life is characterized by its low biomass and high diversity and clearly reflects the prevailing abiotic, environmental features, particularly the nutrient deficient water, low tidal amplitude and temperature regime.

In the Egyptian coastal waters, as in the eastern Mediterranean in general, marine biological diversity is relatively impoverished, when compared to areas in the western Mediterranean (UNEP, 1999) and is dominated by species with smaller individuals and shorter life cycle (Bellani-Santini *et al*., 1994). Primary productivity in that area is characteristically rather low, with pelagic phytoplankton blooms being quite variable and largely associated with the seasonal variation in temperature and salinity gradients.

The following is a detailed description of key components of marine biodiversity in the Egyptian Mediterranean coastal waters.

Phytoplankton

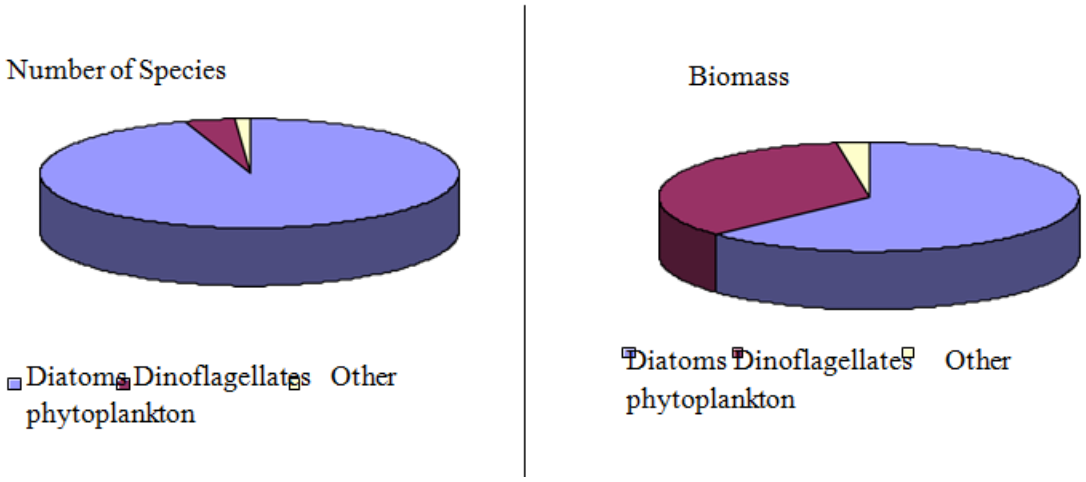
The southeastern Mediterranean is poor in the number of phytoplankton species. This is particularly true along the western stretch of the Egyptian coast of the Mediterranean. The coastal waters fronting the Nile Delta is usually more fertile due to the eutrophication effect of the Nile water and land drainage. The density of phytoplankton in the offshore waters of that area, however, is low.

Phytoplankton of the Mediterranean coastal waters of Egypt has been thoroughly investigated during the last 40 years (NBU, 1995). Several systematic lists of phytoplankton as well as a number of studies of seasonal variations in phytoplankton flora have been published. (Dowidar, 1974; El Maghraby and Halim, 1965). With at least 661 species recorded, the group exhibits high species diversity (NBU, 1995). A general character of the phytoplankton population in the area is the high species diversity and the comparatively small number of individuals of each species; a character which classifies the region among oligotrophic environments (NBU, 1995).

This rich phytoplankton flora consists mostly of diatoms, dinoflagellates, siticoflagellates and to a much lesser extent chlorophytes and cyanophytes. Diatoms constitute 90 to 95% of the phytoplankton biomass and are represented by 409 species belonging to 84 genera. Among these species, 137 also occur in the Red Sea (NBU, 1995). Only few of species however, form the bulk of diatom population.

Dinoflagellates comprise about 3.8% of the total phytoplankton and include 247 species and varieties belonging to 38 genera and 20 families. Diatoms density is highest during winter and to a lesser extent autumn months and is minimal in summer. Dinoflagellates, on the

other hand, occur throughout the year but reach their maximum abundance during summer. Figure 44 compares the biomass and species richness of main phytoplankton groups in the Mediterranean coastal waters of Arab‘s Bay, Egypt.



Biomass and species richness of main phytoplankton groups in the Mediterranean coastal waters of Egypt.

Sea Grass and Marine Algae

One of the typical marine ecosystems of the eastern basin of the Mediterranean Sea including the Egyptian coast is the *Posidonia oceanica* ecosystem, which form large meadows in the infra littoral zone. Along the western part of the Egyptian Mediterranean coast that sea grass predominates, along with patches of *Zostera*. Belts of the sea grass *Posidonia oceaica* along with strands of the brown algae *Sargassum spp.* and patches of the green algae *Caulerpa prolifera* occur in the inshore water of that part of the Egyptian coast (Ramadan 1979; Farag, 1981, Abdel Aleem, 1993). The green algae *Caulepra Codium, Halimeda* and *Udotea* also occur in that area. Other species of *Padina* and *Halimeda* are quite rare.

Red algae, particularly calcareous species of *Lithothamnion* and *Lithophyllum* frequently occur in the offshore waters. Other less abundant red algae species include the genera *Grateloupia, Vidalia, Gigartina, Peyssonnelia, Botryocladia* and *Opuntiella*. Algal growth generally increases during spring and summer.

Zooplankton:

The composition, distribution and seasonal variations of zooplankton populations along the Egyptian Mediterranean coast have been investigated by several authors (El Maghraby, 1965; Halim *et al.*, 1976; Dowidar and EI Maghraby, 1970; 1971; 1973; Abu EI-Ezz, 1975; Hussien, 1977; and Samaan, 1979) and have been recently reviewed (NBU, 1995). According to these

studies, the subclass copepoda represents the most abundant zooplanktonic element, consisting of 184 species in 70 genera and 35 families, forming about 82 % of the total zooplankton. Copepod larvae are also quite abundant, forming about 45 % of the total copepoda. Copepod density is particularly high in near shore waters, especially during autumn months, the genera *Paracalanus, Oithona, Euterpina, Clausocalanus, Cerycoeus, Microstella, Oncoea, and Calocalanus* are most abundant among all copepods. *Acartia, Candacia, Centropages, Euchaeta, Pleuromamma,* and *Temora* are much less frequent. It should be noted, however, that the standing crop of the copepods off the Egyptian Mediterranean coast has declined progressively since the construction of the Aswan High Dam. The standing crop recorded in 1984 was almost 1/3 of that recorded in 1963 (NBU, 1995).

Planktonic protozoa constitute about 3.9 % by number of the total near shore zooplankton and include many species of the groups Tintinnids, Radiolaria, Acantharia and Foraminifera. Family Tintinnidae dominates protozoan families, with the genera *Favella, Tintinnopsis, Cedonellopsis,* Halicostomella and *Coxbiella* being the most dominants. Foraminifera are relatively rare and are represented by six holoplanktonic species belonging to five genera and three families (NBU, 1995), with *Giobigerina spp.* being the most numerous. While protozoa are most abundant during spring, foraminifera attain their maximum abundance in the autumn. Appendicularia is represented by the two Urocordata genera *Oikopleura* (eight species) and *Firitillaria* (seven species). A total of 25 Siphonophores species, 23 Hydromedusae species and eight species of Scyphomedusae have been recorded from the Egyptian Mediterranean waters (Dowidar, 1983, NBU, 1995). Planktonic larvae include larval stages of PoIychaeta, Cerripedia, Echinodermata and Decapoda.

Herbivorous zooplankton include copepods, salps and appendiculariae, while carnivorous plankton is represented by gelatinous organisms, such as medusae, ctenariae, siphonophores, chaetognates, crustaceans and very small pelagic fishes (Bellan-Santini *et al*., 1994).

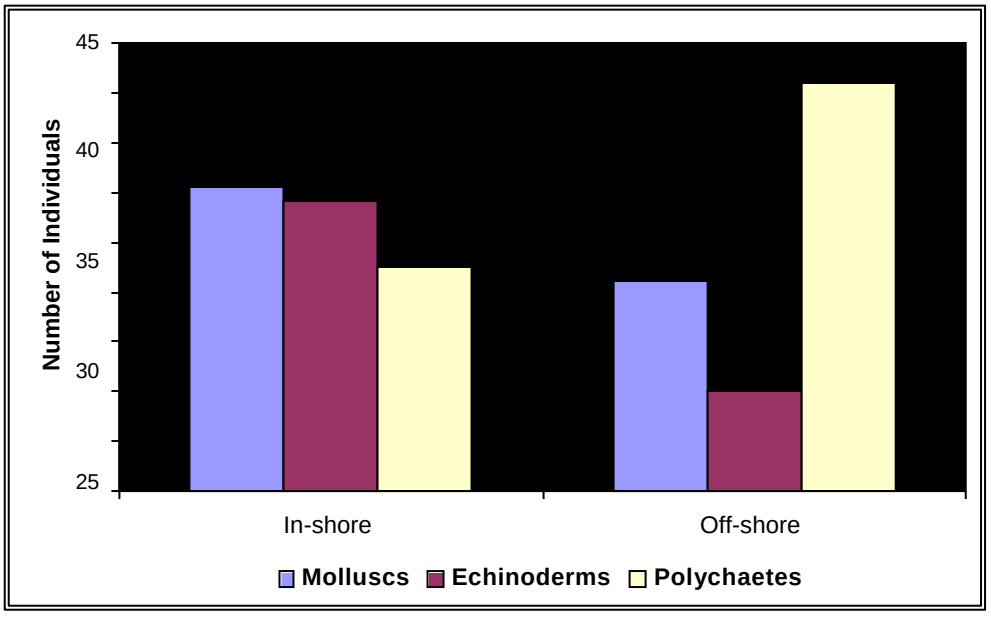
Benthic Fauna

Macrobenthic fauna in the Mediterranean coastal waters of Egypt include 8 phyla (RAC/SPA, 1993). Among these, Annelida, Mollusca and Echinodermata are the most abundant. Arthropoda, Brachiopoda, Ascidians, Nemertini and Sipunculida are much less abundant. Brachiopoda are only restricted to offshore waters. Figure 45 shows the relative abundance of the eight, most common phyla of macrobenthic fauna in the Egyptian Mediterranean coastal waters in different seasons.

The structure of the macrobenthic community is greatly influenced by depth (RAC/SPA, 1993). In the inshore zone (10 to 50 m depth parallel to the coastline), macrobenthic fauna is numerically dominated by mollusca (30.5%), echinoderms (29.2 %) and polychaetes (22.5%). In the offshore zones extend to a depth ranging between 50 and 100 m, macrobent hic fauna is dominated by polychaetes (41%), mollusca (21.1%) and echinderms (10%). The remaining macrobentic phyla

are mostly restricted to deeper, off shore waters. Figure 46 shows a comparison of the relative abundance of the three most common macrobent hic faunal groups in inshore and offshore waters of the western sector of the Egyptian Mediterranean coast near Alexandria, in addition to depth, bottom type determines the type of benthic community. Silty/sandy bottom is dominated by the echinoderms *Amphiura* and *Schiaster;* the mollusca *Tysiria, Mucula, Cerula* and *Natica,* the polychaetes *Arenicola, Euclymene* and *Glycera* the crustacians *Gammarus* and *Portunus.* In the rocky/coarse gravel bottom, the molluscan *Glycemeris, Venus, Chamelea, Caffista* and *Tellina;* the polychaetes *Hermodice, Eunice, Aphrodite, Lumbricoides;* the echinoderms *Astropecten* and *Echinocardium* as well as the crustaceans *Maja* and *Ethusa* dominate.

Offshore of the western sector of the Egyptian Mediterranean coast, the bottom is predominantly silty with scattered pebbles. This type of bottom supports a variety of sponges particularly off El Dabaha. Associated with this bottom type polychaetes (*Hermodice, Eunice* and *Aphrodite*), ascidians (*Cytoditus* and *Archidistoma*), crustaceans (particularly *Synalpheus*), molluscans (mostly *Astarte*) and echinoderms (*Echinus, Cidaris* and *Asropecten*) occur.



Relative abundance of the three most common macrobenthic faunal groups in inshore and offshore waters of the western sector of the Egyptian Mediterranean coast (data from RAC/SPA, 1993).

Main Marine Faunal Groups

Porifera

Publications on sponges in the Egyptian Mediterranean waters, including commercial species are

limited in the literature (Burton, 1936, Kheriailah, *et al.,* Abdel Aleem, 1961; 1989; and Ramadan *et al.,* 1989). A total of 51 specie s belonging to 32 genera and 13 families have been recorded. Five species are commercially important (*Spongia officinalis adriatica, Spongia o. mollissina, Spongia agarcinia, Spongia zimocca, Hippospongia communis*). Table 9 shows a list of common sponge species recorded from El Agamy in Alexandria (Burton, 1936) and the Egyptian Mediterranean coastal waters west of Alexandria (Kheriailah, *et al.,* 1989; and Ramadan *et al.,* 1989).

Cinac yra australiensis	*Adocia cinerea*
Adocia grossa	*Myxilla prouhai*
Tendania nigrescens	*Clathria gradlis*
Thlysias jolicoeuri	*Rhaphidostyla hitchingi*
Cliona viridis	*Tethya aurantium*
Spongia equina	*Spongia officinalis adriatica*
S. officina/is mollissina	*Spongia zimocca*
Spongia agarcinia	*Cacospongia molliar*
Cacospongia scalaris	*Hircinia variables*
Suberites doumuncula	*Age/as oroides*
Petrosia ficiformiss	*Calyx nicaensis*
Hippospongia communis	*Ircinia fasciculate*

Lists of common sponges recorded from two areas along the Egyptian Mediterranean coastal waters (Burton, 1936, Kheriailah, *et al.*, 1989; and Ramadan *et al.,* 1989).

Polychaeta

Polychaetes recorded from Egyptian Mediterranean coastal waters include a relatively diverse assemblage of 126 species (Fauvel, 1937 in RAC/SPA, 1993; Farag, 1981; NBU, 1995). (Fauvel, 1937 in RAC/SPA, 1993; Farag, 1981).

Sphaeros yllis hystriz	*Syllis hyaline*
Syllis spongicola	*Syllis sp.*
Polyphthalamus pictus	*Arenicola claparedii*
Autolytus longeferiens	*Pontogenia chrysocoma*
Hermione hystrix	*Hermione sp.*
Hermodice carunculata	*Hermodice sp.*
Euphrosyne foliosa	*Staurocephalus rubrovittatus*
Lepidonotus clava	*Glycera unicornis*
Glycera sp.	*Ceratonereis costae*
Ciratulus sp.	*Arenicola marina*
Euclymene lumbricoides	*Euclymene oerotedi*
Malane sp.	*Eteone sp.*

Aphrodite aculeata
Nephtys sp.
Lysidic ninetta
Vennillopsis infundibulum
Hesione sp.
Eunice sp.
Lumbrineris sp.

Polychaete species recorded from coastal waters west of Alexandria (Fauvel, 1937 in RAC/SPA, 1993; Farag, 1981).

Crustacea

Crustacea of the Egyptian Mediterranean waters exhibit a relatively high diversity. Microcrustacea of the Egyptian Mediterranean waters in the vicinity of Alexandria include 57 species of amphipoda, 14 species of isopoda, and three species of tanaidaceae (NBU, 1995). Macrocrustacea include 59 brachyaran crabs belonging to 38 genera and 13 families.

(Balss, 1936; Schellenberg, 1936; Larwood, 1940; Ramadan & Dowidar, 1972; and Ramadan, 1976; Farag, 1981).

Stomatopoda
Squilla massavensis

Decapoda
Sicyonia carinata
Athanas nitescens
Athanas sp.
Jaxea mocturna
Upogebia gracilipes
Porcellana Iongicornis
Paguristes ocu/atus
Diogenes pugilator
Eupagurus anachoretes
Ethusa mascarone
Inachus dorhynchus
Inachus dorsettensis
Inachus leptochirurn
Inachus phalangium
Inachus communissimus
Myra fugax
Macropodia Iongirostris
Pisa tetradon
Pisa nodipes
Pisa muscosa
Charybdis mergulensis
Achaeus gordonae
Charybdis hellerii
Charybids Iongicollis
Actaea rufopunctata
Pilumnus hirtellus
Pilumnus spinifer
Pilumnopeus vauquelini
Dromia personata
Homola barbata
Dorippe lanata
Ilia nucleus
Pirimela denticulate
Carcinus mediterraneun
Macropipus arcuatus
Macropipus depurator
Macropodia rostrata
Macropodia Iongirostris
Portunus hastatus
Poftunus pelagicus
Xantho incicus granulicarpus
Eriphia verrucosa
Eucrate crenata
Ocypode cursor
Pachygrapsus marmoratus
Brachynotus foresti
Parthenope macrochelos
Tanaidacea

Acanthonyx lunulatus	*Parapseudes Iatifrons*
Eurynorne aspera	*Lepthochelia dubia*
Scyllarus arctus	
Scyllarus sp.	Isopoda
Pagurus arrosor	*Ciro/ana cranchil*
Penaeus sp.	*Zenobiana prisma tica*
Galathea sp.	*Bagaus stebbingi*
Portumnus sp.	*Munna sp.*
Mala sp.	*Idotea sp.*

Crustacea of the Egyptian Mediterranean waters.

Bryozoa

Seven Bryozoa species have been reported from the Egyptian waters west of Alexandria (O'Donoghue and Watteville, 1939).

Bryozoa species recorded from the Egyptian waters west of Alexandria (O'Donoghue and Watteville, 1939).

Calpensia impressa	*Tubucellaria opunsioides*
Retepora imperati	*Retepora couchii*
Cellulosa sp.	*Chizoporella unicornis*
Palmicellaria shemei	

Mollusca

Lists of mollusca of the Egyptian Mediterranean waters, mostly in the Alexandria area have been published by Hassan, (1972) and Farag (1981). Detailed knowledge of the molluscan fauna of othe r sectors of the Egyptian cause is rather limited. Table 13 shows a list of bivalves, gastropods and scaphopods recorded in the vicinity of Alexandria.

Brachiopoda

Three Brachiopoda species have been reported from the Egyptian waters west of Alexandria (Farag, 1981); namely *Actinotrocha sp., Muehlfeidtia truncata* and *Trebratula vitrea.*

Bivalves

Patella lusitanica	*Arca diluvii*	*Solyrna mediterranea*
Callilostoma conulus	*Arca barbata*	*Nucula nucleus*
Tricoba speciosa	*Arca noae*	*Nuculana fragills*
Bittium Iatreillil	*Glycymeris pilosus*	*Protopectin glaber*
Ceilthiurn vugatum	*Glycymeris violacescens*	*Anomia ephippium*
Atlabta leseuri	*Glycymeris glycymeris*	*Astarte sulcata*

Aporrhais pespelecani
Aporphais serresianus
Natica millepunctat
Natica dilwyni
Polynices losephinus
Cassidaria echinophora
Tritonalia blainvillii
Murex truncu/us
Murex brandaris
Columbella rustica
Euthria eornea
Nassarius corniculus
Nassarius sp.
Nassarius pygmaeus
Marginella mitrella
Cyxhara laevigata
Conus mediterraneus
Acteon tornatilis
Creseis acicula
Creseis virgula
Styliola subula
Dentalium dentale
Cadulus jeffreysi
Marginella mitrella
Pinctada vulgaris
Modiolus adriaticus
Lithophaga lithophaga
Modiolus adria ticus
Lithophaga lithophaga
Chlamys flexuosa
Astarte fusca
Cardita antiquata
Cardita trapezia
Cardita sp.
Begunia trapezia
Diplodonta rotundata
Chama gryphoides
Cardium paucicostaturn
Cardiurn papillosum
Pitra rudis
Pitra thione
Petria hirundo
Venus ovata
Venus verrucosa
Donax semistriatus
Solecurtus chamasolen
Abra ovata
Tellina pulchella
Tellina serrata
Tellina donacina
Tellina balaustina
Aloidis gibba
Cuspidria rostrata
Cuspidaria cuspidata
Myretea spinifera
Ctena decussata
Thysiria ferruginea
Laevicardium papillosum
Callista chione
Chamelea gallina
Gafrarium minimum
Azorinus chamasolen
Macoma cumana
Abra alba
Corbula gibba
Astraea rugosa
Tenagodus obtusus
Naticarius stercusmuscarum
Bulla sp.

A list of bivalves, gastropods and scaphopods recorded in the vicinity of Alexandria (Steuer, 1939; Farag, 1981).

Echinodermata

Echinodermata of the Egyptian Mediterranean waters have been studied by Mortensen and Steuer (1937) and Farag (1981). A total of 48 species belonging to 40 genera and 27 families have recorded (NBU, 1995) and the more common species are listed in Table 14. The most diverse echinodermata group is the echinoids (16 species, 15 genera, 9 families), followed by asteroids (13 species, 9 genera, 7 families), holothuroids (9 species, 7 genera, 4 families), ophiuroids (8 species, 7 genera, 5 families) and crinoids (2 species, 2 genera and 2 families).

Astropecten bispinosus
Amphiura chiajei
Sty/ocidaris affinis
Echinocardium cordatum
Thyone fusus
Ophiopsila aranea
Paracentrotus lividus
Ova (Schizaster) canalifera
Cucumaria elongata
Stropecten sp.

Ceramaster placenta	*Echinaster sepositus*
Spatangus purpureus	*Psammechinus sp.*
Cidaris cidaris.	

Common Echinodermata of the Egyptian Mediterranean waters (Steuer, 1937; and Farag, 1981).

Fishes

According to EI-Sayed (1992), the Egyptian Mediterranean bony fish fauna consists of a total of 297 species belonging to 88 families and 203 genera. Although most of these species are native of the Mediterranean basin, 40 species are of Indo-Pacific origin, seeming to have migrated to the Mediterranean Sea through Suez Canal.

According to Egypt‘s country study (NBU, 1995) a total of 56 species of cartilaginous fishes are known from the Egyptian Mediterranean waters. These include 32 species of shark (22 genera and 13 families) and 24 ray and skates (11 genera and 8 families). Among these, two sharks and one ray are Red Sea species that have migrated to the Mediterranean via the Suez Canal.

Economically important cartilaginous fishes include a number of species of families scyliorhinidae, squatinidae, rajidae and rhinobatidae. Among bony fishes species belonging to the families carangidae, clupeidae, mugilidae, scombridae, serranidae, siganidae, soleidae and sparidae are the most economically important fish species.

Boops boops	*Diplodus annularis*
Diplodus sargus	*Mullus surmuletus*
Saurida undosquamis	*Siganus spp.*
Solea vulgarissparus aurata	*Eutrigla gurnadus*
Argyrosomus regius	*Dicentrarchus labrax*
Dicentrarchus punctatus	*Epinephelus spp.*
Pagrus pagrus	*Scomberomorus commerson*
Trichiurus lepturus	*Engraulis encrasicolus*
Caranx rhonchus	*Euthynnus affinis*
Dussumieria acuta	*Sardinella aurita*
Engraulisen crasico/us	*Sardinella maderensis*
Trachurus mediterraneus	*Sardinella pilchardis*
Pomatomus saltatrix	*Scomber japonicus*
Trachurus mediterraneus	*Blennius spp*

Some common fishes of the Egyptian Mediterranean coastal waters (GAFRD, 2000)

Marine Reptiles

Sea turtles are the only marine reptiles in the area. Three marine turtle species are known to occur in the Egyptian Mediterranean waters (Saleh, 1996). The Loggerhead Turtle *Caretta caretta* is the more common of the three. Records of this turtle are mostly from the Mediterranean front of the Nile Delta. However, no nesting records are known for this species in Egypt.

Records of the Green Turtle *Chelonia mydas* is more widespread along the Egyptian Mediterranean coast, including nesting at the Sinai coast. The Leatherback Turtle *Dermochelys coriacea* is rare at the Mediterranean coast of Egypt, with only few records from the Sinai coast and the Alexandria area. No nesting records are known for this species in Egypt.

Marine Mammals

At least nine species of marine mammals are recorded from the Egyptian Mediterranean waters. These include eight cetaceans (dolphins and whales) and one pinniped (seals).

Cetacean recorded from the Mediterranean waters of Egypt fall into four families. Five dolphins (family is Delphinidae) belonging to five genera, regularly occur in the Egyptian Mediterranean waters. These are:

Delphinus delphis (common dolphin) *Globicephala melaena* (pilot whale) *Grampus griseus* (Risso‘s dolphin) *Stenella coeruleoalba* (Striped dolphin) *Tursiops truncatus* (Bottle-nosed dolphin).

Several records of the Fin Whale *Balaenopteroptera physalus* a Balaen whale are known from different parts of the Egyptian Mediterranean coast. The most recent record is of a dead individual found on a sandy beach west of Alexandria in1988. other cetaceans recorded from the Egyptian Mediterranean waters is the sperm whale *Physter macrocephalus* (family physeteridae) and the Cuvier's beaked whale *Ziphius carvirostris* (family Ziphiidae).

The monk seal *Monachus monachus* is the only member of the family Pinnipedae that might occur in the Egyptian Mediterranean waters. This extremely rare species is still occasionally recorded in Libya not far from the Egyptian borders. Suitable habitats for this seal are found at the coastal waters west of Matruh and westwards to the Libyan border.

Annex X

Law No. 102 of 1983 for Nature Protectorates
Translate By Essam Mostafa
Lawyer of Red Sea Protected Areas
Feb – 18 - 2002

Article (1)

- In implementing the articles of this Law, a natural protectorate is defined as any area of Land, or coastal or inland water characterized by flora, fauna, and natural features having cultural, scientific, touristic or esthetic value. These areas will be designated and delineated by Decree of the Prime Minister upon the recommendation of the Egyptian Environmental Affairs Agency.

Article (2)

- It is forbidden to commit actions (deeds or activities or undertakings) which will lead to the destruction or deterioration of the natural environment or harm the biota (terrestrial, marine or fresh water), or which will detract from the esthetic (beauty) standards within protected areas.

- In particular, the following acs are forbidden:
* Catching transporting killing or disturbing wildlife;
* Damaging or removing any living organisms or natural features and resources, such as shells, corals, rocks, or soil for any purpose;
* Damaging or removing plants (from) the protected areas:
* Spoiling or destroying the geological structures (and other features) of areas serving as natural habitats and breeding areas for plants and animals;
* Introducing foreign (non-indigenous) species of biota into the protected area;
* Polluting the soil, water, or air of the protected areas in any manner.
- It is also forbidden to erect buildings and establishments, pave roads, drive vehicles, or undertake any agriculture, industrial, or commercial activities in the protected areas except with the permission of the concerned Administrative Body and restrictions specified by the Prime Ministerial Decree.

Article (3)

- It is forbidden to undertake activities or experiments in the areas surrounding designated protectorates, which will have an effect on the protectorates environment and natures, except with the permission of the concerned Administrative Body.

Article (4)

- The Administrative Body (responsible for the enforcement of the provisions of this Law and related decrees) will be specified in a separate Decree issued by the Prime Minister. This Administrative Body will be empowered to establish regional offices within the Governorates having protectorates, and will be responsible for the following functions:
* Preparation and execution of necessary studies and programs to enhance protectorates;

* Surveying and monitoring natural features and wildlife within the protectorates, and creating a registry of same;
* Managing and coordinating activities related to the protectorates;
* Guiding and educating the public about the natural resources within protectorates, and the objectives and reasons for creating protectorates;
* Exchanging information and experiences relevant to the protectorates and natural resources therein with other countries and international organizations;
* Managing (operational) funds referred to in Article VI, below.

Article (5)

- Societies for the protection of the environment, promulgated in accordance with national legislation, will be permitted to seek counsel with the concerned Administrative and with the judicial bodies to implement the provisions of the Laws and Decrees concerning the protection of the natural resources of the protectorates.

Article (6)

- A special Fund will be established to collect donations, grants, and (part) admission fees (as appropriate) as well as fines incurred by violators of this Law.
- The Fund will be used for the following purposes:
  - Supplementing the budget of the Administrative Body responsible for implementing the provisions of this Law;
  - Enhancement of the protectorates;
  - Undertaking surveys and field research on natural resources within the protectorates;
  - Paying rewards to persons who provide information concerning offenses or who apprehend offenders who contravene the provisions of this Law.

Article (7)

- Notwithstanding a stronger penalty specified in another Law, any person who contravenes the provision of Articles II and III of this Law and the Executive Decrees associated with it, will be find not less the LE 500 (five hundred Egyptian pounds) and not more than LE 5000 (five thousand Egyptian pounds) and/or will be imprisoned for not more than one year.
- Recurrent offenders will be fined not less than LE 3000 (three thousand Egyptian pounds) and not more than LE 10.000 (ten thousand Egyptian pounds) and/or will be imprisoned for not less than one year.
- In addition to this, the offender will bear the cost of removal or reparations specified by the concerned Administrative Body's representatives will be empowered to confiscate equipment, weapons or tools used in committing the offense.

Article (8)

- The fines and the cost of reparation will be collected through administrative procedures and without delay.

Article (9)

- Competent officials of the concerned Administrative Body responsible for enforcing this Law and the associated Executive Decrees will be designated in a Decree (Order) from Minister of justice upon consultation with the concerned Minister, and shall be accorded magistrate-level judicial powers concerning violations specified in this Law.

Article (10)

- Any provision contrary to the provisions of this Law is abrogated.

Article (11)

- This Law is to be published in the Official Gazette and will be enacted within three months of the date of publication.
- Issued at the presidency on July 18, 1983 (9 Shawwal 1403 11.) and signed byHosny Mubarak.

Ratified by the Egyptian parliament (people, assembly).

Annex XI

National relevant participants who attended in the workshope to validate the National monitoring program for biodiversity and non-indigenous species in Egypt which hold at 10 October 2017 - Steigenberger Altahrer, Cairo.

اليوم الاول

UN environment — SPA/RAC — PARKS EGYPT — وزارة البيئة

ورشة العمل الوطنية لعرض برنامج رصد مكونات التنوع البيولوجي البحري - ساحل البحر المتوسط المصري

10 أكتوبر 2017

فندق شتايجنبرج – التحرير، القاهرة

م	الاسم	الجهة	التليفون	البريد الإلكتروني	التوقيع
1	السيد الأستاذ/ محمد شهاب عبد الوهاب	الرئيس التنفيذي لجهاز شئون البيئة			
2	أ.د. مصطفى فودة	مستشار الوزير للتنوع البيولوجي – وزارة البيئة			MM Fouda
3	المهندس أحمد سلامة	رئيس قطاع حماية الطبيعة – جهاز شئون البيئة			
4	د. خالد علام	رئيس الإدارة المركزية للتنوع البيولوجي – قطاع حماية الطبيعة			
5	~~ممثل وزارة الدفاع~~				
6	مقدم / وليد نبوي	ممثل عن حرس الحدود	٠١٠٤٧٩٩٩٩٢		
7	~~ممثل عن حرس الحدود~~		~~٠١٠٨١٨٥٢٢٤~~ ٠١٠١٨١٥٢٢٤		
8	عميد / حسن البيه	ممثل شرطة البيئة والمسطحات			
9	السيد السفير/ وائل أبو المجد	نائب مساعد وزير الخارجية للشئون البيئة والتنمية المستدامة – وزارة الخارجية			

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اليوم الاول

م	الاسم	الجهة	التليفون	البريد الإلكتروني	التوقيع
10	السيد المستشار/ تامر حماد	مستشار نائب مساعد وزير الخارجية للشئون البيئة والتنمية المستدامة – وزارة الخارجية	٠١٢٢٠٥٠٠٢١٦	tamerhammad34@hotmail	
11		ممثلة عن هيئة قناة السويس			
12	أ.د. جاد محمد القاضي	رئيس المعهد القومي لعلوم البحار والمصايد			
13	المهندس/ محمد العيسوي	مدير عام الإدارة العامة لمحميات المنطقة الشمالية – قطاع حماية الطبيعة	٠١٢٨٢٦١٤٤٠	mpagayahoo.com	
14	د. لؤي السيد أحمد	منسق برنامج الحياة البرية – قطاع حماية الطبيعة	٠١٠٠٦٥٢٢١٠٦	luay09@yahoo.com	
15	البيلي حطب	مدير محمية أشتوم الجميل – قطاع حماية الطبيعة	٠١٠٠٥٨٠٤٢٠٦	bialy.hatab@yahoo.com	
16	د. طارق تمراز	مستشار الوزير لشؤون البحر المتوسط – وزارة البيئة	٠١١٤٨٨٦٦٤٤٠	ttemraz@yahoo.com	
17	أ.د. محمد رضا فيشار	أستاذ البيئة البحرية بالمعهد القومي لعلوم البحار والمصايد	01006373619	mfishar@hotmail.com	
18	المهندس/ عاطف صلاح	مدير عام إدارة المصايد بالهيئة العامة لتنمية الثروة السمكية			
19	أ.د. علاء الحويط	عميد كلية المصايد والاستزراع السمكي بالأكاديمية العربية للعلوم والتكنولوجيا والنقل البحري	01006633541	el-hawedta@yahoo.com	
20	ا.د. محمد موسى سليمان ضرغام	قسم علوم البحار – كلية العلوم – جامعة الإسكندرية	01224609801	mdorgham1947@	

اليوم الأول

م	الاسم	الجهة	التليفون	البريد الإلكتروني	التوقيع
21	د. محمد سعد عبد الكريم	أستاذ الطحالب بالمعهد القومي لعلوم البحار والمصايد			
22	د. وليد محمد الصاوي	أستاذ مساعد الأسماك بالمعهد القومي لعلوم البحار والمصايد			
23	محمود حجاب عامر	أستاذ مساعد اللافقاريات بالمعهد القومي لعلوم البحار والمصايد			
24	د. عواد عبد السيد	أستاذ اللافقاريات البحرية – بكلية العلوم بجامعة الأزهر	01149611715	Awaad_am@hotmail.com	
25	أ. سها طاهر	رئيس الإدارة المركزية للتعاون الدولية بالجهاز			
26	د. حمدي عمر	معهد علوم البحار بالإسكندرية			
27	أحمد فتح الله	فرع الإسكندرية – جهاز شئون البيئة	01002646105	Fathallah74@yahoo	
28	د. أيمن حمادة	مدير عام الأنواع والأجناس – قطاع حماية الطبيعة	01000418222	aymanhamada@yahoo	
29	أ. أسامة الجبالي	مدير مشروع الطيور الحوامة	01221745384	OSS.67@hotmail	
31	أ. أمال طه	رئيس الإدارة المركزية للثقافة والتوعية البيئية – جهاز شئون البيئة	01000692[illegible]	amaltaha26@hotmail.com	
32	محمود فؤاد أحمد	أخصائي تنمية بشرية	01221177671	mahmoud_ncs@yahoo.com	
33	دينا دوالشلي	مجتمع مدني - توعية بيئية	01223476670	dinazulficar@yahoo.com	

اليوم الأول

م	الاسم	الجهة	التليفون	البريد الإلكتروني	التوقيع
34	[illegible]	[illegible]	[illegible]	MRHYDRO35@HOTMAIL.com	
35	[illegible]	[illegible]	[illegible]	Hmr_1971@yahoo.[illegible]	
36	[illegible]	[illegible]	[illegible]	hala_rahmy@hotmail.com	
37	[illegible]	[illegible]	[illegible]	msk_saad@yahoo.com	
38	[illegible]	[illegible]	[illegible]	wm.elsawy@[illegible].sci.eg	
39	[illegible]	[illegible]	[illegible]	hegabmh@yahoo.com	
40	[illegible]	[illegible]	[illegible]	kareemfarouq@A2hur.edu	
41	[illegible]	[illegible]	[illegible]	dr.mb2020682@yahoo	
42	[illegible]	[illegible]	[illegible]	Hu_dar2000@yahoo.[illegible]	
43	[illegible]	[illegible]	[illegible]	Mohamadel@azhar.edu.eg	
44	[illegible]	[illegible]	01006373619	mfisher@hotmail.com	
45	[illegible]	[illegible]	01281633546	el-hawet@yahoo.com	

Date :.....

	Name & Surname	Position	Institution	Tel	Fax	E-mail
46	Dr. Mahmoud farrag.	Lecturer	Fac. Science, Al-Azhar Univ. Assiut	01007253531		m_mdhmoud_farrag@y...
47	Moustafa Sobhy	Specialist	NIOF	01222313859		sobhy_2010@Yahoo.com
48	Christophe DENIAU	Consultant	CIRAD (France)	00337508065 64		deniau.christophe@gmail.com
	~~Aymen Hamed~~	~~GM-Aqua Diversity Dept~~	~~EEAA~~	~~01004182222~~		~~aymanhamed@yah~~
	E					