NATIONAL MONITORING PROGRAMME FOR MARINE BIODIVERSITY IN ISRAEL

The Mediterranean Biodiversity Centre

SPA/RAC

EcAp-Med II Project

With the financial support of

Mediterranean Action Plan
Specially Protected Areas Regional Activity Centre (SPA/RAC)
Boulevard du Leader Yasser Arafat
B.P. 337
1080 Tunis Cedex - Tunisia.
car-asp@spa-rac.org

For bibliographic purposes, this document may be cited as:
UN Environment/MAP-SPA/RAC, 2019, National monitoring programme for marine biodiversity in Israel; by: Barneah O., Roditi-Elasar M., and Kerem D., Mayrose A, Hatzofe O., EcAp Med II project, SPA/RAC, 84p.

Cover photos credit:
© SPA/RAC, Mathieu FOULQUIE.

The present document has been prepared in the framework of the EcAp Med II project financed by the European Union.

For more information:
www.spa-rac.org

National Monitoring Programme for Marine Biodiversity in Israel

EcAp-Med II Project

Study required and financed by:

EcAp-Med II Project

Specially Protected Areas Regional Activity Centre (SPA/RAC)
Boulevard du Leader Yasser Arafat
B.P. 337
1080 Tunis Cedex - Tunisia
car-asp@spa-rac.org

In charge of the study at the Israel Nature and Parks Authority (INPA)

- Ruth Yahel, Marine ecologist
- Simon Nemtzov, Wildlife ecologist

In charge of the study

- Orit Barneah, Marine biologist
- Mia Roditi-Elasar, Israeli Marine Mammal Research and Assistance Centre
- Dani Kerem, Israeli Marine Mammal Research and Assistance Centre
- Asaf Mayrose, Houbara Environmental Consulting and Avian Conservation
- Ohad Hatzofe, Avian Ecologist – INPA

TABLE OF CONTENTS

FORWORD

The Mediterranean Sea is one of the major reservoirs of marine and coastal biodiversity in the planet. Millions of people depend on the ecosystem services it provides. Its richness and diversity contribute to the populations' wellbeing and to the development of coastal areas.

This biodiversity hotspot is threatened by several anthropogenic pressures (overfishing, pollution, habitat destruction, climate change, etc.) which requires the reinforcement of innovative and integrated research and assessment capacities to support an ecosystem-based management at the regional scale.

In 2008, the Contracting Parties (CPs) to the Barcelona Convention agreed to gradually apply the Ecosystem Approach process and they adopted a roadmap for its implementation, with the vision of a healthy Mediterranean with marine and coastal ecosystems that are productive and biologically diverse for the benefit of present and future generations.

In 2016, the CPs adopted the Integrated Monitoring and Assessment Programme and related Assessment Criteria (IMAP), in application of the Ecosystem Approach towards reaching the Good Environmental status (GES) of the Mediterranean Sea and Coast. This programme will enable an integrated monitoring and assessment of the marine environment's status using quantitative parameters based on defined ecological objectives and their common indicators.

The elaboration of this present document was coordinated by the Israel Nature and Parks Authority (INPA) with the participation of national experts and the relevant stakeholders. This activity was supported by SPA/RAC through the financial support of the EcAp-Med II project, to assist the southern Mediterranean countries to update their national monitoring programmes for marine biodiversity and non-indigenous species.

This work was based on existing monitoring programme running since the late 1970's, hence it was the necessity for an enhanced and updated national monitoring programme based on the EcAp/IMAP principles, in order to accommodate all the national needs for marine data collection.

SPA/RAC commend the quality of this present work and hope for further collaboration with INPA to make this challenging second phase of the IMAP implementation a successful step towards reaching healthy and productive marine and coastal ecosystems managed efficiently and sustainably.

LIST OF ACRONYMS

CI	Common indicator
EO	Ecological Objective
EIA	Energy Information Administration
GES	Good Environmental Status
IMAP	Integrated Monitoring and Assessment Programme
INPA	Israel nature & Parks Authority
MAP	Mediterranean Action Plan
MM	Marine mammals
MMS	Mediterranean Monk Seal
SPA/RAC	Specially Protected Areas Regional Activity Centre
UNEP	United Nations Environment Programme

Echinaster (Echinaster) sepositus © SPARAC, University of Sevilla

A. Legislation and regulatory aspects

I. INSTITUTIONAL AND REGULATORY ASPECTS

The overview of the legislation and regulatory requirements, on which National IMAP Monitoring Plan can lean on, consist of three chapters.

First chapter

The main legislative tool protecting the marine and coastal environment in Israel is the Protection of the Coastal Environment Law, 2004. The protection is extended through nature protection legislation, which, although not unique to the marine and coastal environment, is vital to its habitats, flora and fauna protection and monitoring. Those legislative tools are summarized in the first chapter.

Second chapter

This chapter reviews the Israeli legislation transposing into national law the Protocols of the Barcelona Convention for the protection of the Mediterranean Sea against Pollution from different sources.

Third chapter

The third chapter includes an overview of legislation tools that implements the MARPOL convention, regulates the use of hazardous substances and data and information sharing.

Forth chapter

The chapter reviews coordination, management and financing of monitoring activities.

II. LEGISLATION PROTECTING MARINE/ COASTAL ECOLOGICAL OBJECTIVES

The Protection of the Coastal Environment Law, 2004

The Protection of the Coastal Environment Law is the main legislative tool protecting marine and coastal biodiversity in Israel. The law, which came into force on November 15, 2004, is aimed at:

- protecting the coastal environment, restoring and preserving coasts as a resource of unique value, and preventing and reducing as much as possible any damage to them;
- preserving the coastal environment and the coastal sand for the benefit and enjoyment of the public, for present and future generations; and
- establishing principles and limitations for the sustainable management, development and use of the coastal environment.

Under this law, the sea and shore are considered one integral unit that extends from Israel's territorial waters to 300 meters inland. This entire area is considered a public resource which is to be preserved and protected from damage. To ensure this, the law come up with these following measures:

- prohibits damage to the coastal environment,
- sets the authority to impose a fee, which will be paid to the Maintenance of Cleanliness Fund, for the protection of the coastal environment on owners or holders of coastal facilities considered to cause damage to the coastal environment,
- sets the authority to issue an order to prevent or remove environmental damage in order to restore the coastal environment to its former state,
- imposes severe penalties for coastal damage.
- establishes a Protection of the Coastal Environment Committee, which is responsible for decisions on coastal development plans, taking into account such considerations as preventing damage to the coastal environment, preserving the coast for public benefit, assuring public access to the coast, and conserving nature, landscape and heritage values.

The prohibiting of driving on the coast law, 1997 which prohibits driving in the strip of 100 meters extending from the water line inland, was enacted to increase the protection of the coastal area.

National Parks, Nature Reserves, National Sites and Memorial Sites Law, 1998

The law provides the legal structure for the protection of natural habitats, natural assets, wildlife and sites of scientific, historic, architectural and educational interest in Israel. The law established a united Nature and National Parks Protection Authority.

The law provides the Authority and its organs with a wide range of administrative and enforcement powers which include:

- declaration, establishment and maintenance of terrestrial and marine nature reserves and national parks, declaration of fauna and flora outside the confines of nature reserves as «protected natural assets»,
- appointment of inspectors, and administrative powers to prevent harm to and to protect natural assets.

While the Wildlife Protection Law does not protect fish (see below (, every animal, plant or habitat might be proclaimed as protected natural asset. It is unclear if the law applies to the Israeli Exclusive Economic Zone (EEZ).

National Parks, Nature Reserves and National Sites Council, composed of all relevant stakeholders and appointed by the Minister of Environmental Protection, advise the Authority and the relevant ministers on matters related to the implementation of the law.

A professional-scientific subcommittee, of which at least four of its 7 members are experts in the fields of zoology, botany, ecology and geology, is appointed by the Authority's general assembly. The subcommittee advises and recommends the general assembly on subjects relating to nature conservation and the protection of natural assets, and prevention of damage to them as result of development activities.

National Parks, Nature Reserves, National Sites and Memorial Sites Proclamation (Protected Natural Assets), 2005

Wildlife Protection Law, 1955

This law prohibits trading, possessing or transporting protected species without a permit. It implies to Mammals, birds, reptile or amphibian. Fish are not protected by this law. The Minister of Environmental Protection is authorized to restrict the hunting of wild animals, to issue hunting permits and to appoint inspectors to enforce the law. The law serves as Israel's implementation tool for the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Fishing Ordinance of 1937 and Fishing Regulations, 2016

Enacted in 1937, the fishing Ordinance does not deal with the issues of overfishing and protection of the marine environment. The ordinance, which relates not only to fish but to all marine animals, prohibits fishing without permit (except for coastal rod fishing) and fishing using explosives.

Lately new fishing regulations were approved (not entered into force yet), stressing the importance of sustainable fishery, fishery resource management and protecting the marine environment. The regulations impose fishery limitations, including prohibition of trawling in less than 30-40 meters depth to protect sensitive habitats (rocky habitats and Kurkar ridges), imposing use of nets with larger holes to allow undersized fish to avoid capture and avoiding fishing in breeding periods.

III. NATIONAL LEGISLATION TRANSPOSING THE BARCELONA CONVENTION AND ITS PROTOCOLS INTO NATIONAL LAW

The following legislation and regulations were adopted to comply with the Barcelona Convention protocols ratified by Israel.

Prevention of Sea Pollution from Land-Based Sources Law, 1988

The Law implements the instructions of the Land-Based Sources Protocol. In 2005, the law was amended, to bring it in line with the **amended Land-Based Protocol of the Barcelona Convention**.

The law prohibits the discharge of waste and wastewater into the sea in any case where practical and economic alternatives for treatment or reuse exist on land, provides that such processes are less harmful from an environmental point of view.

An inter-ministerial permits committee, chaired by the Ministry of Environmental Protection, is authorized to issue permits and the permit holder should report the discharges.

The law also provides for the appointment of inspectors to carry out enforcement activities, for penalties, and for payment of clean up expenses. An offense under the law is a strict liability offense.

Since 2005, the law authorizes the imposition of financial levy on permit holders who discharge or dump wastewater or waste into the sea. The levy is paid to the Marine Pollution Prevention Fund and will strengthen enforcement and oversight over polluters.

The Prevention of Sea Pollution from Land-Based Sources Levy, Regulations, 2011, include guidelines for calculating the amount of the levy, based on the types of discharged pollutants and the quantities discharged from each type. The amount should reflect the relative environmental damage that is associated with such discharge.

Prevention of Sea Pollution from Land-Based Sources, Regulations, 1990, relates to permits issued or refused by the permits committee. The permits are issued only under special conditions when the waste or wastewater does not contain toxic materials harmful to the marine environment, as specified in the annexes to the regulations. In cases where such materials are contained in the waste, the plant must prove that it undertook and operated the best available technology for waste treatment prior to discharge into the sea. The conditions and criteria for presentation of permits and the types of waste and wastewater prohibited to discharge at sea were established in accordance with the provisions of the Land-Based Sources Protocol.

Prevention of Sea Pollution Law (Dumping of Waste), 1983

The law and its regulations incorporate **the Protocol for the Prevention of Pollution in the Mediterranean Sea by Dumping from Ships and Aircraft** (Dumping Protocol) in the Israeli legislation. Yet, to ratify the amended protocol, the law should be amended.

The law prohibits the dumping of any waste from vessels and aircraft into the sea, except under permit issued by an inter-ministerial committee, headed by the Ministry of the Environment. The law provides for penalties, and for payment of clean up expenses. An offense under the law is a strict liability offense.

Prevention of Sea Pollution, Regulations, 1984, relates to the dumping permits granted by the Permits Issue Committee. Following the Dumping Protocol, the regulations include annexes on materials that cannot be dumped into the sea, materials allowed to be dumped into the sea with a specific permit and considerations in granting a permit. The regulations include also detailed procedures of monitoring requirements, and reporting procedures.

IV. OVERVIEW OF LEGISLATION TOOLS THAT IMPLEMENTS LEGISLATION WHICH CONTAINS ELEMENTS OF MARINE MONITORING

Implementation of MARPOL

Prevention of Seawater Pollution by Oil Ordinance (New Version), 1980

This law and its regulations incorporate **MARPOL's Annex 1** on prevention of pollution by oil. The law provides the legal basis for controlling marine oil pollution. It prohibits discharge of oil or oily substances into Israel's territorial and inland waters by any vessel or shore installation. The Minister of the Environment is authorized to appoint inspectors to discover or prevent violations. Salient features of the law include: an obligation to keep oil record books on vessels; measures to be taken in case of discharge of oil; maximum fines for oil spillage; liability for clean-up costs; and requirements for vessels to use port reception facilities for oily wastes.

The ordinance also establishes a Marine Pollution Prevention Fund to generate income (from fines and fees) for preventing and combating marine and coastal pollution, clean-up operations and purchase of equipment.

The Marine Environment Protection Fee, Regulations, 1983, set a fee on the owners of vessels and tankers calling at Israeli ports and on coastal installations handling oil. Different fees are set for vessels, depending on size and purpose, and for tankers and terminals. The collected fees are paid into the Marine Pollution Prevention Fund.

Port Ordinance & Port Regulations

Chapter 14 of the Port Regulations incorporates **annex 3 of MARPOL** on Prevention of pollution **by harmful substances carried by sea in packaged form**. The Shipping and Ports Authority in the Israeli Ministry of Transport and Road Safety is responsible for maritime traffic, moorings and ports and enforces the regulations.

Port regulations (Dumping of Waste from Vessels), 2010 incorporates **annex 5 of MARPOL** on prevention of pollution by garbage from ships. The regulations will enable ratification of annex5.

As for now, the annex is enforced by the Marine Environment Protection Division in the ministry of Environment Protection through the **Maintenance of Cleanliness Law, 1984**. This law prohibits littering or the disposal of waste into the public domain. The law establishes a Cleanliness Maintenance Fund, whose sources include fees and fines imposed under various environmental laws, to finance a broad range of environmental activities. The minister of environmental protection is authorized to issue Clean-up Orders to offenders (whether individuals, owners of property, or local authorities) and to require disposal of the waste and restoration of the damaged area.

A National Contingency Plan for Preparedness and Response to Combating Marine Oil Pollution, 2008. The plan was approved by the government in June 2008, as part of Israel's commitment under the International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC), ratified in 1999. Within the framework of that plan, Israel has conducted exercises to enhance the skills and efficiency of those who would be called upon in case of a spill.

Monitoring of chemicals and waste regimes

Hazardous Substances Law, 1993

The Law is the central legal tool for the «cradle to grave» management of hazardous substances in Israel and (applies also in the EEZ). It provides the Ministry of Environmental Protection with the authority to control hazardous substances, by authorizing the minister to issue licenses, create regulations, and supervise all aspects of their production, use, handling, marketing, transport, import and export. In addition, Licensing of Businesses regulations relate to disposal of hazardous waste and to dangerous industrial plants.

A Poisons Permit is only granted if the official appointed by the environmental protection minister is satisfied that the applicant is familiar with the features of the hazardous substance in his possession and with safety requirements for its handling. Permit applications require a description of the types and quantities of hazardous substances in the possession of the business, their risk level, and the measures to be taken to prevent and/or treat accidents. The holder of a Poisons Permit is required to maintain a toxic substance register in which details of all sales and purchases of hazardous substances are recorded.

Planning/ licensing regime /EIA

Planning and Building Law, 1965

This law is a comprehensive statute that monitors and regulates all building and land use designations in Israel. The law establishes a hierarchy of planning bodies (national, regional, and local) responsible for land-use planning, taking into consideration all potential impacts, including environmental impacts. The law applies only to the Israeli territorial water.

An applicant might be required to submit an Environmental Impact Assessments. The Environmental Impact Assessments Regulations, 2003 are aimed to incorporate environmental considerations in earlier stages of the planning and decision making processes and to incorporate sustainable development principles in EIAs, such as land, water and energy conservation. The regulations include the possibility to review the sensitivity of the environment in which the plan is proposed and its exposure to pollution and degradation or risk, in addition to the impact of the proposed plan on its environment. The Environmental Protection Ministry is responsible for reviewing the EIA. The 2003 regulations also broadened the possibility to require EIAs for proposed development in environmentally sensitive areas, such as coasts.

Processes which collect and compile marine environmental data

Environmental Guideline for Offshore Petroleum and Natural-Gas Exploration and Production

The Petroleum Commissioner in Ministry of Energy may request petroleum rights holders to submit Environmental documents as an integral part of applications for exploration drills and environmental impact surveys as part of applications for production drills, and with plans for development of petroleum and natural gas reservoirs.

For approval of drilling in Israeli territorial waters, applicants are required to prepare an environmental document, in compliance with the Petroleum Regulations (Authorization to depart from provisions of the Planning and Building Law). For drilling in the EEZ, they are required to prepare environmental documents that includes a monitoring program for the marine environment.

The instructions for monitoring program are detailed in the «Guidelines for Monitoring the Marine Environment due to Petroleum and Natural Gas Exploration Operations and Production Activities in Israel» (which is part of the «Environmental Guideline»). The guidelines refer both to baseline survey and the after-drilling monitoring of the marine environment. The guidelines include seawater, sediment and biological monitoring.

Strategic Environmental Assessment (SEA)

In 2014, the Ministry of Energy launched a Strategic Environmental Assessment (SEA) project in the Mediterranean Sea, which was intended to form a knowledge base and supply as a decision-making tool for the Petroleum Commissioner in granting petroleum exploration and production rights offshore in Israel.

The final report contains maps of habitats and environmentally sensitive areas and includes a discussion of the potential environmental impacts of implementing each of the development alternatives presented in the report. Also, it identifies information gaps and ways to improve the knowledge base, and to establish indices for monitoring the recommendations and their implementation.

The blocks offered in OBR 2016 were delineated in line with the SEA conclusions and they are concentrated in areas of low vulnerability and low knowledge gap.

Rules and regulations related to data and information sharing

Freedom of Information Law, 1998

Israel's Freedom of Information Law was enacted in 1998 to assure open access to public information. The law enables individuals and public organizations to apply to a public authority for information. The 2005 amendment to the Freedom of Information Law is specifically related to the publication of environmental information with «relevance to public health, including data on substances that are emitted, spilled, discharged or released to the environment and the results of measurements of noise, odours and radiation, not on private property.» The objective is to make environmental information, which exists in government agencies, more accessible, through its publication on websites and by other means, and to do away with the need for applications and fees. The requirements for environmental information are detailed in the Public Access to Environmental Information, Regulations, 2009.

Representation of Environmental Public Bodies Law (Legislative Amendments), 2002

This law adds representatives of public bodies, concerned with environmental protection, to committees that are legally established in order to:

- emphasize environmental considerations in these committees,
- protect and preserve the environment
- and to prevent damage to the environment.

The law amends several laws in the areas of marine pollution, territorial waters, land-use planning, water, streams and springs authorities, and nature protection to include the representatives in committees established by those laws.

V. COORDINATION, MANAGEMENT AND FINANCING OF MONITORING ACTIVITIES (ALLOCATED RESPONSIBILITY, TECHNICAL MEETINGS, CONSULTATION WITH RELEVANT STAKEHOLDERS)

Several funds, established by the laws mentioned above, might be involved in financing the monitoring activities such as: the Cleanliness Fund, established by the Regulations to the Maintenance of Cleanliness Law and the Marine Pollution Prevention Fund, established by the Prevention of Seawater Pollution by Oil Ordinance.

The Cleanliness Fund, incoming funds from various environment-related fees and fines, are earmarked for strengthening waste disposal and treatment. The fund's goals include prevention of illegal garbage disposal and treatment of waste, protection of the coastal environment as defined by law, prevention of violations of the Hazardous Substances Law and more.

Established in 1979, the Marine Pollution Prevention Fund is dedicated to the prevention of marine pollution, as well as to the acquisition of the necessary equipment and resources and the training of personnel to properly respond in the case of an oil spill.

- **National coordination**

There are about 16 monitoring programmes in the Israeli marine areas, including a national monitoring programme on marine pollution that started on 1978, financed and guided by the Ministry of Environment Protection. Other programmes support the activities of the Ministry of Agriculture, Ministry of Health, Ministry of National Infrastructure, Energy and Water Resources etc.

An inter-ministerial team established about 2 years ago, with representatives of all stakeholders involved in monitoring. The team is formulating a coordinated monitoring programme, to monitor biological, chemical and physical aspects of the marine and coastal environment, which is based on indicators, targets and descriptors defined under the MSFD Directive and the EcAp adopted by the Contracting Parties to Barcelona Convention in order to achieve the Good Environmental Status (GES).

The Ministry of Environment Protection leads and coordinates the working team and the professional body that accompanies the activity is the National Research Institution – the Israel Oceanographic and Limnological Research (IOLR).

When completed, the monitoring programme will be submitted to the government as a proposed resolution.

- **Regional coordination**

  Israeli involvement in regional agreements

The main regional programmes in which Israel is currently involved are the Mediterranean Action Plan (MAP) and its regional activity centres (RACs) and the Union for the Mediterranean (UfM).

MAP-related activities in Israel include, for instance, marine litter prevention (for example, the MoEP's Clean Coast Programme), Coordinating oil spill contingency plans with MAP members and working to protect the sea from marine pollution caused by offshore gas and oil drilling.

As partner of UfM, Israel's Ministry of Environmental Protection is mainly involved in two of the Horizon 2020 Initiative working groups: Capacity Building (CB) and Review, Monitoring and Research (RMR).

Israel takes part in workshops and study visits of CB on regional, sub-regional, and national levels, in order to learn from the experiences of other countries.

Israel is involved in the ENPI-SEIS Project of RMR subgroup. The entities responsible for SEIS in Israel, are the Ministry of Environmental Protection and the Central Bureau of Statistics. The ministry is working on the establishment of a shared environmental information system for Israel. Its main objective is to improve data sharing and information availability for all relevant stakeholders and for the public.

B. MONITORING PROGRAMME FOR MARINE HABITATS

I. BACKGROUND

1. Integrated Monitoring and Assessment Programme (IMAP)

Monitoring and assessment of the sea and coast based on scientific knowledge, is the essential basis for the management of human activities, in order to achieve sustainable use of the seas and coasts and conserving marine ecosystems. 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 (UNEP/MAP, 2016)

IMAP, through Decision IG.22/7 lays down the principles for an integrated monitoring, which will, for the first time, monitor biodiversity and non-indigenous species, pollution and marine litter, coast and hydrography in an integrated manner. As such, IMAP aims to facilitate the implementation of article 12 of the Barcelona Convention and several other monitoring related provisions under different Protocols with the main objective to assess GES. Its backbone are the 11 Ecological Objectives and their 27 common indicators as presented in Decision IG. 22/7.

In line with the above, guidance factsheets have been developed for each Common Indicator to ensure coherent monitoring, with specific targets defined and agreed in order to deliver the achievement of Good Environmental Status (GES) and as such, provide concrete guidance and references to Contracting Parties to support implementation of their revised national monitoring programs towards the overall goal of implementing the Ecosystem Approach (EcAp) in the Mediterranean Sea and achieve GES (UNEP(DEPI)/MED WG.444/6/Rev.1).

2. IMAP common principles and structure

The overarching principles guiding the development of the IMAP include:

- adequacy;
- coordination and coherence;
- data architecture and interoperability based on common parameters;
- concept of adaptive monitoring;
- risk-based approach to monitoring and assessment.
- the precautionary principle, in addition to the overall aim of integration.

Data gathering: 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.

Information system: The IMAP information system will ensure the establishment of the regional pool of data based on Shared Environmental Information System (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 (UNEP/MAP, 2016).

In order for the IMAP to fulfil its goals, a crucial element will be the possibility to share information between the contracting parties. Therefore, a successful IMAP implementation will also rely on the application of Shared Environmental Information System (SEIS) principles, both at national and regional level, and on the development of an IMAP-compatible Integrated Data and Information System within UNEP/MAP. Equally important will be the further cooperation between countries, but also at regional level, with key partners such as the General Fisheries Commission for the Mediterranean (GFCM) and the Secretariat of the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS).

3. The common indicators (UNEP(DEPI)/MED IG.22/Inf.7)

In line with the recommendations of the Integrated EcAp Correspondence Group on Good Environmental Status (GES) and Targets Meeting (UNEP(DEPI)/MED WG.390/4), 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, but 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 and coastal ecosystem and can deliver valuable information to decision makers.

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. Bycatch of vulnerable and non-target species (EO1and 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).

4. IMAP recommendations regarding national monitoring plans

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.

The IMAP sets out the basis for how the Contracting Parties should design and carry out their national integrated monitoring programmes 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

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

Israel is currently in the final stages of approving and executing the revised and expanded National monitoring plan for its territorial waters and EEZ. The procedure and stages of work towards the implementation of IMAP principles in Israel's National Monitoring Plan are outlined in Appendix 1.

5. Israel's National Monitoring Plan – past and present

Israel's reliance on the sea has grown tremendously over the last decade. The gas discoveries, the ongoing rise in seawater desalination quantities and the constant need for free space for industrial and public infrastructure (airport for example), have all resulted in greater awareness and quest for knowledge in our sea. Moreover, the state of Israel has also expressed its commitment for the conservation of marine biodiversity and protection from pollution in the international arena through the signing of the Barcelona convention (1978) and the CBD convention (2010).

Israel's national monitoring plan has been operating since 1978 but was focused mainly on chemical and physical aspects, with only minor portion concerning biological aspects.

The ongoing «rush» for ocean-based resources concomitant with the dramatic changes occurring in Israel's marine habitats at present, evoked the urgent need to revise and expand Israel's National Monitoring Plan (see IOLR proposal in Hebrew 2017) in order to achieve supervised and science-based development. The new and revised plan was recently approved by the Israeli government (December 2018).

The new plan addresses the following indicators for Good Environmental Status which serve as the baseline for the IMAP (Integrated Monitoring and Assessment Program):

1. Biodiversity in main habitats (including non-native species)
2. Eutrophication
3. Marine food-webs
4. Marine Pollution
5. Seabed wholeness
6. Hydrographic conditions
7. Marine Noise
8. Marine Debris
9. Pollutants in commercial fish and invertebrate species
10. Commercial fish and invertebrate species

The new plan enables the state of Israel to comply with its international commitments (to the Barcelona Convention) by being based on the Ecological Approach (EcAp).

The EcAp was adopted by the Barcelona Convention parties and is being implemented by the Mediterranean Action Plan (UNEP-MAP) through the MEDPOL organization and the Marine Strategy Framework Directive (MSFD) in order to achieve Good Environmental Status (GES) of the Mediterranean Sea.

II. HABITATS IN ISRAEL'S TERRITORIAL WATERS AND EEZ - CURRENT DATA (ACCORDING TO SEA)

Marine habitats description and mapping was recently published as part of the Strategic Environmental Assessment (SEA) for the exploration and production of oil and gas in Israel's territorial waters and EEZ (SEA, 2016). The main phases of work are outlined below:

- In 2012 the Minister of Energy adopted the recommendation of the Petroleum Council to stop granting new exploration licenses in the offshore area of Israel. This temporary hold-up was intended to allow assessing the new gas finds, to update the Ministry's gas policy and to improve its regulatory system and technical capabilities.
- As Part of this measure the NRA launched in 2014 a Strategic Environmental Assessment (SEA) for the E&P activity offshore. The SEA was designed to cover all the marine area of Israel in the Mediterranean Sea (i.e. territorial waters and exclusive economic zone), taking into consideration active licenses or leases at the time of the study; and as a standard recommended by the EC/42/2001 directive, to support sustainable resource development policies. Additionally, the SEA was intended to provide information and recommendations to improve decision making processes regarding resource development, taking into account a comprehensive view of the environment as well as economic and social aspects.
- The SEA preparation has been accompanied by a steering committee, comprise representatives of government ministries, public sector, NGO`s, industry sector and other relevant stakeholders.
- As part of the SEA process a special chapter was dedicated to the description and mapping of marine habitats in the territorial waters and EEZ of Israel. This work has yielded the most comprehensive and detailed analysis of marine habitats ever conducted in Israel. Overall, 55 benthic habitats and 5 pelagic habitats were described (see Fig 1 and Appendix 2).
- In order to describe and categorize the various marine benthic and pelagic habitats, data has been gathered on the biodiversity of Israel territorial waters and the EEZ, as well as abiotic environmental data, to obtain, as much as possible, the current environmental conditions of this area. Data collection and presentation were carried out by IOLR and the Geological Survey of Israel (GSI), by means of GIS. Two main habitat defini-

tion approaches were used by the IOLR and GSI team: the biotic approach, i.e. habitat definition according to its biodiversity, and the abiotic approach, i.e. habitat characterization according to its physical characteristics. The biotic approach was mainly implemented for soft benthic habitats. The abiotic approach was implemented for areas with no sufficient biotic data, i.e. mainly hard seabed habitats and pelagic habitats (of the water column).

1. Habitats in Israel's territorial waters and EEZ - short overview

Israel's continental margins and shelf are divided to 2 main provinces (north and south) with the Carmel ridge acting as the barrier. Both provinces support wide array of habitats belonging to 2 main types: soft substrate (the majority of habitats) and hard substrate. The continental shelf of Israel is currently almost 25 km wide at its southern part, near Rafiakh in the Gaza region, and narrows to less than 3 km at the northern extremity near Lebanon (Fishelson, 2000). The northern edge of Israel's continental shelf and slope harbours the only underwater canyon within Israel's borders which is considered a unique habitat. Further south, at Dor and Palmahim, two major slides occur, and these areas contain exceptional habitats such as methane seeps and deep-sea corals (see SEA, 2016).

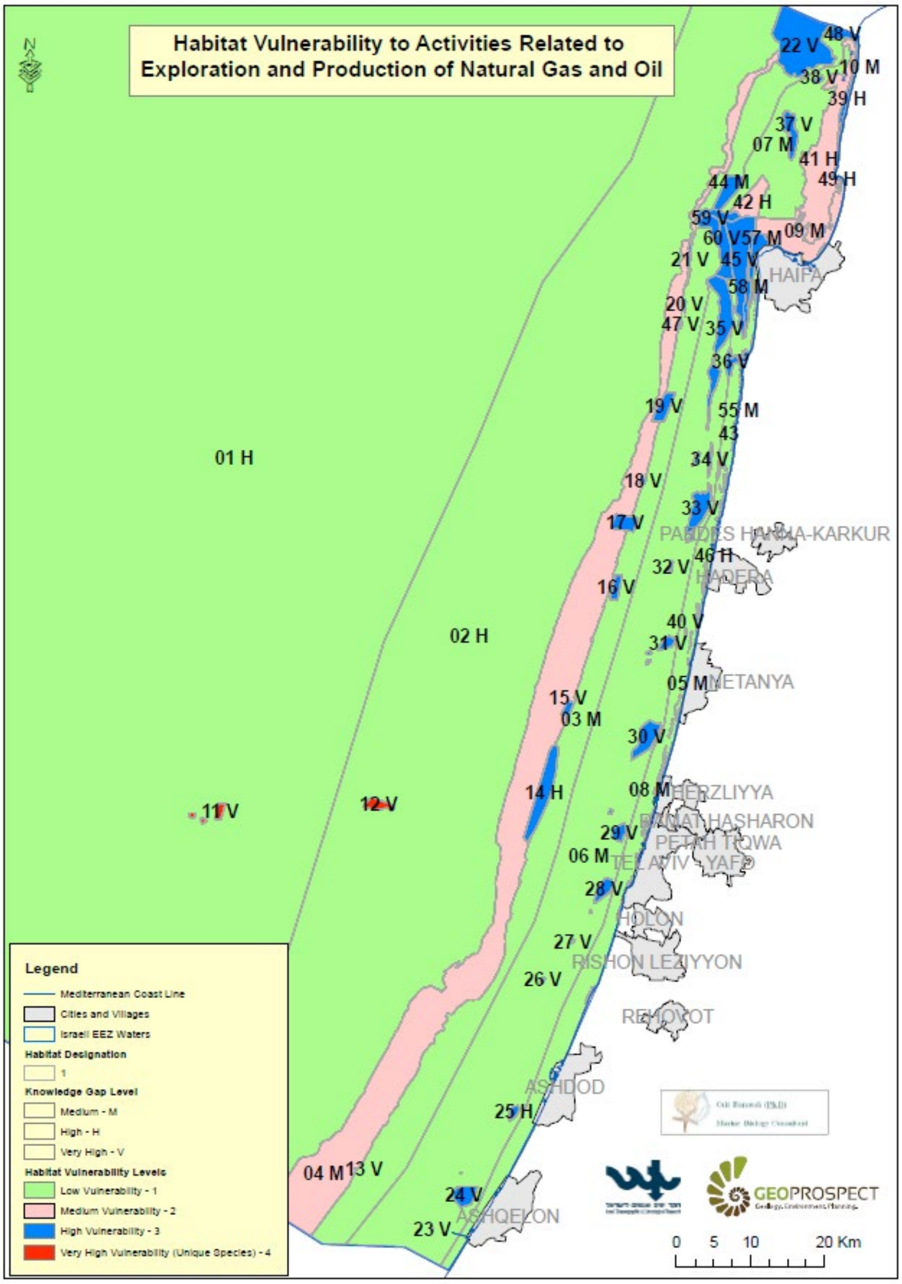

Fig. 1. Benthic habitats in Israel's waters according to SEA (2016).
The habitats names according to their numbers are shown in Appendix 2.

1.1. Soft substrate

Soft substrate covers the majority of Israel's marine area from shallow water down to the abyss. Sand (quartz) is the main constituent of the seabed down to 20 meters depth, while deeper, silt and clay are dominant. Biogenic sand characterizes the soft substrate from Akko to Rosh Hanikra.

The soft substrate habitats are continuous, stretching parallel to the shoreline (from shallow water down to the deep sea) and their boundaries are fuzzy (due to gradual change in sediment composition and characteristics). Yet, a division was carried out as part of the SEA[1] by IOLR (see SEA, 2016-chapter C) according to substrate characteristics and biotic composition and several habitats were specified. Every habitat of soft substrate accommodates organisms on the sediment (see Fig.2), inside the sediment and in the water column above the sediment.

Fig. 2. *Pennatula rubra*, a common inhabitant of silty soft bottom habitats (90 meters depth).

1.2. Rocky substrate

The main hard substrate around Israel's shores and marine area is 'Kurkar'. During the Late Pliocene and up to the Late Holocene, a series of hills of calcareous eolinite were established along the continental shelf of Israel parallel to the shore, relicts of coastal sand dunes. These sands, with a mixture of ground shells, macrogranules, cyanobacteria, and silt, formed the sandstone conglomerate termed 'kurkar'. The westward shifting of the coastal line during this period established these ridges at various depths between 10-130 meters, as outcrops in the silt bottom (Eytam & Ben-Avraham, 1992; Fishelson, 2000). The exposed parts of these ridges (mainly at two depth belts: 35-50 meters and 95-130 meters) constitute less than 10% of the sea floor at that depth range (Yahel and Angart, 2012; Israel marine spatial plan, 2015) yet these areas are characterized by high substrate complexity and rich biodiversity (SEA, 2016, Idan et al., 2018). The gradual degradation of these ridges contributed immense amounts of coarse - grain material to the silty bottoms (Fishelson, 2000). Kurkar is present also along the shores at certain locations where it serves as the base for the vermetid reefs (see below) and also at shallow water (4-20 meters) where it appears as patches. Limestone is exceptional around Israel's shores and appears only around Shikmona/ Carmel head and Rosh Hanikra. Beach rock is an additional formation of sandstone which usually forms flat plates (of reduced complexity) at the shoreline at several locations.

Fig. 3. Rich biodiversity on exposed Kurkar ridge across from Hadera at 35 meters depth

1.3. Vermetid Reefs

Vermetid reefs are bioconstructions composed of rocky substrate (kurkar or limestone) and living organisms (snails and algae). These structures can be found along the shores of Israel (attached to the shore or in close vicinity) at certain locations such as: Palmahim, Jaffa, Michmoret, Jiser Al Zarka, Habonim, Akko, Shavey Zion, Akhziv and Rosh Hanikra. Vermetid reefs in the Mediterranean Sea are hotspots of biodiversity (Goren and Galil, 2001) and have a socio-economic and cultural importance but are rapidly deteriorating with local extinction of the main reef builders in some areas (Galil, 2013). The framework builders of vermetid reefs are two species of vermetid gastropods: Vermetus triqueter inhabiting the inner shallow basins of the reef flat and the densely aggregated Dendropoma petraeum, a filter-feeder, protec-

[1] Strategic Environmental Assessment

ted by a thick shell and a close fitting operculum, inhabiting the surf-beaten edge of the reef where it creates raised rims (Safriel, 1975).

Fig. 4. Vermetid reef near Shavey Zion (northern Israel)

1.4. Deep sea corals and methane seeps at Palmahim disturbance area

In 2010 the research vessel E/V *Nautilus* (using ROV and side-scan sonar surveys aboard) was conducting a survey around certain locations off the coast of Israel (see coleman et al., 2012). One of the areas surveyed, was Palmachim disturbance where large slump and sediment slide features occur. The research team encountered hard, rocky outcrops and possible gas-charged sediments as well as deep-sea corals and symbiotic bivalves and siboglониid worms which are associated with methane seeps (see Weiseman and Rotchild, 2018. in hebrew). Additional research revealed the presence of several types of endangered deep-sea corals such as: *Isidella elongata, Swiftia pallida, Antipathes dichotoma, Leiopathes sp.* and *Viminella flagellum*. These areas were later mapped and included within the habitats list in chapter C of the strategic environmental assessment (see SEA, 2016). Due to their sensitivity to physical disturbance, the above-mentioned habitats were ranked at the highest degree of sensitivity and special limitations apply to future work in their vicinity.

2. The proposal for Israel's National Monitoring plan (according to IMAP ecological objectives) regarding Habitats (Common Indicators 1 and 2)

The monitoring plan regarding Habitats which is presented below is based on the revised and expanded National monitoring plan of Israel (Segal et al., 2018). The latter was recently approved by Israel's government and will be implemented in its new form in the near future. The monitoring plan includes representative sites of the main habitats in Israel's territorial waters and EEZ (see description above).

The common indicators related to Habitats are:

1. Habitat distributional range (EO1);
2. Condition of the habitat's typical species and communities (EO1);

It should be noted that the revised National monitoring plan of Israel also addresses the common indicator 6 (regarding non-indigenous species = NIS) as part of the habitats monitoring but the details of the monitoring plan for NIS are outlined on the last chapter of this document).

The revised National monitoring plan includes monitoring surveys of representative benthic habitats of both hard and soft substrate in Israel's territorial waters. It should be emphasized that the revised plan includes several habitats, which were just recently discovered and/or never been monitored before (such as kurkar ridges at 35 m and 100 m depth and cold seeps/deep water corals at ~800 m depth etc).

3. Monitoring plan (EO1 and EO2) – according to the revised national monitoring plan

3.1. Hard bottom Habitats

Monitoring surveys will be conducted on vermetid reefs located at the shoreline, Shallow Kurkar ridges (up to 25 meters depth) and deeper kurkar ridges (50- and 100-meters depth) as well as the newly discovered habitats around Palmachim disturbance.

Surveys will be conducted by SCUBA diving and snorkelling on shallow habitats and by Remotely Operated Vehicle (ROV) on deep habitats (fig. 2). Furthermore, the monitoring of a-biotic conditions such as temperature, salinity and Ph will accompany the biotic monitoring.

Tables 1 and 2 outline the monitoring plan for hard substrate habitats, the number of locations of each type, the frequency of monitoring and the parameters to be investigated. Fig. 5 shows a map indicating the monitoring locations.

Table 1. Outline of the habitats type (hard substrate), the number of locations and the frequency of monitoring.

Habitat	No. of locations	Frequency of monitoring
Vermetid reefs	2	Fall and Spring
Vermetid reefs	2	Four seasons
Shallow kurkar ridges (up to 25 m)	2	Fall and spring (at 4 different depths)
Shallow kurkar ridges (up to 25 m)	1	Four seasons
Kurkar ridges 35-50 m	4	Once every 3 years
Kurkar ridges 95-120 m	3	Once every 3 years
Palmachim area-deep sea corals and methane seeps	2	Once every 3 years

Table 2. Parameters to be monitored according to taxon type (Surveys on shallow hard substrate habitats)

Taxon	Parameters
Fish	• Species diversity indices • Beta diversity • Invasive to Local species ratio (biomass and abundance) • Commercial to non-commercial species ratio (biomass and abundance)
Macroalgae	• Species diversity indices • Beta diversity • Invasive and turf to Local species ratio (biomass and abundance)
Invertebrates	• Species diversity indices • Beta diversity • Invasive to Local species ratio (biomass and abundance) – mainly for Mollusca specimens • Biomass • net production and net calcification

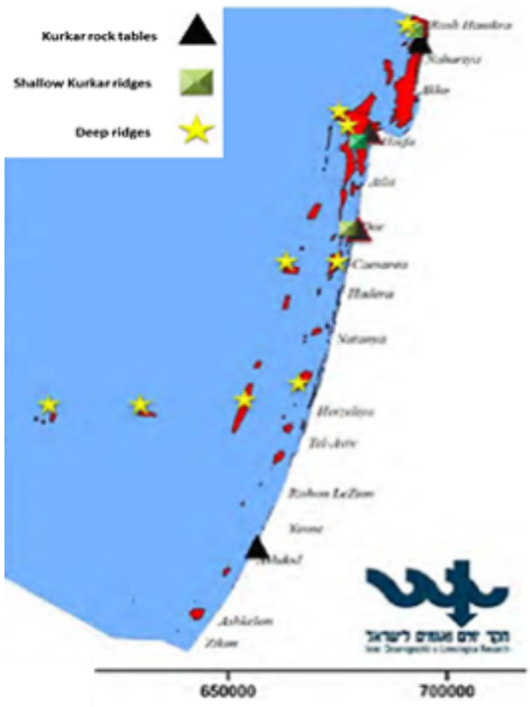

Fig.5. Map of hard bottom habitat monitoring surveys

3.2. Soft bottom habitats

Infauna: The monitoring plan for soft bottom habitats will include several stations along 2 transect lines: one in the northern part of Israel (perpendicular to Akko) and the other in central Israel (perpendicular to Tel Aviv). Sediment will be collected at each of the stations along the transects and microbenthic infauna will be monitored (see Table 3 and Fig. 3 (black stars represent monitoring stations for infauna).

Demersal Epifauna: At 3 locations around the northern and central transects, Demersal slow-moving epifauna will be monitored. Demersal motile epifauna will be monitored at 4 depths belts (20, 40, 60, 80 m) across from the city of Ashdod (see Table 3 and Fig.3). The monitoring will take place at two seasons (spring and fall) and at both daytime and night. The monitoring is performed by professional trawling boats according to specific protocols at fixed locations. The organisms caught in the net will be identified to the lowest taxonomic level possible and will be designated as local or non-indigenous. The dataset will be used for statistical analyses and certain specimen will be sent for molecular analysis.

The methods, frequency and parameters to be investigated are outlined in table No. 3. The monitoring locations and types are outlined on the maps in fig.6.

Table 3: Soft bottom surveys

	Sampling	parameters	Stations	Seasons to be sampled	Repetitions/ station
Benthic Macro-infauna (>250 µm)	Box corer and manual sampler for shallow waters	Community structure, Species diversity and richness indices	9 shallow 14 deep sea 120-1500 meters)	Shallow stations: twice a year - Spring and Autumn Deep stations: Once every two years in Autumn	3
Demersal slow-moving epifauna	15 minutes tow of 1.15 m net, eye size 5X5 mm	Community structure, Species diversity and richness indices, biomass	6 (3 north and 3 south)	Twice a year, spring and autumn, day and night	3
Demersal motile epifauna	90 minutes tows by trawler, 500 µm eye plankton net. 1 trammel net at 1000 ms depth	Community structure, Species diversity and richness indices, biomass	3 shallow 5 deep	Shallow stations: twice a year - Spring and Autumn, day and night Deep stations: Once every two years in Autumn	

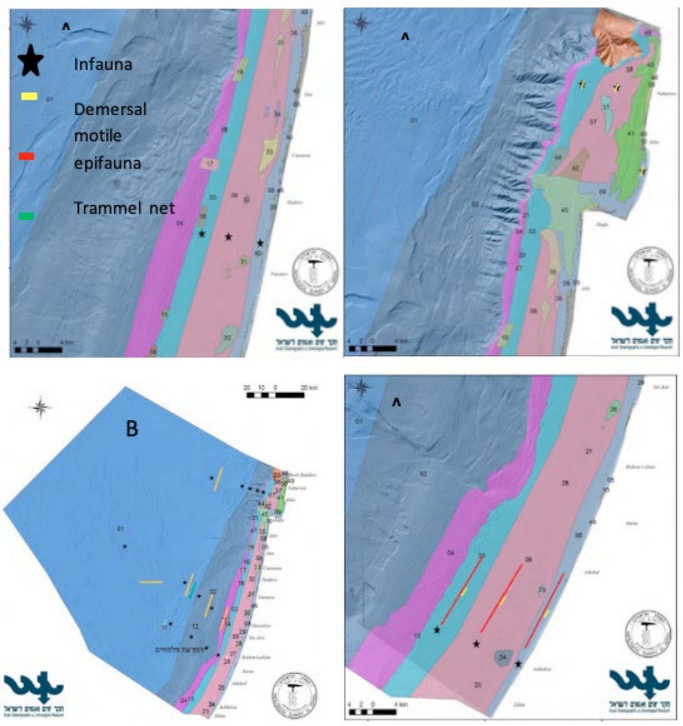

Fig 6. Map of soft bottom habitat monitoring surveys. A –shallow, B- deep

3.3. Phytoplankton, Zooplankton and bacteria

The monitor plan for Phytoplankton, Zooplankton and bacteria (Also relevant to EO4 and EO5) is summarized in table 3 and fig.4.

Table 4: Phytoplankton, Zooplankton and bacteria surveys

Parameter	Methods	Number of stations	Sampling frequency
Shallow stations			
Number of cells, species diversity for microalgae and Autotrophic bacteria	Microscopy, Flow cytometry, HPLC, 18s rRNA, spectroflourometry	11 stations, 7 and 30 m' bottom depths. Some parameters will be tested only at 4 stations	Twice a year -summer and winter. One station - monthly
Zooplankton. Protozoa and secondary consumers: Diversity, biomass, number of individuals	Microscopy, Flow cytometry, 18s rRNA	11 stations, 7 and 30 m' bottom depths Some parameters will be tested only at 4 stations	Twice a year -summer and winter. One station - monthly
Heterotrophic bacteria – diversity and number of cells	cytometry, 16s rRNA	11 stations, 7 and 30 m' bottom depths Some parameters will be tested only at 4 stations	Twice a year -summer and winter. One station - monthly
Primary production and Bacterial production	Radioisotopes	11 stations, 7 and 30 m' bottom depths Some parameters will be tested only at 4 stations	Twice a year, winter and summer
Supporting chemistry: organic and inorganic nutrients in the water column, DO, Fluorescence, Alkalinity and pH		11 stations, 7 and 30 m' bottom depths Some parameters will be tested only at 4 stations	Will be done for all samples
Deep sea stations			
Number of cells, species diversity for microalgae and Autotrophic bacteria	Microscopy, Flow cytometry, HPLC, 18s rRNA, spectroflourometry	6 stations from 25 to 1000 ms depth. Samples of the water surface, DCM and SM	Twice a year, winter and summer
Zooplankton. Protozoa and secondary consumers: Diversity, biomass, number of individuals	Microscopy, Flow cytometry, 18s rRNA	6 stations from 25 to 1000 ms depth. Samples of the water surface, DCM and SM	Twice a year, winter and summer
Heterotrophic bacteria – diversity and number of cells	cytometry, 16s rRNA	6 stations from 25 to 1000 ms depth. Samples of the water surface, DCM and SM. For 16s rRNA sampling also at LIW and Bottom	Twice a year, winter and summer
Primary production and Bacterial production	Radioisotopes	6 stations from 25 to 1000 ms depth. Samples of the water surface, DCM and SM	Twice a year, winter and summer
Supporting chemistry: organic and inorganic nutrients in the water column, DO, Fluorescence, Alkalinity and pH		6 stations from 25 to 1000 ms depth. Samples of the water surface, DCM and SM	Twice a year, winter and summer

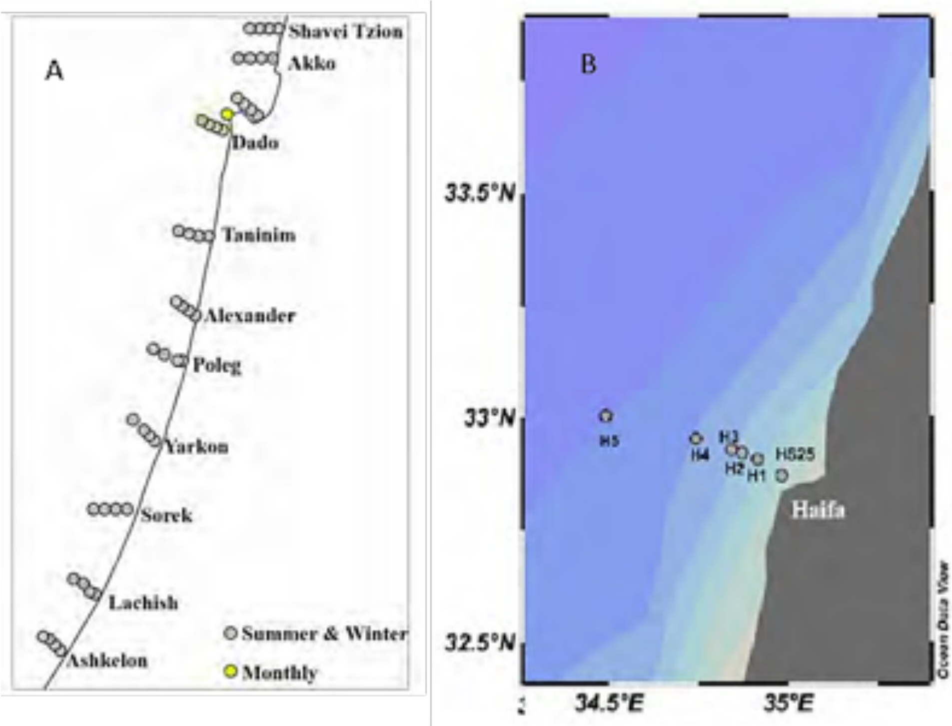

Fig 7. Plankton and water column bacteria sampling stations. A: shallow, B: deep.

3.4. Data collection and storage as part of the National monitoring plan

In order for the IMAP to fulfil its goals, a crucial element will be the possibility to share information between the contracting parties. Therefore, a successful IMAP implementation will also rely on the application of Shared Environmental Information System. In order for Israel to be able to share its relevant data with the contracting parties, the ILOR which is the governmental institute in charge of the National monitoring plan has been investing time and resources in developing two scientific tools which will improve results analysis and data sharing:

1. DNA Barcoding is a new tool for species identification which is based on specific DNA sequences (Hebert et al., 2003). This tool can assist in overcoming the rarity of classical taxonomists. This project includes also the construction of a web-based data centre which will contain the relevant data
2. Specific database which will include historic data as well as new data regarding biodiversity, species composition and a-biotic data. This tool will enable to monitor and detect long -term changes in the above-mentioned parameters.

References

Coleman, DF., Austin Jr., JA., Ben-Avraham, Z., Makovsky, Y and Tchernov, D (2012). Seafloor Pockmarks, Deepwater Corals and Cold Seeps Along the Continental Margin of Israel. *In New Frontiers in Ocean Exploration: The E/V Nautilus and NOAA Ship Okeanos Explorer 2011 Field Season. Oceanography 25(1), supplement, 68 pp*.

Eytam, Y. and Z. Ben-Avraham, 1992. The morphology and sediments of the inner shelf off northern Israel, Israel J. Earth Sci., 41, 27-44.

Fishelson, L. (2000). Marine Animal Assemblages Along the Littoral of the Israeli Mediterranean Seashore: The Red-Mediterranean Seas Communities of Species. Italian Journal of Zoology 67 (4): 393–415.

Galil, B. S. (2013). Going going gone: the loss of a reef building gastropod (Mollusca: Caenogastropoda: Vermetidae) in the southeast Mediterranean Sea. Zool. Middle East 59, 179–182.

Goren, M.& B.S. Galil. (2001). Fish biodiversity in the vermetid reef of Shiqmona (Israel) Marine Ecology, 22(4):369-378.

Idan, T., Shefer, S., Feldstein, T., Yahel, R., Huchon, D. and Ilan, M. (2018). Shedding light on an East-Mediterranean mesophotic sponge ground community and the regional sponge fauna. *Mediterranean Marine Science*, 0, 84-106. doi:http://dx.doi.org/10.12681/mms.13853 http://epublishing.

Safriel, U. N. (1975). The role of vermetid gastropods in the formation of Mediterranean and Atlantic reefs. Oecologia 20:85–101.

SEA (2016) http://www.energy-sea.gov.il/English-Site/PublishingImages/Pages/Forms/EditForm/Strategic%20Environmental%20Assessment%20(SEA)%20-%20English%20Summary.pdf

Segal, Y., Herut, B. and Zurel, D. (2018). IMAP implementation and «Adopt a Beach» project 2016-2018. First Report. Israel Oceanographic and Limnological Institute (IOLR) and Israel Ministry of Environmental Protection.

UNEP/MAP (2016). Integrated Monitoring and Assessment Programme of the Mediterranean Sea and coast.

UNEP(DEPI)/MED WG.444/6/Rev.1. Agenda item 3 Review of proposed IMAP Common Indicator Guidance Facts Sheets (Biodiversity and Fisheries) IMAP Common Indicator Guidance Facts Sheets (Biodiversity and Fisheries). 6th Meeting of the Ecosystem Approach Coordination Group. Athens, Greece, 11 September 2017.UNEP(DEPI)/MED IG.22/Inf.7. Integrated Monitoring and Assessment Guidance. 19th Ordinary Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols. Athens, Greece, 9-12 February 2016.

Yahel, R., Angart, N., (2012). Marine reserves as a tool in protecting the environments and diversity of the Mediterranean Sea. Nature conservation policy in the Mediterranean. Israel Nature and Parks Authority (In Hebrew).

Appendix 1. (Information from Segal et al., 2018)

IMAP implementation in Israel's National Monitoring Programme

Since 2014, Israel's Ministry of Environmental Protection (MOEP) and The Ministry for National Infrastructures, energy and water (MEWR) have been working together with the Israel Oceanographic and Limnological Research institute (IOLR) on enhancing and expanding Israel's National monitoring plan of the Mediterranean marine environment. The initiative is being supervised by the chief scientists of each of the two ministries (Dr. Sinaya Netanyahu for MOEP and Dr. Brach Halaf for MEWR) and coordinated by MOEP's marine ecologist and monitoring and research coordinator, Dr. Dror Zurel, MEWR's Earth and Marine Sciences Research Manager Dr. Einat Magal and the head of IOLR, Prof' Barak Herut.

The existing program has been running since the late 1970's and is conducted by Israel's governmental marine institute, IOLR. The Current program is insufficiently funded and consequently suffers from several deficiencies such as:

- Much of its data not being available to the public.
- Large knowledge gaps regarding many geographic and scientific aspects of Israeli waters.
- An inefficient conduct of monitoring by the different ministries and stakeholders.
- Data from compliance monitoring programs (demanded by MOEP as part of discharge permits and business licenses) are not always available to the national monitoring program or is not comparable to the national program's data due to different methods being used.
- Many of the stakeholders were not aware of or not interested in the existing monitoring program and were thus not exposed to its annual reports.

On September 8th, 2014 a first meeting of the Mediterranean governmental stakeholders was held at IOLR. In this meeting each stakeholder presented the current monitoring programs it is running in the Mediterranean waters and their requirements from an expanded National monitoring program. The meeting included representatives from the following agencies: Ministry of Environmental Protection, Ministry for National Infrastructures, energy and water, Ministry of agriculture – fisheries and aquaculture division, Ministry of health – the division in charge of public beach bacterial and pollution monitoring, Ministry of transportation –shipping and ports division, Ministry of defense - Navy, Ministry of interior – planning division, Nature and Parks Authority, Water Authority (desalination, ground water pollution), Israel Ports development and assets Company, Israel Electricity Company.

In addition, the meeting included representatives from the following academia and research institutes: IOLR, Geological institute, members of Tel Aviv and Haifa Universities, Tel Aviv University Nature Museum.

The stakeholders agreed that an enhanced national monitoring program is needed that will accommodate all their needs for marine data collection. It was agreed that the initiative will be led by the MOEP and MEWR chief scientists.

Between the first meeting and June 2015 a document with the monitoring vision, goals and aims was written by Dr. Zurel, Dr. Magal and Prof' Herut, based on the monitoring needs presented by the stakeholders. Due to the difficulty in gathering all stakeholders for a meeting, Dr. Zurel and Dr. Magal met separately with the representatives that were in the stakeholders meeting to get their comments on the first draft and their agreement on the final draft. The document included the following agreements:

1. Vision: The marine environment is maintained in good environmental status while its potential is used for the good of the country's citizens and the future generations.
2. Goals:
   a. Evaluation of the ecological state of Israel's Mediterranean waters.
   b. Establish a long-term scientific base for science-based decision making that will allow sustainable use of marine resources.
   c. Improve the status of current scientific knowledge as a strategic need.
   d. To define and map sources of geological hazards around the coastal area.
   e. To create a scientific baseline and develop operative tools for dealing with extreme incidents such as Tsunami waves or major oil spills.
3. Objectives: It is agreed that the national monitoring plan will be based on the Ecosystem Approach and on UNEP's Integrated Monitoring and Assessment Program (IMAP). The 11 ecological objectives and indicators set by UNEP are then detailed and translated to Hebrew.
4. Further objectives:
   a. To develop and maintain an open database with all monitoring data collected by the National and compliance monitoring programs.
   b. National financial support for marine data gathering infrastructure for online monitoring of parameters such as currents, waves, temperature and salinity.

c. Develop, upgrade and maintain oceanographic models such as the Medslick oil spill model.
d. National financial support for archiving and taxonomy for biological specimens.
e. Long term projects for handling knowledge gaps:
   i. Bathymetric mapping of Israel's seafloor.
   ii. Build a genetic barcoding database for species taxonomic identification.
   iii. Ecological surveys and habitat mapping.
   iv. Detection and mapping of marine geohazards.
   v. Monitoring-supporting research, including development of monitoring tools.

5. Workplan:
   a. Two committees were formed: A national committee of stakeholders and A scientific committee of 7 academic experts on marine sciences. The following experts were chosen for the scientific committee and agreed to take part in the initiative:
      1. Prof' Micha Ilan, marine biologist
      2. Prof' Menachem Goren, marine biologist
      3. Prof' Ilana Berman-Frank, marine microbiologist
      4. Prof' Boaz Lazar, Chemical oceanographer
      5. Prof' Hezi Gildor, Physical oceanographer
      6. Prof' Eliezer Kit, Marine sedimentologist.
   b. The following actions were proposed: The IOLR scientists will develop a draft proposal for an IMAP-based monitoring program. The scientific committee will comment on the draft and assist in ensuring the proposal meets with IMAP requirements and with the agreed vision, goals and aims.
   c. Once a final draft agreed upon by the scientific committee will be achieved, it will be presented to the stakeholder committee for its approval.
   d. Once the plan will be approved it will be presented to the government ministers, including the yearly budget needed for the plan. A government approval and commitment for the requested budget is needed for the enhanced National monitoring program to begin.
6. Once the program will be approved and running the scientific committee will meet once a year to review the yearly report. Their recommendations will be presented to the stakeholder committee.

Current status:

The Scientific committee met for the first time on September 1st, 2015. The project vision, goals and objectives were presented to them and they were given all the material needed for their task, including existing drafts of IMAP guidelines, previous national monitoring reports and the stakeholders meeting protocol.

It was suggested that a series of meetings will be held during which a draft program proposal will be developed.

The scientific committee met again on October 2015 for the first session of proposal development. The meeting was unsuccessful in achieving a draft. It was decided that instead of the committee meeting and preparing the draft, IOLR scientists from the existing monitoring program will develop a draft and the committee will comment on it and assist in leading it towards a final draft.

Between October 2015 and April 2016 three groups of scientists from IOLR and local universities met for long sessions aimed at developing the different chapters of the program dealing with all aspects of biology, chemistry and physical oceanography.

UNEP-funded IMAP implementation project

In 2016 UNEP signed a contract with IOLR for the IMAP implementation project.

IOLR director Prof' Barak Herut distributed the first draft of the program developed by the IOLR scientists to the scientific committee in order for them to examine the compatibility of the plan to the IMAP guidelines and is up to date with the scientific knowledge regarding their fields of expertise.

A revised draft, addressing the committee's comments, was presented to the committee in a workshop held at Tel Aviv University in December 2016, in which the committee approved that their comments have been addressed and held discussions on comments that were not addressed.

The workshop included all 6 experts of the scientific committee (see above) and the IOLR scientists in charge of the different components of the National monitoring proposal (11 people).

A final draft is currently being prepared by IOLR following the workshop.

Appendix 2. List of Habitats numbers and names according to SEA (2016).

שם בית הגידול בעברית	Habitat_na	Habitat_ID
בתיאל מצע רך	Deep Sea bed	1
מדרון היבשת	Slope	2
מדרון היבשת 60-100 מ'	Shelf 3 60-100m	3
מדרון היבשת 100-200 מ'	Shelf 4 100-200m	4
חוף חולי המשמש את צבי הים להטלה בחודשים מאי - אוגוסט	Intertidal turtle nesting	5
מדף יבשת 30-60 מ' דרום	Shelf 2S	6
מדף יבשת 30-60 מ' צפון	Shelf 2N	7
מדף יבשת 1-30 מ' דרום	Shelf 1S	8
מדף יבשת 1-30 מ' צפון	Shelf 1N	9
שונית הורמטידים	Vermitid reef	10
בוהן גלישת פלמחים	Palmachim slump toe	11
גלישת פלמחים צפון	Palmachim slump N	12
זיקים 100 מ'	Zikim 100m	13
הרצליה 100 מ'	Herzliya 100m	14
נתניה 100 מ'	Natanya 100m	15
מכמורת 100 מ'	Michmoret 100m	16
שדות ים 100 מ'	Sdot-Yam 100m	17
ג'אסר א-זרקא 100 מ'	Jisr-a-Zarka 100m	18
נחשולים 100 מ'	Nachsholim 100m	19
החותרים 100 מ'	Hahotrim 100m	20
חיא"ל 100 מ'	IOLR 100m	21
קניון אכזיב	Akhziv Canyon	22
זיקים 40 מ'	Zikim 40m	23
אשקלון 40 מ'	Ashkelon 40m	24
ניצנים 30 מ'	Nizzanim 30m	25
שורק 40 מ'	Sorek 40m	26
נטעים 40 מ'	Netaim 40m	27
תל אביב 30 מ'	Tel-Aviv 30m	28
רמת אביב 30 מ'	Ramat-Aviv 30m	29
פולג 30 מ'	Poleg 30m	30
נתניה 30 מ'	Natanya 30m	31
חדרה 40 מ'	Hadera 40m	32
קיסריה 30 מ'	Caesarea 30m	33
מעגן מיכאל 30 מ'	Maagan Michael 30m	34
חוף כרמל 30 מ'	Hof Carmel 30m	35
חוף כרמל 20 מ'	Hof Carmel 20m	36
בוסתן הגליל 40 מ'	Bustan Hagalil 40m	37
אכזיב 40 מ'	Akhziv 40m	38
רכס כורכר חופי	Coastal rock	39
חבצלת השרון 20 מ'	Havazzelet Hasharon 20m	40
רכסי מפרץ חיפה	Haifa Bay ridges	41
בליטת ראש כרמל	Rosh Carmel Spur	42
איים	Islet	43
מפרץ חיפה 60 מ'	Haifa bay 60m	44
מדרגת התשבי	Hatishby terrace	45
סלע חוף	Beach rock	46
עתלית 100 מ'	Atlit 100m	47
סלעי ראש הנקרה	Rosh Hanikra rock	48
כתמי חול על מצע סלעי צפון	Coastal sand patches	49
עמודת המים שמעל המדף	בית גידול בעמודת המים - להשל	50
אפי פלגיאל עד לעומק של 300מ' מפני המים, למעט בתי גידול 50 ו- 54	בית גידול בעמודת המים	51
מזו פלגיאל בין האפי פלגיאל לבתי פלגיאל למעט בתי גידול 50 ו- 54	בית גידול בעמודת המים	52
בתי פלגיאל 20 מ' מהקרקעית	בית גידול בעמודת המים	53
עמודת המים מעל המדרון שבין ראש הנקרה לעכו בין עומקי המים של 0-1000 מ'	בית גידול בעמודת המים	54
חוף חולי	Intertidal	55
שונית ספרטן	Spartan reef	56
מדרגת שקמונה	Shikmona terrace	57
שונית כרמל	Carmel reef	58
מדרגת חיל הים	Navy reef	59
שונית חיל הים	Navy terrace	60
אכזיב 100 מ'	Akhziv 100m	61

Stenella coeruleoalba © Massimiliano Rosso

C- MONITORING PROGRAMME FOR MARINE MAMMALS

I. INTRODUCTION

Due to their high trophic level in the marine food-web, their phylogenetic and physiological closeness to humans and their ready detectability at the water surface, marine mammals are considered useful indicators of the health of the marine ecosystem and of the changes it undergoes. 'Health' is meant in the overall sense of maintaining 'Good Environmental Status' (e.g. sensu Santos & Pierce, 2015) as well as in the narrow sense of the health of the human consumers of its resources (Bossart, 2006). As such, long-term monitoring of their conservational status, in terms of diversity, abundance, distribution, threats and wellbeing are called for (Anon, 2017).

In the summer of 1993 IMMRAC (Israel's Marine Mammal Research & Assistance Centre) began collating data on marine mammals occurring along the Mediterranean coastline, under annually renewed ordination conferred by the Israeli Nature & Parks Authority (INPA). This date also represents the start of systematic and long-term marine mammal research, precluding the assessing trends in historical perspective, as was, for example, possible for the Adriatic Sea (Bearzi et al, 2004). At first, data were obtained from beached and by-caught specimens and from anecdotal reports of at-sea encounters and from 1998, dedicated half-day surveys on a donated research & assistance boat commenced, which since 2003, are being conducted according to a standard protocol.

With the recent launch of a Marine Plan for Israel and as part of Israel's obligation under the Barcelona Convention, particularly the implementation of the Integrated Monitoring and Assessment Programme (IMAP) in the framework of the EcAp process (Decision IG22/7, COP19, 2016), there is a call to formalize the monitoring programme related to the biodiversity common indicators including marine mammals as top predators representing the wellness of the supporting food-web. A monitoring plan is also an integral part of the recently composed Israeli Marine Mammal Action Plan (Bearzi, 2017).

The principal aim of the proposed plan is to expand the existing database against which future changes may be assessed and conservation targets set and managed. Realizing the low resilience of marine mammals and that the recovery of small populations may require several decades)Magera et al, 2013), the plan will focus on allowing detection of population declines, even though their absolute abundances are unknown, in time to implement conservation measures that may restrain, halt or reverse the trend.

The plan will address continuous monitoring of fixed strata as well as dedicated monitoring in conjunction of discrete spatio-temporal events (e.g. noise intrusions), in the framework of a required environmental impact assessment (Prideaux, 2016).

II. MARINE MAMMALS IN ISRAELI MEDITERRANEAN WATERS

Since 1993 individuals or groups of 13 species, 12 cetaceans and a single pinnipede, were recorded (Table 1; Kerem et al, 2012; Scheinin et al, 2011b). Reports and museum specimens from the second half of the 20th century do not add to the list. Five cetacean species, all of them dolphins, may be regarded as regular, year-round or seasonal, residents that breed in the region.

Table 1: Marine mammal species documented along the Mediterranean coast of Israel (Bearzi, 2017; Kerem et al., 2014)

Common name	Scientific name	IUCN assessment *	Local status
Gray whale	*Eschrichtius robustus*		Vagrant/strayed
Common minke whale	*Balaenoptera acutorostrata*		Visitor
Fin whale	*Balaenoptera physalus*	Vulnerable	Visitor
Sperm whale	*Physeter macrocephalus*	Endangered	Visitor
Cuvier's beaked whale	*Ziphius cavirostris*	Data deficient	Visitor
False killer whale	*Pseudorca crassidens*		Visitor
Risso's dolphin	*Grampus griseus*	Data deficient	Regular
Indo-Pacific humpback dolphin	*Sousa plumbea*		Alien/ Lessepsian migrant
Common dolphin	*Delphinus delphis*	Endangered	Regular
Rough-toothed dolphin	*Steno bredanensis*	Not evaluated	Regular
Common bottlenose dolphin	*Tursiops truncatus*	Vulnerable	Regular
Striped dolphin	*Stenella coeruleoalba*	Vulnerable	Regular
Mediterranean monk seal	*Monachus monachus*	Endangered	Rare

*Refers to Mediterranean sub-populations of species considered regular in the Mediterranean

1. Cetaceans (Kerem et al, 2012)

Of the visitors: The two Mediterranean giants, the **fin whale** and the **sperm whale** are relatively rare. In the last two decades 9 fin whales, mostly calves and most in bad body condition were sighted, beached or came to shore alive and succumbed. Skulls and mandibles are occasionally brought up in trawl nets (IMMRAC, unpublished). The **false killer whale** and the **minke whale**, both listed as uncommon visitors to the Mediterranean, are documented rather frequently. **Cuvier's beaked whale**, an ultra-deep diver, is mainly known from strandings, males only and mostly in an advanced stage of decay. The southernmost stranding was in Tel Aviv. It seems that we are seeing drifting bodies and occasional sorties from a population to the north.

Of the regulars: The rare Mediterranean species, the **rough-toothed dolphin**, recently received a regular status, mainly on account of repeated sightings in the Levantine Basin and strandings of calves on the Israeli coast. At sea sightings were in waters deeper than 1,500 m and all but one or two records were between February and June (Kerem et al, 2016). The last record from Israel was in 2008, cause for concern.

Risso's dolphin, like Cuvier's beaked whale, resides in the deep water over the slope of the continental shelf. Most sightings in Israeli territorial waters were between March and September, off the northern section of the coast (southernmost was off Ashdod), at depths of 400-1500 m. Stranding of adults and calves, including live or very freshly dead, occurred year-round from the northern border to Ashdod. Taken together, they indicate a stable, breeding, offshore population of unknown size, the scant sightings of its members being due to insufficient search effort in deep waters.

The **striped dolphin**, the most abundant Mediterranean cetacean, is encountered from over the deep shelf out to over the abyss. Regular year-round sightings along the coast, also not south to Ashdod, along with being the second most frequent in the stranding record, point to a stable, breeding, pelagic population, also of unknown size. These two species (Risso's dolphin and Striped dolphin) are known to occur north of Israel, but not to its south. This may be the results of little search effort and/or reporting in the south or else, a real situation, with southern Israel being the southern reach of their distribution along the eastern Mediterranean coast. This issue can only be resolved by wider monitoring of the deep-sea waters of Israel, Gaza and Egypt.

The **common dolphin**, considered to be rare in the eastern Mediterranean (Anon, 2008), is lately experiencing local flourishing, with repeated year-round sightings of large groups of 15-80 individuals, including calves and newborns. Sightings are limited to the southern Israeli coastline (Brand et al, 2016). The species has not been reported within the north-eastern corner of the Mediterranean. The stranding rate is low considering the wealth of sightings (IMMRAC, unpublished). Evidence so far supports the existence of a small thriving sub-population, detached from other known ones, the southern extent of which is unknown.

The **common bottlenose dolphin** is the commonest local cetacean. As of 2014, it accounts for 80% of sightings. 60 % of the strandings and 90 % of bycatch, where species was identified. It is sighted year-round, along the entire coastline, within a strip of ca 10 km wide, with an average group size of 5-6. Groups are usually formed of mothers and calves, including newborns (Scheinin, 2010). Individuals of the species were sighted at distances of up to 30 km from the coast, at water depths of 1300 m (Kent et al, 2006), what may fit a distinct deep-water morph. The annual stranding rate is stable over the years. The species is known from Lebanon, Gaza and Egypt.

All the above speak of a resident, breeding population, stable in size estimated at 300 - 400 individuals, which most probably forms a section of a continuum extending the length of the eastern Mediterranean coast.

The **grey whale** and the **hump-backed dolphin** have been recorded but are considered to be vagrant (Scheinin et al, 2011a) and alien, respectively.

2. Pinnipedes:

The **Mediterranean monk seal** (MMS) is one of the most highly threatened and endangered marine mammals in the Mediterranean (Notarbartolo di Sciara & Kotomatas, 2016), with a fragmented sub-population totalling 300 - 400 adult animals at regional scale. Considered extinct along the eastern Mediterranean coast, during the last decade sightings were reported from Israel (Scheinin et al, 2011b) and its neighbours (Syria, Lebanon and Egypt). Starting from 2009 until the end of 2016, 66 reports were collated in Israel, mostly from Rosh Hanikrah, on the border with Lebanon (Bundone et al, 2016). Based on photo-ID analysis, at least two different individuals were involved, one being a young female, documented 4 times on 3 different years.

III. MONITORING OF MARINE MAMMALS (MM) IN MEDITERRANEAN EUROPEAN WATERS

The future of MM in the world's seas and in the Mediterranean in particular does not look rosy. Even if natural and anthropogenic-enhanced global processes such as warming, acidification and sea level rise do not pose immediate threats to most species, as top predators, any such threats to lower trophic levels are bound to jeopardize their more distant future (Gambaiani et al, 2009). In an attempt to protect the marine resources and system services on which the European socio-economic activity rests, the European Union in 2008 launched the Marine Strategy Framework Directive (MSFD) and ratified it in 2010. Legislation integrating principles of sustainable ecological … into human activities that impact the marine environment were enacted and a six-year strategic plan was developed in order to achieve Good Environmental Status (GES) by 2020. One of GES's criterions is biodiversity, with MM, a functional group with wide-ranging habitation and high trophic position, chosen to serve for an initial assessment of the marine environmental status (Santos &Pierce, 2015).

MM monitoring plans were the next step and MM in European waters were partitioned into 4 ecotypes: Mysticetes, odontocetes, pinnipedes and ice-dwelling MM. Monitoring plans address diversity, abundance/density, habitat range and anthropogenic threats to populations and habitats.

In early 2015, France adopted a MM monitoring plan for the North Sea. Celtic Sea, Bay of Biscay & western Mediterranean (Guichard et al, 2017). It is comprised of 5 sections: coastal cetaceans, coastal pinnipedes, deep-sea cetaceans, strandings and human interactions (fisheries, pollution) with an attempt to evaluate their impact on the populations. Monitoring includes aerial surveys over France's economic waters for one month in the summer, once every six years, acoustic monitoring in select sites (mainly marine protected areas) and monitoring of fisheries catch (mainly in the Atlantic) (Léa David, pers. Comm.).

Spain developed a six-year monitoring plans for regularly residing cetaceans in the Alboran. Gibraltar Straits, Bay of Vera, Balearic Islands and deep waters of the Balearic Sea. The plan is divided between coastal and deep-sea species and includes photo-ID surveys, dedicated ship-based visual and acoustic surveys, opportunistic sightings, tagging, at-sea biopsying, strandings and bycatch. More details in Santos & Pierce (2015).

Greece identified 7 marine regions in which to implement a MM monitoring program, to consist of dedicated visual and acoustic surveys from vessels, photo-ID surveys and static acoustic detectors (Alexandros Frantzis, pers. Comm.). Protocols for aerial surveys in deep water and coastal photo-ID surveys are also being developed in Italy, as part of EU directives (Leonardo Tunesi, pers. Comm.).

Members of the Barcelona Convention, concerning the management of human activity with the aim of conserving the marine system's services, decided to promote a holistic 'Ecosystem Approach' and within its framework, as regards monitoring, to adopt an 'Integrated Monitoring & Assessment Program (IMAP). In order to optimize the implementation of the latter in a unified guiding format, a list of ecological objectives signifying the achievement of GES and a list of guiding common indicators for each objective were formulated. The issue of biodiversity is in Ecological Objective 1 (EO1) and the common indicators pertaining (among others) to MM are:

- Common indicator 3 – species distributional range
- Common indicator 4 – Population abundance
- Common indicator 5 – Population demographic characteristics (age/size composition, sex ratio, reproductive indices, survival/mortality rates).

Methods used for monitoring MM are listed in Table 2 (feasibility in Israel does not include financial issues).

Table 2: Marine mammals' monitoring methods (Berrow et al., 2012; Anon, 2016)

Method	Diversity	Range	Abundance	Habitat characterization	Feasibility in Israel
Marine dedicated visual survey	+	+	++	++	+
Marine dedicated acoustic survey (PAM)	±	++	+	-	±
Aerial dedicated survey*	+	+	++	+	+
Platforms of opportunity (POP) survey	+	+	^+	+	-
Static-passive acoustic survey	-	-	^+	-	+
Photo identification survey	-		^+	-	+
Coastal watching **	±	-	^+	±	+
Tagging & tracking	-	+	-	++	+
Citizens science	±	-	^+	-	++
Stranding	++	-	^+	-	++

* Does not refer to methods in development such as drones, unmanned aerial vehicles (UAV; but see below) and satellite imagery; ** for seals; ^ trends only;

All visual methods searching for MM in the water rely on the individuals being at the surface (or, at times, in the air), mostly for breathing. Aerial surveys may detect MM below the surface, when directly overhead. Pinnipedes may also be observed on land. Dedicated acoustic surveys accompanying vessel-based visual surveys are useful for deep and long-duration divers as well as for those with distinct vocalizations. Moreover, visual surveys are limited to daylight hours and are dependent on weather and on observer proficiency, thereby being limited and prone to imprecision (Nuuttila et al, 2013). These may be overcome by use of static passive acoustic monitoring, which allows, in coastal waters, precise and inexpensive continuous tracking of the presence of voice-emitting individuals (mostly toothed whales) in the vicinity of a moored/anchored sensor.

Monitoring stranded and by-caught MM reflects on the populations living in the near and far adjoining waters, although carcasses may float large distances long-shore with currents. They provide low-cost and thorough tracing of diversity (some of the rare Mediterranean species are known only from strandings), temporal trends in abundance, both acute (unusual mortality events; ten Doeschate et al, 2017) and gradual (McFee et al, 2006), life tables and survivability (Stolen & Barlow, 2003), contaminant levels, and causes of morbidity and mortality (Bossart, 2006).

Abundance may be estimated through dedicated transect surveys using 'distance sampling' and through 'mark-recapture' photo-ID surveys in 'closed' populations (unlike in Israel). In principle, offline analysis of the playback of a UAV-mounted, high quality, stabilized camera, allows identification of all (on surface) groups within the photographed strip. The latter, however, may be rather narrow relative to an aerial survey and the number of expected sighting, may accordingly be too low for a reliable estimation.

Temporal or distributional trends in abundance may be detected, even if absolute abundance is unknown, whenever it may be assumed that the monitored value is proportional to absolute abundance (e.g. sightings per unit effort, acoustically-derived presence per unit time) and that the proportion of the population in the surveyed area is constant over time. Even when the assumptions hold, this may only be attempted when a sufficiently large database is generated by a consistent searching effort within a given area (high enough power). **Therefore, in principle, all monitoring methods except tagging** may be useful, especially when a similar trend is detected by more than one. Citizens science too, assuming if the volume of reporters is constant or increasing, may point to a declining trend. In addition to abundance, photo-ID surveys supply demographic information such as reproductive rates (e.g. Rossi et al, 2017).

IV. HISTORIC & CURRENT MM MONITORING IN ISRAEL

Monitoring is carried out by IMMRAC, along several paths:

- Coastal, half-day photo-ID surveys

  Over 700 surveys, totalling 25,000 of track-line, were performed between 1998 -2017 in the coastal Mediterranean waters. The surveys yielded 270 sightings, the vast majority of which were of common bottlenose dolphin. On the basis of these sightings, a catalogue so far containing 148 identified marked individuals has been compiled, with 52 of them re-sighted more than 4 times. A catalog of identified common dolphins is in the first stages of preparation.

  Surveys cover a coastal strip of ca 10 km, from Acko to Rosh Hanikrah in the north and from Herzliya to Ziqim in the south, at a recommended frequency of twice a month. Up till January 2017, surveys in Avtakh MPA in the south and in Rosh Hanikrah MPA in the north were made in cooperation with INPA, using their boats. From these surveys, gridded GIS heat maps of dolphin sightings, as well as other mega-fauna and trawlers, per unit effort are constructed.

- Citizens' science

  Documentation of opportunistic sightings by yachtsmen, fishers and Navy started in 1994. In the last decade, with the universal availability of smartphones, reports arrive, sometimes in real time, accompanied by photographs and/or video-clips, allowing species identification by experts, and by GPS locations, thereby constituting bona fide scientific evidence.

- Stranding

  Since 1993, 12-15 sick or dead dolphins are beached annually. IMMRAC's volunteers strive to attend to each event.

  A live stranding is attended to following consultation with INPA's head veterinarian and according to a protocol which includes options of refloating, euthanasia and in rare cases, rehabilitation attempts. Freshly dead stranding individuals are taken to the Veterinary School Anatomy Lab in Rehovot for autopsy, whereby samples for genetics, histopathology, bacteriology, virology and pollutant levels (heavy metals, in cooperation with Israel Oceanographic & Limnological Institute) are obtained. From a decayed specimen, according to the state of the carcass, external measurements, teeth for aging, photographs, samples for genetics, stomach content and in the rarer species, skulls or skeletons.

- Monitoring the MMS

  Ever since its rediscovery in Israel, IMMRAC proceeds on several plans:

  a) Compilation of country-wide reports, which are mapped and catalogued according to credibility

  b) Photographic documentation and photo-IDing of animals during sightings

  c) In the summer of 2015, a coastal survey was launched with the aim of mapping potential resting sites at coastal regions where the species was positively identified or from where credible reports were received. During the survey, several suitable caves were located and mapped, and tracking cameras were positioned in some.

- Aerial surveys with unmanned aerial vehicle (UAV)

  Since 2016, UAV surveys are conducted off Ashdod, in collaboration with Eviation Company, the Morris Kahn Marine Research Centre of the University of Haifa and the Technion, as a feasibility pilot to obtain accurate body measurements of cetaceans and sharks.

V. PROPOSITION FOR A MM MONITORING PROGRAMME FOR ISRAELI WATERS

In accord with IMAP requirements and recommendations, as per the EO1 Biodiversity objective and relevant indicators, we hereby outline a proposed National MM Monitoring Program for Israel. The program contains existing methods as well as recommended methods that so far were not implemented in a sequential manner, due to budgetary constraints. To this end, the marine space was divided into three strata, for each of which we recommend survey methods suitable to its oceanographic features, existing threats and logistic constraints (Table 3). For each stratum, routine long-term as well as event-related monitoring is described.

Table 3: Proposed stratification of monitored marine space

Stratum		Location	Relevant species	Risks
1	*Coastal area**	From coastline to the 100 m isobath	Common dolphin, common bottlenose dolphin	Fishing, construction, marine pollution, shipping noise
2	*Remote shelf and slope*	From the 100 to the 1,200 m isobath	Common bottlenose dolphin, striped dolphin, Risso's dolphin	Fishing, marine pollution, shipping noise, oil industries
3	*Abyss*	From the 1,200 m isobath to the limit of EEZ	Striped dolphin, Risso's dolphin, rough-tooth dolphin, false killer whale, Cuvier's beaked whale (?) sperm whale.	Shipping noise, oil industries. Monitoring restricted to event-specific from oil industry.

* Including coastline

1. Monitoring stratum 1

1.1. Monitoring the near coastal stratum – continuous, long-term

The near coastal stratum will be monitored using 3 main methods:

a) Half-day photo-ID coastal surveys from boats and yachts

   Aims: Detecting trends in density of coastal populations of the common bottlenose and common dolphins (common indicator 4), definition of and changes (seasonal and annual) in their distribution ranges and habitat utilization patterns (common indicator 3), demographics (common indicator 6) and fisheries interactions.

   Recommended frequency: Twice a month in each of the below-mentioned coastal sections. In sections where there is a shortage of crafts available for IMMRAC, use of INPA boats or rental of boats through other governmental funding is advised.

   - Rosh Hanikrah - Acko (shortage of crafts)
   - Haifa Bay - (shortage of crafts)
   - Rosh-Carmel - Netanya (with INPA)
   - Netanya - Tel Aviv (with Sea-Gal sailing club and other private yachts)
   - Palmachim - Nitzanim (with Ort Yami School, Ashdod)
   - Nitzanim - Ziqim (with INPA)

It should be noted that surveys in the Rosh Hanikrah - Acko section between November 2007 and January 2017 revealed a substantial drop in sighting frequency, starting in 2013. Between November 2997 and December 2012, there were 0.27 sightings per survey (n=48), while between January 2013 and March 2017 the rate dropped to 0.06 sightings per survey (n-16).

Regular surveys in this section should be reinstituted swiftly so that this trend may be followed and if persistent, its causes sought out.

b) Static passive acoustic monitoring at select coastal sites

This will complement the visual surveys, at known or suspected foci of dolphin and/or anthropogenic activity, by providing long-term 24 h documentation.

Aims: Detection of diel, seasonal and annual trends in density/abundance of the two coastal species (common indicator 4) as well as in response to human interference.

Frequency: Sensors will be deployed for at least one year and continuation will be evaluated one year at a time.

Recommended localities: Six sites, spread along the coast: Haifa and Ashdod Ports (construction), the ShafDan sewage output (eutrophication), the vicinity of fish-farms off Michmoret & Ashdod (attractors) and the entrance to Akhziv's Canyon's eastern channel (past known high-density site).

Method: There are several acoustic sensors in the market for static MM monitoring, with a detection range of between several hundred meters and 3 km, dependent on geographic features and background noise (Dähne et al, 2013; Nuuttila et al, 2013).

Most of them record frequencies between 20 and 200 kHz and several have dedicated software to identify clicks and whistles, sometimes to species, as per manufacturer's specifications. Quantification is in time units of presence (e.g. minutes per hour, day, month), rather than number of individuals. Recently, use has been made of C-Pod sensors in Israel, in a long-term monitoring research on CBD in Haifa Bay by IMMRAC and Israel Ports Company (Zuriel et al, 2016).

Technical details of various sensors can be found in:

C-POD – Cetacean Porpoise Detector, Chelonia Ltd. - www.chelonia.demon.ac.uk

SoundTrap - http://www.oceaninstruments.co.nz/

icListen HF with Reson Sensors - http://oceansonics.com/iclisten-smart-hydrophones/

Song meter SM4M - https://www.wildlifeacoustics.com/products/song-meter-sm4m.

c) Stranding

Aims: Demographic characterization of cetacean populations off Israel's (and neighbouring) coast(s): size/age/sex distributions, survival and mortality tables (common indicator 5); Establishing baseline values for seasonal and annual variance in stranding rate as estimates of density/abundance of the two coastal species and detecting significant short and long-term deviations thereof in a timely manner (common indicator 4); Evaluating nutritional state, pollutant levels & morbidity and mortality causes.

Frequency: Continuous, per event, as ongoing.

During 2015-2016, only 10 out of 25 stranded dolphins were attended to, due to shortage of funding and manpower. The timely arrival (before disposal by sanitation authorities) to each and every stranding should be ensured.

Method: We will follow a recent stranding protocol (Mazzariol, 2016), presented and acceded during the last Meeting of the Parties of ACCOBAMS, with some modifications as applicable to local conditions, facilities, etc.

1.2. Monitoring the near coastal stratum - event-related

Aims: Ensuring reversibility of acute changes in distribution in response to anthropic intervention.

Frequency: Per event. Whenever a localized, long-lasting loud noise or other anthropogenic intrusion suspected to impact species' distribution is planned, monitoring through visual or static passive acoustic means would be performed. Monitoring would commence pre-deployment, in the framework of an EIA by the contractor, during deployment, and if changes occur (i.e. ousting), post deployment until original occupation is restored.

2. Monitoring stratum 2

2.1. Monitoring the remote shelf & slope – continuous, long-term

The proximity of the 1,200-m isobath, representing the approximate edge of the slope to the coastline increases from south to north. The 30 NM limit is chosen, even if the depth is not reached in the south, as being the furthest allowed nautical distance not requiring a passport.

This stratum may be monitored by several methods:

a) Dedicated ship-based visual survey

Multiday systematic population survey.

Aims: Evaluating the distribution range of relevant species (common indicator 3) and estimating abundance or trends in abundance (common indicator 4).

Recommended frequency: 12 survey days during 3 consecutive weeks, once every 3-5 years.

Method: The ship sails west in a 'saw-tooth' transect pattern to the edge of the slope or the 30 NM limit. The bases of the 'teeth' are roughly 14 km long, calculated such that with each 'tooth' being covered for one day, the coastline would be covered in 12 days.

MM observed along the transects are documented by distance sampling (Kent et al, 2006). This method is prevalent in most Mediterranean countries and deployed routinely for population abundance estimation.

b) Dedicated aerial visual survey

Multi-day systematic population survey

Aims: Evaluating the distribution range of relevant species (common indicator 3) and estimating abundance or trends in abundance (common indicator 4).

Recommended frequency: Two survey days, twice a year, during peak low and high temperatures in the cold and warm seasons, respectively.

Method: Protocols basically follow those of SCANS II in the north Atlantic and North Sea and those of Blue World Institution of Marine Research & Conservation & ISPRA, in the Adriatic. Due to the lack of suitable aircraft and experienced trained observers in Israel and the high costs of chartering a plane and crew, we propose to employ the ORCA UMV for this purpose. The UNV will be flown along rectangular transects, perpendicular to expected long-shore movements and parallel to density gradients and species distribution patterns that are dependent on closeness to the shore/water depth. The proposed distance between the parallel transects, that will extend 24 NM from the shoreline, will be 10 km amounting to 17 transects along the coast. Image analysis will be performed in the lab, with the assumption that all groups within the camera's angle will be detected and identified. With this method, distance sampling is unnecessary, however allowance must be made for unavailability at the surface (species specific according to typical dive duration) and corrected for.

2.2. Monitoring the remote shelf & slope – event-related

Aim: Ensuring reversibility of acute changes in distribution in response to anthropic intervention.

Frequency: Per event.

Method: Whenever a localized long-lasting loud noise, such as related to oil/gas exploitation or other anthropogenic intrusion, suspected to affect species' distribution is planned, monitoring through visual or static passive acoustic means would be performed. Monitoring would commence pre-deployment, in the framework of an EIA by the contractor, during deployment, and if changes occur (i.e. ousting), post deployment until original occupation is restored.

Since in most of this stratum, the bottom would be too deep for mooring by diving (as is the case for the C-POD), the static passive acoustic monitoring will be performed by a deep water releasable sensor (Pop-Up), such as the AMAR G3 (JASCO Applied Sciences; www.jasco.com). The sensor can differentiate some species, and it also records the seismic sounds (Kowarski et al, 2017).

3. Monitoring stratum 3

a) Monitoring the abyssal stratum – event-related only

The major threat to MM in this space is noise interference, related to the gas industry.

The Ministry of Infrastructure, Energy & Water recently circulated for public comments environmental directives for the conduction of marine seismic surveys, adopted from existing international protocols and aimed at reducing potential harm to MM and sea turtles from noise introduction during activity. The issue of monitoring distribution pre, during and post the noisy phase, in order to obtain baseline values and then to follow the time course of changes, if any, such as were recently mandated by the Italian Environmental Impact Assessment Commission (Fossati et al, 2017), as yet has not received consideration in Israel.

Aims: Ensuring reversibility of acute changes in distribution in response to anthropic intervention.

Frequency: Per event.

Method: With a deep-water detachable sensor, as in the remote shelf and slope stratum.

4. Selective monitoring of endangered species

a) Common dolphin

As of today, groups of this species were sighted between Herzliya and Ashqelon, within a narrow coastal strip. Mean group size is important for determining density. Group sizes of this species (possibly aggregated by availability of schooling fish) may reach several scores, making counting difficult from small crafts and confounding estimations. Conversely, aerial photography is useful in such circumstances, by being able to capture a large portion of the population during a single survey or even a single transect.

Aim: Closer, dedicated monitoring of the spatially restricted common dolphin population, defining general and seasonal distribution range (common indicator 3) abundance (common indicator 4) and body measurements (common indicator 5).

Frequency: One survey day, twice a month

Method: In the case of the common dolphin, transect lengths will be 3 NM and transects will be placed 2 km apart.

b) Mediterranean monk seal

The MMS has reoccurred here after a long absence. Repeated sightings of a marked female were reported. The possibility that the species is re-extending its range and that this flagship species will be added to the list of local top predators has profound ecological and conservational implications.

Aims: Following the presence of MMS individuals along the coast, obtaining photographic identification and evaluating protective means that would encourage re-habitation.

Methods:

i. In instances of real-time sighting reports, arrival of experienced and expert observer on site to document behaviour and obtain photo-identification, all this until visual contact is lost.

ii. Continuation of long-term infra-red photography by fixed cameras at 3 recommended sites (two caves within Rosh Hanikrah caverns and one on Nahali'eli Island).

iii. Continuation of the mapping of potential resting sites in areas identified during the summer 2015 survey.

5. Annual summary report

A report summarizing monitoring data, including secondary analyses, will be submitted to INPA by 3 months after the end of each calendar year.

VI. PROPOSED BUDGET

Stratum	Monitoring component	details	Inclusive budget ($)	Financed budget ($)	Requested budget ($)
Coastal space	*Visual survey - boat*	Surveyor + boat	Surveyor & boat x 2 days a month x 6 grid cells	Surveyor & boat x 2 days a month 2 grid cells	Ranger & boat x 2 days a month x 4 grid cells
	Acoustic survey	6 acoustic detectors	24,000-79,000 According to the chosen detector		24,000-79,000
	Stranding – fresh specimen	Transporting, PM autopsy, sampling & analyzing	6 animals a year x 605 = 3,630		6 animals a year x 605 = 3,630
	Stranding – decayed specimen	Surveyor in the field + sampling equipment	9 animals a year x 160 = 1,440	6 animals a year x 160 = 960	3 animals a year x160 = 480
Remote shelf & slope	Visual survey - Ship	12 days survey along the Israeli coast	12 days x 3,820 per day = 45,840		45,840
	Aerial survey	4 days a year + Information processing	4 x 8,420 + 3,950 = 37,630	7,630 (university of Haifa)	30,000
Abyss	Acoustic Survey	AMAR G3 acoustic recorder	80,000		80,000

Stratum	Monitoring component	details	Inclusive budget ($)	Financed budget ($)	Requested budget ($)
Endangered species monitoring	Common dolphin monitoring	6 days a year + Information processing	6 x 8,420 + 3,950 = 54,480	7,630 (University of Haifa)	46,850
	Mediterranean monk seal monitoring	Observer in the field when a seal is sighted x 1-2 days a year (estimate)	260	130	130
	IR trail cameras in order to detect monk seal presence in coves	3 cameras, 785-3G-12M, IP67 + housing	3,080 + 3,950 = 7,030		7,030
	Conclusion of monk seal potential habitat survey	4 days of survey + mapping	4 days x surveyor and a boat + mapping	2 days x surveyor and a boat	2 days x surveyor and a boat + mapping
Summary		Annual report (Hebrew)	1,850		1,850

References

Anon. 2008. IUCN red list of threatened species, www.iucnredlist.org/mammals.

Anon. 2016. Monitoring guidelines to assess cetaceans' distributional range, population abundance and population demographic characteristics. Pp. 297-305 in: Report of the sixth meeting of the parties to ACCOBAMS, Monaco, 22-25 November 2016 (Document 37/Annex 12/Resolution 6.13).

Anon. 2017. Draft of common indicator factsheets for Biodiversity (EO1), NIS (EO2) and Fisheries (EO3). Meeting of the Correspondence Group on Monitoring (CORMON), Biodiversity and Fisheries Madrid, Spain, 28th February – 1st March 2017.

Bearzi G., Holcer D., Notarbartolo di Sciara G. 2004. The role of historical dolphin takes and habitat degradation in shaping the present status of northern Adriatic cetaceans. Aquatic Conservation: Marine & Freshwater Ecosystems 14: 363–379.

Bearzi G. 2017. Action Plan for Marine Mammals in Israel, 2017–2020. Israel Marine Mammal Research & Assistance Center (IMMRAC). 96 pp.

Berrow S., McGrath D., O'Brien J., O'Connor I. Wall D. 2012. How can we monitor the favourable conservation status of cetaceans (whales, dolphins and porpoises) in Ireland? In: Butler, F. and Kelleher, C. (eds) All-Ireland Mammal Symposium 2009: 23-30. Irish Naturalists' Journal, Belfast.

Bossart G. 2006. Marine mammals as sentinel species for oceans & human health. Oceanography 19: 134-137.

Bundone L., Roditi-Elasar M., Goffman O., Scheinin A.P., Kerem D. 2016. Monk seal sightings, identification and habitat survey in Israel. 30th Annual Conference of the European Cetacean Society, Madeira, 14-16 March 2016.

Brand D., Edelist D., Goffman O., Hadar N, Kerem D., Scheinin A. 2016. Common dolphins, common in neritic waters off southern Israel, demonstrate uncommon dietary habits. Report of the 1st international workshop on the conservation and research networking of short-beaked common dolphin (Delphinus delphis) in the Mediterranean Sea. Ischia Island, Italy, 13-15 April 2016.

Dähne M, Gilles A, Lucke K, Peschko V, Adler S, Krügel K, Sundermeyer J, Siebert U. 2013. Effects of pile-driving on harbour porpoises (Phocoena phocoena) at the first offshore wind farm in Germany. Environ. Res. Lett. 8, 1-17.

Fossati C., Mussi B., Tizzi R., Pavan G. Pace D.S. 2017. Italy introduces pre and post operation monitoring phases for offshore seismic exploration activities. Marine Pollution Bulletin. https://doi.org/10.1016/j.marpolbul.2017.05.017

Gambaiani D.D., Mayol P. Isaac S.J. Simmonds M.P. 2009. Potential impacts of climate change and greenhouse gas emissions on Mediterranean marine ecosystems and cetaceans. Journal of the Marine Biological Association of the United Kingdom 89: 179-201.

Guichard B., Authier M., Spitz J. 2017. The French MSFD monitoring program and evaluation of good environmental status for marine mammals. 31st Annual Conference of the European Cetacean Society, Denmark, 29 April – 3 May 2017.

Kent R., Scheinin A.P., Kerem D. 2006. Preliminary results of the first dedicated multi-day cetacean survey over the Israeli Mediterranean continental shelf and adjacent waters. 3rd Ann. Meeting of the Israeli Association for Aquatic Sciences. May 2006, Haifa, Israel.

Kerem D., Hadar N., Goffman O., Scheinin A., Kent R., Boisseau O., Schattner U. 2012. Update on the cetacean fauna of the Mediterranean Levantine basin. The Open Marine Biology Journal 6(1): 6-27.

Kerem D., Goffman O., Scheinin A., Elasar M., Hadar N., Edelist D. 2014. Report on the status of small cetaceans in Israeli Mediterranean waters. Report SC/65b/SM09, Meeting of the IWC Scientific Committee, Bled, Slovenia, 12-24 May 2014. 17 pp.

Kerem D., Goffman O., Elasar M., Hadar N., Scheinin A., Lewis T. 2016. The rough-toothed dolphin, Steno bredanensis, in the eastern Mediterranean Sea: a relict population? pp. 233-258 in: Mediterranean Marine Mammal Ecology and Conservation (G. Notarbartolo di Sciara, M. Podestà and B.E. Curry, eds). Advances in Marine Biology 75, Academic Press, Oxford.

Kowarski K., Delarue J., Martin B., O'Brien J., Meade R., Berrow S. 2017. Beaked whales off western Ireland. Poster presented at the 31st meeting of the ECS, 29 April – 3 May. Middlefart, Denmark.

Lavigne D.M. 2003. Marine mammals and fisheries: the role of science in the culling debate. Pp. 31-47 in: Gales N., Hindell M., Kirkwood R. (eds) Marine Mammals: fisheries, tourism and management issues. Csiro Publishing, Collingwood

Magera A.M., Mills Flemming, J.E., Kaschner, K., Christensen, L.B. and Lotze, H.K. 2013. Recovery trends in marine mammal populations. PLoS ONE 8, e77908.

Mazzariol S. 2016. Annex 1: common definitions of terms related to stranding events; Annex 2: common best practices for a basic post-mortem examination of stranded cetaceans; Annex 3: common data collection for alive strandings. Pp. 367-416 in: Report of the sixth meeting of the parties to ACCOBAMS, Monaco, 22-25 November, 2016. Doc37/Annex12/Resolution 6.22.

Mcfee W.E., Hopkins-Murphy S.R., Schwacke L.H. 2006. Trends in bottlenose dolphin (Tursiops truncatus) strandings in South Carolina, USA, 1997-2003: implications for the Southern North Carolina and South Carolina Management Units. Journal of Cetacean Research & Management 8:195–201.

Notarbartolo di Sciara G. Kotomatas, S. 2016. Are Mediterranean monk seals, Monachus Monachus, being Left to save themselves from extinction? pp. 359-386 in: Mediterranean Marine Mammal Ecology and Conservation (G. Notarbartolo di Sciara, M. Podestà and B.E. Curry, eds). Advances in Marine Biology 75, Academic Press, Oxford.

Nuuttila HK, Thomas L, Hiddink JG, Meier R, Turner JR, Bennell JD, Tregenza NGC, Evans PGH. 2013. Acoustic detection probability of bottlenose dolphins, Tursiops truncatus, with static acoustic dataloggers in Cardigan Bay, Wales. The Journal of the Acoustical Society of America 134, 2596-2609

Prideaux G. 2016. CMS family environmental impact assessment guidelines for marine noise-generating activities, Convention on Migratory Species of Wild Animals, Bonn.

Rossi A., Scordamaglia E., Bellingeri M., Gnone G., Nuti S., Salvioli F., Manfredi P. Santangelo G. 2017. Demography of the bottlenose dolphin Tursiops truncatus (Mammalia: Delphinidae) in the Eastern Ligurian Sea (NW Mediterranean): quantification of female reproductive parameters, The European Zoological Journal 84: 294-302.

Santos M.B., Pierce G.J. 2015. Marine mammals and good environmental status: science, policy and society; challenges and opportunities. Hydrobiologia 750: 13-41.

Scheinin A. 2010. The population of bottlenose dolphins (Tursiops truncatus), bottom trawl catch trends and the interaction between the two along the Mediterranean continental shelf of Israel. Ph.D. thesis, University of Haifa, Israel. 142 pp.

Scheinin A.P., Kerem D., Macleod C.D., Gazo M., Chicote C.A., Castellote M. 2011a. Gray whale (Eschrichtius robustus) in the Mediterranean Sea: anomalous event or early sign of climate-driven distribution change? Marine Biodiversity Records 4, e28. DOI: 10.1017/S1755267211000042, 5 pp.

Scheinin A.P., Goffman O., Elasar M., Perelberg A., Kerem D.H. 2011b. Mediterranean monk seal (Monachus monachus) resighted along the Israeli coastline after more than half a century. Aquatic Mammals 37: 241-242.

Stolen MK, Barlow J. 2003. A model life table for bottlenose dolphins (Tursiops truncatus) from the Indian River Lagoon system, Florida, U.S.A. Marine Mammal Science 19: 630–649.

ten Doeschate, M.T.I., Brownlow, A.C., Davison, N. J and Thompson, P.M. 2017. Dead useful; methods for quantifying baseline variability in stranding rates to improve the ecological value of the stranding's record as a monitoring tool. Journal of the Marine Biological Association of the United Kingdom xxx; doi: 10.1017/S0025315417000698. 5 pp.

Zuriel Y., Kerem D., Scheinin A. 2016. Long-term passive acoustic monitoring of bottlenose dolphins (Tursiops truncatus) in Haifa Bay. Environmental report on the influence of sub-marine noise from Haifa port expanding on marine mammals. IMMRAC, April 2016. 19 pp. (in Hebrew).

Caretta caretta © SPA/RAC, Artescienza

D- Monitoring programme for sea turtles

I. BACKGROUND

Turtles are an ancient group of reptiles which, like the marine mammals such as dolphins, seals and whales, have «reversed» their evolution and returned to the sea. Sea turtles are adapted to live in the ocean, with some unique features that help them to survive in the marine environment. As reptiles, they require air to breathe and land to lay their eggs. However, most of their lives are spent underwater. Sea turtles appear to exhibit migratory behaviour at different times in their lives. Reproductive migrations between feeding grounds and nesting beaches are the best documented because of the ease of tagging adult females on nesting beaches. Journeys spanning many thousands of kilometres are known to occur. The seasonal movements of sea turtles in search of food may also be considered as migrations (Eckert et al., 1999).

1. Species of interest

Three species of sea turtles frequent The Mediterranean: The leatherback turtle Dermochelys coriacea, the green turtle Chelonia mydas and the loggerhead turtle Caretta caretta. Only the last two breeds in the basin and their Mediterranean populations have only a limited gene flow with those of the Atlantic (Casale and Margaritoulis, 2010). *Caretta caretta* is more widespread in the Mediterranean and its diet is composed of Molluscs, Crustaceans, Jellyfish and fish (Pritchard and Mortimer 1999). *Chelonia mydas* is less abundant and its diet changes over time: The juveniles are omnivores and the adults are feeding on algae and seaweeds (Pritchard and Mortimer 1999).

- Green turtles frequent mostly the Levantine basin (Turkey, Syria, Cyprus, Lebanon, Israel and Egypt) as well as having foraging areas in Greece and Libya (Casale and Margarituolis, 2010). The Mediterranean green turtle population represents an independent RMU (Wallace et al. 2010). So far, there are no data in support of genetic structuring within this RMU, in spite of the fact that the species shows one of the highest levels of female philopatry among turtles (see Casale et al., 2018). The genetic divergence of Chelonia mydas and its isolation from the Atlantic populations (Encalada et al., 1996), requires specific attention and conservation initiatives in order to safeguard the presence of this species in the Mediterranean (WWF, 2005).
- Loggerhead turtles practically occur in all marine areas of the Mediterranean and they belong to 3 independent RMUs (Wallace et al. 2010): the Mediterranean, the northwest Atlantic and the northeast Atlantic (Monzón-Argüello et al. 2010, Wallace et al. 2010). Only individuals from the Mediterranean RMU breed in the region (Casale et al., 2018).

The Mediterranean Sea is also frequented by turtles originating from Atlantic rookeries, including limited number of leatherback turtles *Dermochelys coriacea* and green, olive ridley *Lepidochelys olivacea* and Kemp's ridley turtles *L. kempii* (see Casale et al., 2018).

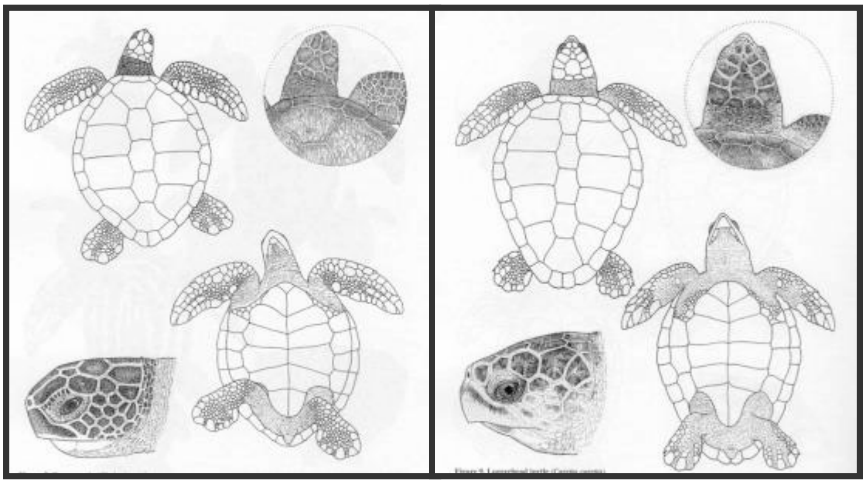

Fig. 1. On the left side: *Chelonia mydas* – The green sea turtle.
On the right side: *Caretta caretta* – The Loggerhead/Brown sea turtle (Eckert et al., 1999)

According to a recent review dealing with current knowledge regarding Mediterranean Sea turtles (Casale et al., 2018), the marine area of Israel was found to serve as a neritic foraging and wintering zone for both species of sea turtles (see Fig. 2).

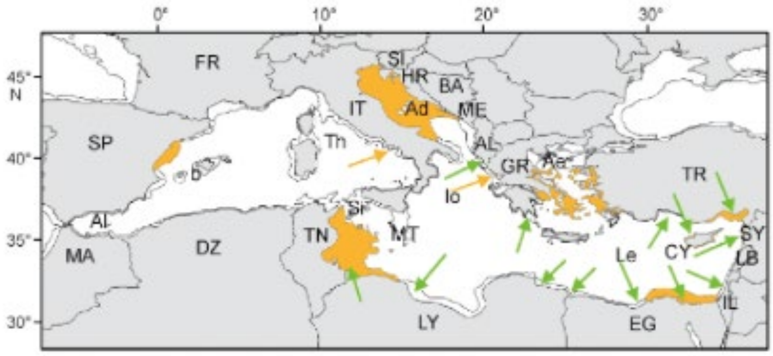

Fig. 2. Neritic foraging and wintering sites for loggerhead turtles *Caretta caretta* (orange areas and arrows) and green turtles *Chelonia mydas* (green arrows). Neritic areas correspond to the continental shelves, which are conventionally delimited by the 200 m isobath (solid line) (Casale et al., 2018)

2. Reproduction

In the Mediterranean Sea, loggerheads breed mainly in the eastern basin, while green turtles restrict their reproduction area to the Levant basin alone (Casale 2011, Levy et al. 2015). Nesting populations of the loggerhead turtles are well structured, due to female philopatry (Casale et al., 2018). The nesting season occurs from mid-May to the beginning of August, peaking between June and the middle of July (Levy, 2005, Levy et al. 2015), simultaneously with the neighbouring Mediterranean nesting sites (Casale & Margaritoulis 2010, Schofield et al. 2013). During the breeding season the females lay on average 3 times, every two weeks. In Loggerheads the eggs are laid in chambers about 30-50 cm deep while Green turtles lay their eggs deeper, at about 50-80 cm. In turtles sex determination is dependent on the incubation temperature. Incubation at 29° - 30° C results in half the hatchlings being male and the other half female. Lower temperatures result in male hatchlings.

3. Threats

- Fishing: Exploitation of turtles in the Mediterranean, from the 1920s to the 1970s, has decimated turtle populations. Tens of thousands of turtles, mainly green turtles, were shipped from the north-eastern Mediterranean, to Egypt, where there was a market for them, and to Europe where there was great demand for turtle soup. Today, the intentional capture of marine turtles is illegal, but turtles are still frequently caught by the fishing industry as bycatch, leading to extremely high mortality rates (Levy et al. 2015). The Mediterranean Sea is considered to have the highest fishery bycatch rates in the world (Wallace et al. 2010, 2011, Casale, 2011), and the south-eastern Mediterranean Sea (also known as the Levant basin) has the highest sea turtle mortality rate in the Mediterranean (more than 1 stranded turtle per km; Levy et al. 2015), leaving the regional turtle population at a high risk of extinction. In 2010, only around 100 nests of loggerhead and green turtles were reported annually from each of the countries Syria, Lebanon, Israel and Egypt (Casale & Margaritoulis 2010). Nowadays, in Israel, the number of nests has doubled (Israel Nature and Parks Authority unpubl. data).
- Beach alteration and tourism: Coastal development is largely the result of recreational/tourist activity and is associated with the presence of hotel resorts and other tourism-related constructions such as restaurants, bars, houses and other businesses typically built along the beach, impacting the original coastline in several ways and reduce the number of potential nesting grounds (Casale et al., 2018). Coastal development is also associated with activities that have an impact on sea turtle nesting activity. Driving on the beach and the use of heavy machinery for beach cleaning purposes are common practices and are responsible for alterations in sand characteristics and the destruction of turtle clutches.
- Marine debris and pollution: Sea turtles can ingest or become entangled in anthropogenic debris. Entanglement has been reported as an important stranding cause in the Mediterranean, in contrast to ingestion (Tomás et al. 2008, Casale et al. 2010a). Studies on marine debris ingestion by sea turtles in the Mediterranean have been reviewed by Casale et al. (2016). Debris in gut contents or faeces of sea turtles has been reported in the western, south-central, Adriatic and eastern basins (see Casale et al., 2018).
- Climate change: Temperature profiles of monitored nesting beaches in the eastern Mediterranean imply female-biased sex ratios for hatchlings (Casale et al. 2000, Godley et al. 2001a,b, Kaska et al. 2006,

Zbinden et al. 2007a, Katselidis et al. 2012, Fuller et al. 2013). In a context of global warming, even more female biased hatchling sex ratios may be produced. However, extremely skewed sex ratios resulting from a moderate increase in incubation temperature may not necessarily be negative for the population dynamics; however, a greater threat is represented by a reduced hatching success at higher temperatures (see Casale et al., 2018).

4. International Protection measures

- Both Green and Loggerhead turtles have been declared by the World Conservation Union (IUCN) as Endangered. Obviously, the Green turtle in the Mediterranean is more endangered due to its smaller population.
- Both species are protected under the Council of Europe's Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention).
- They are also protected under the Barcelona Convention (UNEP) and an Action Plan for their conservation has been approved by Mediterranean States within the Mediterranean Action Plan (MAP).
- The Convention on Migratory Species (CMS) and the CITES Convention also protect turtles.
- The European Union has listed both species as Priority Species for conservation in the Annexes of the Habitats Directive.
- Most Mediterranean countries have now legislation protecting turtles (Cyprus turtle conservation, 2011).
- In Israel Sea turtles have been declared as a wildlife protected species by law (National parks and Nature reserves law 1998). Moreover, Sea turtles are also protected by the Wildlife conservation law (1955) and by sea turtle fishing restriction (1963).

5. The Israel Sea Turtle Rescue Centre

In 1999, the Israel Nature and Parks Authority established the Israeli Sea Turtle Rescue Centre in temporary quarters at the Mevo'ot Yam marine boarding school in Mikhmoret.

The centre's vision:

- Treatment, conservation and rehabilitation of sea turtles in the eastern Mediterranean.
- Increasing public awareness of the damage to the marine environment in Israel and the importance of conservation and working to correct the situation.
- Protection of the marine and coastal environment and the statutory declaration of coastal and marine areas as marine reserves.
- Transforming the centre into a regional and international centre for the treatment, rehabilitation and study of sea turtles.

The centre was established as a temporary facility to provide emergency treatment for injured sea turtles but has expanded its activities since then.

A New facility is being built these days at the Alexander Stream National Park. The new centre will encompass an area of approximately 1.5 dunams (about 0.4 acres), approximately 300 meters from the beach, on the banks of the Alexander Stream. The plan for the new centre includes 300 square meters of buildings, a treatment compound, treatment pools, two breeding pools with an artificial nesting beach where the turtles can nest naturally, a visitor centre and a maintenance compound. The Israel Sea Turtle Rescue Centre treats 50 to 80 injured sea turtles every year (unpubl. data), most of them suffering from fishing related injuries, and also documents more than 200 sightings of stranded sea turtles annually (Levy et al. 2015). Carapace length distribution of sea turtles, documented by the Israel Nature and Parks Authority, reveals that this area serves both young and adult turtles (unpubl. data). Efforts to protect the local and transient population include the declaration of several marine reserves (some are still under the legislative process), a long-term nest relocation program, and a rescue centre that treats wounded turtles and holds green turtles for breeding to increase the number of hatchlings released. The centre also conducts research and works to increase public awareness through tours, volunteering opportunities and media engagement. (http://inhf.org.il/nature/sea-turtles-rescue-center-project/).

According to the recently published Annual report, 13,000 sea turtles hatched along Israel's coastline in 2018, making it a record-breaking year for the reptile's reproduction in the country (Rinat, 2019). The annual report also shows 275 dead sea turtles were washed up on Israeli shores during the past year. 121 injured turtles were provided with medical attention and 64 released back to their natural habitat. The rescue centre said injuries are mainly caused by sea turtle getting entangled in plastic waste and fishing equipment (Rinat, 2019).

6. Integrated Monitoring and Assessment Programme (IMAP)

Monitoring and assessment of the sea and coast based on scientific knowledge, is the essential basis for the management of human activities, in order to achieve sustainable use of the seas and coasts and conserving marine ecosystems. 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 (UNEP/MAP, 2016)

IMAP, through Decision IG.22/7 lays down the principles for an integrated monitoring, which will, for the first time, monitor biodiversity and non-indigenous species, pollution and marine litter, coast and hydrography in an integrated manner. As such, IMAP aims to facilitate the implementation of article 12 of the Barcelona Convention and several other monitoring related provisions under different Protocols with the main objective to assess GES. Its backbone are the 11 Ecological Objectives and their 27 common indicators as presented in Decision IG. 22/7.

In line with the above, guidance factsheets have been developed for each Common Indicator to ensure coherent monitoring, with specific targets defined and agreed in order to deliver the achievement of Good Environmental Status (GES) and as such, provide concrete guidance and references to Contracting Parties to support implementation of their revised national monitoring programs towards the overall goal of implementing the Ecosystem Approach (EcAp) in the Mediterranean Sea and achieve GES (UNEP(DEPI)/MED WG.444/6/Rev.1).

7. IMAP common principles and structure

The overarching principles guiding the development of the IMAP include:

- adequacy;
- coordination and coherence;
- data architecture and interoperability based on common parameters;
- concept of adaptive monitoring;
- risk-based approach to monitoring and assessment.
- the precautionary principle, in addition to the overall aim of integration.

Data gathering: 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. Information system: The IMAP information system will ensure the establishment of the regional pool of data based on Shared Environmental Information System (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 (UNEP/MAP, 2016).

In order for the IMAP to fulfil its goals, a crucial element will be the possibility to share information between the contracting parties. Therefore, a successful IMAP implementation will also rely on the application of Shared Environmental Information System (SEIS) principles, both at national and regional level, and on the development of an IMAP-compatible Integrated Data and Information System within UNEP/MAP. Equally important will be the further cooperation between countries, but also at regional level, with key partners such as the General Fisheries Commission for the Mediterranean (GFCM) and the Secretariat of the Agreement on the Conservation of Cetaceans of the Black Sea, Mediterranean Sea and contiguous Atlantic area (ACCOBAMS).

8. The common indicators (UNEP(DEPI)/MED IG.22/Inf.7)

In line with the recommendations of the Integrated EcAp Correspondence Group on Good Environmental Status (GES) and Targets Meeting (UNEP(DEPI)/MED WG.390/4), 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, but 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 and coastal ecosystem and can deliver valuable information to decision makers. The Common indicators related to marine turtles are:

- 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);

9. UNEP/MAP-SPA/RAC recommendations for long term monitoring programmes for marine turtles nesting beaches, feeding and wintering areas

This Guideline presented in the document (UNEP(DEPI)/MED WG.431/Inf.4) describes and suggests improvement on the methodology for the long-term standardized collection and assimilation of data on adult and juvenile loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtles at nesting, foraging and wintering areas throughout the Mediterranean. In particular, it suggests

(i) standardized monitoring techniques for establishing the current distribution of nesting, wintering and feeding areas in parallel to detecting shifts in distribution over time and

(ii) standardized monitoring techniques for establishing the population size of selected nesting, wintering and feeding areas, along with proposed selection criteria to assimilate a representative cross-section of sites nationally based on the provisions of the UNEP(DEPI)/MED IG.22/Inf.7, the IMAP and the Common Indicators factsheets. The combined use of a variety of assessment techniques is suggested to facilitate demographic analyses, which should be covered in the '*Standardization of methodologies to estimate demographic parameters for population dynamics analysis, such as population modelling*'.

Due to the different financial, personnel, equipment and National Security status of the countries bordering the Mediterranean, the document has been structured to suggest

(1) essential baseline information for collection throughout all countries and

(2) additional information for collection at a network of sites with different characteristics to enhance demographic models and the assessment of key pressures to sea turtles. It is essential to obtain a broad understanding of the current distribution and numbers of sea turtles across all sites to record future shifts in response to changes in anthropogenic pressure, including climate change.

10. UNEP/MAP-SPA/RAC key suggestions regarding sea turtles monitoring

The below recommendations support and expand on those suggested by the Demography Working Group (2015):

1. Standardized 5-yearly aerial surveys (plane, unmanned aerial vehicles [UAV]) throughout the Mediterranean for the delineation of all sandy beaches and those used for nesting, with calibration by ground surveys.
2. Maintenance of ongoing beach monitoring projects and expansion to other areas based on the above-mentioned recommendation.
3. Improved estimates of female numbers, to also include male numbers, for operational and adult sex ratio predictions and demographic assessments, including reproductive longevity, remigration intervals and clutch frequency information.
4. Improved monitoring of existing sites to link females to their nests and offspring output within and across years, including fitness and health predictions.
5. Standardized 5-yearly aerial surveys (plane, UAV or satellite imagery) throughout the Mediterranean across all marine and coastal areas (in combination with cetacean surveys) to delineate key foraging and wintering areas of adults and juveniles.
6. Year-round aerial and boat surveys of focal foraging habitats throughout the year to delineate population structure and demography.
7. Satellite tracking (combined with genetics and stable isotope sampling for validation of non-tracked individuals) of at least 20 adult males and females from each breeding area (4 individuals per sex per year per site to gain information on breeding periodicity, inter-nesting intervals and clutch frequency) and of 60 adult males and females and juveniles from foraging grounds to delineate connectivity between breeding-foraging and foraging-wintering and foraging-wintering grounds across the region.
8. Standardized bycatch projects to update bycatch figures and assess post-release mortality.
9. Mediterranean-wide genetics analysis, blood and stable isotopes at breeding (adult males and females, hatchings) and foraging and wintering sites, as well as of stranded turtles. The genetic component is essential as it will help overcome the challenges associated with the complex population structure of sea turtles and will facilitate the consolidation of all other data collection types.
10. Stranding networks in every Mediterranean country to collect data and samples, including skeletochronology of all dead stranded individuals.

II. SUGGESTED MONITORING PROGRAMME FOR SEA TURTLES IN ISRAEL

In line with the IMAP common indicators and the recommendations presented on the «Progress report on activities carried out by SPA/RAC» which were published on May 2017 (see above) (NEP(DEPI)/MED WG.431/Inf.4), the state of Israel will make the necessary efforts to adopt most of the essential guidelines for the long-term monitoring programs for marine turtles (including nesting beaches, feeding and wintering areas).

The common indicators (according to IMAP) related to Sea Turtles are:

- Species distributional range (EO1, common indicator 3)
- Population abundance of selected species (EO1, common indicator 4)
- Population Demographic characteristics e.g. body size or age class structure, sex ratio, fecundity rates, survival/mortality rates (EO1, common indicator 5).

The suggested monitoring plan for marine turtles in Israel includes 5 parts which are described below and summarized in Table No. 1:

Table 1. The main components of Israel's monitoring plan for sea turtles.

Monitoring Component	Details	Relevant species	Frequency	Status
Nest monitoring	all sandy beaches will be monitored daily during the reproduction season. The nests will be counted and will be either relocated to protected nesting farms or left at their natural location	*Chelonia mydas* *Caretta caretta*	80 days during the reproduction season (mid-May to mid-August)	Active
Hatching and hatching success monitoring	all the hatching nests will be counted. The nests in the nesting farms will be protected and monitored 24/7 during the hatching period.	*Chelonia mydas* *Caretta caretta*	During the hatching period	Active
Stranding monitoring	injured or dead turtles will be monitored and collected. Data regarding types of injuries, causes of injuries and deaths as well as tissue samples for pathology or genetic analysis will be collected and processed.	*Chelonia mydas* *Caretta caretta* *Dermochelys coriacea and others*	All year round	Active
Satellite tags for movement monitoring	each year, 10 specimens will be caught and equipped with satellite tags enabling continuous following over time. This data is used for the detection of spatiotemporal patterns and changes.	*Chelonia mydas* *Caretta ca retta*	All year round	Active
Monitoring of nesting areas	Every 5 years standardized surveys of all sandy beaches should be conducted uniformly throughout the Mediterranean region to delineate all areas with nesting activity and record shifts in area use over time due to different pressures		Every 5 years *It should be noted that part of this task is already carried out as part of the routine nest monitoring	Pending additional budget

1. Nest monitoring

In the Mediterranean, most sea turtles' nest between late May and early August, with occasional nests in April and September at some sites. The hatching period generally extends from 42 to around 70 days after this (depending on sand composition, sand temperature and season). The Monitoring of nesting is carried out all along the nesting period (during sunrise and early morning hours) using routine beach scanning (by foot patrols-see below) at variable frequencies as outlined below:

- Nesting activity will be monitored 3 times a week from May 15th until May 31st
- Daily scanning will be conducted from June 1st until July 31st (allowing adjustment for beach specific variation).
- From August 1st until August 15th the scanning frequency will be reduced to twice weekly.

Due to numerous threats for sea turtles' nests along the Israeli coast, most of the nests are relocated to 6 protected hatcheries (Ziqim, Nitzanim, Palmachim, Gador, Atlit, Bezet) which are being monitored carefully during the reproduction period (see below).

1.1. NEST MONITORING AND RELOCATION

The daily scanning patrols for the location of new nests and/or false crawls will be carried out with 4X4 vehicles operated by the Israeli Nature and Parks Authority. Every finding (either a nest or false crawl) will be immediately recorded with all the necessary data, using a specialized cellular phone Application «Cyber Tracker» which enables direct transmission and storage of the data (see Fig 3 for example of the cyber tracker screen). The main data which will be collected on site include the following parameters (see also Table 2):

- the GPS locations of track apex (highest point of a turtle track), failed nesting attempts and nests. This information shows the area use of beach and shift in use over time. By combining GIS layers on environmental and anthropogenic parameters at the 5-year level or annually, correlations in how nesting characteristics change in response to these parameters can be evaluated, following the provisions of the UNEP(DEPI)/MED IG.22/Inf.7, the IMAP and the Common Indicators factsheets.
- The fresh tracks (emergences) of adult female turtles from the previous night will be recorded. (Tracks which were documented will be erased/marked in order to avoid double counting)
- All adult female emergences will be counted, recorded and classified by the morphology of the track as 'nesting' or 'non-nesting'. Non-nesting tracks will be classified as
  (1) 'false crawls' – where no nesting attempt was made
  (2) 'failed nesting attempts', where the turtle began clearing sand in a "swim" or "body pit" or proceeded to the digging an "egg chamber" but did not complete nesting (i.e. the turtle crawl was interrupted).

The reasons for failure, such as the presence of obstructions like stones, roots or dry sand causing the hole to collapse, will be recorded where possible. The presence of scarp slopes or other obstacles preventing movement up the beach will also be recorded. For published guides see Eckert et al. (1999); SWOT (2011).

- Nest relocation: before relocating a nest, the GPS location will be recorded, the distance from the sea, measurements of the eggs' location in the nest will take place (in order to restore them in the artificial nest dug in the hatchery), the size and number of pit/s will be recorded, the numbers of eggs will be recorded (including intact and broken eggs). See Fig. X.
- Additional data such as evidence of predation activity and evidence of inappropriate human beach use.

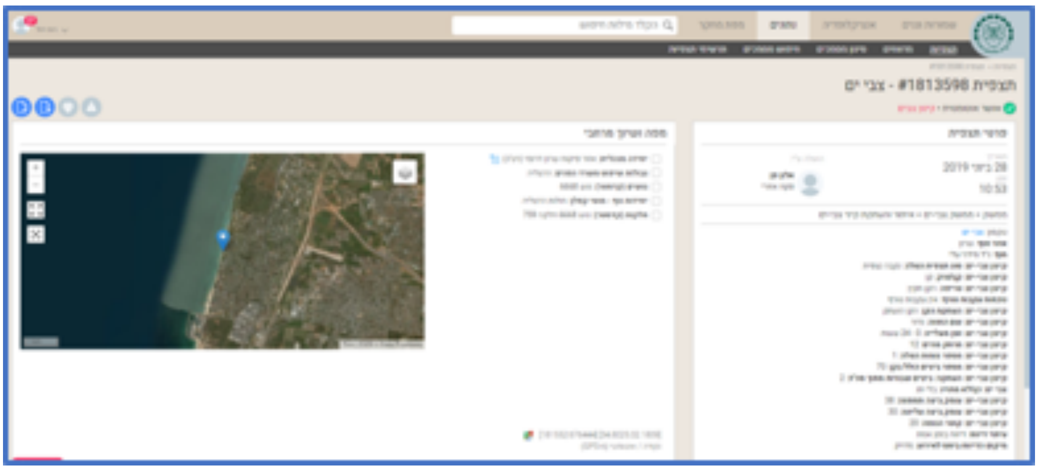

Fig. 3. A screen picture of the «Cyber tracker» cellular phone application which enables «online» recording and transmission of data regarding sea turtles' activity.

Table 2: The Summary of the main data which will be collected for monitoring nesting and hatching activity

1. false crawls
2. failed nesting attempts
3. nests (confirmed or estimated)
4. evidence of nest predation activity
5. the reasons for false crawls (i.e. hit wall, hit dune, unknown) or failed nesting attempts
6. the apex (highest point of each track)
7. the central point of all failed nesting attempts (e.g. swim, body pit or egg chamber)
8. the reasons for failed nesting attempts (dry sand, roots, stones etc)
9. estimated or accurate nest egg chamber location
10. distance of the nest to permanent markers placed at the back of the beach (if present)
11. distance of the nest to the sea

In brief, the data collected provided information on:

a. The 'nesting success' i.e. how many emergences resulted in egg-laying.
b. Nest location with respect to distance from the sea.
c. The spatial distribution of nesting on each beach and across the rookery
d. Nesting densities per beach and across the rookery
e. Reasons for failed nesting attempts.

1.2. Hatching and hatching success monitoring

Surveys of beach hatching activity will be conducted every morning from mid-July until October 1st and initiated from the same point. The official weather status will be obtained from a weather station based in the field.

As previously mentioned, due to numerous threats for sea turtles' nests along the Israeli coast, most of the nests are relocated to 6 protected hatcheries (Ziqim, Nitzanim, Palmachim, Gador, Atlit, Bezet) which are being monitored carefully during the reproduction period. In the hatcheries the clutches are kept until the emergence of the hatchlings, which are released to the sea in a supervised manner (see also Table 3).

The main activities which will be performed in case a nest was relocated:

1. Incubation period monitoring: at the end of the incubation period, the nests will be checked several times a day. Checking frequency will be increased towards the forecasted date of the turtles' emergence.
2. At emergence: The number of emerging turtles and the time of emergence will be recorded. The protecting net will be removed, and the hatchlings will be supervised as they progress towards the sea.
3. 3 days post emergence: the nest will be excavated, and its content will be checked. The number of living hatchlings (that did not emerge), the number of dead hatchlings and the number of eggs that did not hatch, will be recorded.
4. All eggs and dead hatchlings will be returned to the nest following the procedure. Live hatchling will be released on the beach to crawl to the sea after dark.

All the above-mentioned data collection provides information on hatching and emergence success; if the nest has an identifier, it can be linked back to the date of nesting and the specific female that laid the nest (if observed for tagging); this information could be used to assess the fitness of individual females in relation to nest output (and could be combined with the number of emergences required before successful nesting by the same individual). Fecundity is calculated in age-specific birth/hatch rates, which may be expressed as the number of births per unit of time, the number of births/hatchlings per female per unit of time, or the number of births/hatchlings per individuals per unit of time.

In brief, the data collected will provide information on:

a. The number of laid nests that hatched
b. The incubation period for caged/relocated nests (i.e. time lapsed from egg laying to emergence of the first hatchling)
c. The hatching success of the nest (i.e. the number of eggs that hatched in the nest) derived from hatched nests only at excavation
d. The hatchling emergence success rates (i.e. the number of hatchlings that made it out of the nest onto the beach) derived from hatched nests only at excavation
e. Parameters that may inhibit egg development or inhibit hatchling emergence from the nest observed during excavations.

1.3. Monitoring of nesting areas /pending additional budget

Identification and Evaluation of Nesting Areas

Every 5 years (following the suggestion of the Demography Working Group, 2015), standardized surveys of all sandy beaches should be conducted uniformly throughout the Mediterranean region to delineate all areas with nesting activity and record shifts in area use over time due to different pressures (UNEP(DEPI)/MED WG.431/ Inf.4. 2017).

Existing and Potential Nesting Beach Characterization

- A database of all existing and potential nesting beaches present in Israel will be assimilated during May-June.
- Beach-based surveys with hand-held GPS units combined with aerial surveys using Unmanned Aerial Vehicles (UAVs) or small airplanes will be used to map the beach structure, as well as regular (permanent / semi-permanent) environmental and anthropogenic features on the sea turtle nesting beaches. With UAVs or small airplanes, overlapping photographs are taken, 3d models and orthorectified images can be generated, from which beach characteristics can be quantified, allowing changes in structure at 5-year intervals to be delineated (Allen et al. 2015).
- On the Beaches, sand samples should be collected from 50 cm depth at 1 m elevation (representing average nest depth and nest location on the beach), and analyzed for: particle composition (i.e. sand, clay and silt) calcium carbonate content, organic content and pH levels. This information will provide a baseline to identify changes in composition and their source (anthropogenic or environmentally oriented).
- The presence of predators (dogs, cats, rats, seabirds, foxes etc.) on the beach can be recorded by direct observation and the documentation of tracks during 5-yearly surveys.
- The presence of development, including roads, tracks and walls, lamp posts, along the back of beaches should be documented (GPS) annually, along with any changes.
- Light pollution sources will be documented, including recording the GPS range of direct lighting backing beaches and that of sky glow, during cloudless and moonless nights. Light meters could be operated on cloudless and moonless nights to gauge the level of light pollution at regular intervals (e.g. 100 m) along the beach.
- For every single measurement location or sampling collection point, the GPS position will be recorded, to allow repeatability across surveys and feed all information on a GIS database. This information can then be collated with that of sea turtle emergence and nesting activity of the survey year to determine any trends. In addition, this information can be compared with the one collected 5-years previously to document changes to the status of the beach, and whether changes to the status of nesting have occurred in parallel.

2. Stranding monitoring

Table 3: The Summary of the main data which will be collected for monitoring hatched nest excavations

1. number of laid nests that hatched
2. incubation period for caged/relocated nests
3. hatching success of the nest
4. hatchling emergence success rates
5. parameters that may inhibit egg development or inhibit hatchling emergence
6. location of the nest emergence site
7. distance of the nest to the permanent markers, sea and vegetation
8. approximate number of hatchling tracks
9. suspected light source
11. number of live hatchlings
12. evidence of nest and/or hatchling predation activity
13. desiccated hatchlings

As part of its routine tasks, The Israeli Sea turtle rescue centre is responsible for the collection of injured and dead turtles. In case of a reported injured or dead specimen. The trained personnel will arrive on site with 4X4 vehicles operated by the Israeli Nature and Parks Authority. Every finding (either a nest or false crawl) will be immediately recorded with all the necessary data using a specialized cellular Application «Cyber Tracker» which enables direct transmission and storage of the data (see Fig X for example of the cyber tracker screen). In case of injured specimens, the centre's personnel are in charge of investigating the causes of injury, the medical treatment for the injured turtle, its rehabilitation and if possible, the safest release to nature. In cases of dead specimens, the main goal is to detect the cause of death. The data collected during such incidents is very important in terms of obtaining basic biological data as well as specific data regarding each case. The data includes the following parameters:

a. Body size, weight.
b. In turtles captured by fishermen: the nature of injury, the method of entrapment.
c. In stranded turtles: external injury factors are recorded. If there are no external marks, an x-ray will be performed or/and endoscopy procedure.
d. In dead specimens, a necropsy will be performed (if possible).
e. DNA sample will be taken for «DNA fingerprint» analysis.

3. Movement of turtles in the open sea using satellite tags

Attachment of satellite transmitters

Satellite tracking provides detailed information about the movements of individuals within a population, including breeding area use before and during mating/nesting, clutch frequency of individuals (i.e. number of nests laid by specific individuals), inter-nesting period (duration between each nesting event), date of departure from breeding grounds, migration distance and time, identification of foraging and wintering sites, wintering/foraging site fidelity and/or the use of multiple sites, remigration intervals to breed (1-2 years in males and 1-3+ years for females, depending on foraging site and animal condition) and residency at breeding sites, prospecting of alternative nesting sites. This information would provide information of variability in inter-nesting interval and clutch frequency between individuals within the same year and across years with different environmental conditions (Tucker 2010), particularly as the Mediterranean is a temperate breeding area for both loggerheads and greens and inter-nesting interval and clutch frequency vary with local weather conditions. Existing research recommends that a minimum of 20–30 individuals (for populations of >100 individuals) are required for population-level inferences, while 50–100 individuals are required to address more complex issues of animal survival or home-range studies (Borger et al. 2006; Murray 2006; Lindberg & Walker 2007). This number is also likely to vary depending on environmental variables, range of resource requirements and sociality (i.e. solitary versus group living) of target species. However, it is difficult to attain these numbers, due to this technique being very expensive.

Satellite tracking device attachment was already performed in Israel. A total of 15 sea turtles were tracked between 2008 and 2015 using PTTs (Platform Terminal Transmitters; Sirtrack: KiwiSat101, n = 10, Wildlife Computers: SPOT5, n = 5). The tagged turtles included 8 nesting females (5 loggerhead *Caretta caretta* and 3 green *Chelonia mydas*), and 7 rehabilitated turtles (2 male and 3 female loggerhead and 2 male green turtles, all treated at the Israel Sea Turtle Rescue Centre for fishery- related injuries (Levy wt al., 2017). Transmitters were attached using epoxy resin following the methodology of Godley et al. (2002). Track locations were obtained via the Argos satellite tracking system, and were downloaded, stored and managed using the Satellite Tracking and Analysis Tool (STAT; Coyne & Godley 2005).

The tagging project is ongoing in Israel and according to budget constraints, 10 satellite tags are the yearly quota for new tags.

Table 4. The Summary of the main data which will be collected using Satellite tracking device attachment

1. Distribution of individuals (overlay with bathymetry and habitat information)
2. Clutch frequency of females
3. Inter nesting period of females
4. Date of departure from breeding grounds
5. Migration timing, distance and duration
6. Identification of foraging and wintering sites
7. Wintering/foraging site fidelity and/or the use of multiple sites
8. Remigration intervals
9. Residency at breeding sites
10. Prospecting of alternative or future nesting sites.

References

Casale P (2011) Sea turtle by-catch in the Mediterranean. Fish Fish 12: 299–316

Casale P. and Margaritoulis D. (Eds.) 2010. Sea Turtles in the Mediterranean: Distribution, Threats and Conservation Priorities. IUCN/SSC Marine Turtle Specialist Group. Gland, Switzerland: IUCN, 294 pp.

Casale P, Gerosa G, Yerli SV (2000) Female-biased primary sex ratio of the green turtle, Chelonia mydas, estimated through sand temperatures at Akyatan, Turkey. Zool Middle East 20: 37–46

Casale P, Affronte M, Insacco G, Freggi D and others (2010a) Sea turtle strandings reveal high anthropogenic mortality in Italian waters. Aquat Conserv 20: 611–620

Casale, P et al., (2018). Mediterranean Sea turtles: current knowledge and priorities for conservation and research. Endang Species Res. 36: 229–267

Coyne MS, Godley BJ (2005) Satellite Tracking and Analysis Tool (STAT): an integrated system for archiving, analyzing and mapping animal tracking data. Mar Ecol Prog Ser 301: 1–7.

Eckert, K. L., K. A. Bjorndal, F. A. Abreu-Grobois, and M. Donnelly (Editors). 1999. Research and Management Techniques for the Conservation of Sea Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4.

Fuller WJ, Godley BJ, Hodgson DJ, Reece SE, Witt MJ, Broderick AC (2013) Importance of spatio-temporal data for predicting the effects of climate change on marine turtle sex ratios. Mar Ecol Prog Ser 488: 267–274

Godley BJ, Broderick AC, Downie JR, Glen F and others (2001a) Thermal conditions in nests of loggerhead turtles: further evidence suggesting female skewed sex ratios of hatchling production in the Mediterranean. J Exp Mar Biol Ecol 263: 45–63

Godley BJ, Broderick AC, Mrosovsky N (2001b) Estimating hatchling sex ratios of loggerhead turtles in Cyprus from incubation durations. Mar Ecol Prog Ser 210: 195–201

Godley BJ, Richardson S, Broderick AC, Coyne MS, Glen F, Hays GC (2002) Long-term satellite telemetry of the movements and habitat utilisation by green turtles in the Mediterranean. Ecography 25: 352–362.

Kaska Y, Ilgaz Ç, Özdemir A, Bas¸kale E, Türkozan O, Baran I˙ , Stachowitsch M (2006) Sex ratio estimations of loggerhead sea turtle hatchlings by histological examination and nest temperatures at Fethiye beach, Turkey. Naturwissenschaften 93: 338–343

Katselidis KA, Schofield G, Stamou G, Dimopoulos P, Pantis JD (2012) Females first? Past, present and future variability in offspring sex ratio at a temperate sea turtle breeding area. Anim Conserv 15: 508–518

Levy Y, Frid O, Weinberger A, Sade R and others (2015) A small fishery with a high impact on sea turtle populations in the eastern Mediterranean. Zool Middle East 61: 300–317

Levy Y., Keren, T., Leader, N., Weil, G., Tchernov, D., Rilov, G (2017). Spatiotemporal hotspots of habitat use by loggerhead (Caretta caretta) and green (Chelonia mydas) sea turtles in the Levant basin as tools for conservation. Mar Ecol Prog Ser. 575: 165–179.

Monzón-Argüello C, Rico C, Naro-Maciel E, Varo-Cruz N, López P, Marco A, López-Jurado LF (2010) Population structure and conservation implications for the loggerhead sea turtle of the Cape Verde Islands. Conserv Genet 11: 1871–1884

Pritchard, P.C.H., Mortimer, J.A (1999). Taxonomy, External Morphology, and Species Identification. In Research and Management Techniques for the Conservation of Sea Turtles K. L. Eckert, K. A. Bjorndal, F. A. Abreu-Grobois, M. Donnelly (Editors) IUCN/SSC Marine Turtle Specialist Group Publication No. 4, 1999.

Rinat, Z (2019). https://www.haaretz.com/israel-news/.premium-record-number-of-sea-turtles-hatch-in-israel-showing-success-of-rescue-efforts-1.6962220

Schofield G, Scott R, Dimadi A, Fossette S and others (2013b) Evidence-based marine protected area planning for a highly mobile endangered marine vertebrate. Biol Conserv 161: 101–109

Tomás J, Gozalbes P, Raga JA, Godley BJ (2008) Bycatch of loggerhead sea turtles: insights from 14 years of stranding data. Endang Species Res 5: 161–169

UNEP(DEPI)/MED WG.431/ Inf.4. (2017). Progress report on activities carried out by SPA/RAC since the twelfth meeting of Focal Points for SPAs. UNEP/MAP SPA/RAC Tunis.

UNEP(DEPI)/MED WG.444/6/Rev.1. Agenda item 3 Review of proposed IMAP Common Indicator Guidance Facts Sheets (Biodiversity and Fisheries) IMAP Common Indicator Guidance Facts Sheets (Biodiversity and Fisheries). 6th Meeting of the Ecosystem Approach Coordination Group. Athens, Greece, 11 September 2017.

UNEP/MAP (2016). Integrated Monitoring and Assessment Programme of the Mediterranean Sea and coast.

Wallace BP, DiMatteo AD, Hurley BJ, Finkbeiner EM and others (2010) Regional management units for marine turtles: a novel framework for prioritizing conservation and research across multiple scales. PLOS ONE 5: e15465

WWF, 2005. WWF's Species Action Plan for the conservation of marine turtles in the Mediterranean Sea. Coordinated by Paolo Casale and supervised by Massimiliano Rocco and Sue Lieberman. WWF's global Species Action Plans.

Zbinden JA, Davy C, Margaritoulis D, Arlettaz R (2007) Large spatial variation and female bias in the estimated sex ratio of loggerhead sea turtle hatchlings of a Mediterranean rookery. Endang Species Res 3: 305–312

http://www.moa.gov.cy/moa/dfmr/dfmr.nsf/All/3A83645E42F28B5342257FF5002D02E8/$file/TURTLES.pdf?OpenElement

Calonectris diomedea © SPA/RAC, Artescienza

Larus sp © SPA/RAC, Artescienza

E- Monitoring programme of sea birds

I. GENERAL OVERVIEW

The monitoring scheme proposed here was prepared according to the guidelines of the Integrated Monitoring and Assessment Programme (IMAP) of the Mediterranean Sea and Coast, as part of the Mediterranean Action plan of the United Nations Environment Programme (UNEP/MAP).

The IMAP lays down the principles for an integrated monitoring of the biodiversity and non-indigenous species, pollution and marine litter, coast and hydrography in an integrated manner. To achieve this, the IMAP draws a specific list of Good Environmental Status (GES) common indicators and principles.

The common indicators related to Sea Birds are:

- Species distributional range (EO1, common indicator 3)
- Population abundance of selected species (EO1, common indicator 4)
- Population Demographic characteristics e.g. body size or age class structure, sex ratio, fecundity rates, survival/mortality rates (EO1, common indicator 5).

This document presents the national monitoring programme for the IMAP common indicators related to sea birds that will be implemented in the Mediterranean shores of Israel, regarding the selected species of interest. It also details the current status of these species as a basal stage for future reference.

The long-term monitoring scheme presented here will be led by the Israeli Nature and Parks Authority (INPA). The focal person for communication is Dr. Ruth Yahel (ruthy@npa.org.il).

This report was compiled by Asaf Mayrose, with the aid of (INPA personnel):

- Ohad Hatzofe, Avian Ecologist, Science Division
- Gal Vine, GIS and Databases division
- Shmulik Amir, Katerina Brodianska, GIS division
- Yifat Arzi, Hula Nature Reserve and Flocking Birds Ecologist

II. MONITORING AIMS AND METHODS

This chapter presents the IMAP common indicators, the IMAP reference list of species and the proposed methodology by which the data will be collected in order to evaluate these common indicators in regard to the selected species.

1. IMAP common indicators

Species distributional range (common indicator 3)

The change in breeding/wintering distribution of population reflects the habitat changes, availability of food resources, and pressures related to human activity and climate change. This indicator would be based on a set of single species indicators that reflects distribution pattern of breeding/wintering populations of the selected species.

Species population abundance (Common indicator 4)

Abundance is a parameter of population demographics a is critical for determining the growth or decline of a population. The number of individuals within a population (population size) is defined as the number of individuals present in an animal aggregation (permanent or transient) in a subjectively designated geographical range.

The objective of this indicator is to determine the population status of selected species by medium-long term monitoring to obtain population trends for these species. This objective requires a census to be conducted in breeding, migratory, wintering, developmental and feeding areas.

Population demographic characteristics (Common indicator 5)

Demography is the study of various population parameters and it is used in ecology as the basis for population studies. Demography provides a mathematical description of how such parameters change over time. At this basal stage of monitoring, it was decided to focus mainly on the first two common indicators (3, 4).

2. Selected Species of Interest

Table 1 contains a list of vulnerable species included in Appendix II (endangered or threatened species) and Appendix III (species whose exploitation is regulated) of the SPA/DB Protocol of the Barcelona Convention (*Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean*). The table also lists each species' current status in Israel and a recommendation for which part of its population should be included in the monitoring scheme.

Table 1: Selected species of interest, their general status in Israel and the proposed part of their population for monitoring.

Family	Species	Common name	Local Status	Suggested population & timing of monitoring
Falconidae	*Falco eleonorae*	*Eleonora's falcon*	Scarce migrant	Non
Cerylidae	*Ceryle rudis*	*Pied kingfisher*	Common resident	Breeding
Charadriidae	*Charadrius alexandrinus*	*Kentish plover*	Common migrant, scarce breeder	Breeding
	Charadrius leschenaultii columbinus	*Greater sand plover*	uncommon migrant	Non
Halcyonidae	*Halcyon smyrnensis*	White-throated kingfisher	Common resident	Breeding
Hydrobatidae	*Hydrobates pelagicus*	European storm petrel	vagrant	Non
Laridae	*Larus audouinii*	Audouin's gull	vagrant	Non
	Larus armenicus	Armenian gull	Common migrant and winterer	wintering
	Larus genei	Slender-billed gull	Common migrant and winter visitor	wintering
	Larus melanocephalus	Mediterranean gull	Scarce migrant	Non
Pandionidae	*Pandion haliaetus*	Osprey	Scarce migrant and winterer	wintering
Pelecanidae	*Pelecanus crispus*	Dalmatian pelican	vagrant	Non
	Pelecanus onocrotalus	Great white pelican	Common migrant and winterer	Migrating & wintering
Phalacrocoracidae	*Phalacrocorax aristotelis*	European shag	vagrant	Non
	Phalacrocorax pygmaeus	Pygmy cormorant	Common resident	Breeding
Phoenicopteridae	*Phoenicopterus roseus*	Greater flamingo	Uncommon migrant & winterer	Wintering
Procellariidae	*Calonectris diomedea*	Scopoli's shearwater	Uncommon migrant	Migrating
	Puffinus puffinus yelkouan	Yelkouan shearwater	vagrant	Non
	Puffinus yelkouan	Mediterranean shearwater	Uncommon migrant and winterer	Migrating & wintering
	Puffinus mauretanicus	Balearic shearwater	vagrant	Non

Scolopacidae	*Numenius tenuirostris*	Slender-billed curlew	Absent	Non
Sternidae	*Sternula albifrons*	Little tern	Scarce breeder	Breeding
	Thalasseus bengalensis	Lesser crested tern	vagrant	Non
	Thalasseus sandvicensis	Sandwich tern	Winter visitor	Wintering
	Hydroprogne caspia	Caspian tern	Scarce migrant	Non
	Gelochelidon nilotica	Gull-billed tern	Scarce migrant	Non

3. Monitoring Methods and existing monitoring activities

Each one of the selected species of interest has a different pattern of presence, in terms of both timing and spatial distribution, hence requires a different method of, monitoring and evaluating. This chapter describes the various proposed methodologies for monitoring the different species and populations. Most of these methods uses an existing platform (i.e. counts that are already being carried out by various local organizations).

Most of the proposed monitoring scheme will make use of these on-going counts and censuses:

- Waterfowl winter count: performed each winter in the middle of January by the Israeli Nature and Parks Authority (INPA) with the aid of voluntary birdwatchers. This count is part of the International Waterbird Census (IWC), coordinated by Wetlands International and is being done in Israel since 1965. This census includes a single visit of a birdwatching team in each of the significant permanent water bodies in the country (about 330 reservoirs, lakes and blocks of fishponds). This count covers all the major in-land water bodies, as well as few transects along the Mediterranean cost.

  Products: an annual estimation of each species' total wintering population.

- Red list breeding atlas: the Israeli red data book is a comprehensive source for the distribution and abundance of local breeding species. The list is updated approximately every 10 years, but the list is reviewed every year and species that are thought to undergo a rapid change are updated more frequently. The red data book is a joint project of the Israeli Nature and Parks Authority (INPA) and the Israeli Ornithological Centre (IOC). The map grid, used under this framework for the calculation and presentation of species' distribution and abundance, is the grid used in the «Birds of Israel» (Shirihai, 1996) and based on a half-degree block (of the international map grid). These blocks are further sub-divided into 16 smaller blocks, yielding a matrix of 212 blocks covering the entire country (each block of approximately 11.8X13.8 km).

  Products: four Maps (former distribution and abundance, current distribution and abundance, difference between current and former distributions, difference between current and former abundance), total distributional range (sum of all occupied squares).

- A compilation of public observations: it is a summary of mostly incidental observations reported by birdwatchers in the Mediterranean shores of Israel. The data is collected through various designated internet driven data-bases such as e-bird (ebird.org) and BioGis (http://www.biogis.huji.ac.il/), as well as some popular birding internet forums. A first report on the abundance and distribution of Sea birds along the Mediterranean shores of Israel was published in 2013 (Perlman, 2013).

  Products: species' total number of observations, species' map of relative abundance along the Israeli shores.

- Species-specific count: several counts are being carried out in order to estimate the sizes of specific populations, so they differ in their timing and location. The migratory population of the Great White Pelican, for instance, is being counted every autumn in the Hula and Northern Valleys by the INPA together with local fishermen and birdwatchers, so this count is carried out during the entire autumn migration season. Another example is the count of the breeding Pygmy cormorants. This count is being done around all of this species' breeding colonies in the same day and it is meant to estimate its breeding population's size in each area.

  Products: an annual estimation of each species migratory/breeding population.

III. SPECIES OF INTEREST - CURRENT LEVEL OF KNOWLEDGE

This chapter presents a brief summary of each of the selected species' most updated data regarding its population abundance and distribution. This data will serve as the reference and baseline for future monitoring.

Table 2: the selected species for monitoring and their relevant proposed monitoring method

Common name	Species	Local Status	Suggested source / monitoring method	Frequency of repetition
Pied kingfisher	*Ceryle rudis*	*Common resident*	Red-data breeding atlas	10 years
Kentish plover	*Charadrius alexandrinus*	*Common migrant, scarce breeder*	INPA waterfowl count	Once a year
Greater sand plover	*Charadrius leschenaultii*	*uncommon migrant*	INPA waterfowl count	Once a year
Armenian gull	*Larus armenicus*	*Common migrant and winterer*	INPA waterfowl count	Once a year
Slender-billed gull	*Larus genei*	Common migrant and winter visitor	INPA waterfowl count	Once a year
Osprey	*Pandion haliaetus*	Scarce migrant and winterer	INPA waterfowl count	Once a year
Great white pelican	*Pelecanus onocrotalus*	Common migrant and winterer	- Autumn species-specific survey - INPA waterfowl count	Every year
Pygmy cormorant	*Phalacrocorax pygmaeus*	Common resident	Species-specific breeding count	Once a year
Greater Flamingo	*Phoenicopterus roseus*	Uncommon migrant and winterer	INPA waterfowl count	Once a year
Scopoli's shearwater	*Calonectris diomedea*	Uncommon migrant	Compilation of public observations	6 years
Mediterranean shearwater	*Puffinus yelkouan*	Uncommon migrant and winterer	Compilation of public observations	6 years
Little tern	*Sternula albifrons*	Scarce breeder	Species-specific breeding count	Every year
Sandwich tern	*Thalasseus sandvicensis*	Winter visitor	INPA waterfowl count	Once a year
White-throated kingfisher	*Halcyon smyrnensis*	Common resident	Red-data breeding atlas	10 years

1. Pied kingfisher (*Ceryle rudis*)

The species is a quite common resident and breeder in low-lying areas of Northern and Central Israel. It occurs mainly in a Mediterranean climate, mostly in freshwater habitats such as fishponds, streams, lakes and reservoirs.

The breeding population was estimated at 400 pairs at the early 1990s (Shirihai, 1996), and this estimate is roughly accurate as of today, according to expert opinion (Mayrose & Labinger, the Israeli red data book, in prep.).

Monitoring method: Red-data breeding atlas

Current data:

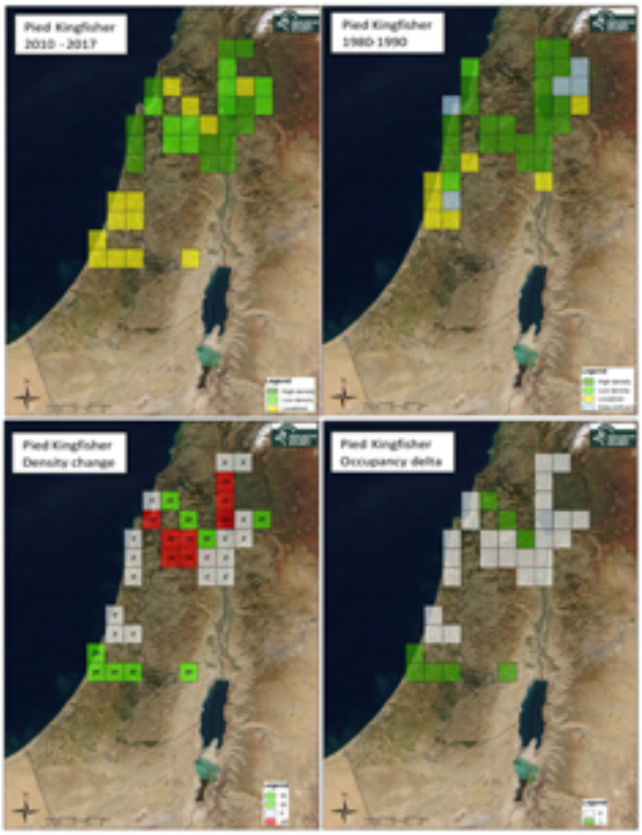

Figure 1: Pied kingfisher breeding distribution:
upper right – distribution during the 1980s (Shirihai 1996), upper left – current distribution,
bottom right – occupancy delta (0 = no change, 1 = positive change),
bottom left – density change (numbers represent relative abundance delta).

2. Kentish Plover (*Charadrius alexandrinus*)

This species is a fairly common passage migrant and quite common winter visitor over much of lowland aquatic habitats. Also, it is a scarce breeder along the Dead Sea shores and in Southern Arava salt pans. Until the 1970s, this species was a common breeder along the Mediterranean coast.

Total breeding population is currently estimated at 30 – 40 pairs and this species is regarded as endangered (EN) in the Israeli red data book.

Monitoring method: INPA waterfowl winter count, Red-data breeding atlas.

Current data:

i. INPA Waterfowl count:

Table 3: Kentish plover mid-winter counts (INPA data)

2006	2008	2009	2010	2011	2012	2013	2014	2015	2016	Annual average 1997-2015	Standard Deviation
1	139	229	116	76	78	85	88	35	16	80	59

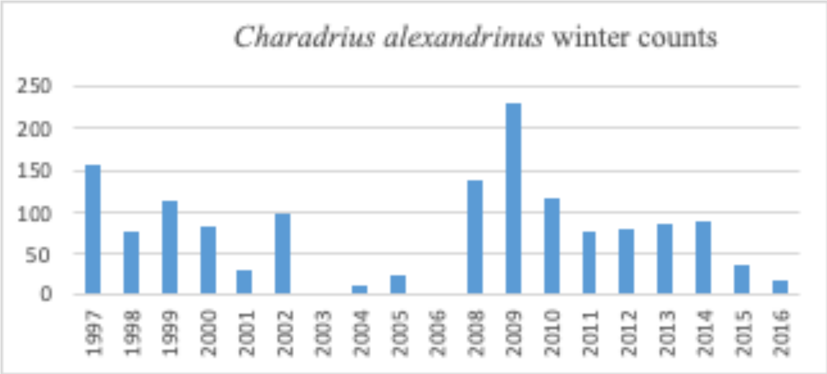

Figure 2: Kentish Plover mid-winter counts (INPA data)

ii. Red-data breeding atlas:

Figure 3: Kentish Plover breeding distribution (Israeli red data book):
upper right – distribution during the 1980s (Shirihai, 1996), upper left – current distribution,
bottom right – occupancy delta (-1 = negative change, 0 = no change, 1 = positive change),
bottom left – density change (numbers represent relative abundance delta).

3. Greater Sand Plover (*Charadrius leschenaultii*)

This species is a quite common passage migrant and uncommon winter visitor along the Mediterranean coast.

Monitoring method: INPA waterfowl winter count.

Current data

INPA Waterfowl count:

Table 4: Greater Sand Plover numbers, INPA mid-winter counts

2006	2008	2009	2010	2011	2012	2013	2014	2015	2016	Annual average 1997-2015	SD
203	66	14	67	31	21	0	17	20	0	34	46

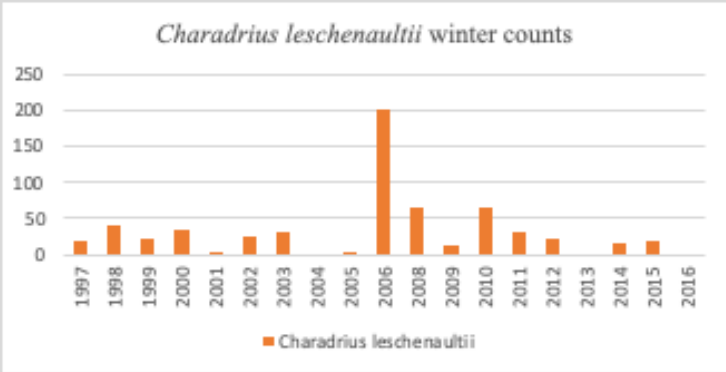

Figure 4: Greater Sand Plover mid-winter counts (INPA data)

4. Armenian Gull (*Larus armenicus*)

It is an abundant winter visitor and passage migrant in northern and west-central Israel. It inhabits mainly the inland fresh water, such as fishponds, reservoirs, sewage ponds and rubbish tips, also it dwells in coastal areas.

Monitoring method: INPA waterfowl winter count.
Current data:

INPA Waterfowl count:

Table 4: Armenian Gull numbers, INPA mid-winter counts

2008	2009	2010	2011	2012	2013	2014	2015	2016	Annual average 2008-2016	SD
2631	6,492	7,056	3,551	4,226	8,962	11,433	6,483	9,779	6,735	2,954

Figure 5: Armenian Gull mid-winter counts (INPA data)

5. Slender-billed Gull (*Larus genei*)

A common passage migrant and uncommon winter and non-breeding summer visitor.

Monitoring method: INPA waterfowl winter count.
Current data:

INPA Waterfowl count:

Table 5: Slender-billed Gull numbers, INPA mid-winter counts

2008	2009	2010	2011	2012	2013	2014	2015	2016	Annual average 2008-2016	SD
84	156	237	346	216	405	139	309	165	229	106

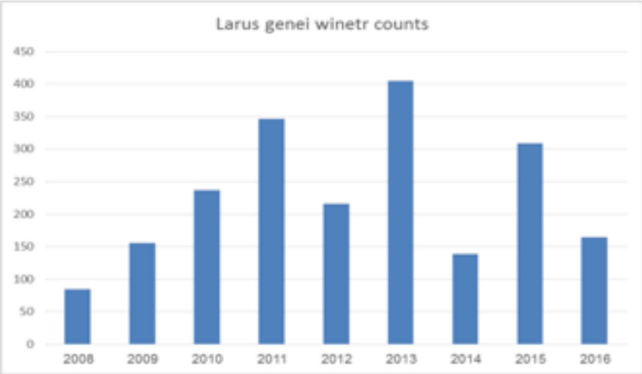

Figure 6: Slender Billed Gull mid-winter counts (INPA data)

6. Osprey (*Pandion haliaetus*)

A scarce passage migrant and uncommon winter visitor, mainly in the Northern parts of Israel, in valleys and low -lying areas with fishponds and reservoirs.

Monitoring method: INPA waterfowl winter count.

Current data:

INPA Waterfowl count:

Table 6: Osprey numbers in INPA mid-winter counts

2010	2011	2012	2013	2014
37	29	28	37	36

7. Great White Pelican (*Pelecanus onocrotalus*)

An abundant passage migrant and uncommon winter visitor, mainly in the northern valleys, around fishponds and reservoirs.

Monitoring method: INPA waterfowl winter count, INPA White Pelican autumn migration count.

Current data:

i. INPA Waterfowl winter count

Table 7: Great White Pelican numbers, INPA mid-winter counts

2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Annual average 1997-2016	SD
68	207	271	265	271	232	301	367	292	208	395	668	263	86

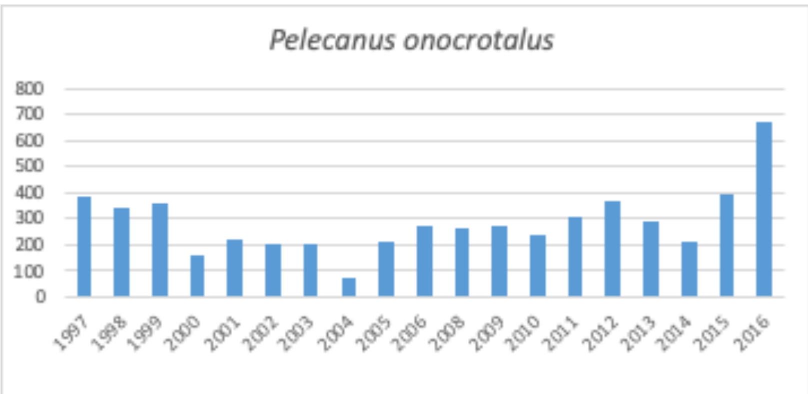

Figure 7: Greater White Pelican mid-winter counts (INPA data)

ii. INPA Autumn migration counts

Table 8: Great White Pelican numbers in INPA autumn counts

Month	2010	2011	2012	2013	2014	2015	2016
AUG	370	0	130	586	1650	1120	600
SEP	25400	7050	21749	30150	27335	14515	29250
OCT	13500	29250	25980	15620	13650	32700	18700
NOV	0	6500	1700	0	2000	0	0
Total	39270	42800	49559	46356	44635	48335	48550

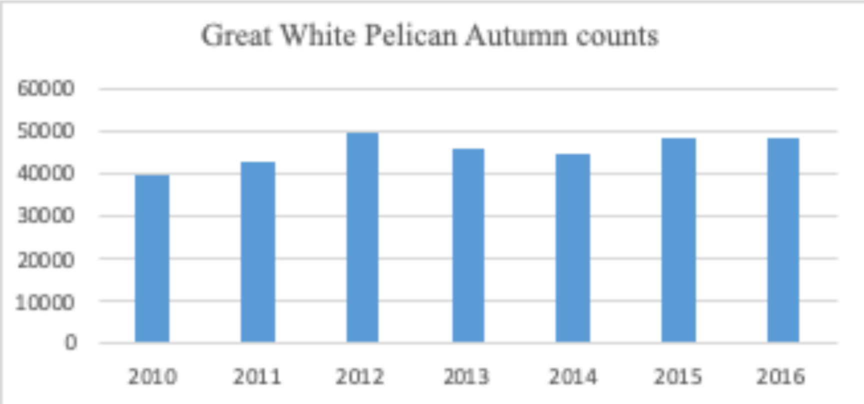

Figure 8: Greater White Pelican autumn counts (INPA data)

8. Pygmy Cormorant (*Phalacrocorax pygmaeus*)

This species is a quite common resident and breeder in aquatic habitats in the northern valleys, especially around the Sea of Galilee. It has become extinct during the 1950s due to the drainage of the Hula Lake and the persecutions by fishermen. The population has naturally recovered since the early 1990s and it is still increasing.

Monitoring method: INPA waterfowl winter count, INPA Pygmy Cormorant breeding colonies census, Red-data breeding atlas.

Current data:

i. INPA Waterfowl winter count

Table 9: Pygmy Cormorant numbers, INPA mid-winter counts

2004	2005	2006	2008	2009	2010	2011	2012	2013	2014	2015	2016	Annual average 1997-2016	SD
77	406	321	417	469	426	274	557	1,386	1,145	1,840	1,938	473	493

Figure 9: Pygmy Cormorant mid-winter counts (INPA data)

ii. INPA Pygmy Cormorant breeding colonies census:

Table 10: Pygmy Cormorant maximal numbers, INPA breeding season counts

Area/Year	2004	2005	2006	2007	2008	2010	2011	2012	2013	2014	2015	2016
Hula Valley	88	380	54	207	123	57	127	184	175	392	370	556
Sea of Galilee	1,064	279	472	495	186	448	150	226	364	669	1,167	655
Jordan Valley	89	530	435	359	361	319	278	649	440	652	1,561	1,118
Acre Valley	21	130	43	50	155	90	153	399	165	182	267	261
Carmel coast										30	90	347
Total	**1,262**	**1,319**	**1,004**	**1,111**	**825**	**914**	**708**	**1,458**	**1,144**	**1,925**	**3,455**	**2,937**

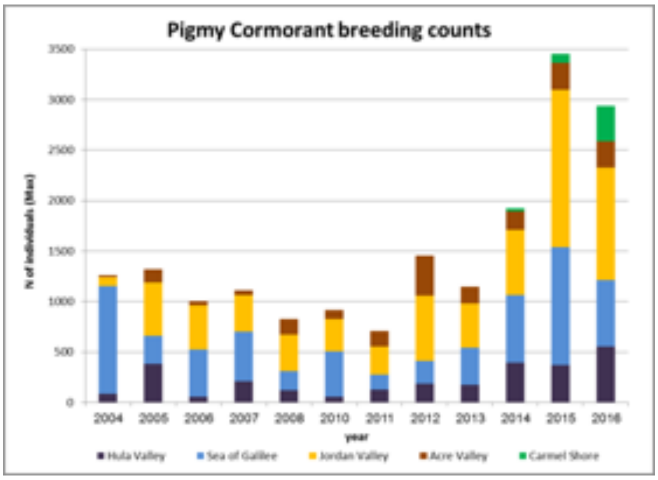

Figure 10: Pygmy Cormorant breeding season maximal numbers, divided by areas (INPA data)

iii. Red-data breeding atlas:

Figure 11: Pygmy Cormorant breeding distribution (Israeli red data book):
upper right – distribution during the 1980s (Shirihai 1996), upper left: current distribution,
bottom right – occupancy delta (0 = no change, 1 = positive change),
bottom left – density change (numbers represent relative abundance changes).

9. Greater Flamingo (*Phoenicopterus roseus*)

An uncommon migrant and winterer, mainly in salt pans in the Carmel Coast and in Southern Arava Valley.

Monitoring method: INPA waterfowl winter count. Current data

INPA Waterfowl winter count:

Table 11: Greater Flamingo numbers, INPA mid-winter counts

2003	2004	2005	2006	2008	2009	2010	2011	2012	2013	2014	2015	2016	Annual average 1997-2016	SD
43	451	369	680	599	568	499	548	583	662	766	868	591	441	250

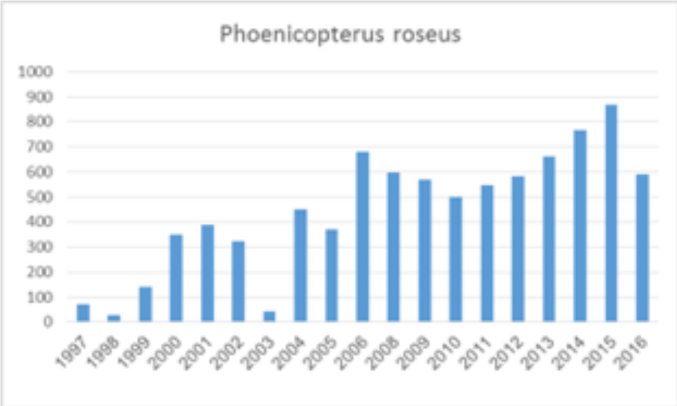

Figure 12: Greater Flamingo mid-winter counts (INPA data)

10. Scopoli's Shearwater (*Calonectris diomedea*)

An uncommon migrant and a scarce winterer along the Mediterranean shores.

Monitoring method: Compilation of public observations Current data:

Compilation of public observations (Perlman, 2013)

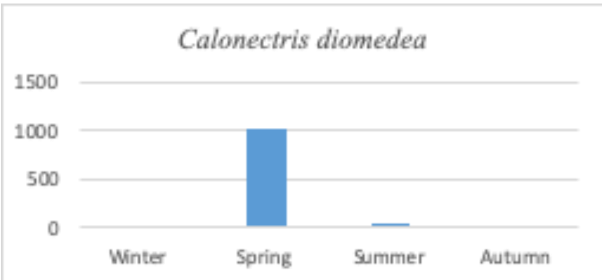

Figure 13: Scopoli's shearwater distribution of observation between seasons (2001 – 2012).

Figure 14: Scopoli's shearwater total number of individuals observed per year

11. Mediterranean Shearwater (*Puffinus yelkouan*)

It is an uncommon migrant and winterer along the Mediterranean shores. A significant decrease in the numbers of individuals is observed during the last two decades.

Monitoring method: Compilation of public observations
Current data:

Compilation of public observations (Perlman, 2013).

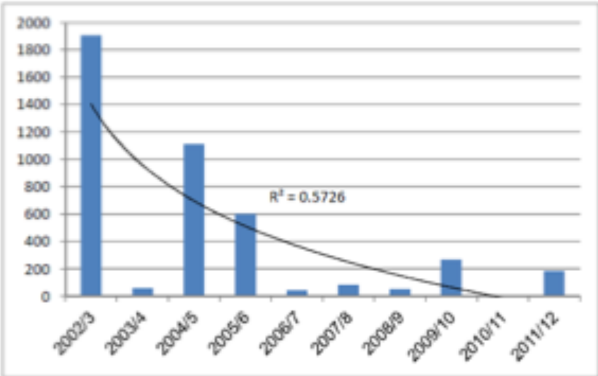

Figure 15: Mediterranean shearwater total number of individuals observed per winter

12. Little Tern (*Sternula albifrons*)

A scarce migrant and a summer breeding visitor, mainly in the Carmel coast area. The species is considered locally endangered (EN).

Monitoring method: species specific breeding census, Red-data breeding atlas.

Current data:

i. Little Tern breeding census

The census is performed by the Tel-Aviv University, the Israeli Ornithological Centre and INPA (Goldstein et al 2016).

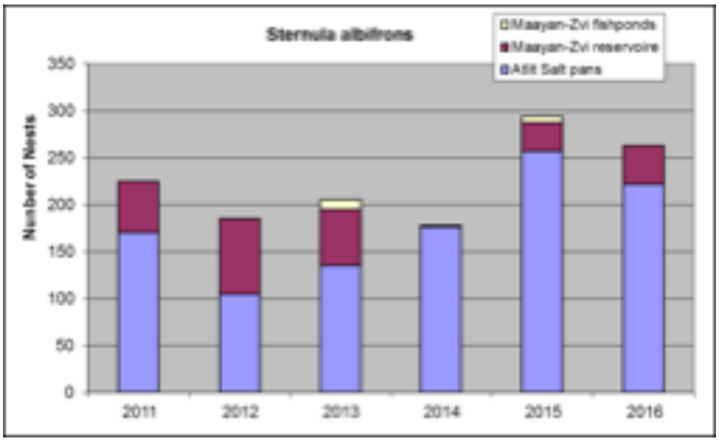

Figure 16: Little Tern number of breeding pairs per year (Goldstein et al 2016)

ii. Red-data breeding atlas

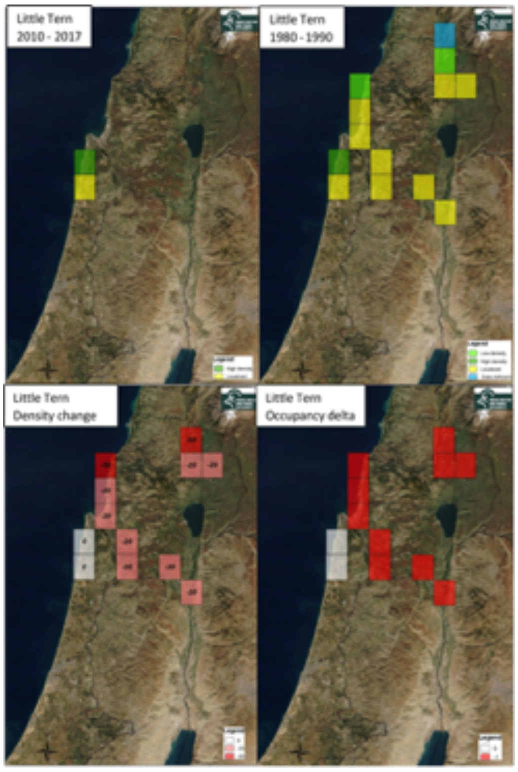

Figure 17: Little Tern breeding distribution (Israeli red data book):
upper right – distribution during the 1980s (Shirihai 1996), upper left: current distribution,
bottom right – occupancy delta (0 = no change, -1 = negative change),
bottom left – density change (numbers represent relative abundance changes).

13. Sandwich Tern (*Thalasseus sandvicensis*)

A quite common migrant and winter visitor along the Mediterranean shores.

Monitoring method: INPA waterfowl winter count

Current data:

INPA Waterfowl count:

Table 12: Sandwich Tern numbers, INPA mid-winter counts

2003	2004	2005	2006	2008	2009	2010	2011	2012	2013	2014	2015	2016	Annual average 1997-2016	SD
7	15	0	52	6	10	4	21	55	77	29	453	8	43	105

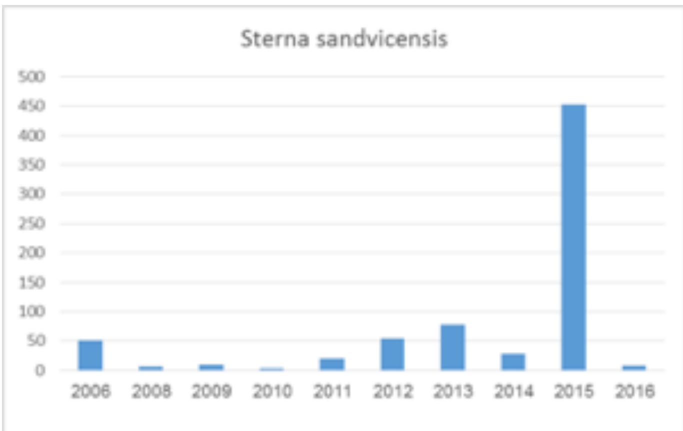

Figure 18: Sandwich Tern mid-winter counts (INPA data)

14. White-throated kingfisher (*Halcyon smyrensis*)

A common resident throughout the entire country, but more abundant in Mediterranean zones and around settlements.

Monitoring method: Red data breeding atlas.

Current data:

Red data breeding atlas:

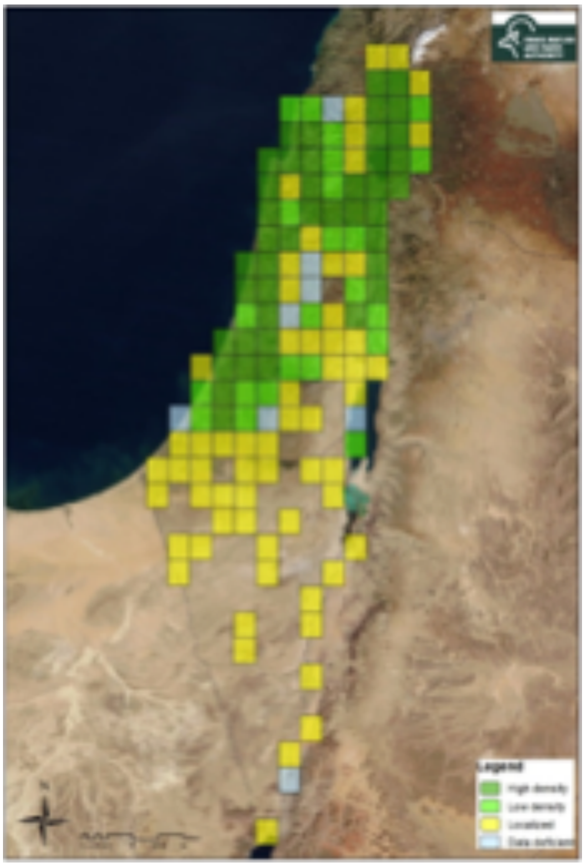

Figure 19: White Throated Kingfisher breeding distribution during the 1980s (Shirihai 1996) and during the 2010s (Israeli red data book).

References

Arzi, Y. 2016. Summary report of the White Pelican Autumn Survey. Internal report of the Israeli Nature and Parks Authority (in Hebrew).

Arzi, Y. 2016. Summary report of the Pygmy cormorant breeding Census. Internal report of the Israeli Nature and Parks Authority (in Hebrew).

Goldstein, I., Kiat, Y. and Hatzofe, O. 2016. Breeding Terns in the Carmel Coast, a summary of annual census (in Hebrew).

Hatzofe, O. 2016. Summary Report of the Annual Wintering Waterfowl Census. Internal report of the Israeli Nature and Parks Authority (in Hebrew).

Mayrose, A., Vine, G., Labinger, Z. and Steinitz, O., 2017 (in prep.). The Israeli red data book of breeding birds.

Perlman, Y. 2013. Trends in distribution and timing of Seabirds along the Israeli Mediterranean shores. Internal report of the Society for the Protection of Nature in Israel (in Hebrew).

Shirihai, H. 1996. The Birds of Israel. Academic Press.

UNEP-MAP-SPA/RAC,2017. Draft of Common indicator factsheets for Biodiversity (EO1), NIS (EO2) and Fisheries (EO3). http://www.rac-spa.org/cormon1/docs/wg430_3_draft_common_indicator_fact_sheet_en.pdf

Pterois miles © SPARAC, Artescienza

F- Monitoring programme non-indigenous species (NIS)

I. BACKGROUND

1. Non-indigenous species in the Mediterranean

Marine non-indigenous (invasive) species are regarded as one of the main causes of biodiversity loss in the Mediterranean (Galil, 2007; Coll et al., 2010), potentially modifying all aspects of marine and other aquatic ecosystems. Marine invasive species represent a growing problem due to the unprecedented rate of their introduction (Zenetos et al., 2010) and the harmful impacts that they have on the environment, economy and human health (Galil, 2008). In general, In marine ecosystems, alien marine species may become invasive and displace native species, cause the loss of native genotypes, modify habitats, change community structure, affect foodwebs' properties and ecosystem processes, impede the provision of ecosystem services, impact human health, and cause substantial economic losses (see Katsanevakis et al., 2014). This phenomenon extends to all regions of the Mediterranean (Galil, 2007, Galil et al., 2009; Zenetos et al., 2010) and requires monitoring (Pomeroy et al., 2004). According to the latest regional reviews, more than 6% of the marine species in the Mediterranean are now considered non-native species as around 1000 alien marine species having been identified (Zenetos et al., 2012), while their number is increasing at a rate of one new record every 2 weeks (Zenetos et al., 2012). Of these species, 13.5% are classified as being invasive in nature, with macrophytes (macroalgae and seagrasses) the dominant group in the western Mediterranean and Adriatic Sea, and polychaetes, crustaceans, molluscs and fishes in the eastern and central Mediterranean (Galil, et al., 2009; Zenetos et al., 2010; Zenetos et al., 2012). The vast majority of NIS in the Mediterranean occurs in the eastern Mediterranean; some are located exclusively in the south-eastern basin, others are restricted to the western basin, while others have colonized the entire Mediterranean.

Although invasive alien species may be responsible for high ecological impact in particular for reducing the population of some native species, some NIS, particularly crustaceans and fish have become an important fishery resource. The migration of Lessepsian (meaning through the Suez Canal) NIS appears to play an important role for fisheries, particularly in the Levantine basin (UNEP(DEPI)/MED IG.22/Inf.7).

2. Pathways of introduction of non-indigenous species in the Mediterranean Sea

The Suez Canal, as a pathway of NIS, is believed to be responsible for the introduction of 493 alien species into the Mediterranean, approximately 11% being invasive (55 species). However, only 270 of these species are definitely classified as Lessepsian immigrants. Of these 270 Lessepsian immigrants, 71 consist of casual records (based on one or two findings) while 175 are successfully established. 126 out of them (including 17 invasive ones) are limited to the Eastern Mediterranean sub-region, whereas the others are progressively spreading into the neighbouring Mediterranean sub-regions.

Shipping is identified directly for the introduction of 12 species only, whereas it is assumed to be the only pathway of introduction (via ballast or fouling) of a further 300 species. For approximately 100 species, shipping counts as a parallel possible pathway along with the Suez Canal or aquaculture.

About 20 NIS have been introduced with certainty via aquaculture, either as escapees of imported species, mostly molluscs, or associated as contaminants: parasites; epibionts; endobionts; or in the packing materials (sessile animals, macrophytes).

Aquarium trade, although currently limited to 2% of introductions, is gaining importance as a pathway of introduction. A total of 18 species are assumed to have been introduced by aquarium trade, the only certain case is that of Caulerpa taxifolia. With the exception of four species, for which aquarium trade is suspected to be a parallel mode of introduction, the remaining 13 species are all tropical fish species kept in marine aquaria. The most plausible explanation for their presence appears to be accidental release, though unaided introduction via the Suez Canal cannot be ruled out for those also occurring in the Red Sea.

The growth of marinas in many Mediterranean coastal areas in recent years could be providing a platform (hulls, chains, anchors, propellers, immersed sides of floating pontoon units, poles, immersed portions of floating structures supporting boardwalks) for the spread of NIS as these sites are closely associated with the movements of vessels (fishing or recreational boats) carrying alien species as hull fouling. Although antifouling paints help to control fouling, hulls are still an important means of transport for non-indigenous species.

NIS introduced via corridors (essentially the Suez Canal) are the majority in the Eastern Mediterranean sub-region, and their proportion declines towards the western basin. The reverse pattern is evidenced for ship-mediated species and for those introduced with aquaculture. Regarding those species linked to both the Suez Canal and to shipping some of these Indo-Pacific species might have actually been introduced by shipping and not by natural means via the Suez Canal but there is insufficient information. They constitute a considerable portion ranging from approximately 9% in the Eastern Mediterranean sub-region to approximately 6% in the Western Mediterranean sub-region.

3. Climate change effects on the spread of NIS in the Mediterranean

Climate change is likely to affect the structure of marine communities and provide further opportunities for alien species to spread and out-compete native species, hence acting synergistically (see Yeruham et al., 2015). In general, many native and alien species are shifting their areas of distribution towards higher latitudes (CIESM, 2008). As the majority of NIS in the Mediterranean are thermophilic that originated in tropical seas of the Indo-Pacific, warming sea temperatures favour the introduction of more Red Sea species into the south-eastern Mediterranean and their spread northwards and westwards (UNEP(DEPI)/MED IG.22/Inf.7).

4. Invasive species in Israel waters

Being situated in the Levant, at the south-eastern edge of the sea, Israel is known as a prime hotspot for species invasions since the opening of the Suez Canal in 1869 (Galil, 2007; Rilov, 2017). The location of the Israeli coast "downstream" of the prevailing current from the opening of the Suez Canal means that it is the first haven for the Erythrean propagules. Most of the Erythrean aliens known from the Mediterranean Sea have been first recorded from Israeli coast (Galil, 2007).

According to Zenetos & Polychronidis (2010) Israel is ranked as the leader in the numbers of marine invasive species in the entire Mediterranean Sea.

Most of the NIS introduced via the Suez Canal have established thriving populations along the Levant from Libya to Greece, and several also spread in the Western Mediterranean. The individual and cumulative impacts of these NIS adversely affect the conservation status of particular species and critical habitats as well as the structure and function of ecosystems and the availability of natural resources (Galil et al., 2014). Significant and often sudden decline of native species, including local population extirpations, have occurred and are occurring concurrent with proliferation of Canal-introduced NIS (Galil et al., 2014; Rilov et al., 2017). Some species are poisonous and pose clear threats to human health. Although effects of many NIS have not been evaluated to date, some significant ecological and social consequences are known and the potential reach and magnitude of the cumulative impacts are enormous (see Galil et al., 2014; Rilov et al., 2017).

5. Israel's National Monitoring Plan – past and present

Israel's reliance on the sea has grown tremendously over the last decade. The gas discoveries, the ongoing rise in seawater desalination quantities and the constant need for free space for industrial and public infrastructure (airport for example), have all resulted in greater awareness and quest for knowledge in our sea. Moreover, the state of Israel has also expressed its commitment for the conservation of marine biodiversity and protection from pollution in the international arena through the signing of the Barcelona convention (1978) and the CBD convention (2010).

Israel's national monitoring plan has been operating since 1978 but was focused mainly on chemical and physical aspects, with only minor portion concerning biological aspects.

The ongoing «rush» for ocean-based resources concomitant with the dramatic changes occurring in our marine habitats at present, evoked the urgent need to revise and expand Israel's National Monitoring Plan (see IOLR proposal in Hebrew 2017) in order to achieve supervised and science-based development. The new and revised plan was recently approved by the Israeli government (December 2018).

The new plan addresses the following indicators for Good Environmental Status which serve as the baseline for the IMAP (Integrated Monitoring and Assessment Programme):

- Biodiversity in main habitats (including non-native species)
- Eutrophication
- Marine food-webs
- Marine Pollution
- Seabed wholeness
- Hydrographic conditions
- Marine Noise
- Marine Debris
- Pollutants in commercial fish and invertebrate species
- Commercial fish and invertebrate species

The new plan enables the state of Israel to comply with its international commitments (to the Barcelona Convention) by being based on the Ecological Approach (EcAp).

The EcAp was adopted by the Barcelona Convention parties and is being implemented by the Mediterranean Action Plan (UNEP-MAP) through the MEDPOL organization and the Marine Strategy Framework Directive (MSFD) in order to achieve Good Environmental Status (GES) of the Mediterranean Sea.

Fig. 1 shows some examples of non-native invertebrate species of several origins.

Fig. 1. Examples of non-native invertebrates in Israel waters.
Top left: *Murex forskoehlii*, top right: *Chromodoris annulata*, middle: *Rhopilema nomadica*,
Bottom right: *Oculina patagonica*, bottom left: *Conomurex persicus*.

6. Integrated Monitoring and Assessment Programme (IMAP)

IMAP, through Decision IG.22/7 lays down the principles for an integrated monitoring, which will, for the first time, monitor biodiversity and non-indigenous species, pollution and marine litter, coast and hydrography in an integrated manner. As such, IMAP aims to facilitate the implementation of article 12 of the Barcelona Convention and several other monitoring related provisions under different Protocols with the main objective to assess GES. Its backbone are the 11 Ecological Objectives and their 27 common indicators as presented in Decision IG. 22/7.

In line with the above, guidance factsheets have been developed for each Common Indicator to ensure coherent monitoring, with specific targets defined and agreed in order to deliver the achievement of Good Environmental Status (GES) and as such, provide concrete guidance and references to Contracting Parties to support implementation of their revised national monitoring programs towards the overall goal of implementing the Ecosystem Approach (EcAp) in the Mediterranean Sea and achieve GES (UNEP(DEPI)/MED WG.444/6/Rev.1).

7. The common indicators (UNEP(DEPI)/MED IG.22/Inf.7)

In line with the recommendations of the Integrated EcAp Correspondence Group on Good Environmental Status (GES) and Targets Meeting (UNEP(DEPI)/MED WG.390/4), 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, but 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 and coastal ecosystem and can deliver valuable information to decision makers.

The Common indicators[2] agreed, which are at the core of the IMAP:

1. Habitat distributional range (EO1) to also consider habitats 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);

[2] Only the first 10 are shown

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);

II. MONITORING PLAN FOR NIS IN ISRAEL WATERS

In accordance with the general IMAP guidelines regarding common indicator 6 (see above), the following monitoring program will be implemented in Israel. The monitoring of NIS in hard and soft substrate habitats will mainly rely on the new and revised National Monitoring Plan of Israel in the Mediterranean Sea as was recently approved by the government. Additional monitoring is based on surveys conducted by Israel Nature and Parks Authority and specific NIS surveys at certain locations which are considered «Hot spots» for NIS.

As previously mentioned, NIS introduced via corridors (essentially the Suez Canal) are the majority in the Eastern Mediterranean sub-region, and their proportion declines towards the western basin. Being aware of this fact, it is of great importance to monitor NIS along the Israeli coast in a gradient way from south to north (in line with the prevailing major shore currents aiding at the spread of larvae and adult NIS arriving through the Suez Canal) in order to detect possible new «arrivals» as early as possible. Furthermore, it is well recognized that NIS in Israel are not solely introduced via the Suez canal so there is a need to monitor also hotspot areas concerning the shipping introduction pathway for NIS (such as ports, marinas etc.). The proposed plan is mostly based on the new and revised National Monitoring Plan for Israel with some additions in order for it to fulfil its goals.

According to the « Integrated Monitoring and Assessment Guidance» (UNEP(DEPI)/MED IG.22/Inf.7), the first step (for each of the contracting parties) of monitoring non indigenous species should be the conduction of surveys which will enable the creation of an initial list of NIS and particularly of invasive species existing in their marine waters, while preferably also monitor all cryptogenic species known in an area. This step will enable the creation of a baseline against which the future changes may be monitored.

Ongoing surveys should list newly arrived NIS, IAS and cryptogenic species, along with newly colonized localities. Moreover, in order for each of the contracting parties to proceed with the recommended monitoring (according to IMAP guide) and to be able to calculate and operate the «trend indicator» for non-indigenous species (see appendix 2) there is a need for at least <u>two years</u> of relevant data on the two parameters[3] (UNEP(DEPI)/MED IG.22/Inf.7). After a minimum period of two years of data collection, the «trend indicator» aiming at monitoring trends in temporal occurrence of NIS can be calculated for the first time and to serve as «NIS state gauge» for subsequent years.

1. Monitoring of NIS (EO2) as part of the biological diversity monitoring (EO1) Work plan (EO1 and EO2) (according to the new «Israel National Monitoring Plan)

1.1. Hard bottom

Monitoring hard bottom areas will include specific habitats according to the classification and mapping which took part as part of the recent Strategic Environmental Assessment project http://archive.energy.gov.il/Subjects/OilSearch/Documents/SEA/SEA_G_summary.pdf.

Monitoring will include habitats from the intertidal zone and down to 100 meters depth (see below). Benthic communities (including Macroalgae and Invertebrates) are the main focus of this monitoring as well as fish in close vicinity to the substrate (see table 1).

Monitoring surveys will be conducted on vermetid reefs located at the shoreline, Shallow Kurkar ridges (up to 25 meters depth) and deeper kurkar ridges (50 and 100 meters depth) Surveys will be performed by diving and snorkelling on shallow habitats and by Remotely Operated Vehicle (ROV) on deep habitats (fig. 2).

Tables 1 and 2 outline the monitoring plan for hard substrate habitats, the number of locations of each type, the frequency of monitoring and the parameters to be investigated.

[3] • Parameter [A] provides an indication of the introductions of "new" species (in comparison with the prior year).
• Parameter [B] gives an indication of the increase or decrease of the total number of non-indigenous species

Table 1. Monitoring outline of hard substrate habitats

Habitat	No. of locations	Frequency of monitoring
Vermetid reefs	2	Fall and Spring
Vermetid reefs	2	Four seasons
Shallow kurkar ridges (up to 25 m)	2	
Shallow kurkar ridges (up to 25 m)	2	Fall and spring
Shallow kurkar ridges (up to 25 m)	1	Four seasons
Kurkar ridges 35-50 m	4	Once every 3 years
Kurkar ridges 95-120 m	3	Once every 3 years

Table 2. Surveys on shallow rocky habitats with regards to invasive species

Taxon	Parameters
Fish	Species diversity indices, Beta diversity **Invasive to Local species ratio** (biomass and abundance)
Macroalgae	Species diversity indices, Beta diversity **Invasive and turf to Local species ratio** (biomass and abundance)
Invertebrates	Species diversity indices, Beta diversity **Invasive to Local species ratio** (biomass and abundance) – mainly for the phyllum mollusca

Fig 2: Map of hard bottom habitat monitoring surveys

1.2. Soft bottom

NIS in soft bottom habitats will be monitored as part of the general biological diversity monitoring (as part of the national monitoring plan) and will be conducted at specific monitoring stations stretching from shallow water (10 m depth) through the continental shelf habitats and down to the abyssal plane (1400 m depth).

Objects for monitoring include: Benthic Macro-infauna (>250 µm), Demersal slow-moving epifauna and Demersal motile epifauna. The frequency and magnitude of monitoring differs among the habitats and monitoring objects as outlined in Table 3 and Fig.3 (map).

The monitoring plan for soft bottom is summarized in table 2 and fig. 3.

Table 3. soft bottom surveys plan

	Sampling method	parameters	Stations	Seasons to be sampled	Repetitions per station
Benthic Macro-infauna (>250 µm)	Box corer and manual sampler for shallow waters	Community structure, Species diversity and richness indices (including **NIS/ native species ratio calculation)**	9 shallow 14 deep sea 120-1500 meters)	Shallow stations: twice a year - Spring and Autumn Deep stations: Once every two years in Autumn	3
Demersal slow-moving epifauna	15 minutes tow of 1.15 m net, eye size 5X5 mm	Community structure, Species diversity and richness indices, biomass (including **NIS/native species ratio calculation**)	6 (3 north and 3 south)	Twice a year, spring and autumn, day and night	3
Demersal motile epifauna	90 minutes tows by trawler, 500 µm eye plankton net. 1 trammel net at 1000 ms depth	Community structure, Species diversity and richness indices, biomass (including **NIS/native species ratio calculation**)	3 shallow 5 deep	Shallow stations: twice a year - Spring and Autumn, day and night Deep stations: Once every two years in Autumn	

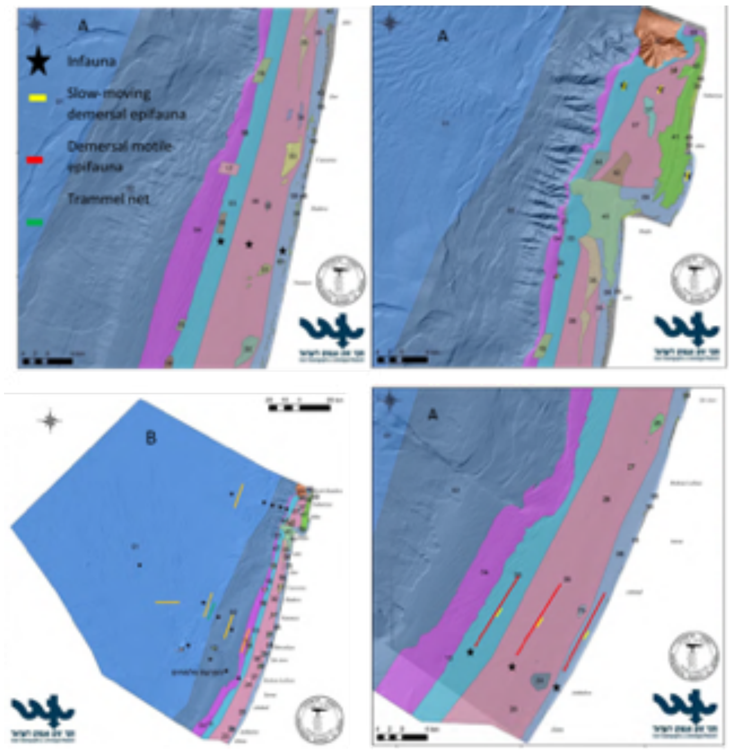

Fig 3. Soft bottom habitats monitoring outline presented on habitats map (SEA, 2016). The different sampling techniques and parameters to be monitored are indicated at specific locations
(Infauna, slow-moving demersal epifauna, Demersal motile epifauna, Trammel net)

1.3. Monitoring of NIS in ports, marinas and other hotspot areas (based on the Cyprus plan)

Initially, a study to identify all hotspot areas of NIS introductions in Israel will be conducted. Potential hotspot areas include ports, marinas, aquaculture facilities, areas of increased seawater temperature (Power plants effluents etc.). All potential hotspot areas will be mapped and during the first year it will be decided which of these areas will be included in the monitoring scheme.

At each of these areas a rapid assessment survey of sessile indigenous and non-indigenous species will be conducted on an annual basis. Based on the availability of funds, occupancy surveys for monitoring of benthic megafauna, will also be conducted, on a less regular basis.

1.4. Rapid assessment surveys of sessile indigenous and non-indigenous species

Rapid assessment surveys of sessile communities on docks, permanently installed pontoons, floats, tires, ropes, and any other available hard substratum will be conducted in all hotspot areas (see e.g. Pederson et al. 2003). Fouling communities will be sampled by the team participating in the rapid assessment surveys, which should include taxonomic experts familiar with native and non-native marine organisms. This will be done by using scrapers, nets, various pans for viewing organisms on the dock, dissecting equipment and all necessary equipment for preserving and transferring specimens in the lab. Participants will be able to identify species in the field and verify them in the laboratory. A list of species will be maintained, and voucher specimens will be preserved and archived. At each location, sampling time will be limited to one hour, and thus all locations will be sampled within a limited number of days. The final output of the rapid assessment surveys will be inventories of both indigenous and non-indigenous species at each hotspot area.

1.5. Occupancy surveys for monitoring benthic megafauna (optional)

At the close vicinity of each of the selected hotspot areas, occupancy surveys with snorkelling and SCUBA diving will be conducted. Specifically, shallow rocky reefs will be surveyed by snorkelling (at least five transects at each hotspot area), and deeper waters will be surveyed by SCUBA (at least three transects at each of the main two habitats: hard bottom and soft bottom. Each transect will be surveyed for 15 min by two independent observers, who will record all benthic or benthopelagic NIS detected (including fish, invertebrates, and macrophytes). The methodology by Issaris et al. (2012) will be applied (see 4.1.1 for details).

1.6. Monitoring of NIS in marine protected areas

Israel Nature and Parks Authority are conducting a bi-annual biological survey of four marine nature reserves: Rosh Hanikra (the biggest and oldest reserve in Israel's territorial waters), Shikmona, Dor-Habonim and Gedor. The top goal of this survey is to test whether the reserves are effective in protecting their natural assets. The products of this survey include:

1. Comparison of biodiversity inside nature reserves vs. control sites
2. High resolution taxa list inside nature reserves and in control sites.
3. Description of spatial occurrence of fauna and flora from shallow waters and down to 30 meters depth.
4. Creation of flora and fauna data base which will serve as a baseline for future monitoring.

At the present stage, the survey mainly focuses on hard substrate habitats and is performed on the above-mentioned reserves as well as control sites.

As part of the biological data collection and analysis, the identification of NIS is performed, and the data is available. It is suggested to include this data as part of the NIS monitoring plan.

References

UNEP(DEPI)/MED WG.444/6/Rev.1. Agenda item 3 Review of proposed IMAP Common Indicator Guidance Facts Sheets (Biodiversity and Fisheries) IMAP Common Indicator Guidance Facts Sheets (Biodiversity and Fisheries). 6th Meeting of the Ecosystem Approach Coordination Group. Athens, Greece, 11 September 2017.

UNEP(DEPI)/MED IG.22/Inf.7. Integrated Monitoring and Assessment Guidance. 19th Ordinary Meeting of the Contracting Parties to the Convention for the Protection of the Marine Environment and the Coastal Region of the Mediterranean and its Protocols. Athens, Greece, 9-12 February 2016.

Appendix 1 (from UNEP(DEPI)/MED WG.444/6/Rev.1 factsheet)

Common Indicator 6: Trends in abundance, temporal occurrence, and spatial distribution of non-indigenous species (NIS)

Relevant GES definition: Decreasing abundance of introduced NIS in risk areas

Related Operational Objective: Invasive NIS introductions are minimized

Proposed Target(s): Abundance of NIS introduced by human activities reduced to levels giving no detectable impact

Justification for indicator selection

Marine invasive alien species are regarded as one of the main causes of biodiversity loss in the Mediterranean, potentially modifying all aspects of marine and other aquatic ecosystems. They represent a growing problem due to the unprecedented rate of their introduction and the unexpected and harmful impacts that they have on the environment, economy and human health. According to the latest regional reviews, more than 6% of the marine species in the Mediterranean are now considered non-native species as around 1000 alien marine species have been identified , while their number is increasing at a rate of one new record every 2 weeks (Zenetos et al., 2012). Of these species, 13.5% are classified as being invasive in nature, with macrophytes (macroalgae and seagrasses) as the dominant group in the western Mediterranean and Adriatic Sea, and polychaetes, crustaceans, molluscs and fishes in the eastern and central Mediterranean (; Zenetos et al., 2010, 2012). Although the highest alien species richness occurs in the eastern Mediterranean, ecological impact shows strong spatial heterogeneity with hotspots in all Mediterranean sub-basins (Katsanevakis et al. 2016).

To mitigate the impacts of NIS on biodiversity, human health, ecosystem services and human activities there is an increasing need to take action to control biological invasions. With limited funding, it is necessary to prioritize actions for the prevention of new invasions and for the development of mitigation measures. This requires a good knowledge of the impact of invasive species on ecosystem services and biodiversity, their current distributions, the pathways of their introduction, and the contribution of each pathway to new introductions.

Common indicator 6 is an indicator that summarizes data related to biological invasions in the Mediterranean into simple, standardized and communicable figures and is able to give an indication of the degree of threat or change in the marine and coastal ecosystem. Furthermore, it can be a useful indicator to assess on the long run the effectiveness of management measures implemented for each pathway but also, indirectly, the effectiveness of the different existing policies targeting alien species in the Mediterranean Sea.

Appendix 2 – The trend indicator

Indicator analysis methods

General definitions (according to UNEP(DEPI)/MED WG.420/4)

'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. 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. Natural shifts in distribution ranges (e.g. due to climate change or dispersal by ocean currents) do not qualify a species as a NIS. However, secondary introductions of NIS from the area(s) of their first arrival could occur without human involvement due to spread by natural means.

'Invasive alien species' (IAS) are a subset of established NIS which have spread, are spreading or have demonstrated their potential to spread elsewhere, and have an effect on biological diversity and ecosystem functioning (by competing with and on some occasions replacing native species), socioeconomic values and/or human health in invaded regions. Species of unknown origin which cannot be ascribed as being native or alien are termed cryptogenic species. They also may demonstrate invasive characteristics and should be included in IAS assessments.

Indicator Definition

For the needs of Common Indicator 6, the following definitions apply:

	Indicator units	Definition
Trend in abundance	the interannual change in the estimated total number of individuals of a non-indigenous species population in a specific marine area.	% change per year
Trend in temporal occurrence	interannual change in the estimated number of new introductions and the total number of non-indigenous species in a specific country or preferably the national part of each subdivision, preferably disaggregated by pathway of introduction	% change in new introductions or % change in the total number of alien species per year or per decade
Trend in spatial distribution	the interannual change of the total marine 'area' occupied by a non-indigenous species	% change in the total marine surface area occupied or % change in the length of the occupied coastline (in the case of shallow-water species that are present only in the coastal zone)

Methodology for indicator calculation – The Trend Analysis

To estimate Common Indicator 6, a trend analysis (time series analysis) of the available monitoring data needs to be performed, aiming to extract the underlying pattern, which may be hidden by noise. A formal regression analysis is the recommended approach to estimate such trends. This can be done by a simple linear regression analysis or by more complicated modelling tools (when rich datasets are available), such as generalized linear or additive models.

To monitor trends in temporal occurrence, two parameters [A] and [B] should be calculated on a yearly basis. Parameter [A] provides an indication of the introductions of "new" species (in comparison with the prior year), and parameter [B] gives an indication of the increase or decrease of the total number of non-indigenous species:

- [A]: The number of non-indigenous species at Tn that was not present at Tn-1. To calculate this parameter the non-indigenous species lists of both years are compared to check which species were recorded in year n but were not recorded in year n-1 regardless of whether or not these species was present in earlier years. To calculate this parameter the total number of non-indigenous species is used in the comparison.
- [B]: The total number of known non-indigenous species at Tn minus the corresponding number of non-indigenous species at Tn-1. Hereby Tn stands for the year of reporting.

The trend analysis should be accompanied by an evaluation of confidence and uncertainties. Standard regression methods (simple linear regression, generalized linear or additive models, etc) provide estimates of uncertainty (standard errors and confidence intervals of estimated trends). Such uncertainty estimates should accompany all reported trends.

Furthermore, the issue of imperfect detectability should be properly addressed, as it may cause an underestimation of the relevant state variables (abundance, occupancy, geographical range, species richness). There are many available methods that properly tackle the issue of imperfect detection when monitoring biodiversity, by jointly estimating detectability (see Katsanevakis et al. 2012 for a review).

Methodology for monitoring, temporal and spatial scope

Available Methodologies for Monitoring and Monitoring Protocols

It is recommended to use standard monitoring methods traditionally being used for marine biological surveys, including, but not limited to plankton, benthic and fouling studies described in relevant guidelines and manuals. However, specific approaches may be required to ensure that alien species are likely to be found, e.g. in rocky shores, port areas and marinas, offshore areas and aquaculture areas. As a complimentary measure and in the absence of an overall NIS targeted monitoring programme, rapid assessment studies may be undertaken, usually but not exclusively at marinas, jetties, and fish farms (e.g. Pederson et al. 2003).

The compilation of citizen scientists' input, validated by taxonomic experts, can be useful to assess the geographical ranges of established species or to early record new species.

For the estimation of Common Indicator 6, it is important that the same sites are surveyed each monitoring period, otherwise the estimation of the trend might be biased by differences among sites. Standard methods for monitoring marine populations include plot sampling, distance sampling, mark-recapture, removal methods, and repetitive surveys for occupancy estimation (see Katsanevakis et al. 2012 for a review specifically for the marine environment., Katsanevakis S, et al., 2012. Monitoring marine populations and communities: review of methods and tools dealing with imperfect detectability. Aquatic Biology 16: 31–52., Pederson J, et al., 2003 Marine invaders in the northeast: Rapid assessment survey of non-native and native marine species of floating dock communities, August 2003 (available in https://dspace.mit.edu/bitstream/handle/1721.1/97032/MITSG_05-3.pdf?sequence=1)

Available data sources

Marine Mediterranean Invasive Alien Species database (MAMIAS) - http://www.mamias.org/

European Alien Species Information Network (EASIN) - http://easin.jrc.ec.europa.eu/

CIESM Atlas of Exotic Species in the Mediterranean - http://www.ciesm.org/online/atlas /

World Register of Introduced Marine Species (WRIMS) - http://www.marinespecies.org/introduced/

Spatial scope guidance and selection of monitoring stations

The monitoring of NIS generally should start on a localized scale, such as "hot-spots" and "steppingstone areas" for alien species introductions. Such areas include ports and their surrounding areas, docks, marinas, aquaculture installations, heated power plant effluents sites, offshore structures. Areas of special interest such as marine protected areas, lagoons etc. may be selected on a case by case basis, depending on the proximity to alien species introduction "hot spots". The selection of the monitoring sites should therefore be based on a previous analysis of the most likely "entry" points of introductions and "hot spots" expected to contain elevated numbers of alien species.

It is important to establish a network of monitoring sites at regional level in which common protocols are applied so that Common Indicator 6 can be assessed at both national and regional level.

The use of Habitat Suitability Models and Ecological Niche Modelling (ENM) may be considered at a later stage of IMAP to identify priority monitoring sites and to predict the spread of NIS.

Temporal Scope guidance

Monitoring at "hot-spots" and "steppingstone areas" for alien species introductions would typically involve more intense monitoring effort, e.g. sampling at least once a year at ports and their wider area and once every two years in smaller harbours, marinas, and aquaculture sites.

Data analysis and assessment outputs

Statistical analysis and basis for aggregation

Standard statistics for regression analysis should be applied to estimate trends and their related uncertainties.

Expected assessments outputs

Graphs of the time series of the calculated metrics (abundance, occurrence, etc), including confidence intervals

- Distribution maps of the selected species, depicting temporal changes in their spatial distribution
- National inventories (and also by the national part of each marine subdivision, if relevant) of non-indigenous species by year

Known gaps and uncertainties in the Mediterranean

NIS identification is of crucial importance, and the lack of taxonomical expertise has already resulted in several NIS having been overlooked for certain time periods. The use of molecular approaches including bar-coding are sometimes needed to confirm traditional species identification.

Sampling effort currently greatly varies among Mediterranean countries and thus on a regional basis current assessments and comparisons may be biased.

United Nations
Environment Programme

Mediterranean Action Plan
Barcelona Convention

The Mediterranean
Biodiversity
Centre

SPA / RAC

Specially Protected Areas Regional Activity Centre (SPA/RAC)
Boulevard du Leader Yasser Arafat - B.P. 337 - 1080 Tunis Cedex - Tunisia
Tel: +216 71 206 649 / 485 | car-asp@spa-rac.org | www.spa-rac.org