Regional experience-sharing workshop
of the MedPAN network
25-27 November 2014, Tirana, Albania

Monitoring for managing Mediterranean MPAs

Workshop proceedings

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The MedPAN network's 2014 regional experience-sharing workshop

The MedPAN network[1] brings together managers of Mediterranean Marine Protected Areas and supports them in their management activities. For this purpose the network organises every year an experience-sharing workshop for MPA managers to pool and share their experiences.

The MedPAN network's 2014 regional experience-sharing workshop was held on 25 - 27 November in Tirana, Albania on the theme **"Monitoring for managing Mediterranean MPAs"** (including ecological and socio-economic monitoring).

The high attendance (150 participants from 14 Mediterranean countries[2]) and the participants' commitment in the talks demonstrated how interested the managers, partner NGOs and scientific communities were in this key topic. Members of regional institutions, local and national policy makers and donors also participated in the workshop.

The workshop was organised by MedPAN and the RAC/SPA (Regional Activity Centre for Specially Protected Areas) in partnership with the Albanian Ministry of Environment, APAWA (Association for Protection of Aquatic Wildlife of Albania) and with the support of the IUCN Med, French Marine Protected Areas Agency and WWF Mediterranean.

The workshop was funded by MAVA Foundation, the French GEF (FFEM), WWF Mediterranean, the RAC/SPA, the Ministry of Environment of Albania, Conservatoire du littoral, the French MPA Agency, the Region Provence-Alpes-Côte d'Azur, the City of Marseilles and the French Embassy in Albania.

[1] the network of Marine Protected Areas managers in the Mediterranean
[2] Albania, Algeria, Croatia, France, Greece, Italy, Lebanon, Monaco, Morocco, Montenegro, Slovenia, Spain, Tunisia, Turkey

Monitoring for managing Mediterranean MPAs: A key topic for the effectiveness of the MedPAN network

Linked to this year topic, the MedPAN organisation started collecting ecological and socio-economic monitoring protocols in 2013. Many different actors were requested to contribute to this initiative (MedPAN members and partners, MPA managers, scientists, experts, NGOs…) and several protocols have been collected so far, encompassing a wide range of topics.

In 2012, MedPAN also analyzed the situation regarding monitoring initiatives implemented in MPAs through the MAPAMED database (for further detail, please refer to the Status of Marine Protected Areas in the Mediterranean Sea 2012).

In the above mentioned report, MedPAN led also a study to identify the main monitoring regional and sub-regional programmes related to MPAs in the Mediterranean[3]. One hundred monitoring programmes in all were identified. Some have been completed (e.g. EMPAFISH, AMPAMED) or are in progress (e.g. COCONET). Monitoring studies for MPAs have been identified in different areas: ecological, governance, oceanographic, ecological networks, socio-economic…

Moreover, some useful guidelines related to monitoring have been developed in the past through the MedPAN North and MedPAN South projects and the MedPAN INTERREG IIIC project (management effectiveness, invasive species, climate change, visitor management…).

MedPAN has also supported, through its 2011-2013 call for small projects, some projects related to monitoring that have been implemented and developed by some MPAs and sharing their results would be of high interest for all MPAs. RAC/SPA has organized, in the framework of the MedMPAnet project, three Mediterranean training sessions on ecological monitoring in MPAs (2011, 2012 and 2013) in collaboration with the University of Alicante (Spain). A fourth similar session will be organized in September 2014, in Santa Pola (Spain). In this context, RAC/SPA is planning to compile and edit a Teaching Package on Ecological Monitoring in Mediterranean Marine Protected Areas, in collaboration with the University of Alicante.

Finally, MedPAN and WWF Mediterranean have co-organized in 2013 at the Plemmirio MPA in Siracusa, Italy, a workshop to bridge the needs of managers in Mediterranean MPAs with regional scientists and scientific institutions.

[3] Chassanite A., S. Marinesque and J. Claudet, 2012. Etats des lieux des programmes de suivis multidisciplinaires visant les AMP de Méditerranée. MedPAN, 95p.

Steering Committee

A multidisciplinary Steering Committee was set up for reviewing the objectives of the workshop, defining the content of the workshop, and identifying case studies that will be presented during the workshop. This Steering Committee met at the Paul Ricard Oceanographic Institute on Les Embiez Island (France) on 3-4 June 2014.

Workshop's objectives

- Support MPA managers to identify and implement monitoring in line with the objectives of their MPA;

- Discuss the idea to 'promote' specific protocols to harmonize data collection throughout the system of MPAs.

Field trip to Rodoni Cape

Tuesday 25 November

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Rodoni Cape is one of the proposed areas as a potential MPA from the National Biodiversity and Action Plan of Albania. Currently, the GEF/UNDP project on marine and coastal protected areas in Albania has started the assessment and preparation of procedures for the MPA proclamation of this area. This assessment includes marine and coastal biodiversity, habitat mapping, socio-economy, legal and institutional framework, which has to be followed by the public hearing and consultation with local and national stakeholders.

Regarding biodiversity, the most highlighted features are the large and well developed underwater meadows of Posidonia oceanica, the diversity of underwater microhabitats, the well preserved Mediterranean forest and maquis at the terrestrial part of the cape, as well as many landscape amenities of this cape, facing two very nice bays: the Rodoni Bay with the Patok Wetland Complex in the northern part, well known recently as an important foraging site for the sea turtle Caretta caretta; and Lalzi Bay in the southern part, famous for its sandy, clean and beautiful beaches.

Apart from biodiversity and natural values, Rodoni Cape is well known for its historical and cultural values, from the antiquity to nowadays, as it has been situated in a strategic position between old civilizations and maritime trade routes for the Adriatic region. Currently, the most important historical - cultural features to highlight are the catholic church of St. Antony from the XV century that is supposed to have been converted from a former Byzantine orthodox church of IV - V centuries, as well as the Sckanderbeg Castle (also known as Donika's Castle) built at XV century on the top coastal part of the Rodoni Cape. All these mentioned features and values, besides others, will be highly important for the management of the new expected MPA, also providing considerable benefits for the local community, through the sustainable use, conservation and management of this area.

Workshop day 1

Wednesday 26 November

« Support MPA managers to identify and implement monitoring in line with the objectives of their MPA »

The first day of the workshop was focused on the issue of monitoring for managing an MPA on the individual scale. The morning programme consisted in a suite of plenary presentations to oversee several principal issues in order to feed into the afternoon exchanges that took the shape of several parallel discussion groups.

Speech by Mr. Lefter Koka, Minister of Environment of Albania during the opening session of the workshop ©M. Mabari/MedPAN

Introductory plenary session: Challenges in implementing monitoring for managing Mediterranean MPAs

General introduction

Speakers: Laurent Sourbès (Zakynthos National Marine Park, Greece / MedPAN Vice-President) & Joachim Claudet (CNRS / CRIOBE, France / President of MedPAN Scientific Committee)

[presentation]

Why conduct monitoring?

"Why conduct monitoring" is rightly the first question raised. The objective is mainly to **help the managers improve the management efficiency in their MPA** (first pillar of the MedPAN Network Scientific Strategy). It is thus in this perspective that the objectives of this year's workshop are built:

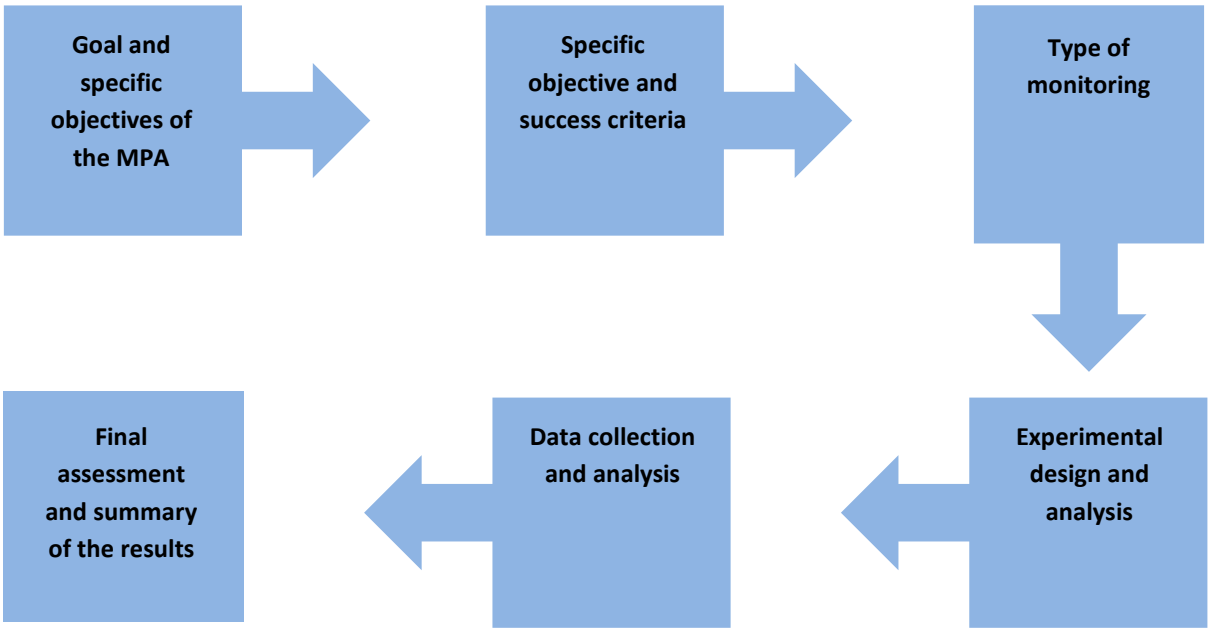
1. **Help the MPA managers identify and implement monitoring in line with the objectives of their MPA;**
2. **Discuss the idea of "promoting" specific protocols to harmonize data collection throughout the system of MPAs.**

Referred to as **all the management/research activities carried out to monitor the marine environment and MPA-related human activities** (habitats, species, uses, management), monitoring for management is aimed at:

1. Assessing management
2. Monitoring the development of a system
3. Managing the unexpected

"Monitoring for management" methodological framework

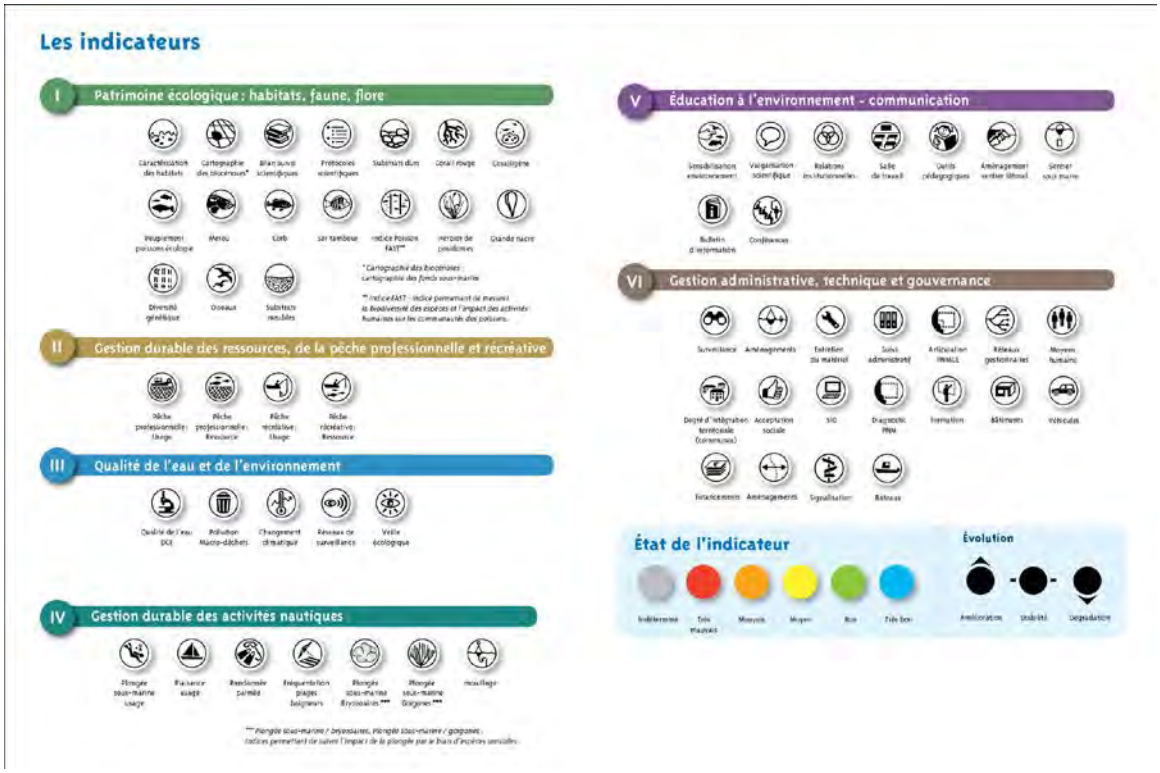
The "monitoring for management" methodological framework can be represented in the following diagram:



Which monitoring indicators?

Monitoring indicators are:

- Qualitative or quantitative variables that can be obtained from field measurements or mathematical models and **linked to management objectives**
- Single variables or integrating complex measurements
- Data used to monitor and reproduce the progress of a system
- Sensitive and specific to the effect to be measured
- Part of the decision-making process.



The importance of cooperation between scientists and MPA managers

- Understand management needs and constraints
- Capacity-building and best practices
- Transfer of knowledge
- “How it could be”, “how it should be”
- Feel useful (science to support societal questions).

The issues of science for management

- Take account of the local context (ecological, socio-cultural, socio-economic, political)
- Prioritization
- Short-term vs. long-term effects
- Multiple and multidisciplinary expertise.

The issues of monitoring from the manager's point of view

- Identify conservation needs and priorities
- Identify relevant ecological and socio-economic monitoring actions
- Manage: plan – implement – assess
- Cooperate to get to understand what is going on elsewhere (necessary for the monitoring of migratory species, for instance)
- Communicate: scientific data are important for the managers. They can be used to communicate, present arguments and justify management choices, and at the local level, raise awareness among users and decision-makers
- Anticipate – Precautionary principle
- Contribute to decision-making.

Main constraints to the implementation of monitoring

- Human resources (staff, capacity…)
- Economic resources
- Equipment and infrastructures
- Geographical characteristics of the MPA (secluded, extended…)
- Knowledge.

Presentation of the recommendations that came out of the MedPAN/WWF workshop "Science for management" (March 2013, Syracuse, Italy)

Speaker: Giuseppe Di Carlo (WWF Mediterranean, Italy)

[abstract] [presentation]

To bridge the needs of managers in Mediterranean MPAs with regional scientists and scientific institution, a workshop was hosted by WWF and MedPAN on March 5-6 March 2013 at Plemmirio MPA in Syracuse, Italy. The workshop was intended to guide a network of managers and scientists to answer key questions focused both on ecosystem health and socio-economic conditions, to achieve effective science-based management. This was the first Mediterranean-wide opportunity to enable an open dialogue between scientists and managers working on MPAs in different countries. In this respect this meeting has set important benchmarks for the 2014 regional experience-sharing workshop of the MedPAN network.

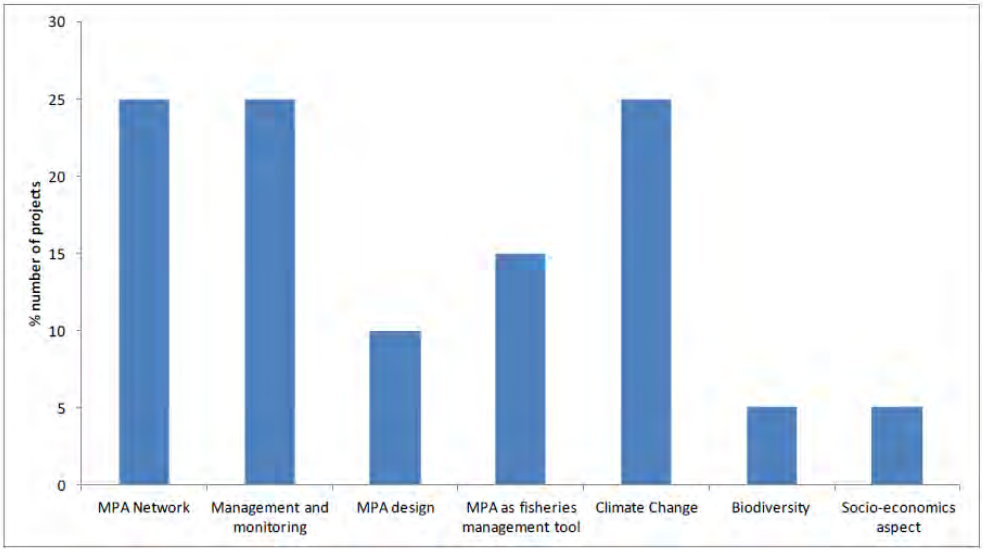
The objectives of the workshop held in Syracuse were to:

1. Assess (and prioritize) current gaps both on research and MPA management, and to understand how to address these gaps.
2. Strengthen existing partnerships between research institutions and MPA practitioners and to develop new mechanisms where needed.
3. Identify project opportunities and facilitate multi-partner collaborations.

Overview of research projects involving MPAs in the Mediterranean

Prior to the workshop, stock was taken of existing research efforts, main monitoring regional and sub-regional programmes, key research projects, and studies published in relation to MPAs in the Mediterranean. This overview has shown that:

- **The highest number of projects were developed by Italian, Spanish and French institutions;**
- **Only 69% of the projects reviewed directly involved MPAs;**
- The majority of these projects produced report and articles relevant for **informing managers to design better management strategies.**



Main research topics of projects involving MPAs

Outcomes of the workshop held in Syracuse

- The workshop highlighted **the lack of on-site MPA managers in several countries** (a known challenge in the Mediterranean) as a major issue making cooperation with research institutions difficult.

- The participants agreed that there was the **need for a greater effort from managers to make better use of existing scientific information and management tools and to develop the means to become involved in research projects** and at the same time that **scientists should make a greater effort in reaching out to managers** (or managing authorities) when including MPAs into their projects.

- The **creation of a permanent platform at regional and national level** was proposed in order to enhance the collaboration, dialogue and cooperation among managers and scientists, and to develop joint research projects.

- It was briefly discussed the **need for NGOs to put more effort into digesting existing scientific information**, typically only available in peer-review journal into management tools useful to MPA practitioners.

The outcomes of the workshop helped inform the MedPAN network scientific strategy and contributed to identify future priority actions for MPAs.

Integrating scientific monitoring into the MPA's basic operation: the case of Zakynthos National Marine Park

Speaker: Laurent Sourbès (Zakynthos National Marine Park, Greece)

[abstract] [presentation]

The Zakynthos National Marine Park (ZNMP) was established in 1999 by Presidential Decree and has been managed by a Management Body since 2000. It is located on the Southern Coast of Zakynthos Island in Greece. The ZNMP includes three species *(*the loggerhead turtle *Caretta caretta,* the Mediterranean monk seal *Monachus monachus* and the Cory's shearwater *Calonectris diomeda*) and a marine habitat with *Posidonia oceanica* meadows. These are all classified as a priority under Annexes I and II of Directive 92/43 and Annex I of Directives 79/409 EEC and 2009/147/EC.

Many monitoring issues identified since the creation of the ZNMP

Since the creation of the ZNMP, many issues have been identified through the scientific monitoring activities, both in terms of effectiveness of the existing protective measures, and governance due to a particularly hostile situation, especially at the local level.

As regards the *Caretta caretta* loggerhead turtle, regular scientific monitoring has been carried out, mainly by a Greek NGO (Archelon), since 1984 – which was 15 years before the creation of the Park. This scientific monitoring, mainly consisting in counting and locating the nests on the beaches of Lagana Bay, largely contributed to the first attempts to regulate the uses and activities developed in the terrestrial area, and to a lesser extent, in the marine area. However, the other species and habitats of community interest have had little systematic monitoring before the creation of the Park. This has been a contributing factor to the local communities' lack of understanding of the rules and zoning which were established in 1999 and went beyond the mere immediate protection of turtle nests (creation of peripheral zones, landscape and nature protection areas, wetlands, marine areas).

Besides, the significant human pressures exerted on these protected species and habitats during the summer (mass tourism) as well as the changes linked to abiotic factors result in the need to provide an appropriate and focused management response, over the short, the medium and the long term. The major management challenge in Zakynthos is to ensure effective protection while encouraging sustainable development.

Main scientific monitoring objectives in the ZNMP

- **To respond appropriately to the pressures** exerted on the protected area, whether they are known and recurring in time or unidentified.
- **To acquire relevant knowledge to ensure integrated management of species and habitats**, both in the protected area and in their general distribution area (global approach needed for the monitoring of migratory species such as the *Caretta caretta* and their lifecycle).
- **Acquire a suitable governance tool,** which meets the information, consultation, planning and legislation needs and scientific requirements (consistent data).
- **Establish a simplified and flexible interface in terms of adaptive management, enhancing the field staff's role in data collection and the communication between the different decision-making levels within the Park's management body.**
- Set up **regular scientific monitoring on the long term, viable in terms of cost-efficiency** and **streamlined in terms of available resources** (human resources and equipment).
- **Focus on precautionary approach and ecological coherence on the basis of knowledge gained and the access** to centralised and processed information from other MPAs.

Responses provided by scientific monitoring integrated into MPA management

Based on these previously stated factors, which are mostly due to the ZNMP's own experience, the management body has put in place and is implementing a set of measures to improve the management efficiency:

- **Implementation of adaptive management principles:** since 2006, the ZNMP's management body has been relying on an adaptive management approach, namely "**a planned and systematic process to continuously improve the environmental management practices by learning from their results**"; this is a combination of field experience and general scientific knowledge which is required to understand the management issues. Such approach requires the identification of several key factors to be monitored, and daily data collection:
    - **Identification of key factors affecting the management** (consultation between the Park's scientific staff, the field officers and different third organisations involved in scientific monitoring) and data collection carried out on daily basis (e.g. number of visitors, turtle nests, and fishing boats) or occasionally, when relevant (beaches geomorphology).

- **Identification of "critical" factors** (immediate prior information such as stray dogs preying on turtle nests, gulls preying on hatchlings, the number of permitted umbrellas has been exceeded and they are near the nests, the number of visitors present at one time in relation to the beach carrying capacity, high number of dead fish on the coastline, etc.)

- **Standardized scientific monitoring related to the "Conservation Status Assessment" of Natura 2000 sites:** since 2014, the ZNMP has been cooperating with Greek universities and research organizations to assess the conservation status of species (reptiles including loggerhead turtles, amphibians, birds, marine and terrestrial mammals, fish, shellfish) and habitats (marine, coastal, terrestrial) identified in its jurisdiction zone.

- Scientific data are used to improve users and decision-makers' knowledge while promoting Citizen science (Science & Citizens)

- Scientific data collection carried out by the Park officers (surveillance staff) is standardized and they are given prior training by scientists to ensure continuity over time and scientific validity.

- The activities (patrols, surveillance zone) and the agents' actual abilities are taken into account so that the collection of scientific information remains supplementary and does not distract them from their main mission (surveillance, information).

- Distinction made between recurring and non-recurring research. Maximization of cost/efficiency using the staff abilities and any other cooperation opportunities with the Universities, research centres and NGOs. Cost related to the quality of data and their validity on the long term. Prioritization of needs.

- Use other MPAs' experience and scientific knowledge in terms of methodology, management and assessment practices to maximise the efficiency of the protection and prevention measures.

Conclusions drawn from the ZNMP experience

- Identifying and implementing scientific monitoring in an MPA must be closely linked with the strengthening of management measure efficiency.
- Consider that the assessment is carried out to ensure management in a challenging economic context - which tends to limit the equipment and human resources available - in order to provide a protection that, even if it is minimal, can be described as effective.
- Scientific monitoring (ecological and socio-economic) must be integrated into every type of action taken (planning, implementation, assessment) by MPA managers - without this necessarily resulting in an additional prohibitive cost - and used to support and enhance the credibility and consistency of the implemented management measures.
- Cooperate with all the stakeholders likely to contribute to a better knowledge of the MPA
- Promote an ecosystem-approach considering the environmental and socio-economic dimension.

Improving management of Mediterranean Marine Protected Areas taking advantage of a solid scientific support

Speaker: Paolo Guidetti (University of Nice Sophia Antipolis, France)

[presentation]

Logical preamble: MPAs exists because there are problems at sea we have to solve or, at least, alleviate. The cost of MPAs is justified toward society if they work, i.e. if MPAs are able to produce benefits in comparison with marine areas that are not protected or properly managed. Assessing, therefore, the effectiveness of MPAs needs specific scientific-technical competences and responsibility toward society.

The issues proposed in the present contribution, therefore, come out from about 20 years of personal experience in experimental monitoring in a number of Mediterranean MPAs, and from the related collaboration/interaction/contact with MPA managers (from national to local level) and stakeholders (e.g. artisanal fishermen)*. The aim of this presentation is to share some experiences, results and thoughts, in order to better define the role of scientists within the 'MPA science and management' context.*

What is inside an MPA?

MPAs are like banks, where we secure/protect our natural and cultural heritage. It is therefore crucial for managers to know what is inside their MPA: It is astonishing that most MPAs do not have mapped the ecosystems and habitats they asked to protect, nor they know what species are there and the way they distribute in space and change through time (e.g. benthic and vagile communities, especially fish due to their ecological and commercial value, associated to the various habitat types that MPA embed).

What happens inside the MPA?

Does the MPA work? "*Working*" for a marine "*protected*" area is to **demonstrate that "conservation measures" have some effects**. 'Conservation' is a concept involving 'protection' (e.g. in no-take zones) and management (e.g. in buffer zones). Surprisingly, most existing MPAs in the Mediterranean do not have any (credible) monitoring program aimed at testing the so-called 'Reserve Effects' (RE). There are impacts, in fact, like overfishing, that MPAs should solve or alleviate, at least inside their

borders. **Monitoring the 'Reserve Effect' in space and time by using scientific standards[4] is essential for properly demonstrating that the MPA works and for justifying the MPA to the society** (managing an MPA implies a cost paid by the society, that legitimately wants to make sure it provides a return on investment).

What happens outside the MPA?

One must also look for the benefits produced outside the MPA! Almost no MPA has data about **spillover (export of fishable biomass beyond the MPA boundaries)** or **recruitment subsidy (surplus production and export of eggs and larvae over large distances)**. Collecting these data would provide valuable information to assess how "spatially important" the MPA is. **Indeed, effective MPAs are "virtually" far larger and more important than their actual physical size in the case it is demonstrated they produce benefits outside their borders! Demonstrating recruitment subsidy and spillover effect will therefore give the manager more power in negotiation.**

Monitoring the effect of MPAs on their outskirt will also help developing **effective networks of MPAs** (connectivity) and will contribute to the implementation of the EU Marine Strategy Framework Directive.

Socio-economic responses: Monitoring effects on *human communities* by using scientific standards and operational targets

Socio-economic positive responses of MPAs (e.g. enhanced fishery yields, more sustainable tourism) are the **consequence** of bio-ecological responses. Spillover from no-take zones may benefit local artisanal fisheries, more groupers in the MPA may attract divers and support more sustainable tourism. The crucial importance of MPAs is that they are models to export elsewhere, that's why monitoring their effects is a serious and crucial step, needing competences and responsibility.

Conclusion

Data available at present are scarce, too 'soft' (often unreliable) for most MPAs in the Mediterranean Sea, if not totally absent for a significant number of MPAs. Among those MPAs that have '*data*', therefore, quite a few have *good-reliable-scientifically based-validated data.* Let me do a short digression: we do not like at all the idea that the monitoring our personal health is done by 'amateurs' of medicine, better a doctor, even more if he/she is well qualified and a responsible person. MPAs are 'health treatments' for marine ecosystems, and their monitoring need specific

[4] Scientific standards: proper sampling designs related to a precise hypothesis to test, selection of appropriate methods for collecting and statistically analyzing the data, and for drawing reliable conclusions.

competences and responsibility toward society. The lack of appropriate (i.e. high quality) information is a serious handicap for MPAs: management cannot be improved without proper information, no adaptive management can be applied, the public opinion cannot be informed about the potential and, even less, the actual objectives achieved by MPAs, all this strongly and negatively impacting policy makers at all levels and the future of MPAs.

Monitoring direct and indirect *reserve effects*, inside and outside MPAs' borders (population to ecosystem recovery, spillover, recruitment subsidy, fishery enhancement, tourism, etc) should be done by using 'scientific standards', which include the 'quality certification' of publishing in international journals).

Proper implication of researchers, therefore, is:

- essential to provide information to managers and, therefore, to allow them to adopt proper management measures;
- crucial to avoid the risk of auto-referential assessments (made by MPAs to assess themselves); scientists are competent referees, third parties contributing to assess the management effectiveness and the efficacy of the measures adopted;
- important to promote MPAs via the visibility of their results and achieved targets.

Development of an online tool to promote existing monitoring protocols which may be interesting for MPA management

Speaker: Bruno Meola (MedPAN Secretariat)

[presentation]

www.medpan.org/monitoring-protocols

Basic principle: Why reinvent the wheel when we don't have to? Let's share and promote existing methodologies and expertise!

On one hand, there are a lot of isolated monitoring initiatives, through which scientifically validated methodologies were elaborated and a strong expertise was developed, and on the other hand, many MPA managers need to implement monitoring programmes but lack methodologies or expertise to do so. The basic and logical idea of this project is then to promote and share existing monitoring tools and expertise through an online tool.

Existing methodologies and expertise

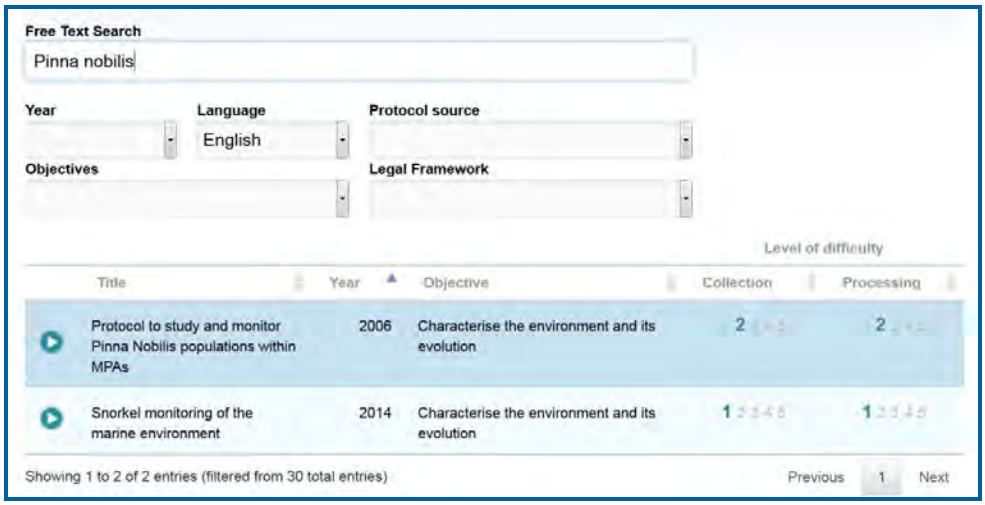
Need for methodologies and expertise

Objective of the tool

- **Inventory** existing socio-economic and ecological monitoring protocols, particularly those which can be adapted and used in Mediterranean MPAs,
- **Promote** these protocols by sharing them online,
- **Facilitate access** to these protocols by providing a user-friendly search tool.

What is it exactly?

An online virtual library containing only monitoring protocols which may be interesting for MPA managers, with a simple search interface.



Problems encountered so far

- Not all monitoring protocols are properly written documents
- Scientific validity
- Adaptability
- Need for expertise

Guidelines, general methodologies, material and methods...
Difficult to find some detailed documents presenting the whole process, from designing the sampling to analysing data, including equipment requirements, field methods, safety measures...

Call for protocols

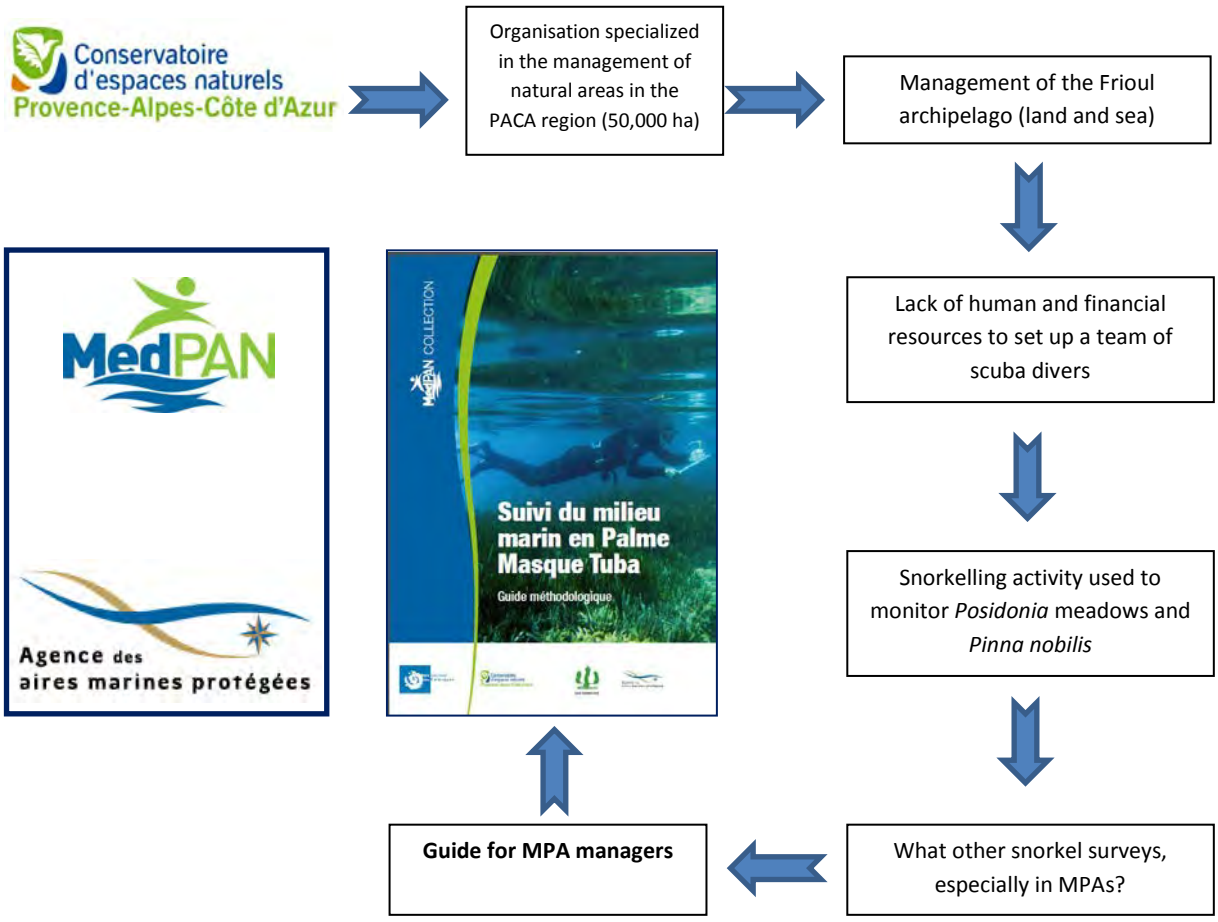
This tool is intended to be enriched over time
If you are willing to share your monitoring protocols, please contact the MedPAN team!

Snorkel surveys of the marine environment - Methodological notes

Speaker: Mathieu Imbert (Calanques National Park, France)

[abstract] [presentation]

Why a guide on snorkel survey?



Purpose of the guide: promote feasible monitoring to be carried out internally by the managers

The field officers should be able to carry out naturalist monitoring, in order to enhance:

- ✓ the field knowledge
- ✓ the understanding of the resources and the issues in the MPA
- ✓ the users' acceptance of the MPA and its officers

Through their daily presence, the officers are **long-term guards.**

Consequence: long-term, simple and easily deployed scientific monitoring.

Snorkelling is an efficient tool to monitor species and habitats in the medio-littoral and upper infra-littoral areas.

Snorkelling meets the constraints faced by the managers:

- Training of field officers
- Quick deployment
- Time spent on the field
- Field coverage
- Low-cost equipment

Methodology used to develop the guide

- Literature search
- Meeting and consultation with:
  - 10 North-Western Mediterranean MPAs,
  - 13 scientific organizations,
  - Convention with the Posidonia Scientific Interest Group

Make an inventory of feasible snorkelling protocols

The protocols identified were systematically field-tested (relevance, identify the implementation difficulties)

Content of the guide

To be used by Mediterranean MPA managers - it includes:

1. **Scientific monitoring,** a decision-making tool for the management of MPAs: Environmental watch/ Assessment of management actions;
2. **Snorkelling** as part of MPA management: equipment to be used and safety principles
3. **Monitoring equipment:** fabrication of waterproof slates for note taking, a quadrat or how to select the camera, etc.
4. **Six methodology factsheets**
    a. Species/habitat conservation issues
    b. Field equipment required
    c. Acquisition method
    d. Organisation of data collection
    e. Ideas for data capturing and enhancement

Methodology factsheets:

1. Fish visual census (target species)
2. Identifying and mapping *Diplodus* spp. nurseries
3. Inventory and monitoring of the *Pinna nobilis*
4. Mapping and evaluation of the vitality of *Lithophyllum byssoides* encrustations
5. Mapping the upper limit of the *Posidonia* meadows
6. Monitoring the populations of *Paracentrotus lividus* on rocky sea bottoms

Each protocol should be adapted to the specificities (environmental and regulatory conditions) of each MPA. Exchanges with scientists regarding the implementation of protocols are also advised.

The idea is to introduce a collaborative approach within the managers' networks (MedPAN and the French Agency of MPAs) and that this work is eventually supplemented by new protocols via the MedPAN directory, for instance.

Discussion sessions 1

These sessions took the shape of several parallel discussion groups lasting 1:30 each and bringing together about forty participants to tackle a key topic. For the topic under consideration, discussions were introduced by short case study presentations. Participants then shared experiences to identify good practices as well as constraints encountered when implementing monitoring. They also took into consideration a number of cross-cutting issues, such as that of the collaboration between scientists and managers, of managing and accessing data, of disseminating results, of new technologies, of the cost-efficiency or cost-usefulness dimension of given monitoring initiatives. Based on participants' experience and knowledge and bearing in mind the diversity of situations, the discussions were aimed at opening new paths of thoughts to optimise the implementation of monitoring initiatives for the management of MPAs.

Discussion session on « Environmental watch: monitoring for adaptive management»
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Environmental watch: monitoring for adaptive management

Moderator: Chloë Webster (MedPAN Secretariat, France)

Case studies presentations in a nutshell

	Monitoring of coralligenous assemblages in Capo Carbonara MPA (South Sardinia)	**Experience of Monitoring on Palm Islands Nature Reserve for Better Management**	**18 years of monitoring of *Caretta caretta* nesting in the Kuriat islands: a real contribution to the conservation of the biodiversity**	**Monitoring gorgonians forests to evaluate the effects of global change and diving in NW Mediterranean MPAs**
Speaker	Ivan GUALA (IMC – International Marine Centre, Italy)	Ghassan Ramadan-Jaradi (Palm Islands Nature Reserve, Lebanon)	Imed Jribi (University of Science in Sfax, Tunisia)	Cristina Linares (University of Barcelona, Spain)
Download	[abstract] [presentation]	[abstract] [presentation]	[abstract] [presentation]	[abstract] [presentation]
Why this monitoring?	The evaluation of the ecological quality of coralligenous assemblages can contribute to the definition of the state of the environment and provide useful information for applying conservation measures at local scale. As first monitoring of coralligenous assemblages, it provides a baseline of fundamental descriptors to evaluate the conservation status of the biocoenosis, to detect changes over time, and to ensure that the conservation measures are effective and consistent with the results of the monitoring.	Four bird species ceased from breeding and were extirpated from PINR and one other species became dominant. Dominance due to trash as food is diagnosed as a cause of extirpation. Reduction of organic trash was an action contributing to achieving the objective. Monitoring proved the validity of the diagnosis & the stability of mammals and herptiles. Several anthropogenic impacts on marine life were also identified and monitored.	The Kuriat islands represent a sensitive coastal area with an important biodiversity including the *Caretta caretta*. Through the monitoring activities, the most favourable nesting beaches were localized, the nesting cycles and inter-nesting intervals were specified, and the threats caused by tourists, rats and goats were identified (damaging nests, preying on hatchlings, fishing/by-catch)	Due to the complexity to evaluate local and regional impacts at a community level, it is crucial selecting representative species of the whole dynamics of the community. Our experience in several NW Mediterranean MPAs show that gorgonians can be a useful indicator to monitor recreational activities such as diving as well as the impacts of global change within MPAs.
What does monitoring consist in?	2 methods applied in Capo Carbonara MPA: ▪ Photographic methods to assess the number and % cover of main	The monitoring targeted organic trash on seasonal basis and bird species during the breeding season only. Other anthropogenic disturbances were occasionally monitored.	Activities carried out: ▪ Breeding female tracks ▪ Searching nests ▪ Localizing eggs	Different protocols and methodologies used to monitoring gorgonian forests in order to assess the impact of different stressors such as diving, warming, invasive species

	taxa and the heterogeneity of assemblages; ▪ Visual techniques (Rapid Visual Assessment) to identify presence, abundance and status of species that characterize the basal (i.e. incrusting organisms), the intermediate and the upper layers.		▪ Protecting nests using signage ▪ Marking (via satellite to follow the migration routes) ▪ Studying hatchlings' sex-ratio	and mucilage aggregates within MPAs were presented. From easy to more complex protocols allowing to answer different questions: Extensive surveys / Random quadrats / Permanent plots
Implementation: who does what?	Monitoring carried out by scientific experts with organizational and logistical support of MPA staff.	Monitoring trash and other anthropogenic disturbance are implemented by the MPA staff and Environment Protection Committee NGO. Monitoring of birds is implemented by an Ornithologist and Master students from Lebanese University.	The monitoring is carried out by the INSTM (National Institute of Marine Sciences and Technologies) in collaboration with the APAL (Coastal Protection and Development Agency), the RAC/SPA (Regional Activity Center for Specially Protected Areas) and the University of Sfax (University of Sciences in Sfax) with the presence of students and volunteers on the islands, during 3 summer months (from June, beginning of nesting, to October, end of emergence)	The 3 methodologies show different level of complexity allowing the participation and collaboration of scientists, managers and volunteers.
MPAs Constraints	✓ Budget: funds not surely available for long-term monitoring ✓ Human resources not available among the MPA staff: need to involve scientific experts from outside ✓ Previous knowledge on the presence of coralligenous biocoenosis is poor, its distribution is highly patchy, thus complicating the selection of sampling sites. The following criteria for site selection should be taken into account while applying the indices: • presence of biocoenosis	✓ Vagaries of the sea reduced the capability of monitoring ✓ Political tension and ammunition smuggling put at risk, in certain days, the access to the MPA. ✓ The high cost of transportation to MPA reduced the potential number of monitoring volunteers that are supposed to contribute to monitoring human activities and cleaning. Hopefully, the Ornithologist and the Master's students studied the monitoring plots as volunteers. ✓ Lack of funds delayed the possibility of the immediate		▪ Local vs. large spatial scales; ▪ Human resources available (collaboration scientist/managers vs. easy and little time consuming protocols for managers or very easy protocols for citizens) ▪ Non-destructive methods

	• depth (30-40 m) • level of protection • human pressures (diving activity) ✓ Applied methods are informative, rapid and reproducible but need of scientific expertise and diving capability.	removal of rubbish and trash. ✓ Lack of marine scientists and cost of diving deprived the MPA from submerged fauna monitoring.		
Operational management measures adopted (or adapted) in response to the results of the monitoring	While some recommendations have been proposed to update the management plan, no management measure has been adopted so far, with the exception of some initiatives in education and awareness-raising through the production of informative materials and meetings with citizens and stakeholders.	▪ Closure of the rubbish dump of Tripoli that is the main source of organic trash on the MPA's shores. ▪ Immediate cleaning of the MPA from the trash left by visitors and from dead sheep, goats, pigs and cows thrown from boats in the sea and washed up on the MPA's shores. ▪ Promoting the removal of rubbish dump away from shore along the Lebanese coast. ▪ Increasing awareness of local communities about the bad impact of trash on marine and coastal life. ▪ Cooperating with army to enforce the Law and control poaching activities.	The measures to be taken are the following: ▪ Control visitors' use on the islands especially during the nesting period ▪ Prohibit the use of umbrellas and tents on the beaches ▪ Stop all fishing activities around the islands ▪ Immediately stop goat farming on the large Kuriat island ▪ Prohibit any nest disturbance ▪ Raise awareness ▪ Declare – as soon as possible - the Kuriat Islands as MPA and take account of the monitoring results	
Cost efficiency/usefulness of the monitoring	▪ Both methods are used in other sites of the Mediterranean and have proven to be reliable, informative and useful to detect changes in coralligenous assemblages when submitted to different human pressures (Piazzi et al., 2014). ▪ a low degree of human-induced	▪ Since the extirpated species have returned to the breeding site, the monitoring has appeared beneficial in measuring the species trend. The trend was positive but not satisfactory, indicating a necessity for strict implementation of monitored actions.		

	damages was detected in CCMPA ▪ financial resources depend on the number of sites to be monitored *however* ▪ in CCMPA the number of sites with coralligenous is small ▪ monitoring is recommended at least every two years (compromise costs-needs) ▪ methods could be improved to reduce time (and financial resources) and enhance repeatability (with lower degree of expertise)	▪ The cost of monitoring is limited to transportation and the actions implemented are not beneficial to balancing bird populations only but also to the threatened marine turtles, visitors and the MPA heath. ▪ Apart from improving the management, monitoring is rewarding in term of showing visitors the seriousness in managing the MPA. By seeing people regulary monitoring on MPA, many visitors appreciated the way in which the management is undertaken. ▪ Only the submerged habitats were not lucky with scientists or trainers of MPA staff to monitor the marine fauna and flora in accordance with the marine management plan set for the MPA.		

Benefits and constraints

Benefits	Constraints
✓ Collaborative approaches (with research institutes, NGOs & voluntary/citizens…) ✓ Possibility to replicate ✓ Opportunity to simplify methods to be used by MPA staff (not just scientists) ✓ Some protocols are easily applicable (by managers, volunteers…), costs less and less time consuming (eg. Alfonso training with RAC/SPA + Mathieu Imbert snorkelling protocols + Cristina Linares) ✓ These monitoring practices have all led to: o to management measures being implemented → results o To update the management plan o To plan a future management plan ✓ Importance of these monitoring initiatives that help with public awareness with local communities and for pushing for the need of protecting the area (for supporting the creation of an MPA).	✓ Budgets are decreasing so difficult for continuity ✓ With some protocols, difficult to select the right sites and the right number of sites ✓ Trained human resources ✓ Turnover in staff that has been trained ✓ For adaptive management: need to be careful with data collected on a daily basis by lay-people (or even knowledgeable people) because there can be mistakes ✓ Some multidisciplinary monitoring shouldn't take over the prioritised baseline monitoring that is linked to the management objectives of the MPA (prioritise is the key word) ✓ Difficulty of implementing adaptive management when the procedure needs to go via adoption of the management plan over 6 years for example.

Recommendations

- ✓ Make sure there is a continuous data collection in the MPA. Results need time!
- ✓ Make sure data collected is stored in MPA and if staff changes that the data is accessible to them in the long term
- ✓ Make sure data collected (by scientists) is given to the MPA rapidly in order to ensure the MPA can take action (reactive/adaptive)
- ✓ When Media involved with talking of the monitoring results, this should be validated by the MPA authority (or else, decision makers can get the wrong messages)
- ✓ Ensure the decree of the MPA allows for MPA adaptive management beyond the adoption of the revision of the management plan of an MPA (over several years)
- ✓ Importance of Communication (between managers and scientists – especially when no money at MPA level, so that what scientists do to help MPA is really useful for MPA objectives
- ✓ Prioritize monitoring initiatives in relation to MPA objectives
- ✓ Encourage Universities to have modules for students to then support MPAs (complementary to the job of the managers).

Involve users in monitoring fishing activities

Moderator: Zafer Kizilkaya (Mediterranean Conservation Society, Turkey)

Case studies presentations in a nutshell

	How a survey of artisanal fishing aims to contribute to the management of this activity in Cap de Creus	**Online recreational fishing logbook: the Port-Cros National Park Experience**
Speaker	Josep Lloret (University of Girona, Spain)	Clélia Moussay (Port-Cros National Park, France)
Download	[abstract] [presentation]	[abstract] [presentation]
Why this monitoring?	The need to monitor the commercial species in the Cap de Creus Natural Park by means of on-board surveys is justified by the impact of this activity on vulnerable species (including fish species showing complex reproductive strategies and sex-changing species), the social and cultural importance of artisanal fishermen and the necessity to complement the evolution of the abundance of fish species carried out through visual census monitoring (unlike these underwater observations, a survey carried out on board fishing vessels does not concentrate on a few particular species, habitats or seasons).	Recreational fishing around the island of Porquerolles is subject to regulation and prior authorization in different areas. Since 2012, a system of online recreational fishing logbook has been implemented within the Park: authorization renewal requests and catch recording are now available online (http://carnet-peche.espaces-naturels.fr). This tool is used to reduce the administrative workload, inform and raise the awareness of fishermen (regulations, anchoring…), better characterize fishing practices (sites, seasons, species, biomass, etc.), and assess the effectiveness of the management measures. The resulting trends can be combined with scientific monitoring.
What does monitoring consist in?	▪ Estimation of the trend in abundance, biomass & size of the most important target species in the Park, that cannot be monitored by other means (good complement to scuba diving census); ▪ Temporal evolution of fishing effort; ▪ Evaluation of the impact of selective fishing (particularly trammel nets, longlines and uncovered pound net) on the reproductive potential of fish species (sex-changing species, species with complex reproductive strategies, large spawners);	An innovative and easy-to-use dual-purpose tool: For the fishers: ▪ Authorization renewal forms ▪ Online catch recording ▪ Exportable charts indicating the catch quantity and biomass, the fishing sites, etc. ▪ Information on regulations and news For the managers:

		▪ Exportable data and charts to estimate the catch quantity and main fishing sites ▪ List of registered fishers
Implementation: who does what?	The survey of artisanal fishing of Cap de Creus is commissioned and financed by the Cap de Creus Natural Park and carried out by the University of Girona in collaboration with fishers (self-sampling).	The tool was developed in collaboration with the scientific and IT departments of the Port-Cros National Park (selection of monitoring criteria) and implemented by a private company. The tool development was financed through the MedPAN North Project. The monitoring actions carried out using this tool therefore rely on the users' participation.
Operational management measures adopted (or adapted) in response to the results of the monitoring	The results of the artisanal fishing surveys aim to be useful to establish new rules for the artisanal fishing in Cap Creus, which will be implemented in the frame of the new marine management plan (so-called PRUG) that is now being discussed (public consultation). ▪ These new rules attempt to reduce the maximum fishing effort that was set elsewhere in the Spanish and Catalan coast for fishing gears often used by artisanal fishers and that exceed sustainable exploitation limits in the MPA. ▪ Other actions are envisaged such as the protection of the most vulnerable species, the avoidance of competition with other stake-holders (recreational fishers and scuba divers) and the engagement of artisanal fishers in the management through effective partnerships.	

Benefits and constraints

Benefits		Constraints	
Involving artisanal fishers to contribute in monitoring activity (case of Cap de Creus)	**Involving recreational fishermen in monitoring activity (on line log book in Port-Cros National Park)**	**Involving artisanal fishers to contribute in monitoring activity (case of Cap de Creus)**	**Involving recreational fishermen in monitoring activity (on line log book in Port-Cros National Park)**
✓ Good way of linking fishers, scientists and managers. ✓ Gives trends (abundance, biomass, size) on the most targeted species; ✓ Complementary method which gives an idea on invasive species, nocturnal species, sedentary species like groupers ✓ Can be carried out in long term which gives good idea of the fish stocks ✓ Covers all type of habitats ✓ Reliable data about the socio economic monitoring of artisanal fishery in the MPA (allow comparison from a year to another; allow calculating catch per unit effort for the management purposes).	✓ On line data collection and delivery of permission reduces administrative burden; ✓ Managers can export data when needed; ✓ Good tool for awareness for better fishing practices (includes information on the regulation); ✓ Shows trends on the fishing effort but must be coupled with scientific monitoring; ✓ An increasing number of registered fishermen each year: larger monitoring sample and more accurate trends; ✓ Can be interactive and enriched with other contents such as pictures (that would help with cross check) ✓ Can help collect socio economic data on the recreational fishing activity ✓ Can easily be implemented for other activities such as diving; ✓ can easily be shared by other MPAs	✓ Reliability of data given by fishermen, who behave different when taking scientists onboard; ✓ Sustainability of the financial support every year (Cap de Creus is paying 30€ per fishing trip); ✓ Difficulty to cover all the aspects of fishery in the region (have to choose certain gear); ✓ Not easy application to management because of strong competition for resources with recreational fishers, competition for space with yachting (mooring buoys) and prohibition of certain baits of terrestrial origin. ✓ Not possible to carry out (for the moment) the evaluation of by-catch, the impact of certain fishing gears on fragile habitats (e.g. coralligenous assemblages) and the impact of ghost fishing (lost gears) ✓ Difficulty to have continuous (yearly) financial support for the monitoring	✓ Reliability of data (cross check required); ✓ Difficult to implement with quotas

Recommendations

- ✓ **Build trust between the MPA and the fishers involved in the monitoring activity to ensure the reliability of data:** In Cap de Creus, monitoring is carried out with confidence in association with three artisanal fishers only; the rest of the fishing fleet is not involved due to a lack of confidence. In Porquerolles, only islanders and "historical" recreational fishers are allowed to fish and consequently involved in monitoring the activity via the online log book.

- ✓ **Cross-check the collected data by adapting control methods** (random check at the port, census of fishing gears to assess fishing captures, check information that users may publish on social Medias like facebook…)

- ✓ **Involve fishers in scientific committees in order to adjust monitoring methods**

- ✓ **For monitoring carried out on board fishing vessels, it is important to choose gears according to the site specific fishery - most used methods and that target the most representative species** (e.g. like trammel nets in Cap de Creus, long lines in Gokova…)

- ✓ **Make technologies developed for monitoring available for other MPAs** (e.g. the on line recreational fishing logbook developed in the Port-Cros National Park could be disseminated throughout the MPAs network)

- ✓ **Funding opportunity?** To help sustain financing, MedPAN could contact with EU JRC (Data collection Framework - DCF) that is interested in data on coastal fisheries (artisanal and recreational) and may be able to provide continuous (yearly or every two years) financial support for the monitoring.

- ✓ **Need to develop complementary studies regarding artisanal fisheries, which consider not only biological sciences but also social (anthropology) and economic sciences, and also new aspects from the biological sciences for which we lack information, e.g. impact of fishing gears on fragile habitats, by-catch or the problem of the so-called "ghost fishing" (fishing gears lost on the seabed that continue to entangle fish).**

Assessing management effectiveness

Moderator: Joachim Claudet (CNRS/CRIOBE, France)

Case study presentation in a nutshell

	The Medes Islands Marine Reserve long-term monitoring program. More than 20 years of applied research to conservation
Speaker	Joaquim Garrabou on behalf of Bernat Hereu (University of Barcelona, Spain)
Download	[abstract] [presentation]
Why this monitoring?	MPAs are presented as an effective conservation tool. Although some of the expectations generated by initial MPA efforts have been confirmed, others have proven much more difficult to demonstrate, existing still some controversy about the actual usefulness of reserves as biodiversity conservation and fishery-management tools. The key of this divergence may be caused to the different biology of species and the different spatial and temporal scales in which different species and ecological processes act. Thus, only a constant long-term monitoring including all groups of organisms has the capability to evaluate the effects of protection or perturbations on the whole ecosystem. Results of these monitoring demonstrate that a regular long-term monitoring at adequate spatial scales, including diverse species with diverse biological strategies is **crucial to understand the whole ecosystems responses to protection and perturbations. These results can thus be useful to design management tools to preserve and restore perturbed marine ecosystems, and for the design of future reserves.**
What does monitoring consist in?	The Medes Islands MPA was created in 1983, and expanded in 1990, when a monitoring program was designed and performed yearly (with some interruptions) until present to evaluate the effects of protection on marine ecosystems. This monitoring included a variety of organisms with important ecological and economic roles, including fish, lobsters, sea urchins, and algal communities. This monitoring program shows a high diversity of responses of organisms to protection due to their different life strategies, dynamics, life cycle or behavior. These characteristics determine also their response to punctual or recurrent impacts such as poaching, trophic cascades, big storms or climate change.
Implementation: who does what?	The monitoring program started in the 1990s and was carried out: ▪ From the 1990s to 2008 by the University of Barcelona and CSIC. ▪ From 2009 to 2011 by a private company ▪ In 2014 by the University of Barcelona.
MPAs Constraints	▪ Budget variable ▪ Interrupted in the lasts years ▪ By different teams (university vs. private companies): Even though a monitoring is standardized, the team that perform the monitoring should be prepared and experienced in this type of work in order to avoid inconsistencies in the data. Therefore, some sort of “quality control” on the teams in charge of conducting monitoring is required. ▪ Recommendations not implemented by the administrations
Cost efficiency/usefulness of the monitoring	▪ Direct economic impact of the MPA: 10.019.600 € / year (2009) ▪ Budget of the MPA: 485.651 € / year (2009) ▪ Monitoring (about 50.000 € / year):

Overview of the available methodological guides for assessing management effectiveness

Speakers: Bruno Meola (MedPAN Secretariat), Maria del Mar Otero (IUCN Med, Spain), Milena Tempesta (WWF Italy - Miramare Marine Reserve, Italy)

[presentation]

Define management effectiveness

The extent to which management is protecting values and achieving goals and objectives of the Protected Area.

Why assessing management effectiveness?

- To find out what is working and what is not
- To help develop adaptive management
- To identify needs and provide information to managers and donors
- To encourage transparency and accountability

The idea is not to evaluate the manager, but rather to assess whether management measures have positive impacts, and if not, adapt the management accordingly.

A diversity of methodologies

- Management effectiveness evaluation in protected areas – a global study (Nature Conservancy, WWF, University of Queensland, IUCN, WCPA, Biodiversity partnership) [download]
- Management Effectiveness Management Tool - MEAT [download]
- Management Effectiveness Tracking Tool [download]
- Management Effectiveness Evaluation of Finland's Protected Areas [download]
- How is your MPA doing? [download]
- Evaluating Effectiveness – A Framework for Assessing the Management of Protected Areas [download]
- Managing Protected Areas – A Global Guide [download]
- Rapid Assessment and Prioritization of Protected Area Management [download]

These methodologies vary in terms of:

- **Level of detail** (rapid / in-depth)
- **Scale** (single site / system)

- **Data required** (qualitative / quantitative)
- **WCPA elements assessed**
- **Management dimensions addressed**
- **Self-assessment** vs. **External assessment**
- **Reporting** (internal / public)

Guide for quick evaluation of management in Mediterranean MPAs: A Mediterranean approach

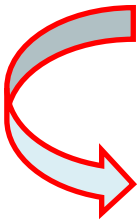
[download]

The guide developed by IUCN Med and Miramare Marine Reserve / WWF Italy within the framework of the MedPAN North Project in collaboration with over 20 MPA managers was drawn from existing methodologies. It offers a simplified toolkit adapted to the Mediterranean context for MPA managers willing to assess the effectiveness of their management.

1. Definition of a first set of indicators based on existing literature
2. Review of these indicators by MPA managers & related institutions for adaptation and refinement
3. Test of the methodology on 8 case study MPAs

Assessment framework

Context Where are we now?	**Status**	Significance, threats, vulnerability, national policy, engagement of partners
Vision Where do we want to be?		Clearly defined objectives
Planning How are we going to get there?	**Adequacy**	PA legislation and policy, PA system design, Reserve design, management planning
Inputs What do we need?	**Economy**	Resourcing of agency Resourcing of site
Implementation How do we go about it?	**Efficiency**	Suitability of management process
Outputs What were the results?	**Effectiveness**	Results of management actions Services and products
Outcomes What did we achieve?	**Effectiveness** **Adequacy**	Impacts: effects of management in relation to objectives



Need for monitoring data

Context: The protected area's current status and importance and the threats and opportunities that are affecting it; this is not an analysis of management, but provides information that helps put management decisions into context.

Planning: The appropriateness of national protected area policies, plans for protected area systems, the design of individual protected areas and plans for their management.

Inputs: The adequacy of resources and the standards of management systems, based on data about resources and management processes. Inputs generally include a measure of staff, funds, equipment, facilities required at either agency or site level.

Output and **outcome:** Whether management has reached the targets and objectives established through a management plan, national plans and ultimately the aims of the IUCN category of the protected area. Output evaluation considers what has been done by management and examines the extent to which specific targets, work programmes or plans have been implemented. Approaches to outcome evaluation involve longterm monitoring of the condition of the biological and cultural resources of the site/system, socioeconomic aspects of use and impacts of the site/system's management on local communities. To some extent measurement of outputs focuses on the quantity of management achievements while outcomes focus on the quality of management in terms of the overall objectives.

Reminder: Management effectiveness = The extent to which management is protecting values and achieving goals and objectives of the Protected Area [no matter how the management is implemented or how much resources the management agency has]. Proper MEE should focus on Outputs and Outcomes in relation with the Vision rather than on Context, Planning, Inputs and Implementation.

But outputs and outcomes are difficult to measure, we lack information and we often have to rely on expert judgement rather than on objective data → Need for long-term monitoring data!
One of the main limitations of existing methodologies.

Recommendations (facilitators, challenges & needs)

Although the existence of many methodological guides, we need to ask why is so limited uptake of assessment of MEE among Mediterranean MPAs? What incentives are needed to make these evaluations taken and used as a normal tool for the MPA managers? **Some proposals to explore to make the MEE at different MPAs to be taken could be the creation of groups of evaluator experts that could assist managers to develop this work. This could be done with the assistance of MedPAN Association?**

Step 1: Process for setting up monitoring of management effectiveness assessment

Facilitators	**Challenges / needs**
✓ Clear priorization of MPA's management objectives; ✓ Management plan with specific sub-objectives and associated success criteria set a priori; ✓ Existence of a Scientific Committee (help for priorization, choice of indicators, sampling protocol…); ✓ Simplified operational tools ; ✓ Legal obligations of monitoring	✓ Resources limitation (financial, human, time…); ✓ Long-term data; ✓ Multidisciplinary & multiple expertise (socio economic, ecological, governance); ✓ Need time to build trust between scientists and managers; ✓ Complexity of social- ecological systems; ✓ Urgency of some management needs vs time to do research; ✓ Adapt scientific information /communication provided to management needs ; ✓ Experts readily available

Step 2: Adapt management from management effectiveness assessment

Facilitators	Challenges / needs
✓ Coordination between institutions (MPA, police, Ministry, national agencies…); ✓ Time/space devoted to discussions between manager and scientists and among managers; ✓ Participatory processes, acceptability of the MPA, communication towards all stakeholders (importance to have local authorities and local people on your side); ✓ Positive incentives to manage effectively but also trust in the manager responsibility	✓ Information channels between institutions; ✓ Ability to change regulations (changing regulations and measures to adapt management is a long collaborative process); ✓ Assess not only management effectiveness but also management efficiency, adequacy between management means and targets; ✓ Identify the real scope of the MPA to externalize management actions that are not directly MPA-related (ex: national centralization)

Discussion sessions 2

These sessions took the shape of several parallel discussion groups lasting 1:30 each and bringing together about forty participants to tackle a key topic. For the topic under consideration, discussions were introduced by short case study presentations. Participants then shared experiences to identify good practices as well as constraints encountered when implementing monitoring. They also took into consideration a number of cross-cutting issues, such as that of the collaboration between scientists and managers, of managing and accessing data, of disseminating results, of new technologies, of the cost-efficiency or cost-usefulness dimension of given monitoring initiatives. Based on participants' experience and knowledge and bearing in mind the diversity of situations, the discussions were aimed at opening new paths of thoughts to optimise the implementation of monitoring initiatives for the management of MPAs.

Discussion session on « The added value of participatory approaches in monitoring for managing Mediterranean MPAs »
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Promoting baseline monitoring: get started and keep on going!

Moderator: Sajmir Beqiraj (APAWA, Albania) & Alfonso Ramos Espla (University of Alicante, Spain)

Case study presentation in a nutshell

	Teaching Package on Ecological Monitoring in Mediterranean MPAs
Speaker	Alfonso Ramos Espla (University of Alicante, Spain)
Download	[presentation]
Why this teaching package?	To answer the question "do MPAs work"?
What do monitoring consist in?	Assess human pressure in impacted and protected sites that are easy to access (walking, snorkeling), by targeting species that are easy to identify and count with simple samplers (such as quadrats, bars, carpenter rule).
Implementation: who does what?	Anybody with basic training
MPAs Constraints	Low-cost, non-destructive, and easy-to-implement methods.

Recommendations

- ✓ **Baseline monitoring to be set up before creation of MPA**
- ✓ **Post-training to support MPAs implementing**
  - Expert group that can be mobilized on request of MPAs
  - Target the right persons among rangers to be trained (permanent staff)
  - Adapt some protocols to local context (ex: different approaches if small or big MPAs for sampling method…)
- ✓ **New technologies (underwater camera, waterproof tablet) can be interesting to maximize costs/efficiency of monitoring**
- ✓ **Interest of the MedPAN monitoring protocols database** (Then expert support needed to choose the best adapted protocols)
- ✓ **Interest for MPAs with no human means**
  - To involve volunteers (divers…) to do monitoring but need good training and need check from scientists to ensure quality of data collected
  - To use existing means (ex: for cetaceans: ferries, military helicopters…)

Monitoring of non-extractive uses and their effects/impacts

Moderator: Elodie Durand (Port-Cros National Park, France)

Case study presentation in a nutshell

	Characterization of recreational boating in Portofino Marine Protected Area
Speaker	Valentina Cappanera (Consortium of Management of Portofino MPA, Italy)
Download	[abstract] [presentation]
Why this monitoring?	In addition to a great boating activity, the MPA of Portofino observes a high diving one, cruise as well as an artisanal and recreational fishery too. As a consequence, a monitoring activity is useful and necessary because of the presence of areas defined as Site of Community Importance (Natura 2000); *Posidonia oceanica* and coralligenous habitat are biodiversity targets to preserve inside Portofino MPA management plan.
What does monitoring consist in?	Since 2006, Portofino MPA, in a strict collaboration with the University of Genoa, has been carrying out specific monitoring campaigns in order to: ▪ Know the full extent of recreational boating problem; ▪ Identify the high-risk area of the MPA ▪ Optimise management strategies already in place. This collaboration brought to the creation of WebGIS MACISTE system (Marine Coastal Information System). The presence of boats can be easily compared with weather conditions as well as, spatially, with habitats. This approach is working well for Portofino MPA and in progress for other Ligurian national MPAs (www.remare.org). The MPA also has a cooperation agreement with ARPAL (Regional Ligurian Agency for Environmental Protection), especially to evaluate the impact of cruise tourism. In this context, some results showed values of solvents and aromatic polycyclic hydrocarbon (PAH) in the Gulf of Tigullio highest of all the Ligurian Region, maybe due to the strong recreational boating activity. Since 2013, the monitoring activity has been improved with information collected with a camera surveillance system, at the moment only useful to evaluate boating fluxes and get information on weather condition.
Implementation: who does what?	The activity is carried out by the students of the University of Genoa (that is part of the board of the MPA). Students come for masters or masters' internship and are accommodated in student residencies owned by the University.
Operational management measures adopted (or adapted) in response to the results of the monitoring	▪ Over a hundred of 'seagrass-friendly' moorings for recreational boating ▪ Creation of a forbidden zone to boats bigger than 10 meters ▪ Since 2012 a swim line forbidden to boats access was created in order to protect swimmers and *Posidonia oceanica* meadows. ▪ A Future development of this study will be to create predictive models for recreational boating in order to inform users, in advance, regarding possible most congested areas and encourage the correct use of Portofino MPA.
Cost efficiency/usefulness of the monitoring	This monitoring activity is quite cost-efficient as it enables to get a lot of information at low cost.

Examples of non-extractive uses in MPAs

The effectiveness of MPA management regarding non extractive uses starts with a right identification and monitoring of the uses (the type of activities, users, different practices etc.). If the discussion started over the two main activities encountered in MPAs - boating and diving, as presented in the case study of Portofino MPA - the participants pointed out the diversity of non extractive uses that can take place in MPAs.

List of different non extractive use identified :

- ✓ Boating – Sailing – Speed boats
- ✓ Snorkeling – Diving
- ✓ Kayak – Kite surf – Paddle
- ✓ Jet skis
- ✓ Cruise ships
- ✓ Touring boats
- ✓ Bathing – beach combing
- ✓ Wildlife watching
- ✓ Shipping – maritime transport
- ✓ Pipes & cables
- ✓ Access & infrastructure

Different examples of monitoring of these activities exist among MPAs:

- ✓ Recreational boating is monitored in Portofino
- ✓ Diving activities are monitored in Punta Campanella
- ✓ Kite surf monitored in Camargue
- ✓ In Zakynthos, the experimentation of beach combing management based on a carrying capacity

Why monitor non extractive uses?

- ✓ To evaluate their pressure and impacts on the ecosystems
- ✓ To define the carrying capacity (based first on ecosystems, then on spatial consideration)
- ✓ To define the management actions and rules to implement
- ✓ To anticipate trends, new usages that are developping in the MPA
- ✓ To evaluate the effectiveness of management actions

Recommandations

- To monitor effectively non extractive uses, the main steps to be taken are :

  1. Identify clearly the hot-spot of the action and the main management objective
  2. Identify the main pressures from human activities
  3. Monitor this use (use feedback experience from MPAs that already implemented this monitoring action)

4. Define carrying capacity[5] and need for actions
5. Implement the management measure(s)
6. Assess and reconsider

- Share monitoring protocols to monitor uses (MedPAN can help disseminate)

- Research work should be subject to the MPA authorization and to the obligation to communicate the data;

- Make the best of technologies to support monitoring

[5] Ecological and social carrying capacity should be defined: for example, in Zakynthos National Park, carrying capacity of beach is assessed by taking into account the location of the turtle nests + 40 m2 required for visitors to be able to bear with each other. Management measures aim at explaining people that it isn't worth all going to the beach at the same time.

The added value of participatory approaches in monitoring for managing Mediterranean MPAs

Moderator: Jorge E. Moreno Pérez (National Park of Cabrera and Natural Park of Eivissa and Formentera salines, Spain)

Case studies presentations in a nutshell

Following an introductory presentation on the usefulness of citizen science monitoring, three pilot case studies were presented to illustrate different participatory approaches and their added value as opportunities to improve data collection and fill gaps by responding to management needs and sometimes to scientists' needs in and around MPAs.

Introductory presentation on the usefulness of citizen science monitoring to develop long term monitoring in and around marine protected areas

Speaker: Patrice Francour (ECOMERS / University of Nice Sophia Antipolis, France)

[abstract] [presentation]

Mediterranean eco/complex-systems

- The Mediterranean Sea is per se a complex system, currently influenced by strong human pressures
- Most of the current MPAs aim to protect or manage biodiversity and resources
- 80% of the biodiversity is present between 0 and 50 m depth
- One half of the Mediterranean native fish fauna is threatened by fishing

How to manage such complex systems?

- One of the way: to identify key elements to monitor as bioindicator
- To settle a monitoring program taking into account spatial and temporal scales (medium to long term)
- Changes (spatially or temporally) will allow to assess management effectiveness

How to implement such monitoring?

Citizen science, also referred to as community science, is the process whereby citizens are involved in science as partners in research. Volunteer based monitoring approaches have recently received greater attention as **a cost-effective way to collect data on the environment**. The data may be collected at a reduced cost as citizens volunteer to work, often supply their own equipment, and can **fill spatial and temporal gaps in traditional monitoring programs** conducted by academic or governmental professionals. Other benefits of volunteer monitoring programs include increased interactions between the public and the scientific community, education about ecosystems and resource management, fostering of local stewardship, and increased scientific literacy of the general public.

Examples: 3 different citizen science monitoring

		
Groupers *(Epinephelus marginatus)* The groupers are high-trophic level species. They play a key-role in structuring the coastal marine ecosystems, and have a high economic value (Scuba diving). However, a regular overfishing has involved a steady regression of assemblages in large areas of the Mediterranean. Fishing regulation throughout marine protected areas allowed a progressive recovery. The non-profit structure GEM (Groupe d'Etude du Mérou) launched in 1986 regular monitoring of E. marginatus in MPAs, and since 1997 in non-protected areas. The underwater visual census developed to specifically assess the grouper abundances could now be applied in citizen science networks as a regular monitoring to assess the recovery of these species and the maturity of the coastal ecosystems.	**NIS** Non Indigenous Species The non-indigenous species (NIS), spreading from the Red Sea through the Suez canal or from the Atlantic through the Gibraltar Strait, represent now a conspicuous part of the Mediterranean biodiversity. The ecological or economic consequences of such a spreading are virtually unknown. Most of scientific studies carried out report only new records and few data are available to assess the dynamic of these NIS. Adopting citizen science can thus be a useful strategy to monitor the spread of invasive species in the Mediterranean.	**FAST** Fish Assemblage Sampling Technique FAST (Fish Assemblage Sampling Technique) has been developed as a low cost method to monitor fish assemblages by Scuba diving. This method does not involve a long and costly training of the Scuba divers and is then well fitted to develop a citizen science monitoring network. The data collected since 1999, in different places of the French Mediterranean coast allow proposing benchmarks to assess the ecological state of the fish assemblages. This method is currently adapted to the North-African coast and to the North-Eastern Mediterranean coast.
Monitoring at Species level		Assemblage level

Conclusion

- First step: **select pertinent bioindicator(s)** and **develop simple sampling protocol** – volunteers training has to be short and enjoyable!
- Second step: comparison of collected data between Scuba divers (volunteers) and academic staff (reference) – **without this inescapable step, the data are untruthful**
- Implementing: data collected at a reduced cost as citizens volunteer to work
- Allow to **fill spatial and temporal gaps in traditional monitoring programs** conducted by academic or governmental professionals, in MPAs and outside
- Other benefits: increased interactions between public and scientific community, education about ecosystems and resource management, **fostering of local stewardship**

Three presentations to illustrate different participatory approaches

	CoastNet: evaluation of the environmental state of the coasts in collaboration with the local schools	**SEASPOTTING (A civilian science based approach to increase the Monitoring capacity of MPA's)**	**EcoSee-A project: Guardian of the Sea with converted boat**
Speaker	Milena Tempesta (WWF Italy – Miramare Marine Reserve, Italy)	Oscar Sague Pla (Underwater Research Society – SAD & International Forum for Sustainable Underwater Activities - IFSUA)	Serena SGARIGLIA and Sergio TREVISANI (Sentina Natural Regional Reserve – Municipality of San Benedetto del Tronto, Italy)
Download	[presentation]	[abstract] [presentation]	[presentation]
Project description	CoastNet is a project that aims to create a network of communication and dissemination via the Internet between schools located along the coasts throughout the Country, for the continuous updating of the "Charter of naturalness" of the Italian coasts by promoting the adoption of the participatory methodology of science.	CMAS, NAUI, SSI, PADI, BSAC... are different diving standards developers that certify hundred thousands of divers annually. Through the SEASPOTTING project , all of them will be invited to cooperate and support coastal ecosystems monitoring by upgrading those standards with a new dive category based in the citizen's science concept. This project is based on common needs: The proposed diving certifications will be a milestone in increasing the capacity and education of divers, providing paramount information for managers and scientists, and at the same time offering new business opportunities to the diving industry.	In Europe, there are too many fishing vessels and fishermen struggling to make a living from ever shrinking resources. To help alleviate this problem, the European Community has last year launched "Guardian of the sea", a call for projects dedicated to the re-orientation of fishermen and fishing vessels towards activities outside fishing. An innovative project, the Ecosee/a project was selected and started in May 2014 on the Italian Adriatic coast. The project calls for the refitting of a fishing boat into a boat for activities at sea and the training of the crew to enable the boat to conduct scientific monitoring campaigns in the central Adriatic sea and carry out recreational and sustainable activities at sea integrating on environmental awareness-raising dimension.
Objectives	▪ Promoting knowledge of marine and coastal ecosystems and the relationship between man and environment. ▪ Provide methodologies for assessing coastal environmental factors applicable to a stretch of coastline next to each school. ▪ Enhance the capacity for observation and	▪ Increase divers' capacity towards understanding and conserving marine ecosystems in Mediterranean basin ▪ Take advantage of underwater activities community's experience to improve MPA management. ▪ Development of practical monitoring	▪ Improve the balance between the EU fishing fleet and the resources available for the fishing activities; ▪ Contribute to the reduction of the EU fishing fleet preserving jobs along the coastal communities; ▪ Demonstrate the feasibility and the

	interpretation of natural phenomena. ▪ Develop knowledge and the link with the territory. ▪ Enhance citizen's participation in evaluating the state of the environment. ▪ Create a map of the state of naturalness of the coasts in co-operation with the schools.	methods in the Mediterranean basin	economic sustainability of maritime activities other than fishing, through a converted fishing vessel; these activities will be carried out by the vessel crew making available his knowledge and skills; ▪ Allocate the fishing vessel to the fishermen training for sustainable activities regarding the use of marine resources.
What does the approach consist in?	▪ Use of 15 simple indicators (bio-physical, socio-economic and governance indicators). ▪ Values obtained by the different indicators or the positive/negative answer to the indicator, lead to a matrix that calculate four different degree from the most natural to the most impacted situation ▪ Final score associated to a colour code = results of the naturalness is right away evident on the map.	By the end of the project different certification levels in citizen-science diving should be commonly developed by experts and then globally disseminated. The education programme should be resilient, taking into account both investigation advances and geographical locations (Eastern, Middle and Western Mediterranean) where the courses may be given.	▪ Collection of oceanographic data to monitor the normal environmental parameters (temperature, salinity, turbidity, fluorescence, dissolved oxygen), dissolved nutrients (nitrate, nitrite, ammonia, orthophosphate and orthosilicates) and pollutants (heavy metals, PAHs, pesticides) with particular attention to Endocrine Disrupting Chemicals; ▪ Collection of data for environmental monitoring of the sediments of the seabed (the benthic and sediment pollution, the trophic conditions, etc.), as well as to study the population structure of the biocoenosis including their morphological and physiological characteristics related and genomics; ▪ Collection of floating marine debris (plastics, micro-plastics, etc.) with a specially net developed.
Implementation: who does what?	Actions carried on by schools start with a collection of data directly on the field along the strip of coast adopted by the classes followed by a bibliographic and sitographic analysis to gather necessary information. Results are then available on the project's site WWW.COASTNET.IT	▪ Coordinator: SAD/IFSUA ▪ Stage 1: Designing the standard levels and choosing the platform (diving associations + scientists + MPA network, stakeholders) ▪ Stage 2: Training the first instructors (scientists) ▪ Stage 3: Presenting and promoting the new standard (diving associations + MPA network)	Ecosee/a is a partnership led by the Fisheries Local Action Group (FLAG) South Marche, and that gathers the City of San Benedetto del Tronto, the Bilge Nature Reserve, the Conero Natural Park, the Marine Protected Area of Torre del Cerrano, the Ancona CNR ISMAR, the University of Camerino and the University of Teramo. It involves an investment of approximately 500,000€ and is 80% funded by the European

		▪ Stage 4: Collecting and treating data and disseminating results (scientists)	Union. The project will end in May 2015 but the boat will remain in operation for at least another 2 years on partner funding.
Benefits	▪ The methodology seems to be a good balance between user- friendly applicability and scientific results. ▪ The connection with the institutions to gather data and information, help to create an exchange of ideas and encourage the adoption of actions and strategies of coastal zone management which have accrued through a participatory scientific investigation. ▪ Possibility to export the methodology to enlarge the coastal areas under assessment and to involve more schools and MPAs all around Italy; ▪ Possibility to Involve other Med Countries and MedPAN partners for a broader and international project connecting schools around the Mediterranean basin (or develop interactions with similar programmes like project developed in Spain for example)	▪ Low cost to MPA ▪ Standardized protocol ▪ MPA network trends ▪ Exchange knowledge ▪ Raising awareness ▪ Faster results ▪ Easy/cheap monitoring promotion	Results of this project will allow water characterization and assessment of contaminants in Marine Areas supporting the development of action plans and monitoring strategies for prevention and control of environmental hazards.
Constraints		▪ Acceptance ▪ Adaptive standard (context) ▪ Global platform ▪ Data exchange coordination (science/MPA) ▪ Global coordination	

Benefits and constraints

Benefits	Constraints
✓ Low cost ; ✓ Standardised protocols exportable to other MPAs; ✓ Exchange of knowledge ; ✓ Allows to raise awareness of society; ✓ Permits to involve stakeholders and citizens.	✓ Acceptance (scientific & public); ✓ Data validation needed; ✓ Abuse of the practice; ✓ Private operators may want to do the same for their clients but this can interfere with management objectives; ✓ Data exchange coordination is weak so necessary

Recommendations

- ✓ **Select eligible data to be collected by managers and scientists**
- ✓ **Develop simple methods and previous protocols to be validated**
- ✓ **Not to be considered as ''THE'' solution but as a help for monitoring (not abandoning responsibilities of administration)**
- ✓ **Previous compromise among managers, scientists and volunteers to assume the complete process**
- ✓ **Feedback to citizens of the usefulness of their work (recognition of their role as a piece of the management)**
- ✓ **Design similar strategies for different stakeholders (especially fishermen, tourism companies, divers, boat owners…)**

It is an opportunity for participation & public awareness and can be a useful tool for management BUT not valid for everything and cannot substitute the role of managers and scientists.

Knowledge cafés & Special session

Posidonia oceanica: which monitoring for which objectives and under which conditions?

Moderator: Patrick Bonhomme (GIS Posidonie, France)

Case studies presentation in a nutshell

	Posidonia oceanica monitoring experiences in Mediterranean protected areas (Italy, Croatia, Montenegro)
Speaker	Ivan Guala (IMC - International Marine Centre, Italy)
Download	[abstract] [presentation]
Why this monitoring?	*Posidonia oceanica* meadows are among the most representative and important ecosystems in the Mediterranean for extension, complexity and ecological functions. Because of their sensitivity and vulnerability to anthropogenic pressures, Posidonia meadows are protected via many international agreements and directives[6]. Mediterranean countries of EU, and in particular most of the marine reserves (whether Sites of Community Importance, MPAs, SPAMIs, National or Nature Parks), are required to protect Posidonia meadows through monitoring and managing measures.
What does monitoring consist in?	Over the past 40 years, a plethora of methods, descriptors, and indicators has been developed to monitor Posidonia meadows. However, funding resources allocated for monitoring Posidonia meadows are often modest and inadequate to ensure their conservation and sustainable management. A cost-effective monitoring protocol has been applied in several areas of the Mediterranean to assess the conservation status of Posidonia meadows and to identify suitable management measures. The protocol, based on non-destructive detection techniques, uses the most fundamental descriptors (namely shoot density, plant coverage and features of the lower limit) that are present in programmes to measure conservation status of *Posidonia oceanica* in nearly all Mediterranean countries.
MPAs constraints	✓ Consistent method with clear objectives ✓ Informative on the ecosystem status ✓ Useful for management ✓ Not destructive ✓ Easy to implement, simple & rapid ✓ Cost-effective

[6] Posidonia meadows are protected by the Habitats Directive 1992/43/EU and are included in the list of priority habitats of the SPA/BIO Protocol of the Barcelona Convention. Moreover, Posidonia oceanica is a Biological Quality Element for monitoring the ecological status of coastal waters under the Water Framework Directive (200/60/EU) and, in some Mediterranean countries, meadows represent a "special habitat type" according the Marine Strategy Framework Directive (2008/56/EU).

Methodologies and results of some case studies where this monitoring protocol has been implemented at both local and national level and with different objectives were presented:

MPA	Objectives	Outcome & management measures
Tavolara – Punta Coda Cavallo MPA (Sardinia, Italy)	✓ assessment of status of *Posidonia* meadows in sites subjected to different pressure of anchoring ✓ implementation of "easy, feasible and long-term" monitoring	✓ Identification of vulnerable zones ✓ Development of an app to avoid mooring and anchoring in these zones.
Other MPAs in Sardinia	✓ assess status of the meadow ✓ identify main pressures ✓ identify preferential areas of boaters ✓ identify areas for setting up ecological moorings	✓ very good conditions of the meadow ✓ negligible impact of recreational boating ✓ no mooring systems are needed ✓ re-modulation of funds
MPAs in Croatia (MedPAN South project)	✓ assess the status of *Posidonia oceanica* and identify changes in seagrass meadows over time in sites under pressure from anchoring	✓ development of the management plan ✓ establishment of mooring system and planning of measures for reduction of impacts due to nautical tourism
MPAs in Croatia (MedMPAnet project)	✓ development of national monitoring protocol for Croatian meadows	✓ start of building baseline data for enhancing the effective conservation of the habitat and the management of MPAs and NATURA 2000 sites according to Habitats Directive
Katic future MPA in Montenegro (MedPAN small project)	✓ proposal of monitoring approach ✓ training of students and volunteer divers ✓ characterisation of *Posidonia* meadows	✓ collection of basic information on *Posidonia* meadows in the future Katic MPA

Discussion key points

- ✓ **Long-term monitoring vs. lack of resources:**
  - Need to keep going to have long-term data: It is difficult to draw conclusions as to what measures should be taken after only one or two years of monitoring.
  - Lack of time and resources (human and financial): from the Croatian experience, the presented protocol is very interesting and easy to implement and enables to get relevant data, but so many other parameters to monitor, and so many MPAs to manage…
  - Cost for monitoring increase while funding decrease.
- ✓ **About sharing protocols:**
  - **The MedPAN monitoring protocol directory is a good initiative, but we should make sure protocols explain in details the context and objectives** (why monitoring *Posidonia oceanica*? why measuring shoot density? why lower limit rather than upper one?…).
  - Email group to inform about what's going on through MedPAN network?

- **Would be interesting to have a common protocol to define standard thresholds at regional or sub-regional scale.** But the idea is not to compare monitoring results in space (between MPAs), but in time (what are the trends), just to define standard thresholds at the regional or sub-regional scale (related with MSFD GES and other frameworks). This is precisely what is supposed to be debated during a geographic process (issues of common interest within the Natura 2000 process, including the definition of good environment status).

- **Same protocol, almost impossible. What is important is to have the trends, and to share data.**

✓ **The added value of participatory approaches:** It is possible to involve recreational divers in monitoring *Posidonia oceanica* (e.g. Posimed initiative in Spain), with quite simple data to collect (to be complemented with more in-depth monitoring programmes).

✓ **Make the best of technology:** In Montenegro, **use of satellite images for seagrass mapping**, with cross-checks on the field especially for the lower limit. But below 25 m depth, no reliable results, and in some cases, *Posidonia oceanica* goes as deep as 40 m depth (in some places in Greece). Guides for mapping (objectives, material, cost…) are available and may be useful.

✓ **About ecological moorings**

- **How to determine whether an area needs the set-up of ecological moorings?** Pretty simple: if an area is subject to a high mooring pressure and impacts have been shown, then take measures, but no need to put ecological mooring where almost no boat anchors (would be a waste of money).

- **Take the fishermen opinion into consideration for installing ecological moorings.** Ecological mooring might represent a loss of their fishing area (experience in the Ligurian sea). Temporary moorings (in the summer only) is an option do avoid this problem.

- **Guidebook for mooring systems?** Example of Göcek, where the mooring system which was set up turned out to be a disaster (ropes were not solid enough, concrete blocks that crushed the meadow…). Such guidebook already exists, but it is almost 7 years old.

✓ **How to deal with dead matte covered with sediment?** Manual check: moving the sediment with the hand to see if there are rhizomes or dead matte underneath.

Innovative technologies supporting monitoring for managing MPAs

Moderator: Giuseppe Di Carlo (WWF Mediterranean, Italy)

Case studies presentations in a nutshell

	S C I R E N A (Programmable system for capturing underwater video images & digital and automatic recognition software application for identifying marine species)	**ARION System for coastal dolphin conservation: a tool for dolphin conservation by a real time monitoring in Portofino MPA**	**CALIPSO Project www.calipso-nais.it**
Speaker	Nicolas Gilbert (Oceanica Prod, France)	Valentina Cappanera (Consortium of Management of Portofino MPA, Italy)	Marco Romani (NAIS, Italy)
Download	[presentation]	[abstract] [presentation]	[abstract] [presentation]
Project description	Monitoring the spatial and temporal variations in marine biodiversity using non-destructive techniques is essential to ensure proper understanding of the ecosystem, and the follow-up and assessment of conservation strategies within Marine Protected Areas. This Research and Development project consists in: ✓ Designing innovative, autonomous and programmable high definition systems for capturing underwater video images. ✓ Developing a software for the analysis and interpretation of video data.	Portofino MPA is a SPAMI site inside Pelagos Sanctuary: a considerable population of bottlenose dolphin (*Tursiops truncatus*) has to coexist with a high level of antropic activities, so that conservation actions are needed. Two detection units were placed one kilometer off the coast of Portofino headland. Each unit is a particular type of elastic beacon equipped with four hydrophones and an acquisition system which can record the typical "social communication whistles" emitted by the dolphins and the sound emitted by boat engines and identify their absolute position in real time. **Information are disseminated in real time to the project stakeholders and every people interested in cetaceans conservation by different ways (website, Arionmobile app and social network as Twitter).** This monitoring activity is really useful for the MPA	CALIPSO© is a software platform for the provision of location-based ICT services to users and staff of MPAs. Institutional users (MPA Authority, Coast Guard) and private users (tourists, boaters, charter, etc.) may benefit with CALIPSO services both on server side (management and monitoring platform accessible via standard Internet browser), and on client side (Android Application for geo-referenced information display on map, and for reports communication). CALIPSO will provide the following functions: ✓ Real-time mapping of the state of the MPA; ✓ Production of reports and statistics for decision support; ✓ Geo-referenced information for a greater appreciation and a better perception of the MPA by tourists.

		management: it provides a continuous data series regarding bottelnose dolphin and boating activity (it's the unique system in Mediterranean Sea).	
Project objectives	✓ Improve underwater image capturing without human interference ✓ Facilitate post-production processing and analysis of pictures	Main objective is to improve the conservation status of the bottlenose dolphin in the area by the implementation of an interference avoidance system capable to track dolphins, to identify threats and to prevent collisions by diffusing real time warning messages to all stakeholders involved.	The platform can offer a broad spectrum of services covering targets of: ✓ Monitoring, ✓ Management ✓ Promotion of the MPA.
Benefits	✓ Non-destructive method, can be used on a large scale ✓ Barely disruptive as no divers involved ✓ No specific skills needed for the implementation so easily transferable ✓ Rapid on the field, many stations can be addressed, at different depth ranges, in a more or less extended area, at different times of the day ✓ Implementation whatever the legal status of the study area ✓ Simultaneous characterisation of habitat and identification of fish ✓ Estimate of fish size ✓ Accurate geo-referencing ensuring thorough gathering of data ✓ Time saved in video analysis in laboratories with the species counting and identification software ✓ Video data archived can be reviewed in case of doubt or for further analysis ✓ Consistency of data in all MPAs	✓ The project involves high costs of installation (but only as starting investment - low maintenance costs). ✓ It could be considered a good and useful tool of management and conservation with a particular characteristic of repeatability both inside and outside the boundaries of the MPA (applicable to many areas of Pelagos Sanctuary) ✓ The buoys were gradually equipped also with a lot of oceanographic sensors in order to detect environmental condition of the sea in the scientific area (Portofino MPA is an L-TER site since 2007) – a logistic advantage	Some cost-efficiency elements to take into consideration: ✓ Assist MPA's operators with a cloud system of monitoring and management of the area by web portal access, able to deliver navigation rules in rea-time and give them useful information about access control and assistance of the visitors. **Low costs of ICT investment** ✓ Support yachtsmen and tourists by App. on mass-market terminals (smartphone and tablet) with accurate information and allow them to communicate sightings of marine protected species or to report rules infringements and or dangers. **No additional cost for commodity** ✓ Assist the Institutional and local Entities responsible for safety and security of the area, making the information available on the positioning of the tourists and yachtsmen in the area. ✓ No additional costs of investment

Discussion key points

- ✓ **The presented monitoring systems are good support tools for research and management but are not foolproof and cannot replace scientists** (e.g. SCIRENA might fail in identifying certain species, in Portofino the system was down for a while due to severe weather conditions…);

- ✓ **Beware potential counterproductive effects of real time monitoring** (e.g. real time information on the presence of cetaceans may increase the pressure on the animals by motivating more boaters and whale watchers to approach them; the transmission of non-validated information may also have negative effects).

Special event on MPAs initiatives in Albania

Moderator: Odeta Cato (Directory of Biodiversity and Protected Areas, Ministry of Environment of Albania)

Marine and coastal protected areas in Albania

Speaker: Odeta Cato (Directory of Biodiversity and Protected Areas, Ministry of Environment of Albania)

[presentation]

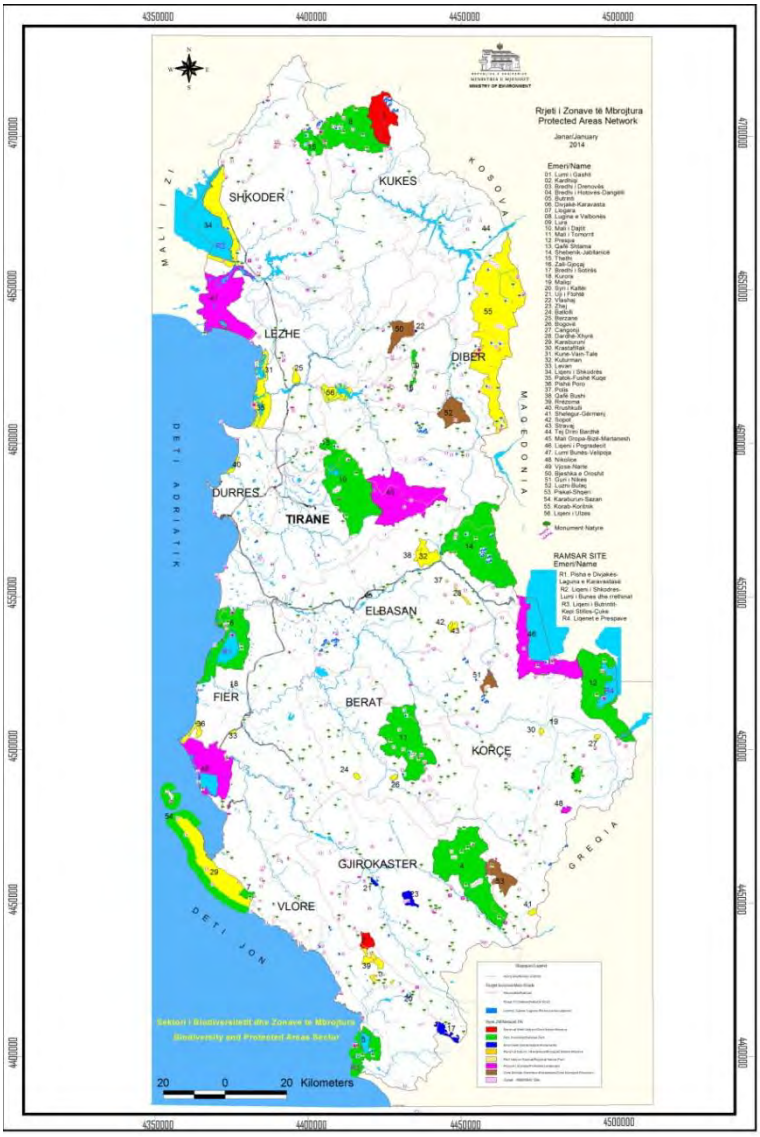
Biodiversity protection in Albania in the Mediterranean context

- Coastal areas are in focus of the Ministry of Environment
- The implementations of CBD obligations and its Aichi Targets
- Till 2020 marine protected areas and coastal protected areas in global level should reach 10% of the total territory under the state's jurisdiction.
- The increase of the PAs coverage will also ensure the completion of the representative network of PAs in the country and in the same time will contribute to the Pan-European Ecological Network.
- Protection of species, habitats and ecosystems is based on the principle of the sustainable use and conservation of biodiversity. The application of the ecosystem approach principle is also essential in the light of recent developments to benefit from ecosystem services.

Current network of protected areas

- Strict Nature reserve /Scientific reserve no.2, sip.4 800 ha.
- National Parks: no.15, sip. 210 501.4 ha.
- Nature Monuments: no. 750, sip.3 940 ha
- Managed nature Reserve/Natural Park: no. 23, sip. 127 180.1 ha.
- Protected Landscape: nr.5, sip. 95 864 ha.
- Nature Protected Area of Managed Resources: no.4, sip.18 245 ha.

TOTAL 460,060.9 ha – 15.54 %



MPAs in Albania

- MPA (IUCN II) of Karaburun–Sazan, was proclaimed in 2010, including a surface area of 12,428 ha. Karaburun Peninsula represent the west part of the Vlora bay, and together with the Sazani Island is identified as a priority area by many environmental policy documents of Albanian Government of the last period.
- The peninsula has a surface area of 62 km2 and divides the Albanian coast of the Adriatic Sea from the Ionian Sea.

Marine and Coastal Protected Areas

1. Marine National Park Karaburun-Sazan
2. Protected landscape of Buna River and surrounding wetlands (including Velipoja and wetland area of Viluni)
3. Managed Nature Reserved Kune –Vaini-Tale;
4. Managed Nature Reserved of Patok-Fushekuqe (including the Patoku wetland);
5. Managed Nature Reserved of Rrushkulli
6. National Park of Divjaka-Karavasta (including Karavasta lagoon);
7. Protected Landscape of Vjosa River (including Narta wetland);
8. National Park of Butrinti (including Butrinti Lake).

Main activities in the protected coastal areas

- fishing,
- tourism,
- agriculture,
- services, etc.,

(in the marine areas is mostly related to fishing activities and some diving activities (only one diving center is known in Saranda and several professional divers spread throughout Albania).

Threats

The Coastal areas of Albania is one of the hotspots of biodiversity in the Mediterranean Sea. Coastal reef is very heterogeneous.

Albanian marine ecosystems are under pressure. Risks are related to internal value of the ecosystems, but also to the loss of biodiversity and natural habitats which play an key role in the health of people, life style, food production and availability of natural resources for economic development and well beeing of coastal populations.

Recent developments

- NBSAP revision and update to 2020
- Strategic document for the development of the MCPA in Albania to 2020 (GEF UNDP-INCA)
- Environment Cross-cutting Strategy as Integral part of the NSDI (National Strategy for development and Integration) to 2020
- National Plan for the European Integration (transposition of the nature protection *acquis*)

Projects and Management Plans of MCPAs

- A number of projects are successfully implemented. Joint committees and groups of experts have been established and meeting in regular basis
- IPA 2013
- GEF UNDP pilot actions
- UNEP GEF Kune – Vaini
- Cooperazione Italiana-IUCN- Lumi i Bunes

Investigations on the Biodiversity of Sazani Island. Activities carried out on Sazani Island under the PIM initiative

Speaker: Sajmir Beqiraj (APAWA)

[presentation]

Two field trips (Sept. 2012 & May 2013) with the participation of an international team of experts; organized by the Conservatoire du Littoral, APAWA, University of Tirana.

Main objective of the investigations

Increase the general knowledge on biodiversity and environmental state of Sazani island[7] and realization of a management scheme for the island, in cooperation with the other existing initiatives and ongoing projects on this area.

[7] terrestrial flora, entomofauna, herpetofauna, ornithofauna, terrestrial mammalofauna, terrestrial pollution and wastes, marine and coastal flora and fauna, geology, habitat cartography

Activities carried out

- collect new data;
- review existing data and updating;
- analysis of species presence, abundance and distribution;
- assessment of species status;
- identification of invasive species;
- assessment of disturbances and threats;
- prepare recommendations for regulation and management;
- training of young researchers;
- incite further research and monitoring

Follow-up actions planned by Conservatoire du Littoral and Albanian partners for 2015

- Elaboration of management document in coordination with the UNDP project on developing MPAs and CPAs in Albania, also related to the preparation of the Karaburuni-Sazani MPA Management Plan.
- Implementation of actions of ecological restoration (management of introduced species, monitoring protocols…).
- Fish visual census (Biomex method) to assess the state of the MPA fish populations at the beginning of the protection measures.
- Implementation of actions to manage public welcoming on the island (visitor center, signage infrastructure, educational activities …)

Sustainable Economic Activities in Mediterranean Marine Protected Areas

Speaker: Zamir Dedej, INCA

[presentation]

Workshop day 2

Thursday 27 November

« Discuss the idea to 'promote' specific protocols to harmonize data collection throughout the system of MPAs »

The second day of the workshop was focused on the issue of monitoring for the management of MPAs on the scale of system/networks of MPAs (national, sub-regional and regional scales). The morning was dedicated to presentations in plenary which to bring elements for the afternoon discussions.

Session on « National approaches for harmonized monitoring » ©M. Mabari/MedPAN

Lessons learnt from existing regional initiatives

Introduction to the day 2 subject and objectives & presentation of the lessons learnt from existing regional initiatives (regional databases, trainings and platforms for scientific support) by Chloë Webster (MedPAN Secretariat) & Souha El Asmi (RAC/SPA).

[presentation]

Objectives of the workshop day 2: Discuss the idea to 'promote' specific protocols so to harmonize data collection throughout the system of MPAs

- Choosing national / sub-regional / regional indicators (with a network approach)?
- What can the Network approach bring in a practical way?
- Explore the use of collaborative plateforms

→ **Make recommendations to MedPAN**

Specific objectives of the afternoon Parallel Sessions

- Participants to contribute their perspective on the topic of monitoring at the regional / sub-regional scale
- MPA managers to voice their needs & their will to contribute to objectives beyond their MPA boundaries?

Examples of regional initiatives

- MAMIAS (RAC/SPA)
- MedMIS (IUCN & Regional Partners)
- RSP
- Scientific platforms (MMMPA)
  - ✓ MEDACES: Scientists are quite reluctant to feed this database with their raw data before publication...
  - ✓ EASINET
  - ✓ POSIMED
  - ✓ OZHM
  - ✓ T-MedNet

Information on the different ongoing policies at European and Mediterranean levels

Coordinated implementation of EU nature, water and marine policies: monitoring and reporting

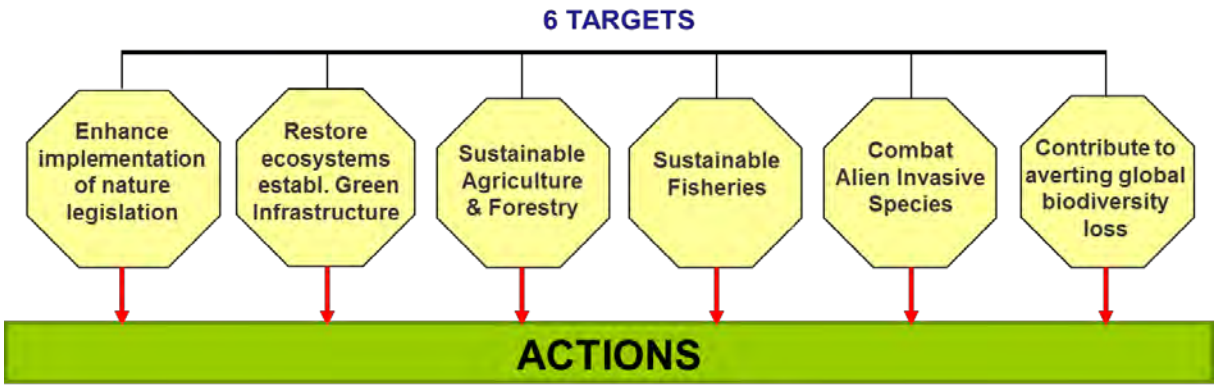
Speaker: Vedran Nikolic (Directorate General for Environment European Commission)

[presentation]

EU biodiversity strategy to 2020

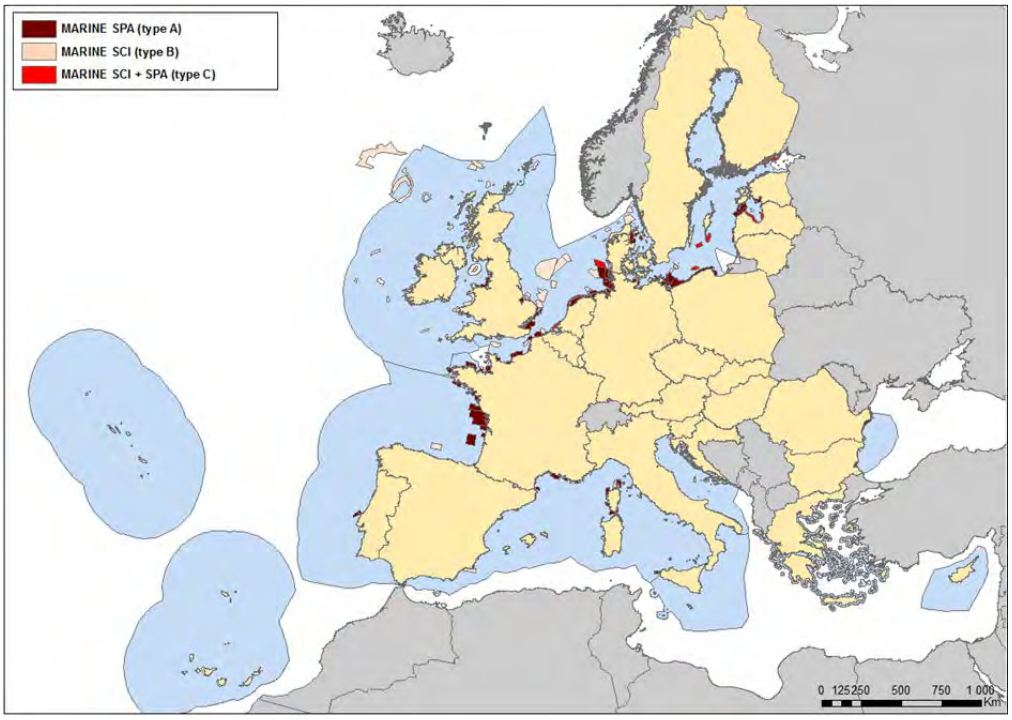
A 2050 VISION: *European Union biodiversity and the ecosystem services it provides – its natural capital – are protected, valued and appropriately restored.*

A 2020 HEADLINE TARGET: *Halt the loss of biodiversity and ecosystem services in the EU and restore them insofar as feasible, and step up the EU's contribution to averting global biodiversity loss.*



European MPAs – state of play

- Nationally designated areas
- International or regional agreements (RSCs/SPAMI, EBSA, GFCM, etc.)
- Natura 2000 and other EU instruments (MSFD, CFP, etc.)
- **MPAs – 5.9%**
- **<u>Key contribution: Natura 2000 – 4%</u> 2960 sites, 251565 km^2**
- **Marine Natura 2000 network is not yet complete: significant gaps offshore**
- **Sufficiency – MED: 20% for habitats, 15% for species**



Future European MPAs

- **Creation of new MPAs under Marine Strategy Framework Directive**
    - Report on the **progress in the establishment of MPAs**, under applicable EU law and International commitments of the Community and the Member States (Art. 21 MSFD) – **coherent and representative network?**
    - Programmes of measures shall include **spatial protection measures**, contributing to **coherent and representative networks of marine protected areas**, adequately covering the diversity of the constituent ecosystems, such as special areas of conservation pursuant to the Habitats Directive, special protection areas pursuant to the Birds Directive, and marine protected areas as agreed by the

Community or Member States concerned in the framework of international or regional agreements to which they are parties

- **Creation of new fisheries reserves under Common Fisheries Policy:** *The CFP should contribute to the protection of the marine environment, to the sustainable management of all commercially exploited species, and in particular to the achievement of good environmental status by 2020, as set out in Article 1(1) of Directive 2008/56/EC*
  In order to contribute to the conservation of living aquatic resources and marine ecosystems, the Union should endeavour to protect areas that are biologically sensitive, by designating them as protected areas. In such areas, it should be possible to restrict or to prohibit fishing activities.

- **Joint recommendations of fisheries measures in Natura 2000**

  - Guidance: *Fisheries measures for marine Natura 2000 sites: A consistent approach to requests for fisheries management measures under the Common Fisheries Policy*
  - Guidance: *Sensitivity analysis for marine habitats and species in relation to fisheries*

- **Fisheries closure areas and measures (technical, emergency, etc.)**

What are we monitoring and why?

- **Site management**

  - To detect whether MPA is achieving its goals

  - To allow adaptive management and implement appropriate conservation actions at the site level

- **Beyond site management**

  - Contribute to the assessment of the conservation status of habitats and species at the European or international level

  - Properly managed MPAs should reflect the pristine conditions and can be used to set baselines and targets

Monitoring programmes under EU environmental legislation

Directive/ Policy	Biodiversity Strategy	Marine Strategy Framework Directive	Water Framework Directive	Habitats Directive	Birds Directive
Objectives to be achieved	Headline target: halting the loss of biodiversity and the degradation of ecosystem services in the EU, and restoring them in so far as feasible	Good Environmental Status (GES) of marine environment	Prevent status deterioration. Good Ecological Status and Good Chemical Status in all water types. Good Chemical and Quantitative status in groundwater. Additional requirements for protected areas.	Favourable Conservation Status (FCS) of protected habitats and species.	Status of population which corresponds to ecological, scientific and cultural requirements (similar to FCS concept)

MSFD Monitoring programmes shall be compatible within marine regions or subregions and should as far as possible be built upon (and be compatible with) existing programmes (relevant provisions for assessment and monitoring laid down by Community legislation, including the Habitats and Birds Directives, or under international agreements).

MSFD monitoring will be done within some MPAs: it is important to coordinate, harmonise and streamline the various initiatives (WFD, HBD…) to avoid waste of time and money.

Reporting under EU environmental legislation

Reporting	**2012** "Largely" completing Nature 2000 network, incl. marine areas (Action 1a) **2014** First mapping and assessment of status of ecosystems and services; **2015** COM mid-term assessment of EU 2020 Biodiversity Strategy	**2012:** initial assessment of marine waters, definition of GES and establishment of environmental targets; **2014:** establishment of the monitoring programmes; **2015:**establishment of the programmes of measures (PoMs); **2018:** update of 2012 reporting **2021:** update of the PoMs	**MS reports**: **06/2004**: administrative arrangements **03/2005**: pressure and impact and economic analysis **03/2007**: monitoring programmes **03/2010 and every six years thereafter**: RBMP **12/2012 and every six years thereafter**: progress on implementation of measures **COM reports**: **2007**: on the basis of the 2004/2005 MS reports **2009**: on the basis of the 2009 MS reports **2012 and every 6 years thereafter**: on the basis of 2010 reports **2015 and every 6 years thereafter**: on the basis of the 2012 reports	**2013** MS report under Art. 17 (HD) and Art. 12 (BD) (conservation status) **2015** COM report on conservation status **2019** MS report under Art. 17 (HD) and Art. 12 (BD) (conservation status) **2021** COM reports on conservation status

Relevance of MPAs for monitoring and reporting under EU environmental legislation

- **Most of the MPAs are at the same time Natura 2000 sites**
    - Monitoring and reporting on the conservation status of habitats and species under BHD
    - Monitoring to ensure reaching the site's conservation objectives
- **Some MPAs will introduce fisheries measures and will need to monitor and report on their implementation**
- **MSFD monitoring (11 descriptors) will be done within some MPAs**
- **WFD monitoring is being done within some MPAs**

All these monitoring efforts should be coordinated, joined and streamlined in order to avoid duplication, save resources and build a common dataset, enhance synergies and maximise the contributions of these policies to achieving higher quality of the environment – which can also help to reach the MPA's goals. This approach is particularly relevant in a trans-boundary context, and has an intrinsic added value.

Workshop on coordinated implementation of nature, biodiversity, water and marine policies

- **Brussels, 2-3 December 2014**
- **BHD, WFD, MSFD and Biodiversity strategy**
- The objective: to identify **good practices for coordinated implementation** and potential future activities of joint interest for these policy fields. To focus on common **lessons learnt, explore inter-linkages** across different pieces of legislation, present case studies from Member States and **elaborate on gaps and recommendations**
- Objectives and Assessment, **Monitoring and Reporting**, and Programme of Measures (including public participation)

Marine biogeographic seminar

Kick-off event: St Malo, France, 5-7 May 2015

The seminar aims to:

- improve and strengthen **the implementation of Natura 2000** and ensure progress towards the EU 2020 Biodiversity Strategy targets
- strengthen **common understanding** of what means in practice to achieve **favourable conservation status for habitat types and species** subject to protection in Natura 2000
- take agreed **priority management actions** designed to improve or maintain favourable conservation status for those habitats and species within Member States' territories
- develop new management insights, **cooperation** between Member States, stakeholder organisations, environmental NGOs and specialist networks that can lead to new 'know-how' to support the achievement of FCS

- To strengthen recognition and action for management of Natura 2000 that also contributes to socio-economic objectives, through the multiple benefits that derive from such action

Possible themes:

- Reaching a common understanding of **conservation objectives**
- Assessing the **conservation status and monitoring issues**
- Using the conservation status as a driver for **adaptive management**
- Implementing **risk analysis regarding fisheries** in Natura 2000 sites
- Developing **joint recommendations on fisheries measures**
- Synergies between **regional networks** and scope for cooperation
- Accessing and collaborating on **financing** marine programmes to support Natura 2000
- Improving **cross-border governance**
- etc.

Way forward

- Full implementation of EU policies and strategies, support to regional sea conventions, networks and initiatives (MedPAN)
- Political support – e.g. through EU Strategy for the Adriatic and Ionian Region – important also for non-EU countries
- Policy integration **(**ecosystem approach): MSFD/BHD/WFD, joint measures and adaptive management
- Financing: **2014-2020** programming period, LIFE, etc.

European Commission is commited to work with Member States (guidance, financing, etc.) and stakeholders (e.g. MedPAN, MPA managers, etc.) to reach goals set by our nature conservation policy.

Presentation of EcAp

Speaker: Souha El Asmi (RAC/SPA)

Integrated monitoring programme adopted end 2015 – test 2015 sub-region adriactic
Barcelona Convention is implementing EcAp in the Mediterranean.

Roadmap until 2019.

- Ecological and socio-economic assessment
- Defining objectives and indicators for GES

Core Activities:

- Preparation of an integrated monitoring programme
- Platform

Elaborating assessment factsheet, a framework for the programme of measures.

RAC/SPA contributes to EcAp for the biodiversity part.
Species: cetaceans, turtles and marine birds.

National approaches for harmonized monitoring

Moderator: Harun Güçlüsoy (Dokuz Eylül University - Institute of Marine Sciences and Technology, Turkey)

Case studies presentations in a nutshell

	Croatian coralligenous monitoring protocol: the basic methodological approach	**Geo-habitat mapping in Natura 2000 sites in the Aegean and Ionian seas: a pilot study for the sustainable management of coastal resources in the context of the EU marine strategy framework directive**	**Towards the creation of a network for fish monitoring in Tunisian MPAs**
Speaker	Silvija KIPSON (University of Zagreb, Croatia)	George Ferentinos (OCEANUS-NET / University of Patras, Greece)	Emna Ben Lamine (INAT/ UNS, Tunisia)
Download	[abstract] [presentation]	[presentation]	[abstract] [presentation]
Why this monitoring?	Coralligenous habitat: ✓ Included in priority habitat type (EU Habitat Directive) and protected under the SPA & Biodiversity Protocol of the Barcelona convention; ✓ Low dynamic systems (dominated by long-lived, slow-growing species) ✓ Great heterogeneity (at geographical and micro scale): characteristics that influenced sampling design (spatial & temporal scale) ✓ Hotspot of biodiversity in the Mediterranean (approx. 20% of species) ✓ Great structural complexity ✓ Habitat for several species of commercial interest	A pilot study for the sustainable management of the coastal zone in the context of the **EU Marine Strategy Directive**. The project aims at developing and promoting **a geo-habitat mapping sonar scheme as an effective, fast and low cost methodological tool** for assessing the spatial distribution and patterns of *Posidonia oceanica* meadows and coralligenous formations, and their status.	The south-western Mediterranean's coastal areas, including those in Tunisia are characterized by a lack of regular monitoring and data on their resources and pressures, particularly for fish populations. The setting up of an effective national MCPA network (Law No. 49-2009, on 20th July 2009) is thought to be an effective way to manage the fisheries in these coastal areas. However, it is important to link this network with scientific monitoring programs on resources and pressures. This will enable to check over time whether the objectives are reached or not by the management measures in place.

	✓ A diving attraction **The proposed basic methodological approach was developed at national level** (in the framework of the MedMPAnet project) **in order to fulfil reporting and monitoring requirements of the EU Habitat Directive (92/43/EEC)**		**That is why it is necessary to select methods which are relevant and inexpensive to ensure an early detection of changes in the current fish populations in situ**.
What does monitoring consist in?	The monitoring protocol is based on **Photo sampling** that satisfies minimal sampling area requirements allows for subsequent more accurate and objective analysis than the one stemming from direct observations underwater, as well as it provides a permanent record that enables the extraction of different levels of information on demand, which is convenient for future development of the monitoring metrics to be applied in the Adriatic context. It is further complemented by **visual census** that enables the assessment of phenomena over a wider area and that provides almost immediate data after minimal subsequent analysis. This methodology provides data on: ✓ habitat structure and function (species composition, habitat complexity, bioconcretion and bioerosion) ✓ degree of impact of the main disturbances (mass mortalities, invasive species, sedimentation, mucilaginous aggregates, fishing gear)	The survey has been carried out in two phases using sonar and visual techniques: ✓ Phase 1: **Large scale mapping** using High Resolution Slide Scan Sonar and CHIRP Sub-bottom profiling systems. ✓ Phase 2: **Ground-Truthing in Selected Areas** using ROV, towed Camera and Divers.	For this research, the choice and the adaptation of monitoring methods that will be applied to Tunisian MPAs was elaborated from a synthesis of fish monitoring methods and indicators in Mediterranean MPAs. **Based on specific criteria (easy to put in place, relevance of results, speed and cost of getting results and able to be carried out by managers themselves), three methods were used on the coastal fish populations:** ✓ To monitor resources: o **a visual count by underwater diving in transects of variable width** o and **the "Fish Assemblage Survey Technique" FAST method**; ✓ To monitor pressures: monitoring **fishing pressure in the coastal zone through inquiries and surveys with artisanal and recreational fishermen**.
Implementation: who does what?	**Field team**: 4 trained divers (marine biologists, MPA staff, trained recreational divers) + good quality underwater photo	A multi-disciplinary project involving: ✓ Marine geologists	These methods can be easily applied by managers or even users (fishermen, divers, etc.) to ensure that the proposed

	equipment -> complete assessment of 1 site per dive. **Data analysis** requires marine biologists (ideally with some experience in coralligenous habitats). **Regarding the occurrence of major disturbances** in the coralligenous habitat (such as mass mortality, presence of invasive species, fishing nets and/or mucilagenous aggregates), an **alert mechanism through citizens' science initiatives could be set up**.	✓ Marine biologists ✓ Fishery scientists	management measures are followed - a necessary step towards developing a true co-management policy.
MPAs Constraints	**National level** ✓ Coordination – an authority ensuring that national guidelines are followed (State Institute for Nature Protection) ✓ Limited view of the conservation status of marine biodiversity ✓ Monitoring of deeper waters (> 40 m depth) – logistically & financially more challenging ✓ Funding – monitoring is responsibility of each member state… ✓ Implementation has not started yet **International level** ✓ Standardization – not easily achieved but valuable effort in the long-term (comparability, enhanced understanding)	No time to conduct the survey in all N2000 sites. It is therefore based on the selection of a sample of sites (Zante, Kefallinia Islands and Cyclades Islands)	✓ Setting up of an effective national MCPA network in 2009 only (Law No. 49-2009 on 20th July 2009); no effective field protection or management yet ✓ Research funding is not currently a priority in Tunisia ✓ Number of scientific divers available reduced to a few individuals ✓ Protecting the environment is the responsibility of all the users on the coastal area
Benefits	✓ Protocol – available tool - applicable at the site level (MPA level) to assess temporal trends ✓ Compilation of comprehensive dataset ✓ Results will enable evaluation of conservation measures & represent	✓ Side scan sonar and sub-bottom profiling systems are reliable tools for mapping the spatial distribution and patterns of benthic habitats as well as depicting areas within habitats, where more detailed investigations are needed with ground-truthing techniques for	✓ Adaptation of the FAST Method in Tunisia; Drafting of a standardized survey form (traditional fishermen, recreational fishermen, underwater fishers) ✓ Training of volunteer divers for FAST

	the basis for adaptive management ✓ In accordance with Barcelona convention, IUCN Red list for Mediterranean corals ✓ Opportunity for awareness raising - citizen science	assessing their status ✓ They are fast and low cost tools for mapping benthic habitats at a rate of about 2.2km^2/h at a speed of 4knots and a swath range of 200m ✓ The coralligenous formations in the Cyclades islands, covers 15% of the surveyed area and they develop mainly between 40 and 70m. ✓ The coralligenous formations are affected and damaged by human activities. ✓ The *Posidonia oceanica* meadows in the MPA are healthy and unaffected by any human activity. However, in the nearby non protected area, the *Posidonia oceanica* meadows are damaged by trawl fishing and anchoring.	and fishermen for the surveys ✓ Development of a database to be used as a baseline for future monitoring and to assess the efficiency of management measures to be adopted ✓ The creation of a fish monitoring network across all Tunisian MCPAs is an important challenge for the ICZM

Discussion key points

- ✓ **Implementation cost** (e.g. about 500 000€ for 6 years in the case of the coralligenous monitoring held at national level in Croatia) may be reduced:
    - o **If MPAs can provide logistics support** (accommodation, boat…)
    - o **Via citizen involvement when feasible and appropriate**: partnerships with universities, Marie Curie doctoral training programs, Erasmus projects, involvement of divers and fishermen via trainings and awareness raising (like in Al Hoceima, Morocco)…

- ✓ **Budget for monitoring programmes under EU environmental legislation** (conservation status monitoring / habitat directive…) must be secured by **national funding**;

- ✓ **Habitat mapping: make the best of technology and statistical techniques to reduce the cost of monitoring.** As reported in the case study of Geo-habitat mapping in Natura 2000 sites in Greece and through other examples given in the discussion (e.g. Declaration of a Canyon in the north of Spain), **the use of technologies such as multi-beam echo sounder and sonar combined with statistical techniques allow to do predictive habitat distribution (posidonia, coralligenous), which is far less expensive and time-consuming than mapping the whole area**.

From local to global (and vice versa): experiences from the field (sentinel sites)

Moderator: Fabio Vallarola (MPA of Torre del Cerrano / AdriaPAN coordinator, Italy)

Case studies presentations in a nutshell

	Columbretes Islands Marine Reserve as global change sentinel site	**T-MedNet: a temperature network for high resolution and long term monitoring of Mediterranean coastal waters stratification**	**Medmis: An alert system for marine invasive species in MPAs**	**Monitoring of the osprey in Al Hoceima National Park in the framework of the Albatros project** (harmonise sea bird monitoring methods across the whole Mediterranean Sea)
Speaker	Juan Carlos Jorquera Gámez (in replacement of Diego Kersting - University of Barcelona, Spain)	Joaquim Garrabou (Institute of Marine Sciences, Spain)	Maria del Mar Otero (IUCN Med, Spain)	Mohamed Jabrane (HCEF, Morocco)
Download	[abstract] [presentation]	[presentation]	[presentation]	[presentation]
Why this monitoring?	Marine global change has become a major concern worldwide. Benthic mass mortalities related to warming have recurrently impacted thousands of kilometers of coast in NW Mediterranean, overlapping their occurrence with that of invasive algae that are spreading at an unprecedented pace. The monitoring of the biological and physicochemical parameters related to this problematic is of major importance to better	Warming is a fact and the Mediterranean region is known as a hot spot for climate change in the world. Warming is heterogeneous in space and time. Most data is SST[8]. There is less data about stratification processes. Surprisingly, long-term temperature data series from coastal areas are scarce, while these are key data to understand the effects of warming and	Many MPAs are located in proximity to major ports, have aquaculture farms in or near-by, or are frequently used by small recreational or fishing boats as well as tourists. Marine alien invasive species (AIS) might be overlooked or pass unnoticed until there are well established into the local ecosystem and eradication prompt to be difficult, costly or impossible. The overall aim of the Strategy on	The osprey (*Pandion haliaetus*) is found in different biogeographic regions. In the Mediterranean, the species is highly endangered. An action programme for the conservation and recovery of habitats and species, including the osprey, was implemented in the Al Hoceima National Park, which is the only

[8] Sea Surface Temperature

	understand the mechanisms involved, the association between parameters and finally to assess the resilience of biological communities and species to global change. **MPAs are serving as unique laboratories to study and monitor the response of species and communities to these new threats free from many additional anthropogenic effects which may confound the results.** Furthermore, many of these MPAs offer research facilities and support, which undoubtedly eases monitoring activities and research. It is important to note that the monitoring programmes carried out in Columbretes started as an initiative of the MPA managers and staff in the need to assess the long-term impact and responses to the rapid changes that were occurring in MPAs. Collaboration with scientists (Universitat de Barcelona and CSIC) has been essential in the development and implementation of the described programmes.	the richness of the ecosystems that develop beyond the surface. Marine Protected Areas are mostly in coastal waters and can help address the lack of long term temperature data in these areas. **The overall aim of the project is to help managers to deal with the effects of climate change in their MPAs.** T-MEDNet has received support from members of the MedRecover (www.medrecover.org) research team based in Barcelona and IPSO Facto (Marseille, France), small project from MedPAN, from the Clmate Change Observatory Scandola Nature Reserve, Agence de l'Eau and the TOTAL Foundation.	marine alien invasive species for the MedPAN network is to **establish a common framework for the MedPAN members to develop action on marine invasive species** (following the CBD hiercharchy: (1) Prevention; (2) Detection/Rapid response; (3) Control/ Mitigation).	coastline in Morocco with a sedentary population. Beyond the first census conducted in Al Hoceima by the NGO AGIR, **a monitoring action carried out on a regular basis is key for understanding and managing the population dynamics**, as in Corsica and in the Balearic Islands. In 2012, to strengthen the management and compensate for the lack of staff in the MPA, a partnership was established between the High Commission for Water, Forestry and Combating Desertification and the Conservatoire du littoral in France through the Mediterranean Small Islands Initiative PIM, in order to carry on the osprey population monitoring actions in the Al Hoceima National Park and to elaborate a national action plan for the conservation of this species.
What does monitoring consist in?	In Columbretes water temperature is monitored daily since 1991, conforming one of the longest local temperature data series in the Mediterranean, and climate change effects on benthic organisms are being studied since 2002 using the endemic reef builder coral *Cladocora caespitosa* as bioindicator. This species is being severely affected by water warming	A temperature measurement strategy using temperature data recorders that are cheap and easy to operate and are therefore valuable and appropriate equipment to fill the gap on the knowledge on temperature regimes. This strategy was implemented in several MPAs in the NW Med. The T-Mednet Web platform that	MedMIS (www.iucn-medmis.org) is an online information system for monitoring invasive non-native species in MPAs. The Webplatform that is available in 3 languages (also available for smartphones) provides a guide for the identification of IAS, a list of MPAs, and a map to visualize what has been	✓ Censuses carried out in May (chick-raising period) ✓ Land-based counting and counting at sea ✓ Checking of nests (breeding validation) ✓ Weighing and banding of chicks ✓ Identification of the threats/disturbances along the 40 km-long coastline hosting the

	and has suffered recurrent mortalities in Columbretes. The evolution of the invasion of the invasive algae *Caulerpa cylindracea* and *Lophocladia lallemandii* has been monitored since their first detection in 2006. Abundance of both invasive algae and their interaction with the autochthonous species is monitored annually.	provide an intranet database management to MPA managers and offers public data visualization. Data belong to the people responsible for each site, but open data is encouraged.	recorded so far.	osprey nests
Implementation: who does what?	The success of these monitoring programmes is the result of the close collaboration between scientists, MPA staff and managers.	The high resolution temperature series available are acquired thanks to the efforts of researchers and technical staff from several research teams and institutions, and rangers from different Marine Protected Areas.	The platform is for all observers (amateur or professional diver, fisherman, marine technician, MPA manager or scientist). Information sent by observers on potential invasive species that they found is verified by the IAS Advisory group, before alerting the MPA's management body as well as other MPAs nearby with recommendations and action plan.	
Constraints	Long-term data series are not always easy to secure in the long-term mainly due to financial problems.	✓ Fulfill the needs of MPAs' managers ✓ Take advantage of collaborative tools ✓ Open data access ✓ Merging international initiatives ✓ Link with biological monitoring ✓ Secure annual funding for database management ✓ Funding to improve the functionalities of the platform and adapt to the MPAs managers needs	✓ Update phone systems ✓ Continue to create synergies with other initiatives and develop IT links ✓ Be able to provide in detail cartography/status of some MPAs ✓ Upgrade technology for easy downloadable information/maps ✓ Revision of species with scientific group ✓ Communication ✓ How to advance to create an alert system	✓ Access to trophic resources: identify the biomass, the fish density and the diversity of species (action initiated by the INRH in collaboration with the MPA and the traditional fishers) ✓ Complete this study inside and outside the MPA to evaluate the reserve effect ✓ Evaluate the impact of threats: number of tourist and fishing boats inside and outside the MPA
Benefits	Monitoring protocols used both for warming effects and biological invasions are contrasted and easy-to-use.	✓ Working local for a Global Action: more than 40 sites across the Med take part to the T-MEDNet project and there are more than 7	Getting to know the extent of the problem.	✓ The participation of local stakeholders, especially the fishers, helped reduce the threats (dynamite fishing, illegal

	Cladocora caespitosa has shown to be an exceptional bioindicator of climate change in shallow habitats and the results obtained over a decade have allowed describing, for the first time in the Mediterranean, the long-term effects of warming in benthic species. These results have showed the importance of long, periodic and accurate monitoring programs in order to assess and understand the response of organisms to climate change. These results have led to several scientific papers in international journals and the protocols are being used in several MPAs.	million temperature values in the database. ✓ Analysis of the link between Temperature conditions and mass mortality events reported from the NW Med. ✓ Support MPAs management plans to enhance resilience ✓ Sharing experiences ✓ Data visibility-Access to data ✓ Mutualized costs ✓ Help validation of modelling efforts		trawling) ✓ Through participative planning, a new zoning of the marine part was proposed, taking account of the monitoring results. ✓ For its involvement, the AGIR Organization was granted the 2014 UNDP Equator Prize, as well as the coastal and marine management special prize. ✓ A monitoring protocol was established and harmonized to be used as a standard

Knowledge cafés

Natura 2000 at sea: monitoring challenges?

Moderator: Renaud Dupuy De La Grandrive (City of Agde - MPA of the Posidonia of Cap d'Agde, France)

- ✓ **Need to update the list of species and habitats to monitor in N2000 at sea sites** (the list of habitats includes 600 terrestrial habitats and only 5 marine ones! Many habitats of importance are not listed). **MedPAN should feedback the managers' proposals to the EU**. However, updating the lists of species and habitats isn't a fast process.

- ✓ **Lack of resources:**

  - o In order to comply with the EU requirements in terms of monitoring and reporting in N2000 at sea sites, managers are often forced to spend funds allocated to other activities.
  - o Money that comes from LIFE programmes does not ensure long-term funding of monitoring programmes.
  - o As reminded by the EU DG Environment, funding is the responsibility of the member states, not of the EU.

- ✓ **Ensuring connectivity between N2000 at sea sites and other Marine Protected Areas is an important but challenging issue**.

- ✓ **Difficulties for the evaluation of the status conservation of certain N2000 habitats and species, due to the lack of studies. The results must be comparable.**

- ✓ **Interest in sharing data between MPAs of the N2000 network at sea:** develop a common database for sharing data in the Med? Which common parameters can be chosen?

- ✓ **Migratory species** are a special issue that will be discussed in Spring 2015 (meeting organized by the EU DG environment in France).

- ✓ **The role of MedPAN is to feedback to the EU the managers' needs for monitoring**.

Monitoring of no-take zones: methods and tools

Moderator: Paolo Guidetti (University of Nice Sophia Antipolis) & Francesco De Franco (Consortium of Management of Torre Guaceto, Italy)

Case studies presentations in a nutshell

	Monitoring Fish Biomass in No-Fishing-Zones in Gökova Bay	**Baseline research for developing monitoring protocol for no-take zones in MPA Telascica**
Speaker	Zafer Kizilkaya (Mediterranean Conservation Society, Turkey)	Hrvoje Cizmek (NGO 20000 Leagues – Marine Explorers Society, Croatia)
Download	[abstract] [presentation]	[presentation]
Why this monitoring?	Mediterranean no-take marine reserves demonstrate total fish biomass is single most important indicator of the health of fish populations. Therefore monitoring trajectory of recovery of fish assemblages will reveal how well the MPA is protected, a major management goal.	The monitoring of no-take zones is one of the priorities of the management plan In Telascica. Baseline research for developing monitoring protocol aims at: ✓ Providing overview of whole no-take area ✓ Identifying biodiversity micro hotspots ✓ Identifying future monitoring sites inside and outside of zones ✓ Providing an overview of fish species, abundances and habitat types
What does monitoring consist in?	SCUBA surveys were carried out in three NFZs and adjacent unprotected areas within the Gökova Bay. Fish data were collected using standard underwater visual census techniques: Along a certain length of transect (50 meters in Gökova case), the diver swims one way at constant speed, identifying and recording the number and size of each fish encountered, that belong to different trophic level between 10-18 meters of rocky bottom.	✓ Detailed map of NTZ 1:2000 ✓ Fish visual census: trained divers – fish abundance and size classes ✓ +baited underwater video – large predators ✓ Benthic sampling – photo and visual cover estimates of hard bottom ✓ Sea urchins – urchin barrens
Implementation: who does what?	The method can be applied by fish biologists or by any trained MPA staff	
Constraints	This method: ✓ Needs good knowledge of fish species ✓ Should be repeated once in a year in the same season. ✓ Is labor intensive and necessitates equipment and diving infrastructure. ✓ Technical aspects should be systematically applied like ample sampling site for reliable results. ✓ Analysing the data requires careful length-weight conversion and trophic level separation.	✓ Cost effective and fast methods ✓ Methods for all types of habitats – with modification ✓ Consistent with the management plan objectives
Benefits	Results advocate why we need well-enforcement for fulfillment of the MPA's objectives: increase in apex predators suggests promising evidence of ecosystem restoration, as the presence of apex predators are often a key sign of the health of a reef ecosystem. Monitoring fish biomass is thus a very useful tool for the health check of the MPA and encouraging for the MPA management pursuing effective enforcement as well as increase the capacity of MPA staff.	✓ Integrated protocol for monitoring of no-take zones in Croatian MPAs ✓ Harmonized data collection with other Mediterranean MPA no-take zones

Discussion key points

- ✓ **It is important to compare MPAs to have a broad picture. There are many statistical tools that allow comparison even though protocols are different.** Protocols may be slightly different from one MPA to another as long as: 1) Results are comparable; 2) objectives of the protocols are clearly defined.

- ✓ **Online platform with standard protocols can be helpful**

- ✓ **Variability of habitats may mask the variability of reserve effect and may introduce a bias between the results recorded inside and outside the MPA**. It is important to take this variability into account in the analysis (statistically remove the bias to keep only what you want and be able to compare). What is important is not to compare the absolute value, but also the trends.

- ✓ Simple and easy-to-implement monitoring protocols maintained on a regular basis (e.g. every year) can be supplemented by in-depth studies carried out occasionally.

- ✓ Monitoring of no-take zones: importance to monitor fisheries, but also other activities such as diving.

- ✓ Baited video for large predators provide valuable additional data (complementary to those collected on transect) because they allow to see deeper (but the deeper you go, the less impact you observe. It is maybe not really relevant to put money and time to monitor deep-sea habitats).

Discussion groups on the harmonisation of monitoring approaches throughout the system of MPAs (at regional or sub-regional level)

The afternoon sessions took the shape of two parallel linguistic discussions groups. For each of the two groups, the objective was to identify which type of monitoring should induce a harmonized monitoring effort on the part of MPAs at the scale of the MedPAN Network (threatened habitats, invasive species, temperature, fisheries, other human activities…?) or which isolated parameter / indicator MPA managers would wish to monitor in a harmonized way on the scale of the current system of MPAs. Each group was asked to assess the pertinence and feasibility of such a 'network' approach. Failing to reach a clear consensus on this question, the discussions highlighted the need to continue the work by sub-region and themes in order to move forward on this issue.

English speaking group	**French speaking group**
Moderator: Zafer Kizilkaya (Mediterranean Conservation Society, Turkey)	*Moderator: Joachim Claudet (CNRS/CRIOBE, France)*
Potential regional monitoring parameters: ✓ Fish biomass ✓ Human activities (extractive: landing values and non extractive) ✓ Social perception of the mpa from the general public ✓ Reserve effect / spillover ✓ **Economic added value of the MPA** ✓ Endangered species (with hot spot MPAs) ✓ Plastics ✓ Migratory species ✓ Noise (hydrophones) ✓ External sources of data (satellites…) On-going initiatives: ✓ Invasive species (medmis) ✓ Temperature (t mednet) ✓ EC project on economic added value -> pilot sites	Why harmonizing monitoring approaches? Need to differentiate: ✓ **MPAs as observatories:** Information of global/underlying biophysical processes can inform understanding the local phenomenon (e.g. link between temperature conditions and mass mortality events). Even though such monitoring are not necessarily targetted towards managers, MPAs as observatories have an added value if monitoring provides either direct or indirect (long-term, covariates…) effects on management. By participating in a network as observatories, MPAs can also increase their visibility which may help secure funding and/or support. ✓ **Harmonization of simple indicators to allow comparison** between MPAs or within an MPA through time. Standardized methods need to be very simple if implemented by MPA managers. **In link with the discussion, it was noted that protocol database should provide:** ✓ Ranking based on a simplicity criteria ✓ The number and type of questions that can be answered

Conclusions and summary of the recommendations

To ensure its legitimacy and efficiency, MPA management should be based on regular and long-term scientific monitoring, viable in terms of cost efficiency, and rationalized in terms of available resources.

Scientific monitoring (ecological as well as socio-economic) should be used in each stage of the MPA management process (planning, implementation, and assessment). Such approach is essential to make sure that the management measures effectively meet the objectives of the MPA and are accepted by the users:

- *To ensure efficient management:* the data collected as part of monitoring activities should be used to define management measures to be implemented according to the objectives of the MPA, the status of the natural environment and the existing pressures. They should also be used to evaluate management efficiency and therefore constitute a tool to adapt the decisions as part of a learning-by-doing iterative process (adaptive management principle).

- *To ensure socially acceptable management:* to be followed by the users, the local stakeholders, and the relevant enforcing authorities, management measures and the related rules and regulations should rely on strong scientific evidence. Such condition will probably not always be sufficient on its own, but it is necessary to make sure that management and the induced constraints are not considered arbitrary by the users and the local stakeholders. The assessment of management efficiency also guarantees the MPA legitimacy and the social acceptance of the management costs.

As management is a continuous and iterative process, the monitoring activities are only meaningful when they are repeated over time on the long term (with periodicities that differ depending on the considered species, habitats, or activities monitored). This raises the question of long-term funding, necessary to ensure the viability of monitoring activities. Not surprisingly, the lack of funding has been reported by 66% of the managers - interviewed as part of the survey conducted before the workshop - as the main hindrance to the implementation of regular monitoring programmes in their MPA. Many participants also reported this same fact during the workshop. **The implementation of regular and long-term scientific monitoring, viable in terms of cost-efficiency, and rationalized in terms of available resources (financial, material and human) is therefore a complex equation to be solved by MPA managers**.

Simple and easy-to-implement monitoring protocols can be conducted on a regular basis by the managers and supplemented by in-depth studies carried out occasionally

Part of the response to the long-term, regularity and funding constraints lies in this recommendation (but only a part of the response!). A simple protocol, drawing on a limited number of key indicators carefully selected based on the MPA management objectives, easily implementable by the manager (considering the resources available and the features of the MPA), may be sufficient to contribute to the management efficiency.

Many managers are interested in this approach: by promoting the field officers' participation in data collection, this approach guarantees regularity and continuity in the monitoring activities, which can be supplemented, if necessary, by in-depth studies to be carried out occasionally.

However, scientific assistance must be provided to the manager, especially to adapt the protocol to the local context (e.g.: sampling plan to be adapted according to MPA features), to help planning the monitoring, to supervise the training of the officers responsible for the implementation, and to regularly assess the relevance of the collected data and ensure they are correctly interpreted.

However, this approach cannot be applied to all types of monitoring and some limits need to be established: while visitor use monitoring based on a simple and solid methodology can be successfully conducted by the managers (even though the assistance of researchers is always advisable for the sampling/experimental plan), the same does not apply to other monitoring - inaccessible to the managers due to their complexity - that remain the responsibility of the scientific research stakeholders and therefore depend on the availability of more substantial means.

Cooperate with all the stakeholders likely to contribute to a better knowledge of MPAs: the added value and the limits of the participatory approaches

In the difficult budgetary context experienced by most Mediterranean MPAs, citizen science initiatives have recently received greater attention as a cost-effective way to collect data on the environment. However, as discussions held during the workshop have shown, citizen science also remains controversial: **whereas volunteer-based monitoring approaches can, to some extent, be helpful for filling spatial and temporal gaps in traditional monitoring programs whilst raising awareness among users, they must not be regarded as a default option and cannot substitute to scientist and manager-led monitoring programs.**

The reliability of a volunteer-based monitoring approach depends, on the one hand, on the simplicity of the indicators that need to be documented (in addition to the relevance, robustness, sensitivity expected of all indicators), and on the other hand, on the competence and motivation of the volunteers responsible for data collection. In any case, **the protocol must be precisely defined, easy**

to implement and readily understandable, appropriate training must be ensured prior to the implementation, and a "quality review" and final validation of the data must be led by a scientific team. When all these conditions are met, participatory approaches may prove useful, especially when MPAs do not have sufficient human resources to conduct monitoring actions (involving diving centres for example).

Besides, the monitoring of socio-economic activities, such as fisheries, requires the participation of the relevant stakeholders. This raises the even more complex question of data reliability, considering the biases potentially induced by possible conflicts of interests: fishermen are generally rather reluctant to report their real catch or to reveal their favourite fishing sites; and the fishing behaviour tends to change as soon as a scientific team gets on board to lead a monitoring action (as reported by a traditional fisherman during the workshop). While there is no simple solution to this issue, the workshop participants however highlighted three key recommendations: **strengthen the trust between the MPA and the stakeholders to be involved in the monitoring programmes in order to ensure reliable data transmission** (even if it implies involving only the fishermen with which adequate trust was established, for instance); **communicate monitoring results to the stakeholders involved, to show them the value and the usefulness of their contribution**; and **involve the MPA socio-economic stakeholders in the design of monitoring programmes** (by inviting them, as part of scientific committees), as well as in the planning process of uses and regulation of the concerned activities (which regardless of the scientific value of the approach can create greater commitment of the local community to the MPA).

Make the best use of existing technologies

Scientific monitoring sometimes relies on expensive and high technology means. Another approach consists in making the best use of cheap and widely accessible technologies to optimize the cost efficiency of monitoring activities. Most exchanges held during the workshop precisely focused on this second approach.

The interest in general public technologies (websites, blogs, social networks, smartphones, tablets computers…) and the related functionalities (interactivity, real time, geolocation, crowdsourcing…) goes together with the interest aroused by participatory and citizen sciences. **Many participatory approaches are based on the use of these technologies, which facilitate data collection and sharing as well as the connection with users**. We will therefore keep in mind here the recommendations formulated on participatory approaches, to highlight the added value as well as the limits to the use of technologies in this context. In line with these recommendations, **the participants also pointed out the potential adverse effects induced by real-time information** - such as disseminating information on the position of cetaceans or priority species as part of participatory monitoring, likely to increase the harassment or harvest of these species. **Also, disseminating non-validated monitoring results may be detrimental if not dangerous for the MPA**: **indeed, incorrect data may lead to inappropriate management measures or convey misleading messages on the MPA.**

From a less mainstream perspective, technologies with monitoring functionalities are being specifically developed for MPAs and prove to be real management tools (CyberTracker, MedMIS…).

The use of public data involving more advanced technologies but that are openly accessible is also an interesting approach: for instance, the use of satellite imagery for mapping shallow coastal areas, or AIS data for monitoring maritime traffic inside the MPA (via marinetraffic.org).

A good collaboration between MPA managers and scientists is key to the implementation of reliable and solid monitoring programmes

Whether to conduct challenging programmes, to design simple protocols to be directly implemented by the managers or to supervise citizen science projects, universities and research laboratories are essential partners of MPAs.

The scientists' participation is crucial for the managers as it guarantees sound and reliable scientific information to support the informed adoption or adaptation of efficient management measures. Conversely, MPAs are "life-sized laboratories" for researchers' field work.

Therefore, the quality of the collaboration between scientists and managers is key to a successful monitoring programme, even if their expectations are different: while managers understandably expect a (quick and appropriate) response to their management needs, research priorities and issues are often different (and they often are more long term-oriented). This can lead to misunderstanding, even frustration, as the main tensions are generally related to the questions of management objectives and result accessibility in a form that is usable for managers.

Distinction should thus be made between research FOR MPAs (funded by or for MPAs) and research IN MPAs (where the MPA is a scenario but research is not necessarily management-oriented). To this end, it is crucial that managers and scientists agree on a clear cooperation framework outlining the expectations and commitments of both parties. More explicitly, some managers consider that scientific research conducted in MPAs should be subject to prior approval from the manager and data-reporting obligation in a format defined beforehand (raw data for instance).

However, one of the greatest challenges, according to both managers and scientists, is to make the (research) offer match the (management) needs: there are many recommendations on this matter, but they are all built around the claim of a better communication between managers and scientists through specific meeting times and spaces, either physical or virtual:

- **MPA Scientific Committees** to help prioritize the objectives, select adapted indicators, sampling protocols…
- **Directory of Monitoring Protocols** updated with information on the context and the objectives of the monitoring protocols presented (why monitor the *Posidonia* meadows? Why measure the shoot density? Why the lower limit rather than the upper limit...) and an indicator of the implementation difficulty level;
- **Online directory** to facilitate the connection between managers and experts according to their scope of competence;

- **Training sessions** to familiarize the managers with monitoring protocols;

- **Participatory platform** with diverse thematic entries to promote scientific research components, taking into account MPA specificities and needs.

- **Encourage bilateral cooperation** : development and implementation of MOU - detailed contracts where the role , objectives and deliverables are clearly defined for each party ;

- **Online platform to facilitate internship offers for students, PhD students, researchers in MPAs with specific topics.**

Beyond these recommendations, let's reiterate that the lack of funding (decrease of funds allocated to research and to MPAs) is considered as the main obstacle to the implementation of regular monitoring programs in MPAs. Collaboration between researchers and managers assumes that MPAs are able to fund research they need or that the research laboratories have funds dedicated to assisting managers. **It is therefore essential to promote the needs of MPAs to universities, public research organizations, funding agencies, and foundations, for them to be better taken into account in the calls for research projects.**

Make progress on harmonized monitoring approaches in the Mediterranean

During the second workshop day, the participants exchanged on the types of monitoring (and indicators) useful to the managers, and which require, according to them, a harmonized approach across the MPA systems/networks.

Given the difficulty in achieving consensus on this matter, the managers might be, rightly, more concerned by the monitoring issues in their individual MPA than the monitoring harmonization issues on the national, sub-regional or regional scale, or they might as well consider this problem unsolvable.

However, as evidenced by many recommendations formulated during and after the workshop (through the questionnaire sent to the participants)**, the expectations related to the identification of priorities and/or common methodologies and the harmonization of monitoring protocols are shared by the managers and the scientists, who point out several arguments:**

- Monitoring results should be comparable in space and time to be able to understand the key factors for efficient management (benchmarking across the network) and to obtain broad-scale trends (assessment of good environmental status in relation to the Marine Strategy Framework Directive – 2008/56/EC - particularly, and other directives);

- Standardised monitoring in MPAs are legitimate when the object or indicator monitored must be considered at the regional level to make sense (monitoring of temperature or migratory species, for example) ;

- As regards reporting and monitoring obligations, which are part of the European environmental legislation (Natura 2000 and MFSD particularly) or at Mediterranean level (EcAp in particular), the methodologies should be shared, coordinated, and rationalized in order to prevent duplication of activities, waste of resources, and to facilitate the pooling of results (common database) for the implementation of more efficient environmental policies.

As evidenced by discussion groups, it is, however, not easy to agree on a list of priority monitoring actions. Managers and scientists point out several recommendations to make progress on this matter:

- Promote a sub-regional and/or monitoring thematic approach gathering managers who share the same interests/problems (*Posidonia* meadows/anchoring, migratory species…)

- Promote protocols based on cost efficiency, easy implementation and strength.

- Take into account the need to move ahead both on the harmonisation of ecological and socio-economic protocols (socio-economic monitoring are fewer and more recent than ecological monitoring in MPAs, and for this reason may be easier to harmonise – the precedence of protocols long used in MPAs being one of the obstacle to the harmonisation of ecological monitoring).

For others, comparability of monitoring results is an important issue, which does not necessarily require common protocols or methodology (sometimes considered high-sounding promises): what is important is to know the trends. **The protocols used may therefore be different from one MPA to another, as long as: 1) the results are comparable (many statistical tools can be used to compare the results of different protocols) 2) the objectives of the protocols are clearly defined.**

Recommendations to MedPAN

1. **Help the managers identify ecological and socio-economic monitoring programmes adapted to the objective and the features of their MPA:**

    a. Assisting them, with the support of the MedPAN Scientific Committee, in the drafting of monitoring protocols related to the different types of MPAs, habitats and activities

    b. Updating the Directory of Monitoring Protocols with information on the context and the objectives of the presented protocols (e.g.: Why monitor the Posidonia meadows? Why measure the shoot density? Why the lower limit rather than the upper limit...)

c. Facilitating the connection between managers and the experts able to advise them, through, for instance, a "directory functionality" associated with the Directory of Monitoring Protocols.

2. **Promote monitoring programmes internally feasible for the managers and assist them in the implementation**:

   a. Providing simple and solid methodologies and protocols to be implemented by the managers (such as the *Methodological guide – Snorkel surveys of the marine environment*[9]), but also recalling the importance of having a scientific adviser for their interpretation.

   b. Integrating an indicator of implementation difficulty level into the Directory of Monitoring Protocols (cost, accessibility, material and human resources, etc.).

   c. Assisting the managers and their partners in the implementation of monitoring programmes (diving centres, fishermen…) through specific training sessions.

3. **Inform the managers about the technologies to be used for the implementation of monitoring actions:**

   a. Listing all the existing technologies and relevant feedback on a blog.

4. **Promote the exchanges between managers and scientists**:

   a. Encouraging the MPAs to establish a Scientific Committee

   b. Suggesting thematic meetings on monitoring for MPA management

   c. Creating an online exchange platform to facilitate the matching of offer (research orientations, fields of expertise…) and demand (MPA management needs) and to share managers' feedback and experiences: collaborative platform with thematic entries (which implies supervision), or *repository* (organized storage space[10]), or simple directory.

   d. Contribute to strengthening the relations between managers and researchers through Memorandum of Cooperation;

   e. Contribute to information about internship opportunities for students/PhD students through a dedicated platform;

   f. Assist research of funding opportunities for scientific projects in relation with topics of interest for MPA managers.

[9] Imbert M. , Bonhomme P. 2014. Snorkel surveys of the marine environment, methodological guide. Parc national des Calanques, CEN PACA, GIS Posidonie. MedPAN Collection. 68 pp. Available on www.medpan.org

[10] http://fr.wikipedia.org/wiki/D%C3%A9p%C3%B4t_%28informatique%29

5. Make progress on harmonized monitoring approaches

a. Identifying solid, simple and common economic methodologies and sharing them through the Directory of Monitoring Protocols

b. Promoting a sub-regional and/or monitoring thematic approach (work groups/collaborative work spaces on the monitoring of migratory species across the basin, or on Posidonia meadows across an ecoregion…)

c. Working on socio-economic monitoring protocols - maybe more easily implemented (as MPAs are less developed in this area, there is less constraint related to the precedence of protocols already used in the MPAs)

d. Communicating to the European Commission and to the UNEP/MAP the managers' needs, in terms of monitoring in relation to the European environmental legislation (Natura 2000, MSFD…) and to the Mediterranean Initiative (ECAP…).

e. Sharing information on funding opportunities which could benefit harmonized monitoring programmes.

Appendix

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