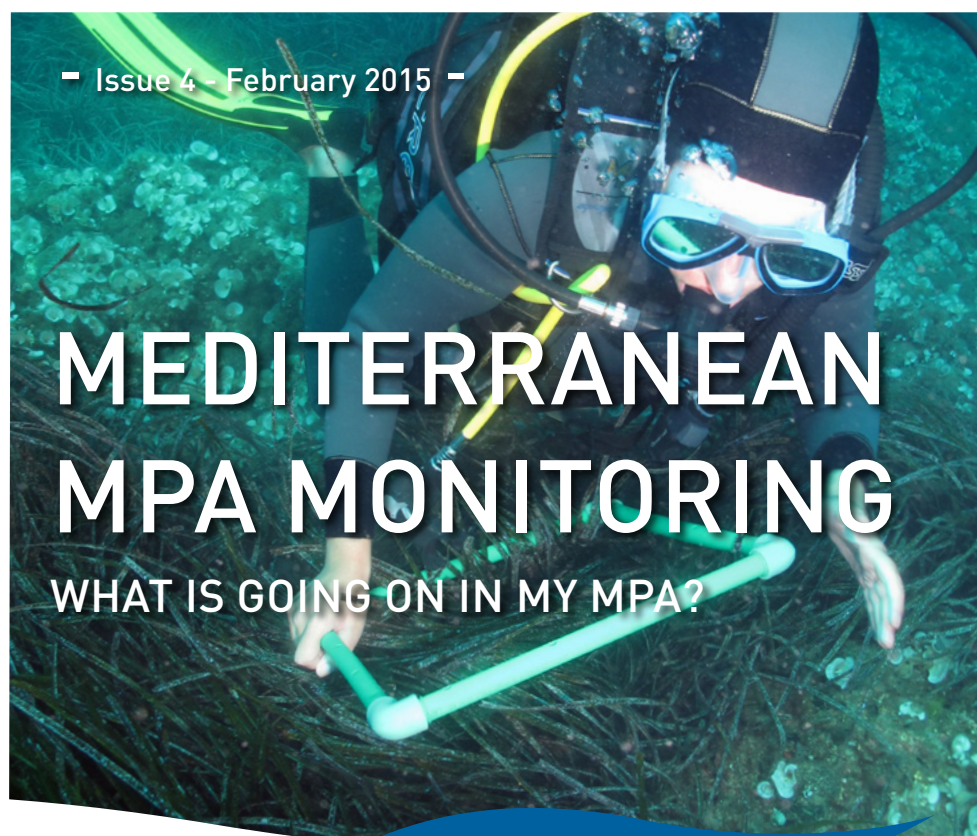


# Science for MPA management



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## EDITORIAL

Sound and regular monitoring is essential to effective MPA management; managers and scientists are unanimous on the subject. But implementing monitoring programmes requires time and money, commodities that are hard to come by nowadays.

This edition of «Science for MPA management» reviews the scientific literature published on this topic. The soon-to-be-published proceedings of [MedPAN 2014 Mediterranean sharing experience workshop: «Monitoring for management of Mediterranean MPAs»](#) will complete this review.

We are also dying to know what you think of «Science for MPA management» and our newsletter. **Click to [answer these 10 simple questions and help us improve our services to you.](#)**

Tell us  
please...

Many thanks for your participation and happy reading...

The MedPAN secretariat



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Fish monitoring using a snorkeling method © CEN/PACA



# HIGHLIGHTS

- **Sound and regular monitoring is essential to effective MPA management;**
- **Monitoring should focus on protected features, pressures and socioeconomic effects of conservation measures;**
- **Most existing MPA monitoring programmes are still scarce, short-term, poorly funded and inconsistent;**
- **Partnering with research institutions, securing monitoring funds and citizen science can help to streamline MPA monitoring efforts.**

This special edition of MedPAN Scientific Newsletter was prepared by David Rodríguez Rodríguez for the MedPAN organisation.

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# GLOBAL CONTEXT

**Monitoring is  
fundamental  
for effective  
management**

Managing a Marine Protected Area (MPA) effectively is a challenging task. Typically, a diversity of protected features needs to be conserved against multiple natural and man-made pressures.

In the Mediterranean, threats posed by coastal and marine tourism, maritime traffic, fishing, climate change, coastal urbanisation, untreated urban sewage discharge, oil exploration, extraction and spills, marine litter, and introduction of alien species, often acting in combination (UNEP-MAP, 2012), do not make things any easier. In a context of multiple pressures and rapid environmental change, having accurate, updated information on the status of protected features becomes fundamental for effective management.

## WHAT IS MONITORING?

Lockwood (2001) proposed a good definition of 'monitoring' applied to protected areas: 'The regular and systematic collection of environmental and biological data by agreed methods and to agreed standards'. A more updated definition should, however, also include socioeconomic data. In the context of protected area management effectiveness evaluation, the IUCN<sup>1</sup> defines 'monitoring' as: 'Collecting information on indicators repeatedly over time to discover trends in the status of the protected area and the activities and processes of management' (Hockings *et al.*, 2006).

## WHY MONITOR MPAs?

There are three main reasons to carry out monitoring in (and, whenever possible, around) MPAs:

1. Managerial: Aimed at elucidating the status and trend of protected features, threats and socioeconomic factors in order to adopt or adapt management actions;
2. Statutory: The most common reason for undertaking monitoring. Aimed at complying with national and/or international legislation or targets (e.g. species of community interest in Natura 2000 sites); and
3. Scientific: Aimed at studying a feature or phenomenon of scientific interest with an applied or merely theoretical purpose.

1 - The International Union for the Conservation of Nature (IUCN) is the world's oldest and largest global environmental organisation, with more than 1,200 government and NGO Members and almost 11,000 volunteer experts in some 160 countries.

Sound and regular monitoring should be the basis of MPA effectiveness assessment<sup>1</sup>, evaluation<sup>2</sup> and adaptive management<sup>3</sup>.

## WHAT SHOULD BE MONITORED?

The features to be included in MPA monitoring programmes should be determined on a case-by-case basis, according to existing legislation, conservation concern (e.g. endangered or endemic taxa), and available resources. Some of the main questions any MPA monitoring plan or programme should answer are:

- What is the status and trend of protected features and their pressures?;
- Are protected features responding positively to protection or management measures?; &
- How is protection affecting the local socioeconomy?



## STATE OF THE ART

### IN THE WORLD

The Convention on Biological Diversity states the need for the identification and monitoring of biological diversity at its three levels: ecosystems, species and genes ([art. 7; CBD, 1992](#)). More specifically, the CBD's Programme of Work on Protected Areas sets up different goals and targets regarding monitoring and assessment of PAs ([CBD, 2004](#)). Additionally, the ecosystem approach to conservation of biodiversity includes the need to consider socioeconomic factors that can be affected by conservation measures ([CBD, 2000](#)).

There is plenty of research in MPAs worldwide that is related to or that can be used for monitoring. For example, the PANACHE project has recently focused on multi-themed marine and coastal monitoring techniques that can be applied to MPAs ([PANACHE, 2014](#)). However, in many places this research is punctual (one-off initiatives for specific scientific studies), short-term (e.g. for the duration of a PhD thesis), or unrelated to managers' needs. When research is relevant to management, its results are often not provided to managers or are provided in inadequate formats (e.g. scientific articles) or language (chiefly, in English, a language insufficiently understood by some managers in non-English speaking countries; [Hockings \*et al.\*, 2013](#)).

1 - The measurement or estimation of aspects related to MPA effectiveness.

2 - The judgment of the status/condition or performance of some aspect of the MPA against predetermined criteria (usually a set of standards or objectives), typically including the objectives for which the MPA was established.

3 - A cyclical way of improving management of a protected area based on feedback from assessment, evaluation or experience.

**Scientific  
interest and  
management  
needs should  
converge.**

Addison (2011) conducted a worldwide review on MPA biological monitoring programmes. Her conclusions are interesting and worrisome: long-term monitoring programmes (longer than 5 years) using recent data in publicly available reports or papers are scarce; all monitoring programmes failed to state and link MPA conservation objectives and monitoring objectives; the data collection methods used are similar to those used in environmental impact assessments; a variety of statistical techniques are used, most of them valid. However, caveats of statistical inference are not usually mentioned; reporting on monitoring ranges from non-technical summary reports, to technical reports or scientific articles, mostly failing to communicate results to non-scientific audiences; the majority of monitoring programmes are conducted by research institutions outside the MPA, which rises issues about effectively matching scientific interests and management needs, and sharing data.

In the current context of economic crisis, additional concern has been stated that increasing funding scarcity may further affect the soundness of monitoring activities by reducing the number of samples and/or sampling frequency below scientific advice or by downgrading monitoring and assessment methods, thus discrediting monitoring activities and making them some sort of ineffective 'make-up' exercise (Borja & Elliott, 2013).

Socioeconomic monitoring of MPAs is a more recent concern (CBD, 2000) and is thus much less developed. MPA designation may have intense positive or negative effects on different social groups, especially on local stakeholders that are economically-dependent on the sea and the coast (West *et al.*, 2006). Pomeroy *et al.* (2004) produced a guidebook to help to evaluate management effectiveness of MPAs that suggests a number of potentially useful biophysical, socioeconomic and governance indicators that can be used for monitoring purposes. They also suggest simple ways of collecting data and measuring the indicators. More specifically, research has recently been conducted on the main studies and methods used to assess the socioeconomic effects of MPAs (Rodríguez-Rodríguez *et al.*, 2014). These authors also produced interesting results on the perception of the socioeconomic effects of MPAs by nearly 40 national organisations from the UK and France (Rodríguez-Rodríguez *et al.*, 2015) and designed a sound and cost-effective framework for socioeconomic monitoring and assessment of MPAs (Rodríguez-Rodríguez *et al.*, under review).



## IN THE MEDITERRANEAN

In the framework of UNEP/MAP-Barcelona Convention MEDPOL programme, the Contracting Parties have implemented a regional marine pollution monitoring programme in the Mediterranean coastal waters since 1982. In 1996, a marine monitoring and reporting strategy was approved and a marine monitoring database including data on oceanographic variables, nutrients, pollutants in sediments and pollutants in marine organisms was created. As a result, the monitoring programme was better coordinated, including an agreement on common monitoring methodologies, a data quality assurance system and a common reporting system. Based upon these activities, a Mediterranean Integrated and Assessment Monitoring Programme for the marine environment is in preparation. It will follow a harmonised ecosystem approach to marine environmental monitoring for all Mediterranean countries based on the 11 descriptors of Good Environmental Status (GES) of marine waters established in the EU Marine Strategy Framework Directive (MSFD; EU, 2008) to maximise coordination and data integration.



Fish capture monitoring in the Bonifacio Strait Natural Reserve, Corsica, France © RNBB

More specifically, the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean (UNEP-MAP, 1995) states the need for 'continuous monitoring of ecological processes, habitats, populations, dynamics, landscapes as well as the impacts of human activities' in Specially Protected Areas of Mediterranean Importance. A number of reporting indicators for assessing compliance with the protocol have been developed.

Additionally, indicators on MPA management effectiveness aimed at linking management actions and ecological objectives are also being developed.

In the European Union, the MSFD guides marine monitoring efforts. It establishes objectives and deadlines for monitoring and assessing marine conditions, although it is not restricted to MPAs. Article 11 states the need for Member States to carry out coordinated monitoring programmes that are compatible within marine regions and with other relevant provisions, such as the Habitats Directive or the Birds Directive. Annex V of the Directive gives detailed guidance on the development of monitoring programmes to assess the GES of Member States' marine waters. Similarly, the EU Water Framework Directive (EU, 2000) includes provisions for the establishment of monitoring programmes for the status of transitional and coastal waters additional to other necessary monitoring in coastal and estuarine PAs (art. 8). The Habitats Directive (EU, 1992) requires the monitoring (art. 11) and periodic reporting (art. 17.1) on the conservation status of the habitats and species included in its annexes for which Natura 2000 sites have been designated. The

Directive also requires Member States to set up ‘a system to monitor the incidental capture and killing of the animal species listed in Annex IV (a)’ [art. 12.4].

Mediterranean MPA managers value biological and socioeconomic monitoring as important research needs to support management (Di Carlo *et al.*, 2013). Nevertheless, and similarly to other settings, MPA monitoring in the Mediterranean is, with some exceptions, scarce, irregular, short-term and inconsistent. Frascchetti *et al.* (2002) showed some common methodological mistakes that should be avoided when monitoring and assessing Mediterranean MPAs. Among these, they cite insufficient or no spatial sampling replication, lack of biological baseline data and unsatisfactory consideration of confounding variables between MPAs (inside) and control sites (outside). Lack of sustained funds for monitoring and evaluation has been identified as an important limitation to regular monitoring in some Mediterranean MPAs, although other factors such as insufficient data and weak institutional support for monitoring are also likely to hinder regular monitoring and assessment activities (Rodríguez-Rodríguez *et al.*, in press).

Some progress has, however, been identified in recent years. For example, progress in assessing ecological baselines and in regularly monitoring some parameters in Mediterranean MPAs was recently reported (Gabrié *et al.*, 2012). Twenty-five per cent of the research projects undertaken in Mediterranean MPAs in the last decade were related to management and monitoring, although most of them were developed in Italy, France and Spain. Among those research projects, socioeconomic aspects were only specifically looked at by roughly 5% of them (Di Carlo *et al.*, 2013). Figure 1 shows the main topics being monitored in Mediterranean MPAs. Overall, scientists participated in 39% of monitoring activities whereas MPA staff was involved in 29% of monitoring activities, consultants in 17%, other operators in 12%, and NGOs in only 5% of such activities (Gabrié *et al.*, 2012). Tempesta & Otero (2013) recently proposed a number of common indicators for evaluating ecological condition and management effectiveness in Mediterranean MPAs. They classified those indicators as ‘priority 1’ (12 indicators) or ‘priority 2’ (6 indicators) according to their interest for MPA managers. This work can serve as a useful basis for standardised MPA monitoring and evaluation in the Mediterranean Sea.

The 2014 MedPAN network regional experience-sharing workshop on Monitoring for MPA management that was attended by 150 participants from around the Mediterranean (25-27 November 2014, Tirana, Albania) confirmed this overall picture. The objectives of the workshop were:

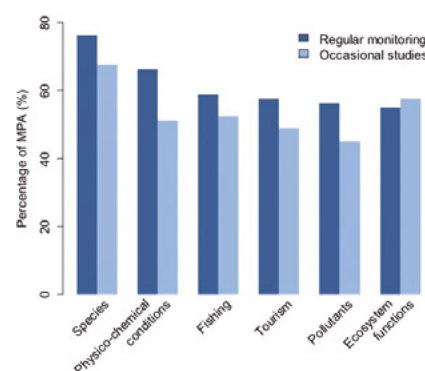


Fig. 1. Main topics being monitored in Mediterranean MPAs. Source: Gabrié *et al.* 2012.

to support managers to better identify and implement monitoring in line with the objectives of their MPAs; and to discuss the idea of 'promoting' specific protocols to harmonise data collection throughout the Mediterranean system of MPAs. Discussions largely focussed on the financial capacity of Mediterranean MPAs to implement long term monitoring. Consequently, the cooperation between MPAs and universities/research institutes on the one hand and the added value of participatory approaches on the other occupied a prominent position in the debates, raising issues on the consistency, reliability, availability and

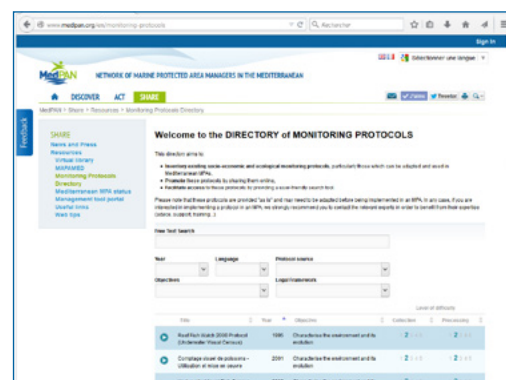


Joachim Garrabou presents T-MedNet at the 2014 MedPAN network regional experience-sharing workshop © M. Mabari / MedPAN

timeliness of data. In relation to the second objective of the workshop, the harmonisation of monitoring approaches at regional or subregional level arose as an important but sensitive issue. Presentations and discussions with the participants provided the opportunity to take stock on existing initiatives at the scale of the Mediterranean. For instance, [MedMIS](#), a platform focusing on the surveillance of invasive species, or [T-MedNet](#), a network devoted to the acquisition of long-term series of surface sea water temperatures. Initiatives on the UNEP/

MAP Ecosystem Approach (EcAp), as well as on policies implemented at European level<sup>4</sup> and their implications in terms of monitoring and reporting for MPA managers were also discussed. Please refer to the soon-to-be-published workshop proceedings for more details on these discussions and their outcomes (to be available on [www.medpan.org](http://www.medpan.org)).

The workshop also highlighted some good examples of scientific, long-term monitoring programmes carried out in Mediterranean MPAs, most of them restricted to countries in the north-west Mediterranean. France is currently developing a common MPA indicator dashboard linked to the MSFD monitoring requirements to monitor and assess MPA effectiveness at the scale of individual MPAs and at the French MPA network scale (AAMP, 2012). Chassanite *et al.* (2012) produced a study that compiled the multidisciplinary monitoring programmes carried out in Mediterranean MPAs. More recently, MedPAN has produced a useful online tool (Directory of monitoring protocols) which aims at compiling, streamlining and facilitating access to existing ecological and socioeconomic monitoring protocols that can be used in Mediterranean MPAs. The Directory can be freely accessed through this link: <http://www.medpan.org/en/monitoring-protocols>.



Mediterranean online directory of Monitoring Protocols © MedPAN

<sup>4</sup> - Biodiversity Strategy, Marine Strategy Framework Directive, Water Framework Directive, Habitats and Birds Directives...





# IMPLICATIONS FOR MPA MANAGERS:

what can I do with limited resources, time and capacity to monitor my MPA?

Besides the obvious solution of increasing MPA management budgets, personnel or material means by the state, below are a number of tips to engage in sound, useful and cost-effective MPA monitoring:

## IDENTIFYING AND PUBLICISING RESEARCH NEEDS

In a world with limited funds to devote to MPA monitoring, making the most of available resources seems wise. Thus, identifying key monitoring topics of managerial interest to be addressed through specific studies or programmes is a necessary first step to streamline monitoring efforts. Secondly, those organisations or social groups with capacity to undertake research in these areas should be made aware of them. Some effective ways of doing so could be: disseminating a list of the research priorities of management agencies among research centres or disclosing those needs on their websites for any interested researcher to be able to undertake research/monitoring activities that are most useful to management. MedPAN's website could serve as a useful platform to centralise MPA monitoring needs and resources in the Mediterranean.

## MAKING YOUR OWN MONEY

The times of asking national or regional governments for more money are (nearly) over!! Make the most of innovative financial opportunities to increase monitoring (and other management-related) budgets!! Some money-making options that could be used (law abiding) combined or in isolation are: looking for private sponsors for your MPA, including businesses and visitors; crowdfunding specific monitoring campaigns; charging some activities by visitors (e.g. mooring, recreational fishing, scuba-diving, etc.); and/or receiving payments for ecosystem services.



Innovative financing mechanism between the national railway company and the Cinque Terre national Park in Italy © Cinque Terre National Park

## DESIGNING CREDIBLE AND ETHICAL MONITORING PROGRAMMES

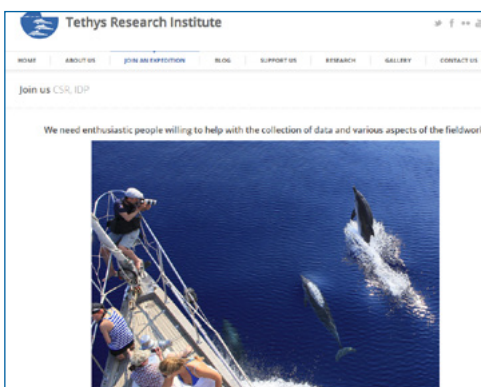
Both [Addison \(2011\)](#) and [Hockings \*et al.\* \(2013\)](#) provide useful advice on credible and ethical MPA research and monitoring designs. Engaging own MPA staff and external research institutions in monitoring activities in your MPA using validated protocols is a good way of ensuring credibility and enhancing ethical standards.

## PARTNERING WITH RESEARCH INSTITUTIONS

Establishing partnerships between MPA management agencies and universities and research centres through adequate and long-lasting protocols can provide professional, enduring and cost-effective information to MPA managers to sustain long-term monitoring programmes. Some of that research may entail some 'voluntary' work by last-year's students finalising their degrees' projects or seeking to gain some professional experience. In exchange, MPA administrations could grant researchers use of their facilities and/or provide them with accommodation for the duration of the study, if need was. A good example of such programme is the Research Partners Program of Parks Victoria, in Australia ([Parks Victoria, 2014](#)).

## MAKING THE MOST OF LOCAL, USER AND VISITOR'S KNOWLEDGE

Local residents, users (e.g. fishers, divers, etc.) and regular visitors to the MPA usually gather (or can easily collect) important data that can be valuable for the monitoring of MPAs if collected carefully and systematically. Research has shown that well-designed citizen science programmes can provide more complete information than



Citizen science programmes at the Tethys Research Institute

the information gathered by professionals in the marine environment for some variables like the number of marine species detected. However, different results between volunteer and professional monitoring protocols have been recorded for some other variables ([Holt \*et al.\*, 2013](#)), suggesting that different protocols should be used depending on the variables of interest. In the difficult budgetary context experienced by most Mediterranean MPAs, citizen science initiatives have recently received greater attention as a cost-effective

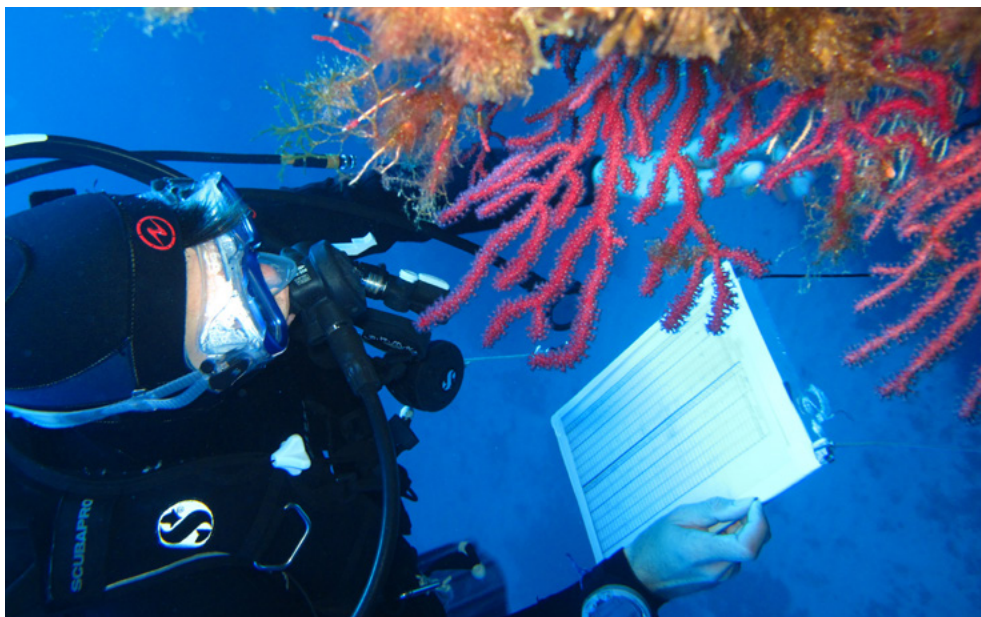
way to collect data on the environment. However, as discussions held during the 2014 MedPAN workshop have shown, citizen science also remains controversial. Whereas volunteer-based monitoring

approaches can be helpful for filling spatial and temporal gaps in traditional monitoring programmes and for raising awareness, they should not generally be regarded as a default option or substitute for monitoring activities implemented by scientific or technical staff.



## CONCLUDING REMARKS

Good monitoring can be expensive. Materials, trained staff, logistics and the characteristics of the MPA may make monitoring seem a luxurious exercise. However, sound monitoring is essential to effective management. Monitoring programmes can be regarded as ‘early warning systems’ to identify trends and alert managers and decision-makers on drifts towards dangerous environmental or socioeconomic thresholds. Without regular monitoring, managers are unlikely to be aware of what is happening in their MPAs and their surroundings and will only be able to take reactive actions, once damage has been produced, often too late to counter it. Thus, investing in monitoring is money well-spent. Prioritising monitoring needs and resorting to additional sources of funding and data, as suggested above, are likely to reduce the ‘burden’ of monitoring to MPA managers. An unavoidable burden, however, for good management.



Red coral monitoring in Scandola Natural Reserve, Corsica, France © Jérôme Payrot



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