AN OCEAN OF PEOPLE

Citizen scientists and Scientist citizens

MARGov – Collaborative Governance of Marine Protected Areas

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CONTENTS

SUSTAINABILITY INDICATORS

In order to measure the level of application of sustainable development it is vital to use tools that can both measure and facilitate progress towards a broad range of environmental, socioeconomic and governance goals. Most of supra-national bodies state that sustainable development indicators (SDIs) are necessary to provide solid bases for decision making at all levels and to contribute to self-regulating sustainability of integrated environmental and development systems [Reed *et al.*, 2006].

Recently there has been a growing effort to implement integrated management plans in MPAs due not only to their natural and cultural importance but also due to the usual conflicts related to local activities. These plans should include the use of adaptive/collaborative sustainability indicators that reflect the stakeholders' concerns, and community interests to improve management and reporting.

The use of sustainability indicators enables MPAs managers to incorporate and monitor the stakeholders' concerns and include them in the process of management [Thompsom *et al.*, 2008; Ojeda-Martínez *et al.*, 2009].

The main aim of this work is to develop a set of adaptive-participative sustainability indicators for the assessment, management and reporting of MPAs that reflect its objectives and include, through the all process, the participation of local stakeholders at every levels, strengthening human and social dimension and helping to minimize and resolve the existing conflicts and difficulties in the management of the MPA.

Methodology

A framework to develop SDIs for MPA was developed with the aim of planning and implementing a tool to support sustainability assessment, management and reporting. This approach was designed to be applied to a particular case – The Luiz Saldanha Marine Park, a Portuguese MPA – supporting the definition of a local set of marine headline indicators through stakeholder active engagement. The framework integrates several main components and information/data flows (Figure 20), supported by a crosscutting support of adaptive and participative process, which involve the major MPA stakeholders from the initial phases along the entire development of the local SDI system.

An indicator selection judgment process was carried out, using relevancy and feasibility criteria, as defined by Ramos et al. [2004]. The selection was supported by an indicator weighted ranking process conducted by a team of experts which identified the most frequent and relevant indicators in the literature review, propose new significant indicators and integrated/weighted the major contributions produced by MPA stakeholders in the workshops and questionnaires (in particular the ones specifically designed to obtain collaborative indicators).

The stakeholders engagement process was conceived to gather the

stakeholders' views on a proposal for MPA SDIs, including the following main components: the stakeholders degree of understanding or perception of each MPA indicator; the stakeholders evaluation of the relevance of each indicator; and a stakeholder self-assessment of the state of each indicator.

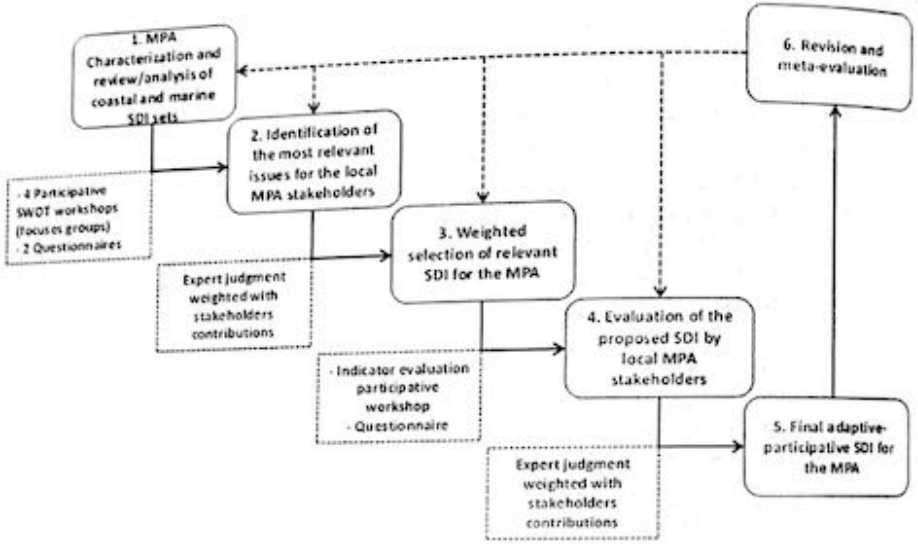

Figure 20. Adaptive-participatory sustainability indicators framework in Marine Protective Areas.

Results and discussion

The international analysis of SDI initiatives for marine and coastal areas allowed to develop and compute a data base with about 1500 indicators (574 environmental (IE), 639 socioeconomic (IS) and 393 governance/institutional (IG) indicators). Taking into account stakeholders SWOT results about the MPA, based upon the four participative workshops and the two short questionnaire survey, and repeated/duplicated indicators with the same meaning but with different names, a reduced number of indicators was produced of 28 IE, 22 IS and 41 IG. The second selection round produce a shorter set of SDI through one more qualitative expert assessment, allowing to reach a new set of 26 sustainability indicators for the MPA (11 IE, 7 IS and 8 IG) listed in the following table.

The results from users evaluation showed that governance/institutional indicators were those that most of stakeholders shown that understand quite well, opposing to IS.

Table 3. Set of the 26 sustainability indicators
Environmental (IE), Socio-Economic (IS) and Governance/Institutional (IG)

Code	Indicator	Description	Unit of measurement
IE1	Water temperature	Measures the temperature of coastal and marine waters	°C
IE2	Water quality (the relevant indicators could be aggregated in indices)	Assessment of individual indicators such as: - pH; - Turbidity; - Dissolved oxygen; - Indicator of faecal contamination; - Nutrients (Nitrogen and phosphorus); - Ratio N/P; - Metals: Zn, Cu, Cd, Pb, Ni, Cb and Cr; - Polycyclic aromatic hydrocarbons; - Surfactants; - Oil; - Polychlorinated biphenyl; - Organotins (TBT); - Conductivity	- m mg/l O_2 MPN/100 ml mg/l NH_4, N e PO_4 - µg/l µg/l µg /l µg /l µg/l µg/l $S.m^{-1}$
IE3	Beaches with blue flag	Quantification of blue flag beaches during the bathing season	Number (total and by n° of bathing beaches)
IE4	Sediment quality (the relevant indicators could be aggregated in indices)	Assessment of individual indicators such as: - Indicators of fecal contamination; - Organic matter; - Redox potential; - Metals: Zn, Cu, Cd, Pb, Ni, Cb and Cr; - Polycyclic aromatic hydrocarbons; - Polychlorinated biphenyls; - Organotins (TBT).	 MPN/100 mg % mV µg/g µg/g µg/g µg/g
IE5	Fish landing	Total quantity of annual captures of the main fish species existing in MPA waters.	Tons/year
IE6	Seafood quality	Samples of marine species with commercial value that have concentrations of contaminants above recommended maximum levels (Belfiore *et al*, 2003).	Type and number of occurrences and severity/year
IE7	Evolution of the shoreline	Changes of the shoreline due to coastal erosion, caused by natural causes and/or accelerated by human action.	m^2/year; m/year
IE8	Land use	Type of land use or occupation in the coastal area according to Corine Land Cover classes.	%; ha
IE9	Key habitats	This indicator could be measure through: - Area, diversity and number of species with status under the Habitats Directive (Belfiore et al., 2003); - Number of species by habitat.	ha; % of habitats n° of species /habitat
IE10	Key species	This indicator could be measure through: - Identification of commercially valuable species with special protection; - Number of coastal species included in the Red List.	Number of species Number of species
IE11	Marine and coastal litter	Number of items collected per unit length (1 km) of coastline.	Number/km
IS12	Evolution of resident the population	Evolution of the population living in areas surrounding the MPA (Parish with coastal area).	Number of inhabitants; growth rate (%); age structure (%); population density (inhabitants/km^2)

Code	Indicator	Description	Unit of measurement
IS13	Tounsm intensity	Relationship between the number of tourists and resident population in a given territory (DGA, 2000). It could also be measured by the number of beds per area of territory.	% Number of beds/ha
IS14	Pressures from coastal and marine recreation	Intensity of recreational activities evaluated by recreation type (e.g fish boats, scuba divers, windsurfers) along the MPA coast during a given period of time.	Number of user per area and per recreation type/ year
IS15	Employment	Active population employed (total and by economic sector).	Number; %
IS16	Nautical traffic	Assess the number and type of boats and vessels within the MPA, during a given period of time.	Number by type of boast and vessels
IS17	Total costs and income for public organizations	Total costs and income related with public management of MPA.	10³€
IS18	Total costs and income for private organizations	Total costs and income related with private uses management of MPA.	10³€
IG19	Community engagement	This indicator could be evaluated through: - MPA communities involved in local nongovernmental organizations or informal voluntary groups. - Stakeholder's participation in volunteer activities to protect/ restore and recover MPA resources.	Number of people/ companies; quality evaluation
IG20	Management actions	Degree of implementation and monitoring of the management plan measures and recommendations.	High/medium or low; quality evaluation
IG21	Surveillance activities	Number of hours of surveillance and covered area.	Number of hours/day in the protected area
IG22	Information and training related to the MPA	Quantity and quality of the trainings and information initiatives (e.g. (i) public meetings, training courses, public observatories and visitors centres; (ii) pocket books, flyers, radio programs, podcasts, internet sites, among others).	Number; qualitative evaluation
IG23	Interaction between mana-gers and users of the MPA	Level of participation in actions of cooperation and collaboration between managers and users of the MPA, by type of initiatives.	Number per type
IG24	Conflicts in the use of the MPA	Complaints addressed to the management agency.	Number
IG25	Corporate sustainable tools and practices in the MPA	Companies and public organizations operating within MPA that adopted sustainability practices and tools (e.g. HACCP; ISO 22000; OHSAS; ISO14000; ISO26000, EMAS e Eco-Hotel) by type of economic activity in place.	Number; %
IG26	Cultural activities and resources related to the MPA	Cultural resources (e.g. museums) and events (e.g. expositions, traditional fairs), as well as other related initiatives within the MPA.	Number

Most indicators were considered relevant according to the stakeholders, in particular the environmental indicators related with water quality, habitats and pressures from water recreation activities. Overall, the governance indicators were those that mostly were considered not relevant.

Although the respondents know and quite understand these indicators, maybe they think they do not need to be addressed for the assessment, management and reporting of the MPA, compared with more traditional ones within environmental, social and economic dimensions.

According to stakeholders self--assessment, the overall state of the environmental indicators is medium and they do not know the state of IS related to MPA costs. In fact socio-economic data and information that is relevant for MPA management is usually either lacking or very limited. Stakeholders believe that the current state of the governance/institutional indicators is negative, probably meaning that they consider that there is no interaction between each other, or that there is lack of information about these indicators. Nevertheless, the meaning, relevance and evaluation of the governance/institutional indicator are still complex issues for stakeholders.

Taking into account that the 26 proposed indicators were somehow understandable and relevant for the engaged stakeholder, with the exception of specific economic and governance indicators, it was concluded that the final set should preliminary include those indicators due to their high importance for MPA, as already referred. Nevertheless special attention should be put on the follow up of those indicators.

Conclusions

An adaptive-participative SDI framework was developed for the assessment of management and development of MPA sustainability reports, and an indicator set was developed and proposed using this case study.

The proposed SDI set (26 indicators) was mainly understandable and relevant according to stakeholders responses. However i) the socio-economical and governance indicators are not only of more difficult understanding to the public in general but are also related to the existent conflicts between the MPA users and the MPA management agency, ii) a high percentage of "do not know" or "do not answer" options along the questionnaires stresses that sustainability awareness, training and education actions should be a priority measure to put into practice, to improve and achieve MPA transparency, commitment, accountability and engagement among stakeholders.

Participatory approaches to develop and implement SDI are not enough, unless they have effective impact on the policies and management plans of the MPA. The involved stakeholders should see how their contributions have affected the strategic or operational actions. Finally, it is important to refer that volunteer monitoring could become an integrated part of the effort to assess the sustainability of a MPA, being able to provide accurate and reliable data.