The socio-economic indicators

Introduction

Experience shows that social, cultural, economic and political factors, more than biological or physical factors, shape the development, management and performance of MPAs (Fiske, 1992; Kelleher and Recchia, 1998; Mascia, 2002; Roberts, 2000). MPAs affect and are affected by people. For this reason, the goals and objectives of many MPAs include socio-economic considerations such as food security, livelihood opportunities, monetary and non-monetary benefits, equitable distribution of benefits, compatibility with local culture, and environmental awareness and knowledge. Understanding the socio-economic context of stakeholders involved with and/or influenced by the MPA (individuals, households, groups, communities, organizations) is essential for assessing, predicting and managing MPAs. The use of socio-economic indicators allows MPA managers to: a) incorporate and monitor stakeholder group concerns and interests into the management process; b) determine the impacts of management decisions on the stakeholders; and c) demonstrate the value of the MPA to the public and decision-makers.

The socio-economic indicators in this guidebook address the overall value of the MPA, in addition to being focused on the achievement of social and economic goals and objectives. Several of the indicators, such as S4, S5 and S6, measure people's perceptions. People's perceptions are known to have an impact on conservation, so while the measurement of perceptions may be imprecise, their use can be of real value to the MPA manager. Several of the indicators, such as S2, S3, S13, rely on interviewing household members and fishers. Interviews provide access to a wealth of valuable information relating to such issues as natural history, resource use and income. With this opportunity in mind, and recognising how busy household members and fishers are, if interviews are to be conducted, questions from several selected indicators should be collected at the same time to capture overlapping information needs more efficiently. Indicators S2, S3, S13 and S14 are concerned with aspects of understanding people's values and understanding marine resources at the broader community level.

It should be noted that there is no one indicator which captures the total economic value of the MPA. Consideration was given to such an indicator but it was felt that the methods for collecting such information were beyond the capability of most MPAs. However, several of the indicators can be used to measure components of total economic value such as use and non-use values of the MPA. These include indicators S6 (perceptions of non-market and non-use value), S7 (material style of life), S8 (quality of human health), S9 (household income distribution by source), S10 (occupational structure), S11 (community infrastructure and business), and S12 (number and nature of markets). While not direct measures of total economic value, used together, these indicators can provide information on benefits and costs associated with the MPA and can adaptively inform MPA managers in their planning and management decision-making.

Collectively, coastal and marine ecosystems provide food, building materials, firewood, recreational opportunities, protection and buffering from coastal hazards, economic development opportunities, and important life support functions. Valuation of MPAs and their associated natural resources necessitates the estimation of benefits and costs of using the natural assets. The total economic value of a natural system is the sum of all net benefits from all compatible uses, including non-use values. Conceptually, it is the amount of resources, expressed in common units of money, by which society would be worse off if the natural resource or environmental amenity were lost. It consists of 1) use value and 2) non-use value. Use values include direct use (fishing, diving), indirect use (coastal hazard protection), and option value (potential future direct and indirect use of a natural system). Non-use values represent values that are not associated with any use and include existence value (the value of knowing that the resource exists in a certain condition), option value (the value of being able to use the resource in the future) and bequest value (the value of ensuring the resource will be available for future generations).

It should be noted that indicator S6 – perceptions of non-market and non-use value – suggests the use of scale analysis rather than more advanced non-market and non-use economic valuation methods. This is due to the complexity of using these methods and the need for advanced economic analysis skills which are usually not found among MPA staff.

Useful references

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Mascia, M. (2002). *The social dimensions of marine reserve design and performance*. Draft manuscript submitted for inclusion in the book J. Sobel (ed.) Marine Reserves: their science, design and use. Center for Marine Conservation. Washington DC, USA.

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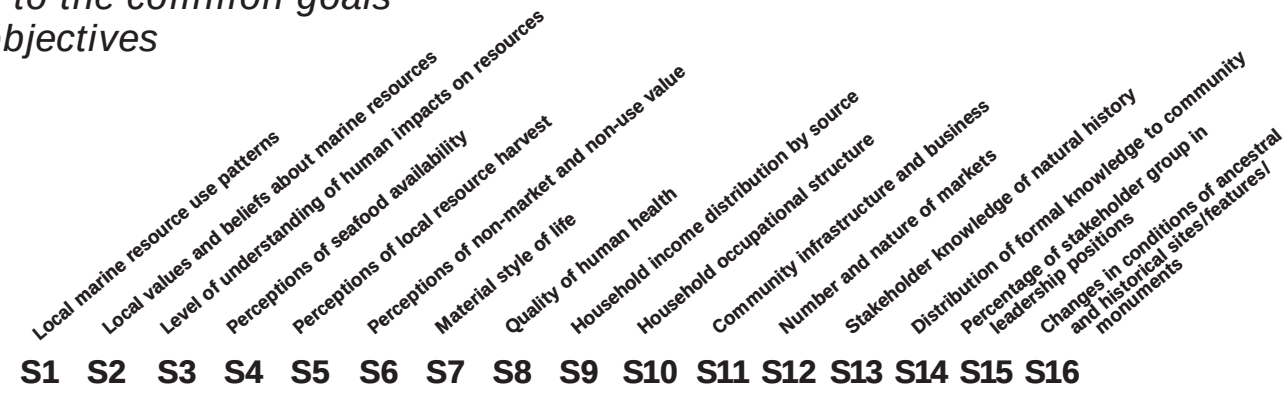
Figure 3 Socio-economic goals, objectives, indicators

Socio-economic goals (n=6) and objectives (n=21) commonly associated with MPA use

GOAL 1	**Food security enhanced or maintained**
1A	*Nutritional needs of coastal residents met or improved*
1B	*Improved availability of locally caught seafood for public consumption*
GOAL 2	**Livelihoods enhanced or maintained**
2A	*Economic status and relative wealth of coastal residents and/or resource users improved*
2B	*Household occupational and income structure stabilized or diversified through reduced marine resource dependency*
2C	*Local access to markets and capital improved*
2D	*Health of coastal residents and/or resource users improved*
GOAL 3	**Non-monetary benefits to society enhanced or maintained**
3A	*Aesthetic value enhanced or maintained*
3B	*Existence value enhanced or maintained*
3C	*Wilderness value enhanced or maintained*
3D	*Recreation opportunities enhanced or maintained*
3E	*Cultural value enhanced or maintained*
3F	*Ecological services values enhanced or maintained*
GOAL 4	**Benefits from the MPA equitably distributed**
4A	*Monetary benefits distributed equitably to and through coastal communities*
4B	*Non-monetary benefits distributed equitably to and through coastal communities*
4C	*Equity within social structures and between social groups improved and fair*
GOAL 5	**Compatibility between management and local culture maximized**
5A	*Adverse effects on traditional practices and relationships or social systems avoided or minimized*
5B	*Cultural features or historical sites and monuments linked to coastal resources protected*
GOAL 6	**Environmental awareness and knowledge enhanced**
6A	*Respect for and/or understanding of local knowledge enhanced*
6B	*Public's understanding of environmental and social 'sustainability' improved*
6C	*Level of scientific knowledge held by the public increased*
6D	*Scientific understanding expanded through research and monitoring*

How the socio-economic indicators relate to the common goals and objectives



TOM WALMSLEY/NATUREPL.COM

Wildlife enthusiasts watch a Blue whale (*Balaenoptera musculus*) blowing in the Atlantic Ocean. Ecotourism is a source of income for many MPAs and an activity that can be monitored and measured as part of the evaluation of management effectiveness.

What are 'local marine resource use patterns'?

Local marine resource use patterns are the ways people use or affect coastal and marine resources.

Why measure it?

By understanding local marine resource use patterns it is possible to determine whether or not management strategies are impacting income and livelihood patterns and cultural traditions. MPA managers can also use this information on local marine resource use patterns to determine what coastal and marine related activities have been affected by the MPA and consequently who may benefit and who may lose from the MPA. This information can be used to try to minimize impacts on the MPA. This information also provides an understanding of potential threats to the MPA.

The degree of compliance and MPA success is influenced by the patterns of local use present within the area. Consequently, understanding local use patterns will help the MPA manager increase support for the MPA and minimize the impacts on resource users by ensuring the formal MPA design is consistent with existing informal patterns of marine resource use.

How to collect the data

The 'area' for identifying marine resource use patterns is defined as the MPA and the immediately adjacent coastal and marine zone.

The data on local marine resource use patterns should be collected first through secondary data from government sources, including village and town offices; and national agency reports, maps, statistical reports, and official regulations. Then through primary data collection from focus groups, semi-structured interviews, structured surveys and observations. Visualization techniques are also useful and include:

Requirements

- Interviewers.
- Notebook and pen.
- Handheld GPS device.
- Basemap of area.

- ❏ Local classifications – to clarify the marine resource uses and associated species;
- ❏ Maps – to show the location of activities, residence of stakeholders, and use rights;
- ❏ Timelines – to show when activities occur and the seasonality of events; and
- ❏ Drawings – to show different marine resource-related activities.

The data collection begins with the gathering of information on marine-related activities, which include activities that directly or indirectly affect marine resources (both land- and sea-based activities). This information will help in understanding the other sub-parameters. Key questions that should be addressed include:

- ❏ What marine related activities are taking place at sea?
- ❏ What reef related activities are taking place on land?
- ❏ What impacts are these activities having on marine resources?

Next, the stakeholders, including the type and number of primary and secondary stakeholders, and their basic characteristics need to be understood. Important questions include:

- ❏ Who is involved in these activities?
- ❏ How many people are involved in each activity?
- ❏ What are their basic characteristics (e.g. gender, residency status, age)?

▼ *A Grey whale 'spy hops' in Baja California, Mexico – and excites participants on a whale-watching trip.*

TOM WALMSLEY/NATUREPL.COM

Relates to goals and objectives

GOAL 2
2A 2B

GOAL 5
5A

S1

Difficulty Rating 3 1–5

The manner in which marine-related activities are carried out needs to be understood including technology used, techniques for applying the technology, and ways people organize themselves in these activities. Key questions include:

- ❏ How are the uses conducted?
- ❏ What technology is used and how much is used?
- ❏ How is the equipment constructed and who owns it?
- ❏ How do these methods affect the marine resources?
- ❏ How are people organized to use marine resources?

The boundaries of the community area need to be understood. This involves asking where are the political, biological/ecosystem, physical/ oceanographic, fishing areas, social/cultural, and traditional/customary boundaries.

The location of marine related activities and stakeholders is also important to understand. Key questions include:

- ❏ Where do these marine related activities occur?
- ❏ Where do stakeholders live and work?
- ❏ Where are the marine resources located for comparison?

Finally, it is important to understand the timing and seasonality of activities, including the daily, weekly and monthly patterns of resource use, seasonal changes and long-term trends in resource use. Key questions include:

- ❏ When do the uses take place and what changes occur at particular times?
- ❏ Why do these changes in use occur?

How to analyse and interpret results

Present the results in a narrative form with accompanying tables, figures, and diagrams to clarify and highlight points. The focus of the data analysis and presentation should be on the major marine-related activities identified through the data collection. Summarize the relevant information on the other sub-parameters for each activity. Diagrams can be drawn from the visualization techniques. The descriptions may also include quantitative data.

▼ ***Fishers use marine resources for a number of livelihoods and cultural activities.***

PETE OXFORD/NATUREPL.COM

© WWF/HOL CHAN MARINE RESERVE

Strengths and limitations

The major limitation of this indicator is that it involves a great deal of preparation and use of several data collection methods. Furthermore, it is time consuming and costly. However, if done well, the indicator can provide very useful and important information for management.

Useful references and Internet links

Bunce, L., Townsley, P., Pomeroy, R. and Pollnac, R. (2000). *Socioeconomic Manual for Coral Reef Management*. Australian Institute of Marine Science, Townsville, Queensland, Australia. Available at www.reefbase.org

Outputs

- A narrative report describing the major marine related activities, with tables, figures, and diagrams to clarify and highlight points.
- Summaries of other sub-parameters with tables, figures, and diagrams to clarify and highlight points.

Box S1

EXAMPLE FROM THE FIELD

The Channel Islands National Marine Sanctuary in California is currently engaged in a five-year management plan review process. As part of this process, the Sanctuary will be proposing broad-based changes to its management plan. As required by the National Environmental Protection Act, CINMS has developed a Draft Environmental Impact Statement (DEIS) including a chapter on the *Description of Affected Area*. The *Description of Affected Area* identifies physical, biological, geological and cultural resources throughout the study area. The study area is from Pt. Sal in the north to Pt. Dume in the south, an area of over 6,000 nautical miles, nearly six times the size of the current Sanctuary boundaries. In addition to the description of the ecosystem, all human use activities, including upland activities in the watershed, are described. These human use activities were prioritized as part of the management plan review process and identified as key resource management issues to be addressed over the next five years. The human uses profiled in the DEIS include: oil and gas development; commercial and recreational fishing; harbour activities; military use; vessel traffic; recreational use; urban and rural land use; tourism activities; and point and non-point source discharge.

Relates to goals and objectives

GOAL 5

5A 5B

GOAL 6

6A 6B 6C 6D

Difficulty Rating 3 1–5

What are 'local values and beliefs'?

Local values and beliefs about marine resources are measures of how people make choices and undertake actions related to marine resource use and management based on their values about what is good, just and desirable and their beliefs of how the world works. A value is a social more or norm manifested as a result of history and culture. It is a shared understanding among people of what is good, desirable or just. A belief is a shared understanding by members of a group or society of how the world works.

Why measure it?

In an MPA context, managers are interested in how values and beliefs related to marine resources, their use, and management practices influence behaviour within the stakeholder group or society. Local values and beliefs therefore influence people's behaviour and assist in forming customary practices. Depending on the structure and orientation of values and beliefs they may undermine or enhance management efforts and the success of the MPA. Consequently, understanding this indicator can help a manager to more effectively integrate people's local values and beliefs into the MPA management structure and thereby minimize adverse effects of management.

How to collect the data

Through a survey of households, respondents should be asked a series of questions about their perceptions related to their values and beliefs on marine resources, their use, and management.

To understand values and perceptions about use and management respondents might be asked questions such as:

- ❏ Why is/are the sea/mangroves/coral reefs important to you?
- ❏ Why is/are fishing/diving/other activities important to you?
- ❏ Does (destructive activity – e.g. bomb fishing) hurt the resource?
- ❏ Why do people conduct this (destructive activity)?
- ❏ What do you think of current MPA management strategies?
- ❏ Do the current MPA management strategies complement local cultural beliefs and traditions?

Any stories or anecdotes that illustrate their thoughts should be recorded.

As an example, Pollnac and Crawford (2000) questioned households in North Sulawesi, Indonesia about their perceptions of bomb fishing and why they use this technique. Respondents were asked:

- ❏ Does bomb fishing hurt the resource?
  Yes___ No___
- ❏ Why do fishers bomb fish?

To further assess values and beliefs about the resources, the respondents can be asked to indicate the extent to which they agree with the following statements:

▼ *Fishers and coastal communities have a variety of differing values and beliefs about their marine resources.*

Requirements

- Survey forms.
- List of households to survey.
- Interviewers.
- Notebook and pen.

- ❑ We have to take care of the land and the sea or they will not provide for us in the future.
- ❑ We do not have to worry about the sea and the fish; God will take care of it for us.
- ❑ We should manage the sea to ensure that there are fish for our children and their children.

Respondents should be asked if they very strongly agree, strongly agree, agree, neither agree nor disagree (neutral), disagree, strongly disagree, or very strongly disagree. This will result in a scale with a range of one to seven.

How to analyse and interpret results

Calculate the percentage distribution of responses. For the example on bomb fishing above, prepare a table showing percentage distribution of responses (see Tables S1 and S2). Prepare a narrative explanation of the results. For example:

Table S1

Percentage distribution of responses on whether bomb fishing hurts the resource

	Yes	*No*
Bentenan	88	12
Tumbak	96	4
Rumbia	94	6
Minanga	94	6

Table S2

Percentage distribution of the perception that bomb fishers fish that way because it is a quick/easy way to obtain fish/money

N=224	*Yes*	*No*	*Total*
Bentenan	61	39	100
Tumbak	64	36	100
Rumbia	56	44	100
Minanga	62	38	100
Total	61	39	100

A large majority of respondents agree with the statement that bomb fishing hurts the resource. The largest percentage of respondents who said it did not hurt the resource was from Bentenan. As to why fishers use the technique, the most frequent response is that it is a quick and/or easy way to obtain lots of fish and/or money (39% of respondents gave this response).

The local values and beliefs of the stakeholders with regard to marine resources and their management are illustrated by a high degree of compatibility between local values and beliefs and the goal and objectives of the MPA. A high level of compatibility is indicated by local values and beliefs being reflected in the MPA goal and objectives, developed in a participatory manner and with local support for the MPA.

Outputs

- Tables of percentage distribution of perception of values and beliefs.
- Narrative explanation of statistical results.

Strengths and limitations

As with any indicator, it is useful to observe and analyse changes in local values and beliefs about marine resources over time to determine, for example, if participation in and activities of the MPA are having an impact on peoples values about conservation.

Useful references and Internet links

Bunce, L., Townsley, P., Pomeroy, R. and Pollnac, R. (2000). *Socioeconomic Manual for Coral Reef Management*. Australian Institute of Marine Science, Townsville, Queensland, Australia. Available at www.reefbase.org.

Kempton, W., Boster, J.S. and Hartley, J.A. (1995). *Environmental Values in American Culture*. MIT Press, Boston, USA.

Pollnac, R.B. and Crawford, B.R. (2000). "Assessing behavioral aspects of coastal resource use". *Proyek Pesisir Publication Special Report. Coastal Resources Center, Coastal Management Report #2226*. Coastal Resources Center, University of Rhode Island, Narragansett, Rhode Island, USA.

▲ ***Mafia Island, Tanzania, with young mangrove trees in the foreground, viewed from Chole Island.***

Box S2

Example from the Field

At Mafia Island Marine Park in Tanzania, an important issue in the Islamic country is the extent to which people regard the availability of natural resources as a consequence of human activities of one kind or another, as opposed to the traditional attitude that everything in nature stems from the will of God/Allah. Respondents in the survey were asked to characterize a number of factors in respect of their impact on the availability of fish in the sea, including dynamite fishing, fisher density and the will of God.

The results show that only 25% of all respondents regard the effect of the will of God as either great or very great. This is the case across all strata, more or less evenly, though interestingly the group attributing the highest effect to God's will was fishers (33%). The percentage of respondents rating the other factors as being of great or very great importance to fish availability is as follows:

- Dynamite fishing – 90%
- Small mesh seine nets – 63%
- Number of fishers – 31%

The relevance to management is encouraging in that there do not appear to be deeply entrenched religious beliefs that preclude people from accepting the connection between human actions and fish availability.

Level of understanding of human impacts on resources

What is 'level of understanding of human impacts on resources'?

Level of understanding of human impacts on resources is a measure of the degree to which local stakeholders understand basic ecological relationships and the impacts that human activities have on the natural environment.

Why measure it?

An understanding of individual perceptions of factors influencing the status of marine resources can be used to identify the distribution of faulty, as well as accurate, perceptions. The knowledge about these distributions can then be used to structure interventions designed, for example, to involve the community in the management of its resources, and to evaluate the resulting changes. This could lead to improved human use patterns and help to target environmental education programmes at user groups and stakeholders.

Requirements

- Survey forms.
- Interviewers.
- List of households to survey.
- Notebook and pen.

How to collect the data

Measuring this indicator involves conducting an assessment of stakeholder perceptions about the extent to which they believe their own activities affect the natural environment. Questions should be asked using a semi-structured interview or focus group, which addresses threats to the natural environment and changes in the natural environment due to the threats. The questions might include:

- ❏ What events, activities or changes do you feel have affected or are affecting the natural environment?
- ❏ What changes in the natural environment do you attribute to these threats?
- ❏ How do you compare the threats in terms of levels of impact?

Visualization techniques are particularly important when assessing stakeholder perceptions because they provide visual and oral ways of communicating ideas. Several visualization techniques can be used, including maps and transects, decision trees, Venn diagrams, and flow charts.

How to analyse and interpret results

Prepare narrative text descriptions of the answers to the questions based on the relevant data and responses. These data will often be qualitative and include anecdotes, stories, historical accounts and legends, informant observations of apparent causes and effects, and opinions on how the natural environment should and should not be used. Illustrate important points in the text with diagrams using visualization techniques to ensure that stakeholder perceptions are being accurately presented.

Relates to goals and objectives

GOAL 6

6B

Difficulty Rating 3 1–5

▼ *Fishing boats, Indonesia. Unchecked human use of coastal resources, such as the public's over fishing of an open access fishery, can lead to long-term, negative impacts on the marine environment and its ecology.*

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Outputs

- Narrative text.
- Maps and transects.
- Decision trees and flow charts.
- Venn diagrams.

Measure and describe the level of understanding of the extent to which stakeholders believe their own actions affect the natural environment and their level of environmental awareness.

Strengths and limitations

Stakeholder perceptions are difficult parameters to assess because people's perceptions, opinions and attitudes are highly variable and often there are few secondary data on stakeholder perceptions.

Useful references and Internet links

Bunce, L., Townsley, P., Pomeroy, R. and Pollnac, R. (2000). *Socioeconomic Manual for Coral Reef Management*. Australian Institute of Marine Science, Townsville, Queensland, Australia. Available at www.reefbase.org

Box S3

Example from the Field

At the Sian Ka'an Biosphere Reserve in Mexico, a survey, semi-structured interviews, focus groups, informal communications and observations provided information on the stakeholders' level of understanding of human impacts on the resource. Members of the Punta Allen community identified the main threats and problems listed below.

It was expected that most resource users would think that negative environmental conditions, such as hurricanes and storms, had the most serious impacts on marine resources. But when it came to human impacts, results from the questionnaire showed that tourism development is the human impact that most concerns the population. In order to simplify the analysis, tourism development here considers different kinds of responses, including permit supply, infrastructure, foreign investments, and introduction of bigger boats. When the focus groups were asked why they considered tourism development a threat to their community, they said that they are afraid of being displaced by big international companies. With regard to marine resources, they mentioned that more development for tourism activities will bring more tourists to the community and with that, big hotels. All this, they said, will damage their mangroves and beaches; there will be more boats in the water and more oil will be spilled; and also more waste will be generated.

	COMMUNITY		MARINE RESOURCES	
N=153 (3 answers by respondent)	Responses	Percentage	Responses	Percentage
Threats	Hurricanes and storms	17%	Hurricanes and storms	13%
	Tourism development	24%	Tourism development	17%
	Blank spaces	23%	Blank spaces	30%
	Uncontrolled fishing	6%	Uncontrolled fishing	23%
	Waste and pollution	9%	Waste and pollution	15%
	Population growth	9%	Lack of surveillance	2%
	Others	12%		
Problems	Roads	22%	Uncontrolled tourism	24%
	Power and water supply	14%	Uncontrolled fishing	6%
	Waste and pollution	25%	Waste and pollution	17%
	Blank spaces	24%	Blank spaces	47%
	Lack of participation	5%	Lack of participation	3%
	Feral fauna	6%	Lack of surveillance	3%
	Others	4%		

What is 'perceptions of seafood availability'?

Perceptions of seafood availability is a measure of what the primary food purchaser/preparer in the household thinks about the local availability of seafood for the household.

Why measure it?

This indicator is important for understanding the contribution of the MPA to food security in the local community. Household food security can be defined as "that state of affairs where all people at all times have physical and economic access to adequate, safe and nutritious food for all household members, without undue risk of losing such access" (FAO).

This indicator is especially important if one of the stated objectives of the MPA is to improve local nutrition or the availability of local seafood. For example, households may respond that the availability of seafood was reduced right after the establishment of the MPA, but two years later they may respond that seafood availability has increased. If household perceptions of availability of local seafood does not improve or if it drops in the MPA community, and if similar trends do not appear in the control communities, one could suspect that the MPA is negatively impacting seafood availability. If this is so, and if this is not a desired impact, the MPA management plan and management measures must be adjusted.

This indicator is also useful for responding to complaints from the local community about the MPA. If households perceive an increase in the availability of local seafood over time, then this information can be used in support of the MPA.

Several questions must be asked of households in the MPA community to measure perceptions of seafood availability. In particular, the household primary food purchaser/preparer should be interviewed. Questions can be asked in a separate survey or as part of a larger survey that includes questions from other indicators. The questions might include:

❑ How many days during the past month did your family have an insufficient amount of food?

Never____, Once a week____, Twice a week_____, More than twice a week_____
Specify number of days: _____

(This question should be asked for the same period (season, month) every year since there are seasonal differences in food and seafood availability.)

❑ How many days during the past month did your family have an insufficient amount of local fresh seafood due to lack of availability?

Never____, Once a week____, Twice a week_____, More than twice a week_____
Specify number of days: _____

(Again this question should be asked for the same period (season, month) every year.)

Requirements

- Survey of food purchaser/preparer in the households in the MPA community.
- Interviewers.
- List of households to be surveyed.
- Paper/pencil.
- Optional: ladder-scale diagram.

Relates to goals and objectives

GOAL 1
1A 1B

GOAL 2
2D

GOAL 4
4B

Difficulty Rating 3 1–5

S4

▼ ***The public may assume that a sufficient supply of seafood caught outside the MPA remains to meet their needs, but in reality the supply may have decreased, driving prices up and reducing food security.***

TONI PARRAS

- ❑ How many days during the past year did your household have an insufficient amount of local fresh seafood due to lack of availability? Never____, Specify number of days_____, Specify month(s) or season_____
- ❑ Have you observed changes in the availability of local seafood since the MPA was established? Increase___ Same____ Decrease_____ Why?
- ❑ Do you feel that the MPA is having an impact on the availability of local fresh seafood? Yes/No. Why?

An alternative to these questions is to use a self-anchoring scale. This approach utilizes a ten-point ladder-scale where the bottom step indicates no seafood at all and the top step indicates the availability of more than enough seafood for the family throughout the year. The respondent is asked to identify on the ladder-scale the situation at the present time and the situation at some time period in the past (such as before the MPA). The number of and direction of changes in the steps is a measure of the perceived change.

TONY ECKERSLEY

Outputs

- Tables of the availability of food and seafood in the local community.
- Strengths and limitations.

How to analyse and interpret results

Present the data in a table showing percentage distribution of the responses to each question.

Analysis of the data from the self-anchoring method involves calculating mean values for the differences between each indicator for today (T2) and the pre-project period (T1). Conduct a paired comparison t-test to determine whether the mean differences between the two time periods are statistically significant.

Strengths and limitations

The strength of this indicator is having data to compare over time so that trends in responses can be measured.

The usefulness of this indicator will depend upon the availability and cooperation of the household food purchaser to respond to the questions. Also, it is assumed that when using this indicator to evaluate food security, specifically improvements in local nutrition, that availability and consumption of local fresh seafood contribute positively to nutrition.

Useful references and Internet links

Bunce, L., Townsley, P., Pomeroy, R. and Pollnac, R. (2000). *Socioeconomic Manual for Coral Reef Management*. Australian Institute of Marine Science, Townsville, Queensland, Australia. Available at www.reefbase.org

Berkes, F., Mahon, R., McConney, P., Pollnac, R. and Pomeroy, R. (2001). *Managing small-scale fisheries: alternative directions and methods.* International Development Research Centre, Ottawa, Canada. Available at www.idrc.ca/booktique

Pollnac, R.B. and Crawford, B.R. (2000). "Assessing behavioral aspects of coastal resource use". *Proyek Pesisir Publication Special Report. Coastal Resources Center, Coastal Management Report #2226.* Coastal Resources Center, University of Rhode Island, Narragansett, Rhode Island. Available at www.crc.uri.edu

What is 'perceptions of local resource harvest'?

Perceptions of local resource harvest is a measure of what local fishers think about the availability of target fish species and changes in the availability of fish.

Why measure it?

This indicator provides information on fishers' perceptions of changes in the availability of target species, which is useful for determining if the MPA management is achieving its objective of increasing harvests of seafood and consequently the availability of locally caught seafood. If the perceptions are a positive increase, then the fishers may be more receptive to MPA management. If the perceptions are negative, then the fishers may be less receptive to MPA management, and changes in MPA management may be necessary. The indicator is also a useful measure of fish abundance, availability and size, and species composition.

How to collect the data

Information on this indicator is collected by conducting a survey of fishers. They may be asked:

> Compared to ten years ago, what is the quantity of available (target species)?
>
> A lot less____ less_____ same_____ more_____ a lot more_____

The responses produce a five-point scale ranging from a lot less to a lot more with same in the middle.

As an alternative, a self-anchoring scale can be used. This approach utilizes a ten-point, ladder-scale where 1 is the worst situation and 10 is the best situation. The respondent is asked to identify on the ladder-scale the situation at the present time and the situation at some time period in the past (such as before the MPA or a period of years ago). The number of and direction of changes in the steps is a measure of the perceived change. For this approach the fisher is provided the following scenario and question:

Given a scale where 1 indicates a situation where none of the target species are available and a 10 indicates a situation where there are so many fish that the fisher can catch as many as he/she wants in a very short period of time, how would you rank conditions:

Today_____ Before the MPA_____

Requirements

- Survey form.
- List of fishers to be surveyed.
- Interviewers.
- Paper/pencil.
- Ladder-scale diagram.

How to analyse and interpret results

Present the data from the first question dealing with comparison in a table showing percentage distribution of the responses to each category (i.e. a lot less, less).

To analyse the data from the self-anchoring method, calculate mean values for the differences between each indicator for Today (T2) and the pre-project period (T1). Conduct a paired comparison t-test to determine whether the mean differences between the two time periods are statistically significant.

Indicator	*T1*	*T2*	*T2-T1*	*P*
Availability of target species	4	6	2	<0.01

Strengths and limitations

A limitation of this indicator is that fishers who have fished on target species in an impacted (target) area over the time period being evaluated must be present and willing to respond to the questions. Also, every individual's baseline for assessing

Outputs

- Table of graded ordinal judgement of local fisher perception of fish harvest.
- Strengths and limitations.

Relates to goals and objectives

GOAL 1

1B

Difficulty Rating 3 1–5

S5

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▲ ***The people who know the most about the marine environment in and around the MPA are often those whose livelihoods and dietary needs are dependent upon the resources found nearby. However, their observations and assumptions regarding the state and trends in the resources do not always mirror reality.***

status and changes in fish catch is personal and not really intergenerational. As a result, historical over-fishing is often not evaluated in this assessment of people's perceptions of the status of the fishery.

Box S4

Example from the Field

At the Sian Ka'an Biosphere Reserve in Mexico, a survey was conducted of 53 inhabitants in Punta Allen, representing 24% of the total productive population, about perceptions of local resource harvest. The questionnaire responses revealed the following information about the perception of Punta Allen community members on lobster catches:

N=51	%
Much higher	0%
Higher	4%
Same	18%
Less	69%
Much less	10%

Results were discussed and confirmed during interviews with key informants. They said that lobster catches decreased considerably after Hurricane Gilbert in 1988. They explained that other hurricanes, such as Roxanne in 1995, also caused serious damage to the reef and other marine environments, resulting in important decreases in catches.

The strength of this indicator is having data to compare over time so that trends in responses can be measured.

Since this indicator uses a survey to obtain information from fishers, it can provide a wealth of other types of information, such as natural history of living marine resources.

Useful references and Internet links

Bunce, L., Townsley, P., Pomeroy, R. and Pollnac, R. (2000). *Socioeconomic Manual for Coral Reef Management*. Australian Institute of Marine Science, Townsville, Queensland, Australia. Available at www.reefbase.org

Berkes, F., Mahon, R., McConney, P., Pollnac, R. and Pomeroy, R. (2001). *Managing small-scale fisheries: alternative directions and methods*. International Development Research Centre, Ottawa, Canada. Available at www.idrc.ca/booktique

Pollnac, R.B. and Crawford, B.R. (2000). "Assessing behavioral aspects of coastal resource use". *Proyek Pesisir Publication Special Report. Coastal Resources Center, Coastal Management Report #2226*. Coastal Resources Center, University of Rhode Island, Narragansett, Rhode Island, USA. Available at www.crc.uri.edu

NOAA Photo Library

What is 'perceptions of non-market and non-use value'?

Perceptions of non-market and non-use value of the MPA is a measure of how individuals think about the value of coastal resources that are not traded in the market (non-market) and the value of the resources to those who do not use the resources (non-use). It provides information on community members' perceptions of the value of the MPA and coastal resources.

Why measure it?

Non-market values are the economic value of activities that are not traded in any market, which includes direct uses, such as divers who have travelled to the MPA by private means; and indirect uses, such as biological support in the form of nutrients, fish habitat and coastline protection from storm surge. Non-use values represent values that are not associated with any use and include existence value (the value of knowing that the resource exists in a certain condition), option value (the value of being able to use the resource in the future) and bequest value (the value of ensuring the resource will be available for future generations).

This information is useful in order to:

- ❏ Understand the value of the MPA in non-monetary terms, which can be used to evaluate the tradeoffs between alternative development, management and conservation scenarios;
- ❏ Demonstrate the importance of the MPA to the larger population by calculating the value of the resources to people; and
- ❏ Understand the changing value of the MPA to stakeholders over time.

Requirements

- Survey form.
- List of households to survey.
- Simple statistical analysis (computer and spreadsheet software).
- Interviewers.
- Paper/pencil.
- Optional: economist to provide specialist assistance.

How to collect the data

The concepts of non-market and non-use values are largely abstract and theoretical. The economic methods used to obtain this information are too complex to be carried out without thorough training. The use of economic valuation methods such as travel costs and contingent valuation require an economist experienced in the use of the methods. When an economist is not available, an alternative approach using scale analysis is recommended.

The approach is to obtain community members' perceptions of the value of the MPA and coastal resources. A sample of households in the community is interviewed. Each respondent is asked to indicate the degree of their agreement or disagreement with a series of statements. These could include statements about beauty, about looking after the sea for their children's children, about "enjoying time on the water", and about other non-extractive goods and services that a 'healthy' marine environment can provide. Each individual MPA will need to decide the specific wording of the questions. An example of questions that involve some aspect of relationships between coastal resources and human activities include:

- ❏ The reefs are important for protecting land from storm waves (indirect non-market value).
- ❏ In the long-run fishing would be better if we cleared the coral (indirect non-market value).
- ❏ Unless mangroves are protected we will not have any fish to catch (indirect non-market value).

Relates to goals and objectives

GOAL 3
3A 3B 3C 3D 3E

GOAL 4
4B

S6

Difficulty Rating 4 1–5

▼ *Nearshore homeowners are often the first to recognise the benefits of a healthy coastline. For example, coastal forests can serve to buffer homes from the full effect of natural threats such as storms and increased wave action.*

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- ❏ Coral reefs are only important if you fish or dive (existence non-use value).
- ❏ I want future generations to enjoy the mangroves and coral reefs (bequest non-use value).
- ❏ Fishing should be restricted in certain areas even if no one ever fishes in those areas just to allow the fish and coral to grow (existence value).
- ❏ We should restrict development in some coastal areas so that future generations will be able to have natural environments (bequest value).
- ❏ Seagrass beds have no value to people (existence value).

Note that the statements are written such that agreement with some indicates an accurate belief, while agreement with others indicates the opposite. This was done to control for responses where the respondent either agrees or disagrees with everything. Statements are randomly arranged with respect to this type of polarity. Respondents are asked if they: very strongly disagree, strongly disagree, disagree, neither disagree nor agree (are neutral), agree, strongly agree or very strongly agree with each statement. This results in a scale with a range from 1 to 7.

The aesthetic beauty and mere fact of existence of natural areas along the coastline is of great value in many societies. Several studies of particular places have clearly documented how the total of such non-market values exceeds the total income generation from such areas.

Table S3

Example of percentage distribution of scale values

Statement number	*One*	*Two*	*Three*	*Four*	*Five*	*Six*	*Seven*
1	-	06	-	18	05	45	26
2	03	11	03	23	-	33	27
3	-	-	-	06	03	61	30
4	06	35	-	39	02	17	02
5	14	32	06	17	02	18	12
6	18	44	-	06	02	17	14
7	03	11	-	35	-	36	15
8	-	08	-	29	06	39	18

How to analyse and interpret results

Calculate percentage distribution of responses to the statements and report them in a table. Polarity of the statement is accounted for in the coding process, so as a score value changes from 1 to 7 it indicates an increasingly stronger and more accurate belief about the content of the statement.

A more complete analysis can be conducted on the data using more advanced statistical methods. The scale values associated with the eight attitude statements about relationships between coastal resources and human activities can be factor-analysed, using the principal component analysis technique and varimax rotation. The scree test can be used to determine the optimum number of

MIKE READ/NATUREPL.COM

Outputs

- Table on percentage distribution of scale values.

factors to be rotated. Factor scores were created to represent the position of each individual on each component.

Where resources are available, it may be possible to use more advanced economic methods to value coastal and marine resources. A number of methods are available depending upon the situation and the data needs. The main methods and approaches can be categorized as: generally applicable, potentially applicable, and survey-based. Generally applicable methods are directly based on market prices or productivity. Potentially applicable methods use market information indirectly. Use survey-based methods in the absence of data on market or surrogate-market prices.

Strengths and limitations

The main limitation of this indicator is that the concepts of non-market and non-use values are largely abstract and theoretical. As a result, the economic methods usually employed are too complex to be carried out without thorough training. The approach presented above is a simpler technique for obtaining information on people's perceptions of value of the MPA and coastal resources, although conducting it still involves a certain level of advanced analytical skills. The indicator may require infrequent specialist studies, such as by an economist.

Useful references and Internet links

Bunce, L., Townsley, P., Pomeroy, R. and Pollnac, R. (2000). *Socioeconomic Manual for Coral Reef Management*. Australian Institute of Marine Science, Townsville, Queensland, Australia. See page 224, "Non-market and non-use values". Available at www.reefbase.org

Grigalunas, T.A. and Congar, R. (eds.) (1995). *Environmental economics for integrated coastal area management: valuation methods and policy instruments. Regional Seas Reports and Studies No. 164*. United Nations Environment Program, Nairobi, Kenya.

Lipton, D.W., Wellman, K., Sheifer, I.C. and Weiher, R.F. (1995). Economic valuation of natural resources – a handbook for coastal resource policymakers. *NOAA Coastal Ocean Program Decision Analysis Series No. 5*. NOAA Coastal Ocean Office, Silver Spring, MD, USA.

Pomeroy, R.S. "Economic valuation: available methods". *In* Chua, T.-E. and Scrua, L.F. (eds.) (1992). "Integrative framework and methods for coastal area management". *ICLARM Conf. Proc. 37*. International Center for Living Aquatic Resources Management, Manila, Philippines.

Table S4

Economic valuation measurement and valuation techniques

Generally applicable	*Potentially applicable*	*Survey-based*
Those that use the market value of directly related goods and services: ■ change in productivity ■ loss of earnings ■ opportunity cost ■ marketed goods as proxies	Those that use surrogate-market values: ■ property values ■ wage differential ■ travel costs	Contingent valuation
Those that use the value of direct expenditures: ■ cost-effectiveness ■ preventive expenditures ■ shadow project	Those that use the magnitude of potential expenditures: ■ replacement cost	

Box S5

Example from the Field

As one means of obtaining some information about community members' perceptions of the non-market and non-use value of marine resources, a sample of household members in Matalom were requested to indicate the degree of their agreement or disagreement with five statements. The following five statements were used, each of which involves some aspect of non-market or non-use value.

1. The reefs are important for protecting land from storm waves.
2. In the long-run fishing would be better if we cleared the coral.
3. Unless mangroves are protected we will not have any fish to catch.
4. Coral reefs are only important if you fish or dive.
5. I want future generations to enjoy the mangroves and coral reefs.

Respondents were asked if they agree, disagree, or neither (are neutral) with respect to each statement. If they indicated either agree or disagree, they were asked if they agree (disagree) strongly, agree (disagree), or agree (disagree) just a little with each statement. Percentage distribution of responses to the statements are in the table below.

Toni Parras

Table S5

Example of percentage distribution of scale values

Statement number	*One*	*Two*	*Three*	*Four*	*Five*	*Six*	*Seven*
1	-	06	-	18	05	45	26
2	03	11	03	23	-	33	27
3	-	-	-	06	03	61	30
4	06	35	-	39	02	17	02
5	14	32	06	17	02	18	12

What is 'material style of life'?

Material style of life is an indicator of the relative social status of a community and is often used as an indicator of wealth. It involves assessing household structures (e.g. roof, walls) and furnishings (e.g. television, radio).

Why measure it?

Material style of life is important for determining the extent of equity of monetary benefits through the community. It is also important for understanding the economic status and relative wealth of coastal communities. It is particularly useful for determining changes in wealth where it is difficult or impossible to obtain accurate income data.

Positive economic impact of the MPA should be indicated by increasing material style of life items present in the community households. If the MPA has a positive impact on improving economic or social status or relative wealth, it should be indicated by increasing material style of life scores over time in the MPA community. Increases should be larger in MPA communities than in control communities. Likewise, if MPAs have an equitable impact, increases in material style of life scores should occur for all identified social groups, especially poorer and disadvantaged groups in the community. If this has not occurred, then the MPA project manager should compare findings with the control community. If changes are less negative in the MPA community, the MPA is probably not responsible for the negative change.

Requirements

- Survey form.
- Interviewers.
- List of households to survey.
- Paper/pencil.

How to collect the data

As a first step, the appropriate assets to assess need to be determined based on locally derived items associated with wealth and poverty. This list should include items that are likely to be purchased or upgraded within a reasonable time period, such as five years. The list will usually include items about type of roof, structural walls, windows, and floors.

These lists are not simple to construct. For example, house structure indicators might include four roof types: thatch, wood, tin and tile. It is possible to select only the most expensive type and use it in the list, but that would leave out all the gradation available in the different types. If the different types are used, how are values assigned to each type? The addition of different wall, floor, and window types, as well as appliance and other furnishings, greatly complicates the problem. The measure cannot be a simple addition of items. Items must be evaluated, accepted or rejected, and given

Relates to goals and objectives

GOAL 2
2A

GOAL 4
4A

Difficulty Rating 2
1–5

S7

▼ *Housing quality has been found to be a useful measure of the relative level of household wealth within coastal communities.*

TONY ECKERSLEY

TONI PARRAS

weights based on scale construction which deals with these problems. Techniques such as Guttmann scale analysis and factor analysis have been developed. Accurate scale construction is needed to make meaningful comparisons between individuals and groups of individuals (occupational subgroups, communities), as well as to make comparisons between different time periods, such as pre- and post-MPA.

Most importantly, the lists of assets to be measured should be appropriate to conditions of wealth within the target areas, to facilitate comparisons and measure change. For example, in one area a television may be considered by the local people as the top household asset representative of wealth, while in another area a radio is considered to be the top asset of household wealth.

The list of household structures and furnishings might include:

- ❏ Type of roof: tile ___ tin ___ wood ___ thatch ___
- ❏ Type of outside structural walls: tiled ___ brick/concrete ___ wood ___ thatch/bamboo ___
- ❏ Windows: glass ___ wooden ___ open ___ none ___
- ❏ Floors: tile ___ wooden ___ cement ___ thatch/bamboo ___ dirt ___
- ❏ Toilet: flush ___ pail flush ___ outdoor ___
- ❏ Water: inside tap ___ pump ___ outside tap ___
- ❏ Electricity: yes ___ no ___
- ❏ Household furnishings: fan ___ refrigerator ___ radio ___ television ___ wall clock ___

Table S6

Example of percentage distribution in Village A

Item	*Village A*
Bamboo wall	30
Cement wall	57
Wooden wall	15
Glass window	55
Wooden window	45

Outputs

- Table of percentage of distribution of material items in the community.

The actual collection of material style of life data during the survey is not difficult. A list is prepared and the interviewer simply checks off the items by observation or by asking the respondent if they are present or not.

How to analyse and interpret results

Calculate the total number of items and the percentage distribution of each item and present them in a table.

Box S6

Example from the Field

As part of the baseline survey conducted in Bentenan and Tumbak and the control sites of Rumbia and Minanga, the presence or absence of several aspects of house construction, considered by the research team to be indicative of differential social status, were recorded for each household included in the survey. The items and their percentage of distribution in the control and pilot project sites are found in the table below.

Item	*Bentenan/Tumbak*	*Rumbia/Minanga*
Bamboo walls	30	31
Cement walls	57	49
Wooden wall	15	24
Glass window	42	39
Open window	26	37
Wooden window	33	39
Cement floor	73	73
Dirt floor	7	31
Tile floor	1	0
Wooden floor	22	4
N	81	51

Source: Pollnac R.B. and B.R. Crawford (2000).

Strengths and limitations

One of the major difficulties with this indicator lies in properly identifying household items indicative of relative wealth/poverty in the community. In addition, it is often difficult to separate impacts of the MPA from impacts of other economic changes in the household caused by general economic and community development. To address this issue, it is recommended that a control be used. For example, a control site may be a neighbouring community that has similar characteristics to the community near the MPA but that has no relation to or impact from the MPA. Alternatively, it may be possible to use control groups, such as people in the community associated with the MPA (fishers) and compare them with those with no association with the MPA. By comparing the control site or group with those impacted by the MPA it is possible to account for impacts caused by the MPA versus those from general economic and community development.

Useful references and Internet links

Berkes, F., Mahon, R., McConney, P., Pollnac, R. and Pomeroy, R. (2001). *Managing small-scale fisheries: alternative directions and methods.* International Development Research Centre, Ottawa, Canada. Available at www.idrc.ca/booktique

Pollnac, R.B. and Crawford, B.R. (2000). "Assessing behavioral aspects of coastal resource use". *Proyek Pesisir Publication Special Report. Coastal Resources Center, Coastal Management Report #2226.* Coastal Resources Center, University of Rhode Island, Narragansett, Rhode Island, USA. Available at www.crc.uri.edu

Pomeroy, R., Pollnac, R., Katon, B. and Predo, C. (1997). "Evaluating factors contributing to the success of community-based coastal resource management: The Central Visayas Regional Project 1, Philippines". *Ocean and Coastal Management, 36 (1-3):97-120.*

DAVID SHEPPARD/IUCN

Relates to goals and objectives

GOAL 2
2D

GOAL 4
4B

Difficulty Rating 2 1–5

What is 'quality of human health'?

The quality of human health is a measure of the general nutrition and health of people in the community.

Why measure it?

Information on the quality of human health is used to indicate the general nutrition and health of people in the community and the quality of life and relative wealth of people in the community. It has been stated, for example, of one measure of quality of human health, infant mortality rate, that, "No statistic expresses more eloquently the differences between a society of sufficiency and a society of deprivation than the infant mortality rate". If the MPA is providing improvements in livelihood and income, and overall improvements in wealth in the community, then it could be expected that the quality of human health should increase.

How to collect the data

A variety of measures of quality of human health can be used. These include infant mortality rate, availability of health services, child weight, variety and rate of diseases, type and number of vaccinations.

Secondary sources, such as the local health department, community nurse or doctor, or local hospital or health care centre, provide this information for the local context, but it is most likely aggregated for some larger area. Regional health services may have the disaggregated data which could be used to calculate an index for the local context. National statistics offices and reports may also have the data. At least a five-year series of data should be used to analyse trends. Key informants (mayor, doctor, nurse, midwife, health department, hospital) can be contacted to provide an explanation of reasons for and changes in the measures.

When secondary sources are not available, the information could be collected by interviewing key informants (mayor, doctor, nurse, midwife, health department, hospital) and asking them to provide a general description about the selected measure in the community.

For example, data can be collected on the occurrence of diseases in the area. Key informants (mayor, doctor, nurse, health department, hospital) are interviewed to identify major and minor diseases in the area. They might be asked:

- ❏ What are the five major diseases in the community?
- ❏ What were the five major diseases in the community ten years ago?
- ❏ If there is a change, what was done to address the disease problem?
- ❏ What is being done to address the disease problem?

Requirements

- Information on infant mortality rate, health services, child weight, diseases, vaccinations (from secondary sources).
- Paper/pencil.
- Interviewer.

How to analyse and interpret results

Collate the data and present it in a narrative format. For example:

▼ ***Human health measures, including the availability of health services, nutritional levels and infant mortality rates, can be proxies for the relative wealth within a community.***

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Box S7

EXAMPLE FROM THE FIELD

The infant mortality rate in Placencia was one in 200 births in 1990. The MPA was implemented in 1994. As a result of the MPA, new occupations were created in Placencia such as dive master, fly fishing guide, and boat guide. These new occupations have raised the income level of households in the village and a doctor arrived in the community in 1998. In the 2000 national census, the infant mortality rate had improved in Placencia to one in 400 births.

The town of Bontoc had an infant mortality rate of 10 infant deaths per 1,000 births in 2001. Five years ago (1996), the infant mortality rate was 18 infant deaths per 1,000 births. In 1999, a health clinic staffed by a nurse was established in the community. The nurse provides minor medical care and midwife services. A doctor visits the clinic one day per week. The people of the community pooled their own time and funds to build the health clinic.

Outputs

- Narrative presentation on quality of human health in the community.

Strengths and limitations

It may be difficult to obtain the secondary data at a village/community level as data is often reported in an aggregated form. The original source of the data will need to be contacted.

Useful references and Internet links

Bunce, L., Townsley, P., Pomeroy, R. and Pollnac, R. (2000). *Socioeconomic Manual for Coral Reef Management*. Australian Institute of Marine Science, Townsville, Queensland, Australia. Available at www.reefbase.org

Pollnac, R. (1998). "Rapid assessment of management parameters for coral reefs". *Coastal Resources Center Coastal Management Report # 2205*. Coastal Resources Center, University of Rhode Island, Narragansett, Rhode Island, USA. Available at www.crc.uri.edu

Relates to goals and objectives

GOAL 2

2A 2B

Difficulty Rating 3 1–5

What is 'household income distribution by source'?

Household income distribution by source is a measure of the principal sources of income for households in the community.

Why measure it?

An important part of understanding stakeholder characteristics are household livelihood and sources of income, which include the way people combine the resources and assets at their disposal to make a living for themselves and their families. An understanding of these livelihood and income sources will allow the MPA manager to better measure and understand the impacts of the MPA on local households. It will allow the MPA manager to understand who is winning and losing, following shifts in household income sources, as a result of the MPA. Shifting sources of income may indicate a positive or negative impact of the MPA on households. Understanding income sources will also enable the manager to determine levels of community dependency on the resources, which can be used to make changes in MPA management to diversify occupational and income structures. For example, if more than 90% of the community are fishers, then the MPA might offer aquaculture training so they are less dependent on one income.

Also, if households perceive a decrease in the sources of household income over time, then this information can be used to make changes in MPA management to ensure that local households are obtaining adequate livelihoods and incomes. Finally, if households perceive an increase in the sources of household income over time, then this information can be used in support of the MPA.

How to collect the data

Secondary data is first collected to determine the main sources of income for households and to sort out a few broad groups of people dependent on particular income sources, such as fishing, farming or dive operations. These data may be available from census bureaus and local government offices. The following secondary data are most often available:

- ❏ Economic status (ownership of key assets such as land, fishing boats) and aspects of social status (particularly membership of formal organizations).
- ❏ Sources of livelihood of community members, which often only cover the principal economic activity of individuals or households (specific information on stakeholder households is often available).

Requirements

- Survey form.
- Sample of community households to be surveyed.
- Interviewers.
- Notebook and pen.

Primary data may need to be collected using a survey or a semi-structured interview to gather data from a sample of households in the community on different sources of household income and different sources of livelihood for households. Questions might include:

- ❏ What are the different sources of income in your household? List all.
- ❏ What is the relative importance of each source of household income in the community? Provide percentages.
- ❏ What are the different types of livelihood of the household? List all.
- ❏ What is the relative importance of each livelihood activity to overall household income? Provide percentages.

This data is collected from a sample of households in the community over time to assess shifting sources of income, especially those related to the MPA, such as fishing, dive operations, and tourism.

How to analyse and interpret results

Prepare tables of percentages showing the different sources of household income, relative importance of each source of household income in the community, different types of livelihood of the household, and relative importance of each livelihood activity to overall household income. Prepare a narrative text to explain the quantitative results.

Outputs

- Narrative presentation on quality of human health in the community.

Strengths and limitations

A limitation is that the usefulness of this indicator will depend upon the availability and cooperation of the household informant to respond to questions about source of income, often a sensitive topic.

Useful references and Internet links

Bunce, L., Townsley, P., Pomeroy, R. and Pollnac, R. (2000). *Socioeconomic Manual for Coral Reef Management*. Australian Institute of Marine Science, Townsville, Queensland, Australia. Available at www.reefbase.org

Note that this indicator (S9) and S10 (occupational structure) both use a survey to collect data and may be conducted at the same time.

▼ ***Many, but not all, households generate revenues through multiple sources and family members. Decreased reliance on a single income stream, for example from fishing, means that a household will be more resilient to any change that might occur within the fishery occupation as a result of adapted management efforts.***

DAVID SHEPPARD/IUCN

Box S8

EXAMPLE FROM THE FIELD

At the Sian Ka'an Biosphere Reserve in Mexico, a census was used to gather information about the monthly average income by productive activity. Results show that women, who represent 23% of the economic force of the community, are earning the same amount of income as many men involved in tourism activities and even more when it comes to their own businesses.

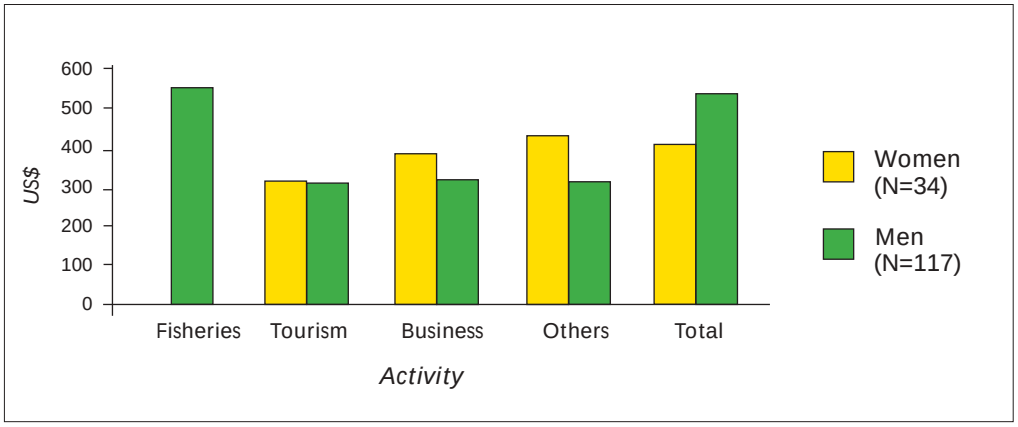
Average income comes from dividing the total amount reported for each activity, by the number of men/women that provided information on their monthly income.

At Tubbataha Reef National Marine Park in the Philippines, the mean income level in Cagayancillo is 3,812 pesos per month or 45,744 pesos per annum. This is below the poverty threshold level in the Philippines which is set at 92,500 pesos per year (National Statistics Office, 1998). Only 10% of the households are above the poverty threshold, leaving 90% below. The main occupations in Cagayancillo are seaweed farming and fishing. Farming becomes a supplementary occupation to provide staple food for home consumption. The table (right) shows that most households engage in multi-occupation – 35% of the households engage in farming, fishing and seaweed farming, 17% engage in fishing and seaweeds, 16% engage in fishing and farming, and 11% engage in farming and seaweeds. Small percentages engage in fishing only (4%), seaweed farming only (3%) and farming only (15%). The remaining 1% is in non-agri/fisheries activities such as services and government employment. Mat weaving is also a popular supplementary source of income among women. They use pandan and buri as raw materials.

Distribution of respondents by income source

	Income source percentage	*No. of respondents*
Fishing only	4	8
Farming only	15	30
Seaweeds only	3	5
Fishing & Farming	16	32
Fishing & Seaweeds	17	33
Farming & Seaweeds	11	21
Farming, Fishing & Seaweeds	35	69
Non-Agri or Non-Marine	1	2
TOTAL	100	200

Average income by productive activity per month in USD



S9

Household occupational structure

What is 'household occupational structure'?

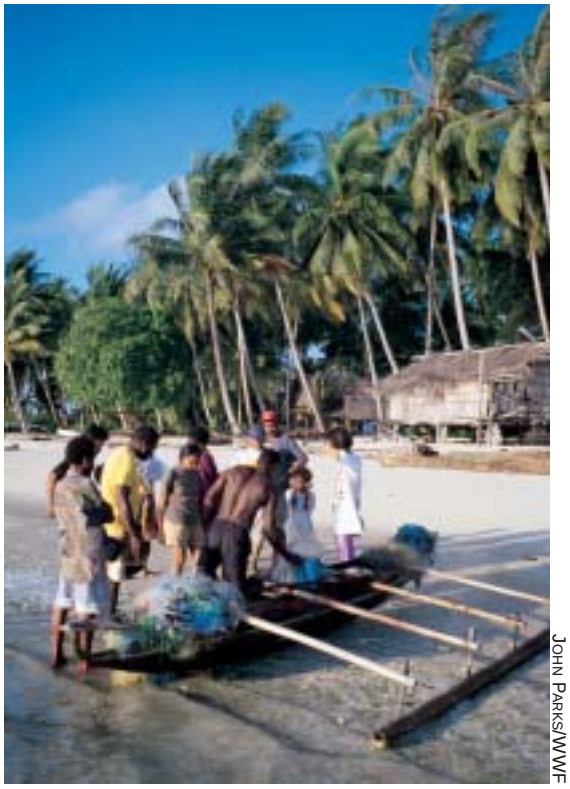
Household occupational structure measures the distribution of productive activities (occupation, sources of income, both monetary and non-monetary) across households and social groups (age/gender) in the community. It is a list of all the household members, and each member's occupation. It can also include the gender, age, ethnicity and religion of each household member.

Why measure it?

Household occupational structure is an important aspect of social structure as well as an indicator of the relative importance of the different uses of coastal resources. It is an indicator of stabilization or diversification of occupations and level of resource dependency. The indicator is used to determine the percentage of households dependent on coastal resources for livelihood, changes in household occupations as a result of the MPA, and to identify and determine the acceptance and relative importance of alternative (non-target resource based) livelihood activities.

This indicator is useful for determining if the MPA and associated activities, such as alternative livelihood activities, are impacting upon households in the community. It is possible to determine, for example, that fishers in the community are shifting from fishing as a primary occupation to fly fishing guides or dive boat operations as a result of the MPA. It will allow for a measure of the dependence of households on coastal resources for livelihood and income and changes over time on that dependence. The indicator results in a measure of impact of the MPA on household occupational structure in the community.

Ideally, the value of all coastal activities that contribute to the household should be obtained, for example, the income earned from fishing, the value of fish brought home for food. The problem is that most primary producers in developing countries do not keep records of income, and income from fishing, for example, varies so much from day to day that it is difficult to provide an accurate figure for weekly or monthly income. It not only varies from day to day, but also from season to season. The difficulty with estimating income is further compounded by the occupational multiplicity. Household occupational structure is a realistic alternative means of understanding the relative importance of these activities to the individual household.



JOHN PARKS/WWF

▲ *In many parts of the world, three or four generations all live together under the same roof. In such situations, each household member typically contributes to the whole by engaging in a wide variety of specific roles and productive activities.*

Requirements

- List of households to survey.
- Secondary data on household occupational structure.
- Survey form.
- Interviewer.
- Paper/pencil.

How to collect the data

Secondary data is an inadequate source of information about occupations, since most published statistics only include the full-time or primary occupation. Most coastal communities, especially in rural areas, are characterized by occupational multiplicity – a given individual or household may practice two, three, four or more income or subsistence-producing activities. The only way to determine the distribution and relative importance of these activities is by the use of a sample survey.

Relates to goals and objectives

GOAL 2
2B

GOAL 4
4A

Difficulty Rating
3
1–5

S10

Household member	Age	Gender	Education level	Primary occupation	Secondary occupation	Tertiary occupation
1						
2						
3						
4						

A survey form can be administered to a sample of households in the community. Respondents are asked to list all the members in the household. They then are asked the age and gender of each person and then their primary, secondary and tertiary occupations. A table such as that above can help organize these data.

In addition, the respondent should be asked about the overall primary and secondary sources of income. This is particularly important to determine the range of household sources of income that may not be noted by occupation, such as remittance. The questions might include:

- ❏ What is the primary source of household income?
- ❏ What is the secondary source of household income?

How to analyse and interpret results

Calculate the distribution of occupations in the community. During the testing process, as shown in the following sample table, the number of household members throughout the community that were noted as farming for their primary occupation was calculated, then the same for fishing, fish trading and so on. The same calculations were then done for secondary occupations and then tertiary occupations. Once the raw numbers were noted, the percentages could be calculated as noted in parentheses in the sample table.

Construct a similar table for primary and secondary sources of household incomes.

Construct a final table noting the distribution of age, gender and education.

Outputs

- Table of percentage distribution of ranking of occupational activities in community.
- Table of primary and secondary sources of household incomes.
- Table of distributions of age, gender and education.

Note that this indicator (S10) and S9 (household income distribution by source) both use a survey to collect data and may be conducted at the same time.

Table S7

Number of household members in each occupation (percentage distribution)

Occupation	*Primary*	*Secondary*	*Tertiary*
Farming	0 (0%)	10 (17%)	0
Fishing	70 (63%)	17 (28%)	15 (17%)
Fish trading	25 (23%)	7 (12%)	10 (11%)
Carpentry	15 (14%)	6 (10%)	0
None	0	20 (33%)	65 (72%)
Total	110 (100%)	60(100%)	90(100%)

Strengths and limitations

This indicator can be an accurate measure of dependence on coastal and marine resources if appropriate methods are used. Respondents must know the sources of household income and be able to rank them in terms of relative importance. The interviewers must make it clear to the respondent that the list of activities and ranking must relate to the full year of activities. This is especially important where there are seasonal differences. Another complication is that defining the household may be challenging in certain locations due, for example, to an extended family living in the house.

Useful references and Internet links

Berkes, F., Mahon, R., McConney, P., Pollnac, R. and Pomeroy, R. (2001). *Managing small-scale fisheries: alternative directions and methods.* International Development Research Centre, Ottawa, Canada. Available at www.idrc.ca/booktique

Pollnac, R.B. and Crawford, B.R. (2000). "Assessing behavioral aspects of coastal resource use". *Proyek Pesisir Publication Special Report. Coastal Resources Center, Coastal Management Report #2226.* Coastal Resources Center, University of Rhode Island, Narragansett, Rhode Island, USA. Available at www.crc.uri.edu

Box S9

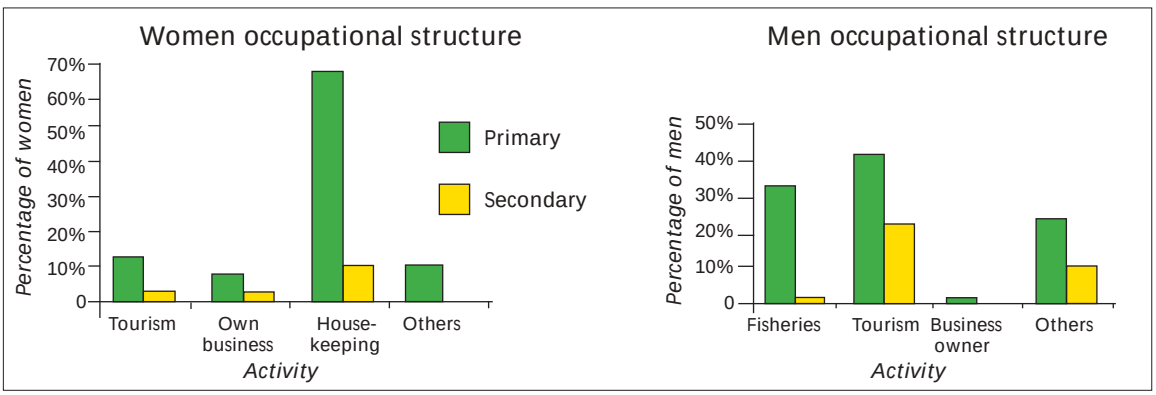
EXAMPLE FROM THE FIELD

At the Sian Ka'an Biosphere Reserve in Mexico, a census was conducted in Punta Allen to collect data on occupational structure. The census was conducted in 113 households, containing a total of 433 inhabitants.

For over 30 years the primary source of income of the men of Punta Allen was lobster fishing (*right*). Nowadays, tourism activities and services are growing fast, as a consequence of the increasing massive tourism developments in the north of Quintana Roo.

Women of Punta Allen are still dedicated to housekeeping, but in the past six years, they have been incorporated into economic activities, particularly in the tourism sector, where they participate in a wide variety of activities: members of tourism cooperatives, owners of boats, chefs, waitresses, housekeepers in guesthouses, secretaries, etc. Other significant sources of income for these women are their own businesses, including supermarkets, restaurants and guesthouses.

JOHN PARKS/WWF



Relates to goals and objectives

GOAL 2

2A 2C 2D

GOAL 4

4B

What is 'community infrastructure and business'?

Community infrastructure and business is a general measure of local community and economic development. It is a description of the level of community services (e.g. hospital, school), and infrastructure (e.g. roads, utilities), which can include information essential for determining sources of anthropogenic impacts on coastal resources (e.g. sewage treatment). It is also a description of the number and type of commercial businesses in the area, especially those associated with activities related to the MPA.

Difficulty Rating 2 1–5

Why measure it?

If measured over time, community infrastructure and business is useful for determining changes in economic status and relative wealth and development of the community, as well as access to markets and capital. A positive change in community infrastructure and services (e.g. improved roads, hospital) indicates an increase in the relative wealth of the community, resulting, in part or wholly, from economic gains obtained from the MPA. A negative change in community infrastructure and services may indicate no or limited changes in the relative wealth of the community being obtained, in part, from the MPA. An increase in commercial business, such as dive shops, hotels and restaurants for tourists, indicates an increase in overall community economic development resulting from activities associated with the MPA.

Requirements

- Baseline information on community infrastructure and services and businesses.
- Survey form and check list.
- Interviewers.
- Paper/pencil.

How to collect the data

This information is collected by interviewing key informants (e.g. mayor, town engineer), reviewing secondary data and/or observing the community. A checklist needs to be developed to enumerate and determine the existence of community infrastructure items. The checklist of items might include the items listed opposite.

Other items may be added to the list depending on the infrastructure, services and businesses in the area. This checklist may also include information on the condition of the item (e.g. roads: smooth, few pot holes, or many potholes). It may also be useful to ask business people about the number of employees, number of locally hired employees, and if the business is locally owned. This information will provide an indication of the impact of local businesses on the economy.

How to analyse and interpret results

Collate the data and present it in a narrative format. For example:

> Matalom has 1km of asphalt road (3km of stone and 0.5km of dirt), as well as one bridge, which reportedly needs maintenance. The town has water piped to all homes and businesses. There are telephones and electricity.

TONY ECKERSLEY

◀ *Businesses that generate revenues based on the presence of an effectively managed MPA, such as boat trips for visitors, provide additional jobs and livelihood opportunities for those within the coastal community.*

There is a primary school and a health clinic. In the last two years, three guesthouses been established, one dive shop and two restaurants to serve the increasing number of divers coming to the MPA.

Data can also be presented quantitatively by making a table showing the presence and/or number of each item. Changes in type of items, number and characteristics, either new or gone out of business, should be noted over time.

TONY ECKERSLEY

Outputs

- Narrative presentation of community infrastructure and business.
- Table showing presence and/or number of each item.

Strengths and limitations

A challenge with this indicator is accurately identifying significant infrastructure and business items in the community. Similar to material style of life, it is often difficult to separate impacts of the MPA on level of community infrastructure and business development, such as a paved road or sewage treatment, from impacts of other economic changes in the community caused by general economic and community development. As noted in S7 – Material style of life – a control could help account for these changes and impacts.

Useful references and Internet links

Berkes, F., Mahon, R., McConney, P., Pollnac, R. and Pomeroy, R. (2001). *Managing small-scale fisheries: alternative directions and methods.* International Development Research Centre, Ottawa, Canada. Available at www.idrc.ca/booktique

Pollnac, R.B. and Crawford, B.R. (2000). "Assessing behavioral aspects of coastal resource use". *Proyek Pesisir Publication Special Report. Coastal Resources Center, Coastal Management Report #2226.* Coastal Resources Center, University of Rhode Island, Narragansett, Rhode Island, USA. Available at www.crc.uri.edu

Checklist of items that might be included in the survey of community infrastructure and business

Hospitals	yes___ no___ #____
Medical clinics	yes___ no___ #____
Resident doctors	yes___ no___ #____
Resident dentists	yes___ no___ #____
Secondary schools	yes___ no___ #____
Primary schools	yes___ no___ #____
Water piped to homes	yes___ no___
Sewer pipes and canals	yes___ no___
Sewage treatment facilities	yes___ no___
Septic/settling tanks	yes___ no___
Electric service hook-ups	yes___ no___ #____
Telephones	yes___ no___ #____
Public transportation	yes___ no___
Paved roads	yes___ no___

Businesses

Food markets	yes___ no___ #____
Hotels	yes___ no___ #____
Guesthouses	yes___ no___ #____
Resorts	yes___ no___ #____
Restaurants	yes___ no___ #____
Food stalls	yes___ no___ #____
Gas stations	yes___ no___ #____
Banks	yes___ no___ #____
Specialty shops	yes___ no___#____ type_____
Gift shops	yes___ no___ #____
Dive shops	yes___ no___ #____
Tour operations	yes___ no___ #____
Fishing guides	yes___ no___ #____

Box S10

EXAMPLE FROM THE FIELD

Tumbak has 1km of asphalt road (3km stone and 0.5km dirt), as well as one bridge, which reportedly needs maintenance. Microlets and boats link the community to nearby towns. The town nearest to Tumbak with full services (bank, gas stations, markets, government offices) is Belang, the seat of the kecamatan (district government), which is about two hours and 28km to the south. People and products can also be transported by the three automobiles, one motorcycle and 20 bicycles, and numerous boats recorded in the village statistics. The pipe meant to deliver fresh water to the community is out of service, so residents must travel by boat to the river for fresh water, which is transported back to the village in plastic jerry cans. Approximately 8% of the households have septic or settling tanks and 26% are officially connected to the national electric company lines. The survey indicates that 85% of households have electricity, many of them unofficially connected to the neighbour's supply. There are no telephones, gas stations, markets, restaurants, or accommodation for visitors. There is one elementary school.

Source: Pollnac, R.B. and Crawford, B.R. (2000).

What is 'number and nature of markets'?

The number and nature of markets is a measure of the number and types of markets where marine products from the area of the MPA are purchased and sold. The market is the connection between the producer (e.g. fisher, mangrove harvester) and the consumer (e.g. resident, tourist, hotel owner). The market serves both a physical function (i.e. buying, selling, storage, processing) and an economic function (i.e. price, behaviour).

Why measure it?

Since the livelihoods and incomes of people in the community are linked to markets, it will be important to understand the changing nature of markets. This indicator is particularly useful in determining coastal resident access to markets and capital, which contribute to livelihood opportunities. The MPA can have both positive and negative impacts on markets for coastal resource goods (e.g. fish, mangrove) and services (e.g. tourism, recreational fishing, diving). The positive impacts will be shifts in markets resulting in increased income as demand changes for different goods and services provided by the MPA. The negative impacts will be a reduction in the number of markets as goods and services from the MPA are reduced due to management and potential loss of income.

Requirements

- List of key informants to interview.
- Survey form.
- Secondary data on major marine products and markets.
- Paper/pencil.

This indicator allows for measurement of the impact of the MPA on markets for major marine products from the area. It allows for an analysis of changes over time in the supply and demand of major marine products and market channels as a result of MPA management. It is important to recognise that market demands also have an impact on the MPA through economic incentives to participate in illegal and/or unsustainable activities.

Locally caught fish outside MPAs are often sold at a number of different markets, including local (town/village), provincial/state, national, and international.

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Relates to goals and objectives

GOAL 2

2B 2C

Difficulty Rating 3 1–5

How to collect the data

The data can be collected through either a key informant survey of representative fishers and traders or through a survey of fishers and traders. Secondary data on these major marine products may be available in the MPA management plan, economic studies of the region, and from government agencies such as fisheries, environment and natural resources or tourism departments.

Since the market may vary from product to product, there is a need to identify each one. For example, the market for lobster may be different from that for finfish.

As a first step, the major marine products (i.e. fish, shellfish, crabs, mangrove) in the area of the MPA need to be identified. The key questions might include:

- ❏ What are the ten most important vertebrates harvested? Note local and scientific names.
- ❏ What are the ten most important invertebrates harvested? Note local and scientific names.
- ❏ What are the five most important flora harvested? Note local and scientific names.

The data collection should only focus on the major marine products as the analysis can get complicated the more products that are included.

For each resource, it is important to understand the harvest patterns, importance and marketing. Important questions to ask might include:

- ❏ What time of year is the resource harvested (month)?
- ❏ Where is the resource harvested (inshore, reef, offshore, distant waters)?
- ❏ What is the importance, in terms of value and quantity, of each resource? Rank from 1 to 10.
- ❏ What is the resource primarily gathered for? Household consumption, trade/barter, or sale in the market.
- ❏ If the resource is sold, where is the market located (local, regional, national, export)? And to whom (wholesaler, retailer, transporter, processor)?

To supplement the information collected above, for each product, the key informants should be asked to rank the degree of demand for the product using the following scale:

Outputs

- A narrative identifying the major marine products in the area and harvest and marketing for these products.
- Summary table of important market characteristics of each product.
- Map showing market channel flow or movement of each product.

1 = little or no established market exists for the product; never sold or traded
2 = limited demand for the product; can occasionally sell some
3 = some demand for the product; can sometimes sell it
4 = strong demand for the product; can usually sell it
5 = very strong demand for the product; can always sell it

How to analyse and interpret results

Prepare a written narrative for each product describing the harvest patterns, importance and marketing system. Prepare a summary table that compares important market characteristics for each product. This information can be presented on a map showing the flow or movement of each product from harvest to consumer along the market channel.

Strengths and limitations

Ranking the major marine products will be important as there may be a long list generated by the key informants.

Useful references and Internet links

Bunce, L., Townsley, P., Pomeroy, R. and Pollnac, R. (2000). *Socioeconomic Manual for Coral Reef Management*. Australian Institute of Marine Science, Townsville, Queensland, Australia. Available at www.reefbase.org

Box S11

EXAMPLE FROM THE FIELD

At Tubbataha Reef National Marine Park in the Philippines, the market outlets for fishery products, including dried seaweeds from Cagayancillo, are either Puerto Princesa City or Iloilo City. There are wholesale buyers stationed in the islands who deliver in bulk to outside markets. Prices are dictated by these buyers who exact patronage by offering advance sums of money for the producers' daily consumption of basic goods which they themselves supply. A foreign operator of live fish products (lapu-lapu) markets directly to Taiwan through its own network.

Agricultural products are sold locally or consumed by the producing households. Likewise, mats are sold locally or through individual contacts who visit the islands. Products are transported to the markets by 4 boats (10-20 gross tons) that ply the Iloilo and Puerto Princesa routes. Except for the summer months (March to May) there is no regularity in the schedule of these boats. Schedules are highly dependent on weather. The regular fare for passengers is 350 pesos going to Puerto Princesa City and 300 pesos going to Iloilo City. These include food for the entire duration of the trip. For cargoes, a bag of rice or cement costs 50 pesos each.

TONI PARRAS

TONI PARRAS

TONI PARRAS

Relates to goals and objectives

GOAL 6

6A

Difficulty Rating 3 1–5

What is 'stakeholder knowledge of natural history'?

Stakeholder knowledge of natural history (referred to here as local knowledge) is a measure of the knowledge held by stakeholders that is not based on scientific research but comes from stakeholder observations, experiences, beliefs and perceptions of cause and effect. It is also the degree to which local stakeholders pass on to next generations local knowledge and beliefs about the natural environment and the effects of human use.

Why measure it?

MPA compliance and success may be influenced by changes in the distribution of local knowledge and awareness among the stakeholders of natural history and biological event timing across generations, gender, and community roles and positions. In order for people to take action to protect and manage the environment, they need to understand how the natural ecosystem works. Those with higher levels of knowledge of natural history tend to be more receptive to management initiatives, such as an MPA, and provide more support for the MPA.

Stakeholder knowledge of natural history can be used by MPA managers to:

- Contribute to their scientific understanding of marine resources, e.g. local fishers may advise on reef fish behaviour, habitat and migration patterns.
- Facilitate interactions with stakeholders by ensuring the managers know as much as the stakeholders, since fishers may not respect a manager if he or she is not as knowledgeable about marine resources as the locals.
- Facilitate accurate communication and data collection by ensuring that managers, scientists and stakeholders use the same terms.
- Determine if the MPA is enhancing community respect and/or understanding of local knowledge.

▼ *Resource users have varying degrees of knowledge about the life history and behaviours of target marine organisms. Such knowledge can both hinder and assist MPA management.*

JOHN PARKS

Requirements

- Survey form.
- Interviewer.
- Notebook and pen.
- Map of area.

How to collect the data

The focus of this indicator is folk taxonomy and local knowledge of resources. Folk taxonomy involves understanding the local names of marine aquatic resources, locations of the resources and related activities, particularly significant places such as fishing grounds and landing sites, and related activities around the resources. Important questions to address when assessing local knowledge may include:

- ❏ What are the local names of the marine resources?
- ❏ What are the local names of the places where they are located?
- ❏ What are the local names of particularly significant places related to the resources (e.g. spawning sites)?
- ❏ What are local names of activities related to the resources?

This involves understanding how these items are classified, e.g. while scientists may divide fauna into families and species using scientific criteria, stakeholders may use very different groups such as edible/non-edible, species that live in similar environments, seasonal availability, etc.

Local knowledge refers to stakeholder understanding of the marine aquatic resources including: the location of resources, their mobility, quantity, interactions among resources, feeding behaviours, and breeding behaviours and locations. Key questions may include:

- ❏ Where are the resources located?
- ❏ What is the extent of their mobility?
- ❏ What is the population size of each resource?
- ❏ What kinds of interactions are there among resources?
- ❏ What are feeding behaviours of the resources?
- ❏ What are the breeding behaviours and locations?

This knowledge also involves understanding how these characteristics have changed over time and why. Local knowledge may be limited to commercially important species, with which stakeholders are often most familiar.

Variations in local knowledge may occur. This refers to the range of perceptions among different stakeholders, e.g. fishers may know more about changes in the fish populations because they harvest these resources; whereas divers may be more familiar with coral conditions since they see the corals while diving.

Folk taxonomy should be assessed first because it will provide important information for local knowledge and variations in knowledge. It will probably be found that there is little secondary data on local knowledge, which is often passed on by word of mouth from generation to generation.

A range of data collection methods and visualization techniques can be used. Semi-structured interviews, oral histories, surveys, observations and focus group interviews are all important for collecting information. During the data collection it is particularly important to record who the informants are and their characteristics (e.g. age, gender), which will be used to assess variations among people and stakeholder groups.

Visualization techniques include:

- ❏ Local classifications to identify local taxonomies;
- ❏ Ranking matrices to assess variations among individuals and stakeholder groups; and
- ❏ Ranking matrices and timelines to encourage discussion and analysis of changes in resource abundance or other features of local knowledge where relative quantities are important.

It is also important to measure through semi-structured interviews with MPA managers:

- ❏ Their awareness of stakeholder knowledge of natural history;
- ❏ Their use of this knowledge; and
- ❏ The interaction and consistency of local stakeholder knowledge and scientific knowledge.

How to analyse and interpret results

Summarise the data into descriptive text based on the qualitative information and quantitative data. Use tables and figures to clarify and illustrate variations and trends, e.g. knowledge of place names and beliefs about distributions of flora, fauna and

minerals can be put on maps; ranking matrices and timelines created by informants during field data collection can be included to show stakeholder knowledge and perceptions of resource conditions and changes.

Analysis of variations is unique and involves comparing responses from informants to determine the basis of their differences. By comparing the responses on local taxonomies and local knowledge with the informants' basic characteristics, it will be possible to determine the socio-economic basis of their differences, e.g. variation may be related to area of residence or work experience.

Outputs

- A narrative text on each sub-parameter such as folk taxonomy and local knowledge.
- Summary table of important market characteristics of each product.
- Maps showing location of resources.
- Ranking matrices and timelines showing stakeholder knowledge and perception of resource conditions and changes.

Strengths and limitations

An appreciation of local knowledge by managers and scientists is needed.

It is important to note that local knowledge is variable. For example, a spear or hand line fisher usually has greater knowledge than a deck hand on a trawler. While some local resource users may have an extensive knowledge of marine organism life history and behaviour, a lot of local knowledge is based in (or flavoured by) mythology, religion, etc. and is inaccurate. Local knowledge often includes a lot of spurious reasoning for observed patterns. While local knowledge is important and can be very useful, caution must be used and the information should be checked with others in the community and with scientific experts.

Useful references and Internet links

Bunce, L., Townsley, P., Pomeroy, R. and Pollnac, R. (2000). *Socioeconomic Manual for Coral Reef Management. Australian Institute of Marine Science, Townsville,* Queensland, Australia. pp. 202-204 in Chapter 6, "Traditional Knowledge". Available at www.reefbase.org

Box S12

Example from the Field

At the Galapagos Marine Reserve, a survey of 348 individuals in three inhabited islands was conducted to measure stakeholder knowledge of natural history. The table below provides results of the survey showing the percentage of stakeholders in the different islands with knowledge of natural history.

	Santa Cruz	San Cristobal	Isabela
Origin of the archipelago	45%	44%	43%
Weather of the archipelago	38%	35%	21%
Marine currents	35%	32%	38%
Evolution of the species	38%	33%	37%
Concept of endemic species	47%	44%	46%
Fisheries resources	18%	16%	20%
Vegetation	21%	16%	20%
Danger of extinction	25%	17%	37%
Alien species	38%	33%	52%
Average	***34%***	***30%***	***35%***

There is a relatively higher degree of stakeholder knowledge of terrestrial natural history than marine due to a greater effort on environmental education about terrestrial systems. There is a need to improve stakeholders' knowledge of marine systems.

What is 'distribution of formal knowledge to community'?

Distribution of formal knowledge to community is a measure of the degree of awareness of information generated by the scientific community held by stakeholder and user groups about MPA use and ecosystem impacts.

Why measure it?

The information generated by this indicator can help to contribute to improved scientific understanding of local ecosystems and to facilitate interactions with stakeholders by ensuring the stakeholders have confidence in the scientific information. It can also facilitate accurate communication and data collection by ensuring that managers, scientists and stakeholders use the same terms. As a result, rewritten, interpreted, translated, disseminated/communicated, and ideally understood scientific information can lead to meaningfully applied and managed MPAs.

▼ *Scientific knowledge and techniques can be a valuable asset to local users and coastal communities.*

JOHN PARKS

How to collect the data

A list of scientific information provided to the community by MPA management and scientists is prepared. This may be material on expected impacts of the MPA, expected changes on resources from the MPA, and impacts from changes in certain use patterns provided at meetings, in publications, or through television and radio. Second, each respondent is asked whether they are aware of this information or not. Third, they are asked to describe the types of scientific information provided to them. Any stories or anecdotes that illustrate their thoughts should be recorded.

Based on these conversations, the following scale should be used to rank the awareness they have about scientific information.

1 = no awareness of information generated by the scientific community about MPA use and ecosystem impacts.
2 = limited awareness of information generated by the scientific community about MPA use and ecosystem impacts.
3 = moderate awareness of information generated by the scientific community about MPA use and ecosystem impacts.
4 = extensive awareness of information generated by the scientific community about MPA use and ecosystem impacts.
5 = complete awareness of information generated by the scientific community about MPA use and ecosystem impacts.

A follow-up question should be asked about why they do or do not have confidence in the scientific information: to what extent do you believe the scientific information?

Also, a question to be asked about how to improve the information provided to them is: how can this information be improved?

Requirements

- Survey form.
- Interviewers.
- List of households to survey.
- Notebook and pen.
- Map of area.

Relates to goals and objectives

GOAL 6
6B 6C 6D

Difficulty Rating 2 1–5

S14

Outputs

- Narrative report with text boxes on anecdotes and stories.
- Tables and figures to clarify and illustrate important points.

How to analyse and interpret results

Summarise the data into descriptive text based on the qualitative information and quantitative data. Use tables and figures to clarify and illustrate variations in the scale ranking of confidence. Include anecdotes and stories, and opinions about the scientific information.

Strengths and limitations

This indicator can provide valuable information for improving MPA education programmes and scientific research.

Useful references and Internet links

Bunce, L., Townsley, P., Pomeroy, R. and Pollnac, R. (2000). *Socioeconomic Manual for Coral Reef Management*. Australian Institute of Marine Science, Townsville, Queensland, Australia. Available at www.reefbase.org

▼ ***Scientific information can be combined with local knowledge of the marine resources to improve management.***

TONI PARRAS

Box S13

EXAMPLE FROM THE FIELD

In Mafia Island Marine Park in Tanzania, respondents were asked to gauge the extent to which they felt they had acquired information on the marine environment from various information sources disseminated by MIMP, with the following results:

Information gained through discussions/meetings with MIMP workers in the village

	Elders	*Fishers*	*Farmers*	*Other*	*Women*	*Youth*	*Students*	*Total*
Very much	9	15	7	5	13	10	7	66
Average	8	15	11	11	5	10	5	65
Little	8	15	5	9	7	5	7	56
None	12	30	22	25	28	46	54	217
Total	**37**	**75**	**45**	**50**	**53**	**71**	**73**	**404**

Information gained through the booklet called Bahari (for primary school)

	Elders	*Fishers*	*Farmers*	*Other*	*Women*	*Youth*	*Students*	*Total*
Very much	2	4		3	2	3	4	18
Average		1		1	2	4	7	15
Little		4		3	3	3	4	15
None	35	66	45	45	46	61	58	356
Total	**37**	**75**	**45**	**50**	**53**	**71**	**73**	**404**

Information gained through calendars, leaflets and meetings conducted by the Mafia Turtle and Dugong Project

	Elders	*Fishers*	*Farmers*	*Other*	*Women*	*Youth*	*Students*	*Total*
Very much	4	12	5	5	8	10	23	67
Average	1	17	4	6	4	6	16	54
Little	5	10	11	12	8	13	9	68
None	27	36	25	27	33	42	25	215
Total	**37**	**75**	**45**	**50**	**53**	**71**	**73**	**404**

These results indicate that about 30% or so of villagers feel that they have received information thanks to the awareness-raising methods described above and that more than 50% of people feel that they have had no information at all. It is notable that even amongst primary school children only 15% have acquired information from a booklet on the marine environment (Bahari) that was specifically circulated to primary school teachers. Given the size of the resident communities within the marine park (over 15,000) these results are not as negative as they otherwise seem, nonetheless they illustrate the wide scope for further awareness-raising and will provide a baseline for ongoing environmental education efforts.

At the Far East Marine Reserve in Russia, the following groups were polled during 2002: local inhabitants, visitors to the museum, dive tourists and schoolchildren. They were requested to give an estimate of the quality of scientific information provided by the MPA specialists, to say whether they trust them when they recount the actual threats from unregulated human activity in the Peter the Great Bay (i.e. poaching, unregulated tourism on the coast, land-based pollution), and to express their expectations about the information provided by the reserve. Of particular interest is the level of trust in the reserve's information on environmental threats and the importance of the MPA. The results are summarised below:

Group	***Number of people polled***	***Level of trusting (%)***
Local people	50	Limited - 35 Moderate - 55 Extensive - 10
Outside visitors	500	Moderate - 15 Extensive - 70 Complete - 15
Dive tourists	70	Moderate - 10 Extensive - 85 Complete - 5
School children	60	Extensive - 35 Complete - 65

Percentage of stakeholder group in leadership positions

Relates to goals and objectives

GOAL 4

4B 4C

Difficulty Rating 3 1–5

What is 'percentage of stakeholder group in leadership positions'?

The percentage of stakeholder group in leadership positions measures the number of individual stakeholders from the various stakeholder groups who have been or currently are in a leadership position related to MPA management.

Why measure it?

This indicator is important to measure because it provides an understanding of the degree of equity among social groups associated with the MPA. If a range of stakeholders (especially those from minority groups) are involved in leadership positions in MPA management, a broader representation of ideas and interests is achieved; a more democratic and equitable management structure is in operation; and a greater level of participation in management is achieved. If all stakeholder groups are not represented, recommendations can be made to include non-represented stakeholder groups in a leadership position in MPA management.

How to collect the data

First, a copy of the organizational structure of the MPA management should be obtained and reviewed.

Second, the representative structure of stakeholder groups from the organizational structure should be identified.

Next, through a key informant interview of MPA management, the stakeholder groups and the representatives of the stakeholder groups to MPA management, both previous and current, should be identified.

Then through key informant interviews of MPA managers and known stakeholder groups, a listing of all stakeholder groups associated with the MPA can be prepared. The list should be cross-checked with information provided by the stakeholder groups to identify leaders and representatives.

Note that if you have difficulty in identifying the stakeholder groups using key informant interviews, a stakeholder analysis can be conducted using the methods described under indicator G12.

Requirements

- Survey form.
- Interviewers.
- List of leaders and representatives of stakeholder groups to survey.
- MPA management plan and organizational chart.
- Paper/pencil.

Each leader and representative should be interviewed in order to describe their stakeholder group history and the role of their group in MPA management.

Finally, a check should be made to see if all stakeholder groups identified through the stakeholder analysis are represented in MPA management. If a stakeholder group is not represented in MPA management it should be asked why not and whether there are plans for it to be represented. It is important to measure this indicator over time as stakeholder groups and representatives may change.

How to analyse and interpret results

Identify the total number of stakeholder groups associated with the MPA and present this in a table. Calculate the total number of stakeholder groups that have been, or currently are, in leadership positions and present these in a table. Prepare a narrative report to accompany the tables that describes the history and role of stakeholder group representation and leadership in MPA management.

Outputs

- Table of total number of stakeholder groups that have been, or currently are, in a leadership position in MPA management.
- Accompanying narrative describing the history and role of stakeholder group representation and leadership in MPA management.

Strengths and limitations

One strength of this indicator is that it provides a measure of the percentage of stakeholder groups represented in leadership positions in MPA management. However, the indicator will not measure the 'power' that each stakeholder group has in MPA management. It should be noted that some stakeholder groups may not have defined representation procedures to select their representatives or may not be organized enough to have representation.

Useful references and Internet links

Langill, S. (compiler) (1999). *Stakeholder Analysis. Volume 7. Supplement for Conflict and Collaboration Resource Book*. International Development Research Centre, Ottawa, Canada.

Box S14

EXAMPLE FROM THE FIELD

At Tubbataha Reef National Marine Park in the Philippines, the Tubbataha Protected Area Management Board, which is the policy-making body for the park is composed of 15 members, four of which are from non-governmental organizations and 11 from branches of government. With the assumption of office of the new set of local government officials in Cagayancillo last July 2001, department officers of the government have become more active. Most of the development and conservation activities are initiated by these officers under the Coastal Resource Management Programme. However, participation of fisherfolk and farmers is encouraged through the activation of various groups like the Municipal Fisheries Resource Management Council composed of Barangay Councils. These organizations are constituted by about 60% fishermen and farmers and 40% elected government officials. A Livelihood Committee was also recently formed involving representatives from farmers, fishermen and women's groups. The committee is composed of four members from government and two from private groups.

▼ ***The local community participates in management at Mafia Island Marine Park, Tanzania. Stakeholders external to the management team often actively participate or can be recruited to serve as community leaders in support of MPA management efforts.***

Changes in conditions of ancestral and historical sites, features, and/or monuments

Relates to goals and objectives

GOAL 5

5B

Difficulty Rating 3 1–5

What is 'changes in conditions of ancestral and historical sites, features, and/or monuments'?

Changes in conditions of ancestral and historical sites/features/monuments is a measure of the significance, presence and use of material features that have at some point in time become significant for a society's culture and history.

Why measure it?

This indicator can be used to measure impacts of the MPA and its activities, such as increased tourism, on the ancestral and historical site/feature/monument. This is important for maximizing compatibility between the MPA management and local culture.

Requirements

- Basemap of area.
- Camera.
- Survey form.
- Interviewers.
- Notebook and pen.
- Handheld GPS device.

The information generated by the indicator can be used for interpretive programmes and for raising cultural awareness and/or sensitivity.

This indicator also provides feedback on the level of knowledge about any site/feature/monument, as well as its condition to assess how well the MPA contributes to preserving the community's and society's culture and history.

If appropriately designed, MPAs can provide protection not only to living marine organisms and habitat, but also to valuable cultural resources such as historic sites and shipwrecks.

FRANCIS ABBOTT/NATUREPL.COM

How to collect the data

First, a basemap of the land and sea area around the MPA should be prepared. Second, all ancestral and historical sites/features/monuments on the land and sea should be identified on the map. Third, historical profile information should be collected. This involves addressing the following questions:

- ❑ What is the historical importance of the site?
- ❑ What local folklore is associated with the site?
- ❑ What is the condition of the site?
- ❑ What is the level of restoration of the site?
- ❑ What is the level of access to the site?
- ❑ What is the level and availability of interpretive materials?

Information on these sites/features/monuments can come from many sources. Secondary data on the history of the area is available in libraries. Interviews should be conducted with local government officials, national museums, community historians, and national or university archaeologists. Interviews should also be conducted with key local informants, such

as elders and traditional leaders, to identify these sites/features/monuments. Local fishers may need to be interviewed to locate sites/features/monuments at sea. It should be noted that many traditional sites in the community, such as burial grounds, will need to be identified.

In addition, photographs should be taken from all angles and sufficiently close to show details of wear and tear. A scale can be used to rank the condition of the site/feature/monument. A scale of 1 to 10 can be used where 1 is very poor/deteriorating condition and little knowledge of the site/feature/monument and 10 represents excellent condition and high knowledge about site/feature/monument.

A survey of the site/feature/monument should be conducted at least every five years unless a major event, such as a natural event (hurricane, flooding), change in access, or change in cultural attitude, has occurred.

How to analyse and interpret results

Prepare a narrative text describing the sites/features/monuments. It should include location on the map, detailed photographs, and copies of significant secondary source publications/documents (e.g. brochures, historic documents).

Strengths and limitations

A limitation to this indicator is that access to the site may be difficult. Another challenge is identifying all the important sites/features/monuments. This may require understanding the local culture and talking to knowledgeable local residents about these areas. This indicator may have limited application in many places, but be useful in other places, such as a World Heritage Site, where culture is a major factor.

Outputs

- Narrative text describing the site/feature/monument.
- Basemap with locations of cultural resources and historic sites.
- Photographic documentation.

It will be important to work with an archaeologist and a historian as much as possible to make sure that all sites are identified. Older members of the community should be identified and interviewed as they may have knowledge of such site/features/monuments.

Useful references and Internet links

McClanahan, T.R., Glaesel, H., Rubens, J. and Kiambe, R. (1997). "The effects of traditional fisheries management on fisheries yields and the coral reef ecosystems of Southern Kenya". *Environmental Conservation* 24(2): 105–120.

Mascia, M. (2002). "The social dimensions of marine reserve design and performance". Draft manuscript submitted for inclusion in the book by J. Sobel (ed.) *Marine Reserves: their science, design and use*. Center for Marine Conservation. Washington, DC, USA.

Fiske, S.J. (1992). "Sociocultural aspects of establishing marine protected areas". *Ocean and Coastal Management* 18: 25–46.

Kelleher, G. and Recchia, C. (1998). "Lessons from marine protected areas around the world". *Parks* 8(2): 1–4.

Roberts, C.M. (2000). "Selecting marine reserve locations: optimality versus opportunism". *Bulletin of Marine Science* 66(3): 581–592.

JIM THORSELL/IUCN

The St Elias World Heritage site is a transboundary MPA with sections in Yukon (Canada) and Alaska (USA). Transboundary sites can present challenges to governance.