# Managing Marine Protected Areas

## A TOOLKIT for the Western Indian Ocean

2004

**PUBLISHED BY**

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**in collaboration with**

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WI MSA

IUCN
The World Conservation Union

UNEP

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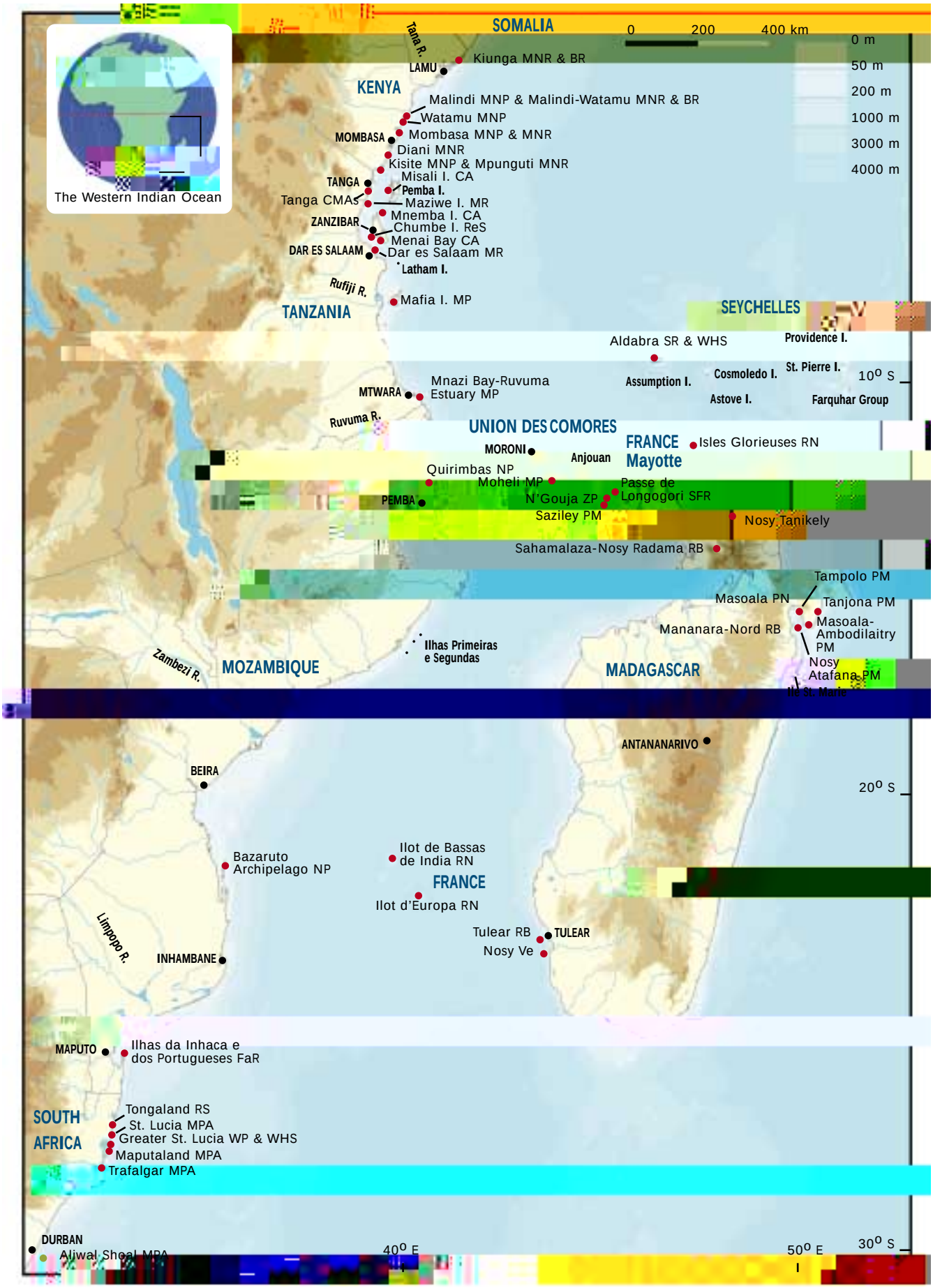
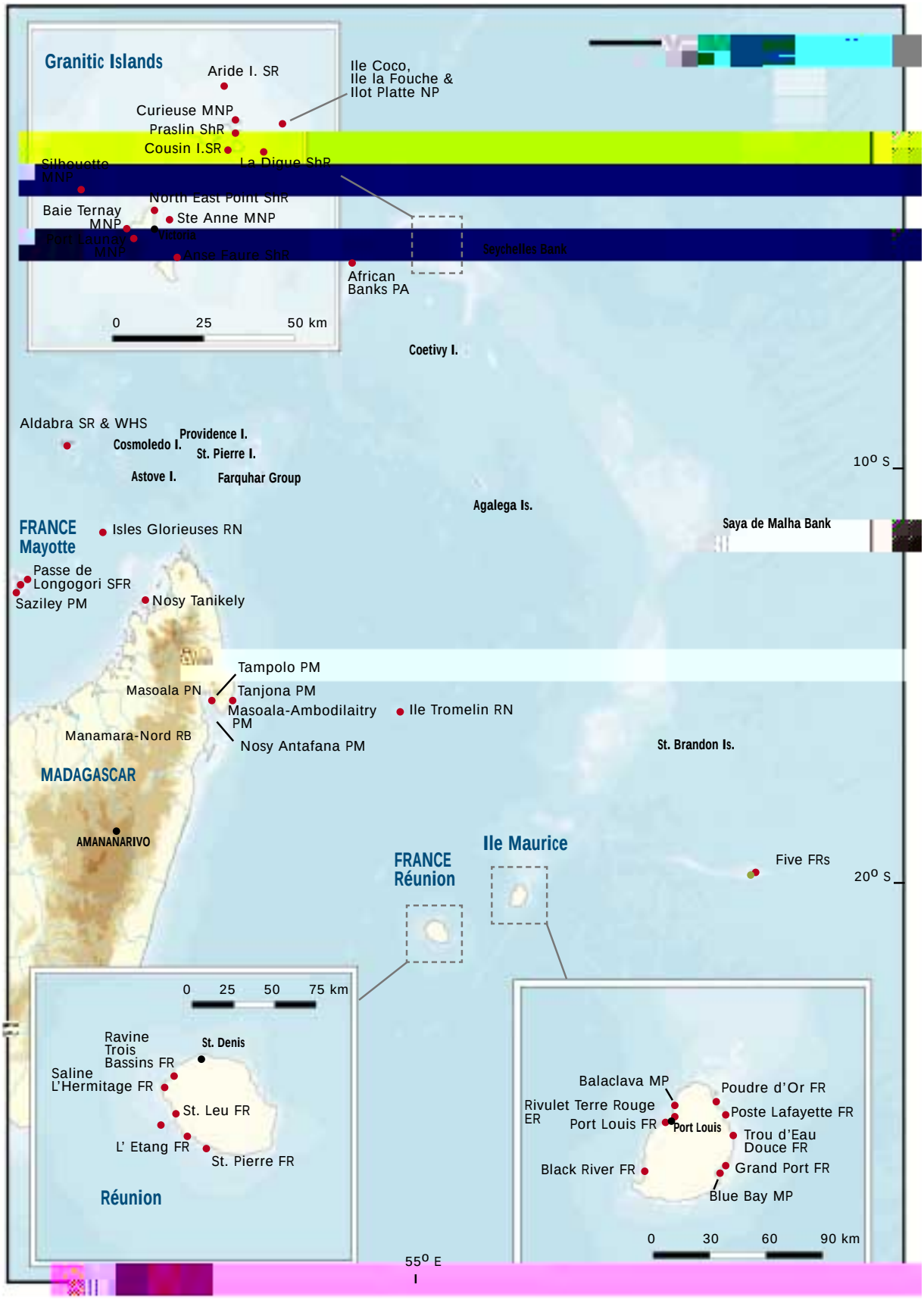
MPAs in the WIO are supported by a host of managers, wardens, rangers, community members and others. These MPA managers are tasked with having to deal with a multitude of different situations, issues and problems on a daily basis, often in remote locations, without easy reference to sources of information or help. These may range from purchasing a boat, managing staff, annual planning, monitoring fish populations in the MPA, building an information centre, consulting local villagers, to writing a proposal to secure funding. This is not an easy job and requires a diverse array of skills. Recognising this need, partners involved in the IUCN/NORAD WIO Marine Biodiversity Conservation Project decided to publish a Toolkit for managing MPAs in the WIO. This consists of a ring-binder of theme sheets, each of which addresses a key issue faced by an MPA manager, with a focus on the situation in the WIO. The Toolkit also has a complementary website ( ) and CD-ROM.

The Toolkit was designed to support MPA managers in the WIO by providing them with a hands-on guide to a diverse array of topics, ranging from Communications, Monitoring Coral Reefs, Energy Sources, Solid Waste Disposal, to Octopus




See overleaf for explanation of abbreviations used for MPA names.




Abbreviations for MPA names:

| | | | | | |
|---|---|---|---|---|---|
| BR | Biosphere Reserve | MP | Marine Park | RN | Réserve Naturel |
| CA | Conservation Area | MPA | Marine Protected Area | RS | Ramsar Site |
| CMA | Collaborative Mngmt Area | MR | Marine Reserve | ReS | Reef Sanctuary |
| ER | Estuary Reserve | NP | National Park | SFR | Strict Fishing Reserve |
| FaR | Faunal Reserve | PA | Protected Area | ShR | Shell Reserve |
| FR | Fishing Reserve | PM | Parc Marin | SR | Special Reserve |
| MNP | Marine National Park | PN | Parc National | WHS | World Heritage Site |
| MNR | Marine National Reserve | R | Reserve | WP | Wetlands Park |
| | | RB | Réserve de la Biosphère | ZP | Zone de Protection |

| | | | | |
|---|---|---|---|---|
| | Marine Park | 2001 | n/a | 404.00 |
| | Réserve Naturelle | 1975 | IV | .. |
| | Réserve Naturelle | 1975 | IV | .. |
| | Réserve Naturelle | 1975 | IV | .. |
| | Réserve Naturelle | 1975 | IV | .. |
| | Strict Fishing Reserve | 1991 | VI | 13.80 |
| | Parc Marin | 1991 | II | 25.90 |
| | Zone de Protection | 2001 | - | 2.00 |
| | Parc Marin de la | 1997/98 | VI | 18.20 |
| | Fishing Reserve | 1992 | VI | .. |
| | Fishing Reserve | 1978 | VI | .. |
| | Fishing Reserve | 1992 | VI | .. |
| | Fishing Reserve | 1992 | VI | .. |
| | Fishing Reserve | 1992 | VI | .. |
| | Fishing Reserve | 1992 | VI | .. |
| | Marine National Reserve | 1979 | VI | 250.00 |
| within | Biosphere Reserve | 1980 | - | 600.00 |
| | Marine National Park | 1968 | II | 6.30 |
| | Marine National Park | 1968 | II | 10.00 |
| | Marine National Reserve | 1968 | VI | 245.00 |
| | Biosphere Reserve [partially covers the MNR] | 1979 | - | 196.00 |
| | Marine National Park | 1986 | II | 10.00 |
| | Marine National Reserve | 1986 | VI | 200.00 |
| | Marine National Park | 1978 | II | 28.00 |
| | Marine National Reserve | 1978 | VI | 11.00 |
| | Marine National Reserve | 1995 | VI | 75.00 |

| | | | | |
|---|---|---|---|---|
| cont. | Fishing Reserve | 1983/2000 | IV | 25.40 |
| | Estuary Reserve | 1999 | - | .. |
| | Fishing Reserve | 1983/2000 | IV | 5.70 |
| | Five Fishing Reserves proposed 1984 - 1998: | | - | .. |
| | Reserve | .. | - | 1.20 |
| | Reserve | .. | - | 9.50 |
| | Reserve | .. | - | 5.20 |
| | Reserve | .. | - | 0.30 |
| | National Park | 1971/2001 | II | 1,430.00 |
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Management of protected areas is increasingly being carried out in the style referred to as 'management by objectives'. This means that it is proactive i.e. designed to achieve a specific aim and set of results, rather than reactive, or simply responding to issues that arise. This management style requires that MPA managers and personnel look critically at the goals and objectives of the MPA (which are often very general), and develop a clear understanding of the values and importance of the site, and thus the reasons why it was protected. There are four important steps in 'management by objectives':

- Establish clear, concise objectives;
- Develop realistic plans for achieving these (see sheet C3);
- Monitor performance and achievement (see sheet G9);
- Take corrective (or adaptive) management.

Project logframes (see sheet C4) also use the terminology of goals and objectives. It is important not to confuse the MPA's goals and objectives with those of specific projects that it is involved with, though they may coincide.

## G

Sometimes also called visions, aims, or long-term objectives, these are general summaries of the desired future state of an MPA. Goals should be:

- **V** – a positive statement outlining the desired long-term state of the MPA.
- **B** – a broad and general statement that captures the vision of the MPA.
- **B** – short and succinct so that it can be remembered and easily communicated.


IUCN/WCPA-Marine has compiled generic goals (Pomeroy ., 2004), based on global survey of MPAs: five for biodiversity (e.g. 'individual species protected'); six for socio-economic issues (e.g. 'food security enhanced or maintained'; and five for governance (e.g. 'effective management structures and strategies maintained'). Examples of MPA goals in the WIO are:

**C** Seychelles (called a vision): , and:

Mozambique (called a long-term objective):

## B EC VE

Sometimes called purposes, these are the specific statements that describe how the goal will be reached. They should relate to the key values of the MPA (i.e. important species or ecosystems) or to major areas of management activity (e.g. tourism, education). The objectives help managers with planning, measuring progress, and evaluating success, but this is difficult if they are poorly expressed or provide only vague guidance (e.g. they are sometimes worded more like goals). Two or more objectives are usually required to reach the goal, and should be:

- Specific and easily understood by all stakeholders;
- Written in terms of what will be accomplished, not how to go about it;
- Achievable, being quite clear when the objective has been reached;
- Achievable within a reasonable, defined time period; this should not usually exceed 10 years, although longer may be required for long-lived, slow-reproducing species (e.g. turtles and dugongs), or the recovery of degraded habitats with slow recruitment (e.g. coral reefs);
- Measurable and able to be validated, thus easier to set up a monitoring programme;
- Realistic, practical and appropriate within the local context. For example, an objective to exclude resource use in an MPA would be impractical if local communities depend on this area for food.

WCPA-Marine has compiled generic objectives to help MPAs develop their own. These comprise:

**26 B** e.g. Focal species abundance increased or maintained;

**21** e.g. Nutritional needs of coastal residents met or improved.

**21 G** e.g. Management planning and process effective.

Cousin Island Special Reserve has eight objectives, five covering biodiversity and natural values, two covering socio-economic issues, and one covering governance:

1. To maintain viable populations of endemic land birds and internationally important breeding seabird populations on the island.
2. To maintain or establish threatened endemic plant species where appropriate, so long as this does not conflict with objective 1.
3. To maintain and enhance viable populations of the island's endemic terrestrial vertebrates and invertebrates.
4. To protect and maintain the integrity of the island's coastal and littoral habitats, especially the coral reef and its associated flora and fauna and the internationally important breeding populations of hawksbill turtle.
5. To understand and mitigate long-term and external influences.
6. To use the island's conservation features as a vehicle to raise and maintain education and public awareness.
7. To maintain a safe, effective and sustainable physical infrastructure for carrying out the reserve's management plan.
8. To administer and manage the reserve in a professional manner ensuring that all Nature Seychelles standards are maintained or exceeded

## DEVE G G D B EC VE

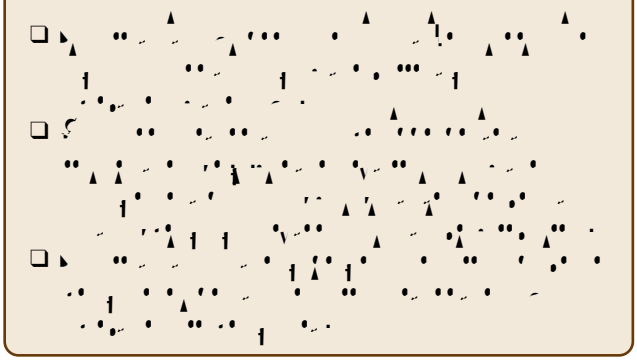
In order to ensure that a full understanding of the ecological and socio-economic values of an MPA is used in the development or revision of the goals and objectives, the process should be participatory and involve consultation with all stakeholder groups. Many of the objectives of MPAs in the WIO are worded more as goals, and would benefit from being made more specific (the example of Cousin Island illustrates objectives that are based on a good understanding of the values of the protected area). The generic objectives developed for MPAs by WCPA-Marine, and by Hockey & Branch (1997) for South African MPAs may be helpful when revising or developing those for other MPAs. However, it is essential that the process uses a careful analysis of the specific values and management issues at the site in question.

Sometimes, the need to make objectives 'measurable' leads to objectives being defined with quantitative targets e.g. 'Over the next three years, income from MPA tourism to increase by 4% a year', or 'Average ecological knowledge of visitors to increase by 50% within 5 years'. This approach is not recommended as, even when it is based on good information, unforeseen events could make such objectives unrealistic and inappropriate (e.g. the first example is vulnerable to changes in the global economic situation). Further, such specific parameters may be difficult to measure (e.g. in the second example, there are no simple techniques for quantifying 'ecological knowledge of visitors'). Statements like this may be useful as targets to encourage good performance in an MPA, but objectives are best left open-ended (e.g. 'Income from MPA tourism to show a significant increase within 3 years').

The goals and objectives are generally laid out in the legislation or agreement used in setting up the MPA, and defined in more detail in the management plan. They should be assessed at intervals (preferably when the management plan is reviewed) to see if they need revision. If they have been formalised through legislation, this may not be immediately possible, but it may be useful to identify any weaknesses for future revision opportunities.

Once the objectives have been determined, the MPA can be categorised according to the IUCN system (see sheet A1), and a monitoring and evaluation programme can be developed (see sheet G1), using indicators specifically selected for measuring the objectives.

### KEY POINTS FOR THE MPA




Eagles, P.F.J., McCool, S.F. & Haynes, D.A. 2002.
IUCN, Gland, Switzerland and Cambridge. 183pp.

Hockey, P.A.R. & Branch, G.M. 1997. Criteria, objectives and methodology for evaluating marine protected areas in South Africa. **18**: 369-383.

Margoluis, R. & Salafsky, N. 1998.

arrangements), and to set licences and other fees. Regulations should also address:

- Public rights to which people are ordinarily entitled e.g. rights of navigation, fishing and mangrove harvesting;
- Public activities that are generally tolerated but that usually have no legal basis e.g. use of the beach;
- Private rights e.g. ownership of the foreshore or private/communal fisheries.

The territorial sea-bed is usually state property, but the foreshore between high and low water marks and the adjacent coastal land can be privately owned, which can create difficulties. For example, MPAs may have no control over turtle nesting areas above high water mark. There may also be private or customary and traditional fishing rights in inshore waters. Careful consultation is thus required before regulations are introduced.

### T E EG T E EV T

Many other pieces of national legislation are relevant to an MPA and essential for its effective management (e.g. for fisheries, forestry and mangroves, shipping, waste disposal, mining, tourism, wildlife and E.I.A). Enforcing this can be difficult if the mandates of these government agencies take precedence over that for the MPA. Unless the primary legislation resolves this, such conflicts can undermine the effectiveness of the MPA. Harmonisation of MPA legislation with both primary and secondary fisheries legislation is particularly essential. An MPA manager must also have a good understanding of national legislation relating to employment (MPA personnel), the judiciary (powers of arrest and court procedures), and financial activities (management of the MPA's finances and fundraising).

### C

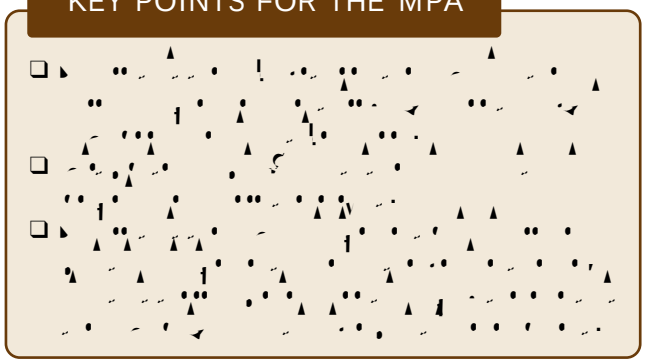
It is important to understand the difference between legislation and policy. Policies are non-binding, guiding principles, usually for specific sectors (e.g. fisheries, forestry) that outline the government's intentions in relation to international obligations and national development. The legislation should then be drawn up to permit implementation of the policy. Many countries are revising their policies relating to the environment and natural resources to reflect new thinking and the obligations of international agreements. It often takes longer to revise the legislation which means that national laws may lag behind the stated policy of the government.


Gibson, J. & Warren, L. 1995. Legislative requirements. Chap 3. : Gubbay, S. (ed.) . Chapman and Hall, London.

Kimball, L.A. 2001.

Some large multiple-use MPAs are very similar to ICM programmes, in that they allow for different uses of marine and coastal resources within an area, and the involvement of large numbers of stakeholders in the management process. Such MPAs may be able to help catalyse the development of an ICM programme in the area. Where programmes are already in place, the MPA needs to become one of the ICM 'stakeholders' and should share information and experiences.

## KEY POINTS FOR THE MPA




Best, B. 2003. Biodiversity conservation and integrated coastal management: looking beyond marine protected areas. / ... N ... **43**: 20-23.

Cicin-Sain, B. & Knecht, R.W. 1998. / ... ... Island Press, Washington D.C.

Francis, J. & van't Hof, T. 2003. Module 1. The Marine Environment / Francis, J. ... (eds.) ... CZMC/Univ. Dar es Salaam, WIOMSA, The World Bank.

NOAA & WCPA. (in prep.) ... .t (Cnt ...

Chonguica, E. & Brett, R. (eds.) 2003. . IUCN-The World Conservation Union. Available from IUCN Regional Office for Southern Africa, 6, Lanark Road, Box 745, Harare, Zimbabwe.

Gove, D.Z. 2003. . Centre for Sustainable Development of Coastal Zones, MICOA, Maputo. 10pp.

Grange, N. & Odendaal, F. 1999. . SEACAM, Maputo, Mozambique. 197pp.

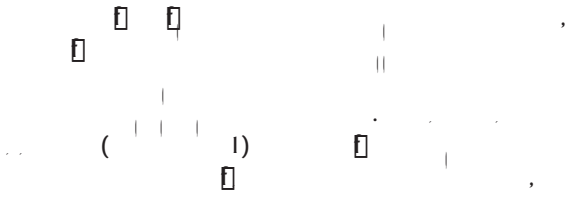
Hambrey, J., l. 2000. t. SEACAM, Maputo, Mozambique. 213pp.

Wamukoya, G.M. & Ludeki, J.V. 2002. . A CREEL Publication No. 2. Centre for Environmental Legal Research and Education creel9vonD9-Zewilablpcomvbn.Egdogi&r

**[illegible] ( ) -** A general term for one or a combination of the above activities. Using several methods help to corroborate (or 'triangulate') the findings. Can be used to identify stakeholders, critical issues and priorities.

**[illegible] -** The process of identifying specific remedial actions for each management issue, and assigning a responsible person or organisation for implementation.

**[illegible] E [illegible] -** Involvement of stakeholders in monitoring of the physical, organisational and management aspects (see sheets in section G).



## KEY POINTS FOR THE MPA

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## CASE STUDY

### Resolving a conflict with stakeholders in Masoala National Park

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The term ‘gender’ refers to the socially-determined roles,
rights and responsibilities of men and women and the
relationship between them. derR?;;BLLPS3/CB?‘NderRil’;?R;D3BLC?//3LGP3eB?‘Nthem. GWVB?‘NderR?;‘R?;;BLnR? GWVC;‘’;?R;D3BLC?//cB’VI
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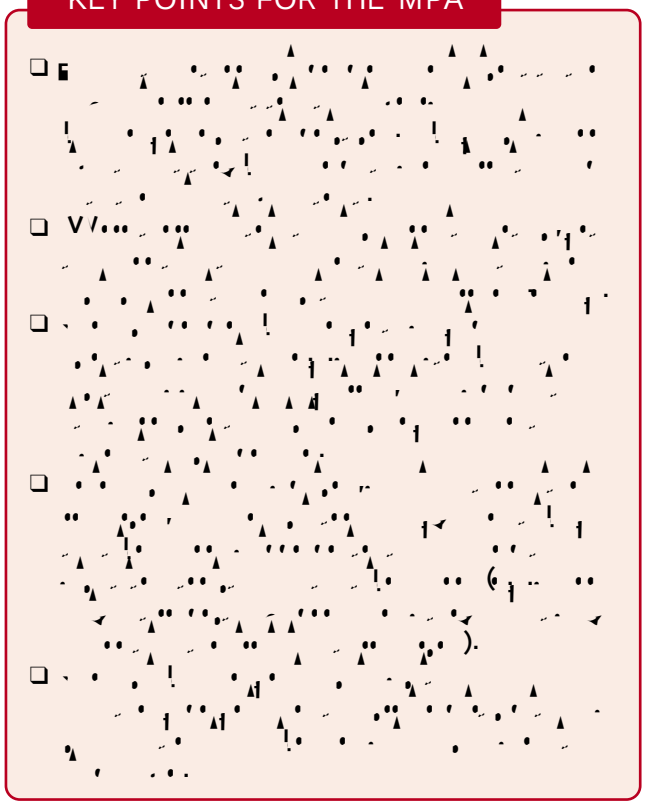
in initiatives undertaken in collaboration with the Fisheries Department, NGOs and other government agencies, to introduce and enforce regulations banning damaging fishing methods and to increase the use of local knowledge in management. This has been particularly important in Diani, where a Marine National Reserve was gazetted in 1995 but never implemented because of opposition from local communities. New initiatives that respect the indigenous people of the area and their traditions may prove to be more effective.

## KEY POINTS FOR THE MPA




Beltran, J. 2000. . IUCN, Gland, Switzerland and Cambridge, UK.

Bunce, L., . 2000. . GCRMN/IUCN/AIMS/NOAA., AIMS, Townsville, 251pp. -000.

Haggan, N., Brignal, C. & Wood, L. (eds.) 2003. Putting Fishers'

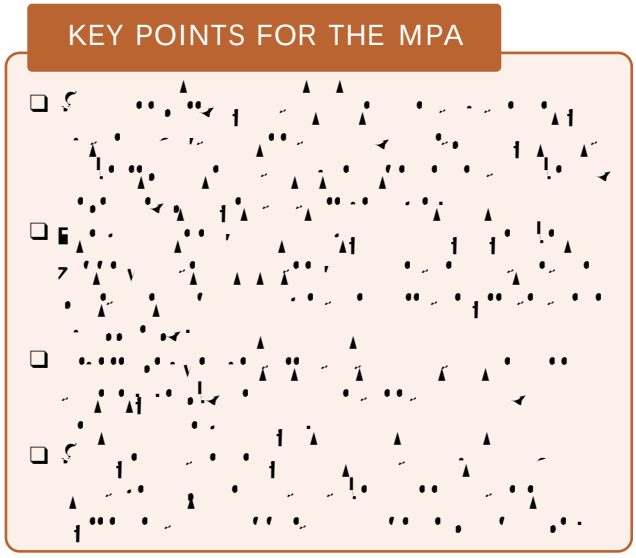
A map of the MPA has a wide range of uses. It improves the quality of leaflets, posters, souvenirs, and other materials for visitors; it enhances reports; it assists with research and monitoring; and it helps to make boundaries and zonation schemes clear to MPA users. Oil spill contingency planning (see sheet K3) requires sensitivity mapping to highlight areas vulnerable to oil spills.

Maps designed for use at sea are called ‘charts’. They show water depth (bathymetry), currents and details related to navigation (e.g. positions of channels, buoys, islands,

The following characteristics affect the use of maps:

- The size of the MPA, the scale required and the size of the printed map (and thus the paper to be used) must be chosen on the basis of needs and expected uses. Scale refers to the degree of reduction of the graphic

## KEY POINTS FOR THE MPA




Anon 2004. Acoustic tracking of fish: how continuous data on fish movement could change the planning of MPAs. **5**(9): 1-3.

Francis, J. & van't Hof, T. 2003. Module 1. The Marine Environment and Protected Areas. : Francis, J., . (eds.) . CZMC/Univ. Dar es Salaam, WIOMSA, The World Bank.

Hocking, M., Stolton, S. & Dudley, N. 2000. . IUCN, Gland, Switzerland and Cambridge, UK. 121pp.

Marshall, P. & Schuttenberg, H. 2004. . GBRMPA/NOAA.

Obura, D.O. (in review). Resilience, coral bleaching and MPA design.

Phillips, A. 2002. . IUCN, Gland, Switzerland and Cambridge, UK.

Salm, R.V., Clark, J.R. & Siirila, E. 2000. . 3rd Edition. IUCN, Washington, D.C., USA.

Stein, D. 2003.Tips for developing marine boundaries. **4** (7).

Thomas, L. & Middleton, J. 2003. . Best Practice Protected Area Guidelines Series No. 10, IUCN, Gland, Switzerland and Cambridge, UK. 79pp.


## CASE STUDY

### Zonation scheme in Quirimbas National Park, Mozambique

Quirimbas National Park covers some 6,000 km$^2$ of land and 1,500 km$^2$

- Incorporate comments and publish final Plan (preferably both as a hard copy and electronically)
- Submit plan for approval (the mechanism for this varies between countries) and disseminate it.

Where an MPA does not have sufficient capacity or expertise to prepare a Plan, it may be useful to hire a consultant. Such a person must work closely with MPA personnel and stakeholders so that when he/she leaves all involved feel ownership of the Plan and are willing to implement it.

## C TE T

The Plan may be a single document covering all aspects of management or a general 'umbrella' document. In the latter case, specific plans are developed separately, such as a day-to-day operational plan, annual work plans, detailed zoning plan, business and financial plan, and visitor plan. These may have different target audiences and may need to be prepared in different ways. The level of detail to be included in the plan will be decided by the site manager and the relevant management agency.

The Plan should present both the stategic and operational elements of the MPA and clearly link them, be flexible enough to cater for unforeseen events and interpret national policies in relation to the MPA, taking into account obligations under international conventions. It should identify the assumptions (e.g. adequate funding and political stability) that have to be made for successful implementation; these may be beyond the manager's control but may have consequences that require contingencies. Many Plans give too much description; detailed biological and socio-economic information can be placed in annexes or a separate volume. Good presentation, with maps and other visual aids, will help to ensure the Plan is used. The text should be clear, concise and accurate. It may be necessary to translate it, or key sections, into local languages, and prepare a summary for broader dissemination.

### KEY POINTS FOR THE MPA

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Amend, S., . 2003.

## PRINCIPAL METHODS

**Factor Analysis (FA) -**

**Principal Component Analysis (PCA) -**

**Redundancy Analysis (RDA) -**

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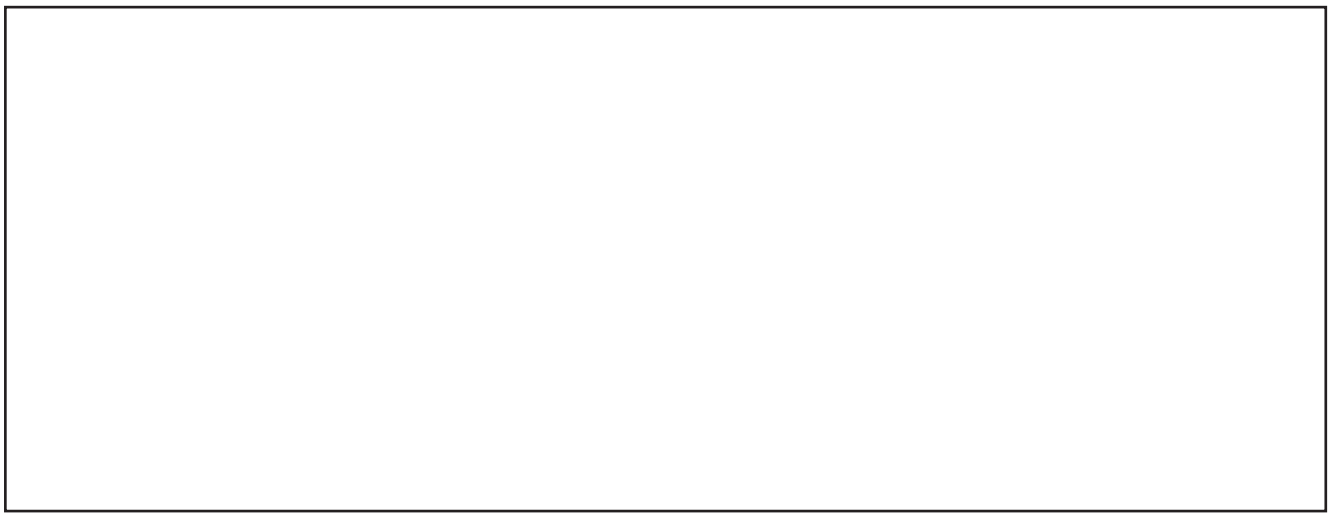


The personnel of an MPA are one of its key resources and an important task for the manager is to put in place a group of staff who are capable of working together as a team. The operational part of the management plan (or the operational plan if this is a separate document) should identify the activities and tasks that are needed to meet the objectives of the MPA. These will range from issuing permits and patrolling, to research and monitoring, education and interpretation, community consultation and facilitation, and a range of support duties. Each task will need to be broken down into a set of roles and responsibilities, with individual goals that can be assigned to different staff members. In this way the needs in terms of capacity and skills can be assessed. In reality, some tasks may be carried out by several people; conversely, individual staff members may have several responsibilities.

The number of permanent staff employed by MPAs in the WIO is highly variable and can range from one or two to over 50. MPA staff are usually a combination of professional and technical staff with skills in key programme areas (e.g. fisheries, monitoring or community activities) and support staff with more general skills, but there tends to be much overlap in jobs. Important staff positions include field staff or rangers, boat crews, MPA manager, communications officer, research personnel, community development coordinator and law enforcement officer. Support staff such as cooks, mechanics, cleaners and security guards may also be needed. In general, the larger the area of the MPA and the greater the number of visitors (e.g. involved in recreational or commercial activities), the higher the staff levels. The work force can be increased by using seasonal staff or volunteers, as well as consultants or contract staff.

In large MPAs, there may be sufficient funding to appoint a human resources manager who would be responsible for management of personnel. However, this is not possible in most WIO MPAs, and this responsibility often falls to the senior manager and/or the overall management agency (whether government or NGO). A good manager will be in touch with and approachable by employees and will be aware when there are problems relating to performance, job satisfaction or working relationships.

It is also important to ensure that all aspects of recruitment are carried out as fairly, efficiently and transparently as possible. Following appointment, a probationary period (usually 3-6 months) may be appropriate to see if the new employee performs well. The new staff member should be given the necessary training or induction course and helped to settle in.

### D -T -D T FF E F CE

All staff must have clearly assigned roles and responsibilities, laid out in their Terms of Reference and individual work plans. These should relate clearly to the job description, and set realistic and time bound targets or measurable standards that must be accepted by both employer and employee. 'Output' rather than 'input' related work standards should be set, e.g. 'MPA vehicles must not break down as a result of lack of engine oil', rather than 'check the engine oil once a week'; 'the beach by the guest houses must be clean' rather than 'clean the beach every morning'.

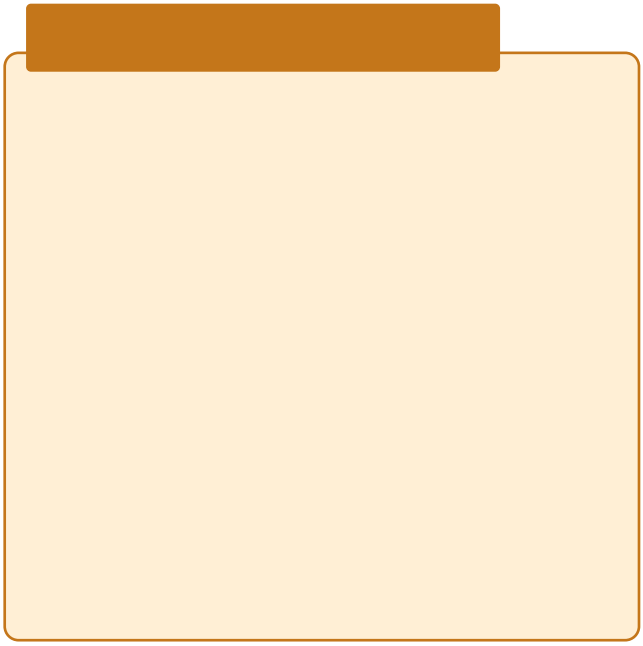
Staff often prefer to wear uniforms rather than their own clothes, as it saves on wear and tear, and provides them with the necessary status when dealing with visitors, stakeholders and particularly those who may be causing problems for the MPA.

### E F CE

An annual performance appraisal for each staff member is

## SELECTING CONSULTANTS

## PREPARING TERMS OF REFERENCE (TOR)



Individuals participating in one of the organised volunteer programmes will usually be paying a substantial sum of money to cover their travel and costs. Thus they are not only providing their time for free, but they are also paying for the experience. It is important that the MPA personnel they work with understand this – there is often an assumption that such volunteers are getting something for free. Furthermore the volunteers will be expecting some personal benefits, usually in the form of gaining experience or on-the-job training. Many volunteers of this type are highly motivated and can make a major contribution over a short period of time. On the other hand, they may require support which takes time (particularly if they are from overseas) and there can be problems if volunteers choose to ignore, or have not been fully briefed on, cultural issues and dress codes, and as a result behave inappropriately in local villages.

## KEY POINTS FOR THE MPA

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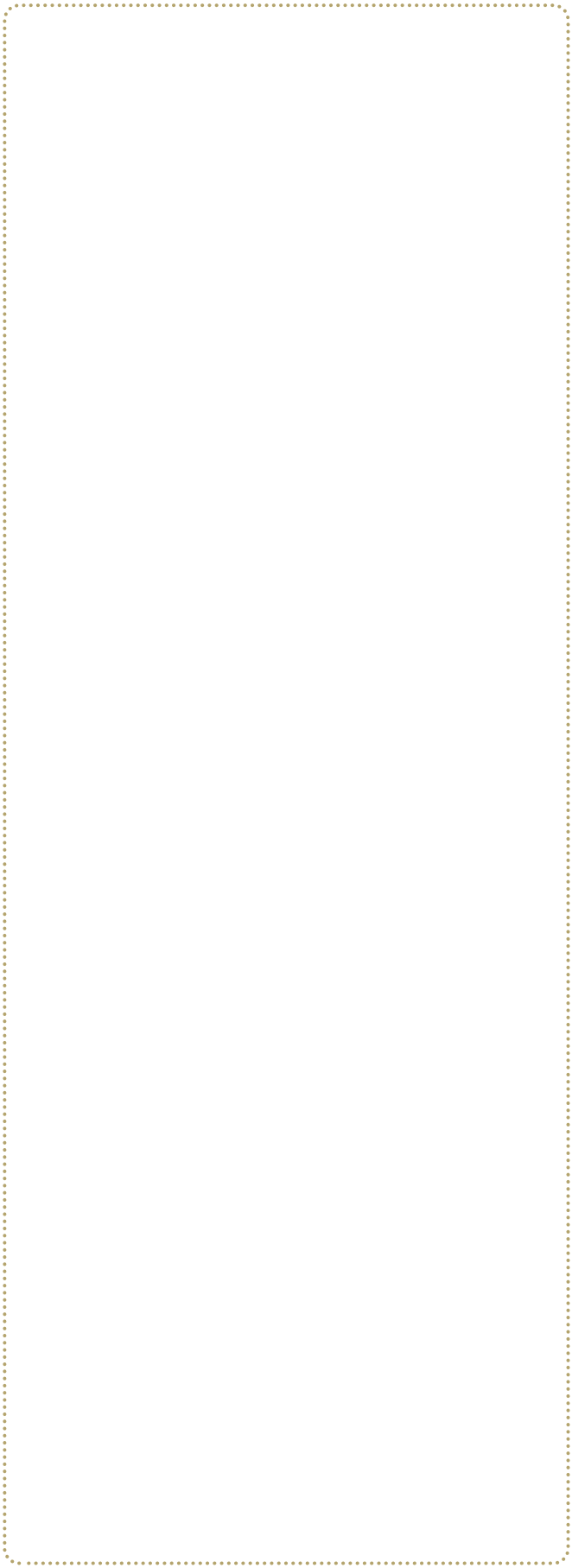

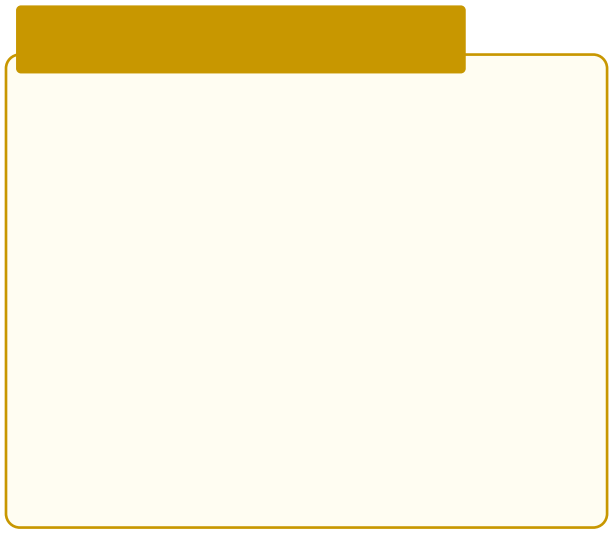

Donors vary considerably in their interests and what they wish to fund. Poverty alleviation is currently a priority for many bilateral donors, with an emphasis on good governance, institutional strengthening, public sector reform and integration of biodiversity issues with sustainable development. Foundations and NGOs also support sustainable development, but many have a strong focus on biodiversity conservation. Many funding organisations look for programmes rather than individual projects, and there is an increasing expectation of professionalism, good performance, and strong emphasis on learning and sharing of lessons. Bilateral and multi-lateral donors and foundations generally deal only with large-scale funding, but local companies, NGOs, and embassies often give small grants. Scholarships for staff training and development are available, usually on a competitive basis, from some embassies and international organizations.

A long period may elapse between submitting a proposal and hearing if it has been successful, so it is important to start the process well in advance of any potential funding shortfall, and to engage with several potential donors. Long-term support by a donor providing regular small sums of money can be as valuable and often more cost-effective than a one-off large grant that may be difficult to manage and is not renewable. Reliance on donor funding can result in fluctuations in activity levels, unless attention is paid to ensuring that there are no gaps between projects.

**CE F F D G**

**B** - The USA, Canada, Japan, Australia, someqEBif RJhe'I:qEBif RLif RJhe'IntrqEBand RJ(qEBinternam ternames EBthan RJ(qEEBtEBoften RJ(erRIZqL ensurinEusalRJ RJ(qErojUnL

**Ca G G B D**

with media coverage). In some cases tourism operators may cover most running costs of an MPA (e.g. Chumbe Reef Sanctuary in Zanzibar) or make in-kind contributions.

### E G

Proposals should not be written as begging letters, but rather as an invitation to a donor to share in achieving a particular goal. Donors receive numerous applications. Transparency, clarity and accountability are key elements, and the more focused and concise the application, the better the chance of success. Proposals for small grants should be short and to the point. For larger grants, a maximum length of about 15 pages is appropriate, depending on the format required. The proposal should be comprehensive, refer to partner organisations that the MPA is working with, and have an adequate budget for all the activities envisaged: there may be little opportunity for extensions or upward budget revisions once a funding agreement is in place. If funding is needed for only a part of a larger project, this needs to be clear.

## KEY POINTS FOR THE MPA

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- ❑
- ❑
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- ❑
- ❑
- ❑


Conservation Finance Alliance 2003. . Available at: or CD.

IUCN 2000. . IUCN/WCPA Financing Protected Areas Task Force in collaboration with the Economics Unit of IUCN. IUCN, Gland, Switzerland and Cam(CD.

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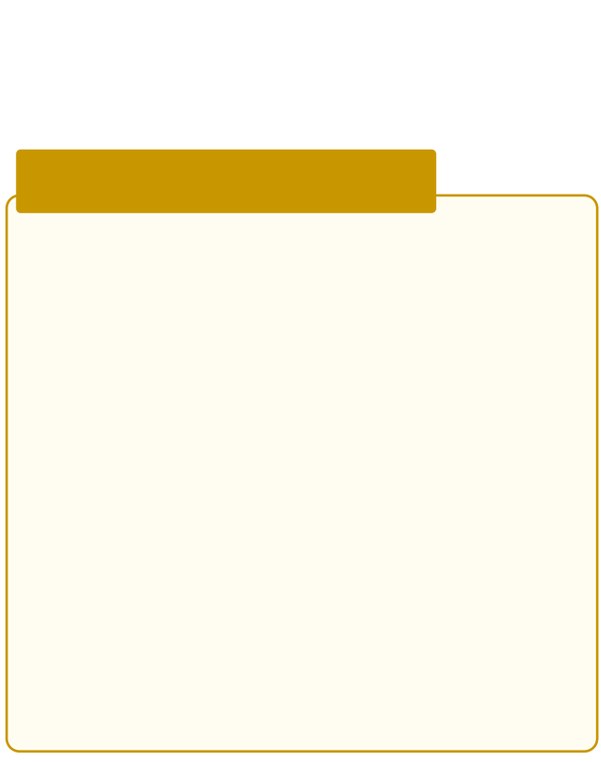

## VE T T DC JEC T

It is important to decide at an early stage whether natural ventilation will be adequate or if climate control is needed. Effective natural ventilation in the tropics requires open plan spaces with high ceilings, and windows and doors located to maximize air movement, with usually at least two windows per room, on different walls. Climate controlled spaces by contrast are sealed and of minimum volume compatible with their function. Sometimes local climatic factors or equipment that is sensitive to dust or salt laden air will dictate the decision. Dehumidifiers or air conditioning can however require alot of supply.

## JE D T T

Freshwater is often a scarce resource in MPAs. It is important to establish if seasonal or permanent streams or springs, wells or boreholes exist in the vicinity. If water is available locally, an assessment should be made of extraction impacts on ecosystems or users downstream. Ground-water aquifers can be accessed relatively inexpensively, if not deep, but must not be over-used, as in coastal situations this often leads to salt water intrusion. Check quality of locally-available water, particularly salinity.

If mean annual rainfall is more than 700mm and spread over three months or more, rainwater harvesting may be feasible. This requires a catchment area (roofs), capturing system (gutters and drains) and storage (ground or surface tanks). A roof of 50 sq. m, with an annual rainfall of 1,000 mm should provide 50 tonnes of freshwater a year, or about 140 litres per day.

Minimise water consumption and wastage. Recycle water by separating drains carrying ‘grey water’ (from washing and kitchen facilities) from toilet drains, and using the grey water on gardens or vegetables. Ensure none remains stagnant to attract mosquitoes. Consider water saving

The management of an MPA requires a reliable energy supply to provide power for many activities and facilities, ranging from remote radio communications to staff accommodation, offices, and visitors' centres. Energy requirements are likely to include lighting, charging batteries, air compressors, computers, fridges and possibly laboratories.

Many MPAs do not have access to mains electricity supplies and, although generators are available in every size, they require fuel and regular maintenance, and produce noise and pollution. Traditional electricity generation from fossil fuels contributes to carbon emissions and thus to global clih L8fossil 21s9 58[td7(H8As 21(H8dgs 21(H8and 21(S‘9gh 21(9 56H5(ssibly zHb‘(n

Solar energy can be used directly to heat water for washing and cooking. The simplest method is a black plastic container but, for a continuous supply, thermal solar panels are available comprising an array of water pipes under a glass cover which can be connected to the water supply. Many good products are available to meet any of these requirements, including more sophisticated heat exchange systems.

Electricity generated by solar energy has relatively high capital outlay costs but low operating costs. Photovoltaic panels, which generate electricity when exposed to light, are available in many sizes and when linked together, form an array. Individual panels are typically rated at 60-80 Watts. The panel rating represents the maximum power output which occurs when the panel is perpendicular to direct sunlight. Solar panels mounted so as to 'track' the sun, for example with morning, midday and afternoon positions, greatly increases efficiency. They need to be kept clean if they are to remain efficient. This may occur naturally through rain, but cleaning may need to be made part of the maintenance schedule.

### B 7]E E

Whilst both solar panels and wind turbines can directly drive small loads, including borehole water pumps, normally the energy generated is used to charge batteries and the load drawn from them. This means that power will still be available when the sun is not shining and the wind not blowing. Batteries can be ordinary lead acid vehicle batteries but preferably should be deep cycle batteries, designed for a renewable energy installation. Batteries are 12 volt or 24 volt if linked together. For small-scale uses, like radios, power can be drawn directly from the batteries. For larger uses, like computers and lighting, an inverter is normally used to convert DC to AC. This takes low voltage direct current from batteries and produces mains voltage alternating current, allowing ordinary domestic equipment to be powered. Suitable inverters come in output power sizes of between 1 and 3 kilowatts.

### KEY POINTS FOR THE MPA

CASE STUDY

## Lessons Learned from Solar Energy Systems in the Seychelles

Diesel generators have served the electricity needs of protected areas in Seychelles for many years, because of noise and pollution, a few MPAs have opted for solid state solar panels. Cousin Special Reserve, Aride Special Reserve and Curieuse Marine Park, for example, have introduced modern integrated systems recently. TpA'olid '43ve

The MPA office is the focal point for day-to-day operations. Many, if not all, the administrative duties are carried out there. Ideally the office is situated within the MPA but this is not always possible and it may be in a nearby centre where communications and other facilities are better. Even in this situation, those who staff the office need to be in regular contact with the field staff, at minimum by radio. The office generally has to have some or all of the following facilities:

Many equipment purchases are made without careful consideration of what is really required, what is most appropriate for the operating environment, and whether the skills and funding are available to operate and maintain it.

Purchasing from a local agent or dealer may save a lot of time and effort in dealing with freight and clearing agents, if the equipment is to be imported. Local agents should be willing to provide the names of other customers whose opinion on the agent's level of customer care, during and after the sale, can be valuable.

Equipment has several costs including the initial purchase price (usually the main focus of attention), the through life running and maintenance costs, and the residual value, if any, on sale and disposal (a credit). For large and expensive items such as vehicles and boats, the through life running costs can be equal or greater than the purchase price, especially if labour for operation and maintenance is taken into account. When comparing quotations and tenders, ask questions about running costs i.e. fuel consumption and replacement of spare parts.

All new equipment should be unpacked and handled carefully, whether it is obviously delicate or not. It may have already been paid for and may have travelled round the world to reach the MPA. The last thing any one wishes to see is it being dropped off the back of the MPA pickup!

All components must be checked (if possible) before delivery is accepted, or notes made of any missing or damaged components. Instruction manuals should be read carefully. Installation may require the supplier or someone professionally competent. This is a small price to pay for increasing the chance of trouble free service. Instruction manuals are usually available in major languages, and individual requirements should be specified at the time of purchase.

Purchasing equipment without having sufficiently trained staff to operate and maintain it is a waste of resources and will quickly lead to problems. In some cases, training may be available from the supplier, but the MPA manager should try to recruit staff with the necessary skills or to plan a training programme that can start as soon as the equipment arrives. Local technical and vocational training to meet most of the basic operator skill needs of the MPA is available in most WIO countries. Some training will lead to nationally recognised qualifications. Training areas to consider include:

- Vehicle drivers and mechanics;
- Boat operations and maintenance;
- Radio operators and maintenance;
- Information technology and computer skills;
- SCUBA diving, mooring installation and maintenance;
- Electrical installation and maintenance;
- Water plumbing and piping systems;
- First aid, secretarial and office management, foreign languages.

Within an MPA, boats are used for many activities including: patrols; transporting equipment, personnel and visitors; search and rescue operations; and research, surveys and monitoring. A boat for transporting equipment needs a large cargo area but few furnishings, but a boat for personnel transport should have seating and preferably shade. Boats used for SCUBA diving should have space for equipment and diver access. Rough open sea conditions require boats with greater stability, higher freeboard, stronger hulls and more powerful engines than those operating in sheltered waters. Where boats have to operate in both si search a bssear0HIYjbBOIH4HB60O1eB61Y4I524B014HIYar)1%qpI.Hsiigear R

DE

The design and shape of the hull is very important to consider, especially in relation to:

- Shallow keel - preferable where the mooring dries out at low tide.
- Flat bottom shallow draft - idealsHzHA83zBWBor out

Most MPAs use vehicles to transport personnel, equipment, and supplies or to tow boat trailers. The range of vehicles used might include mini-buses, saloon cars, four-wheel drive (4x4) vehicles, small trucks and tractors, motor cycles and even bicycles. Before investing in new or additional vehicles, the MPA should first consider what requirements it has for land transport, both inside and outside the MPA. In particular, it is important to decide on

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## CCE E

Boat trailers and the corresponding tow bars are a common requirement of MPA vehicles. Although their use is fairly simple, there are differences in design that need to be considered before fitting a tow bar. For example, a boat trailer fitting may be different from that of a standard goods trailer i.e. one being a 'pin hook' and the other being a 'ball hook'.

MPA vehicles may need to be equipped with auxiliary equipment such as radios (and relevant antenna) and search lights. A complete tool kit, tow rope, jump leads, and other items such as flares, torches, first aid kit, fire extinguisher should also be considered, factored into the costs, and fitted accordingly. Many other potentially useful vehicle accessories are available, particularly for 4x4 vehicles used in research, such as roof racks, heavy duty and high suspension systems, winches, mounted water tanks, external airfilter extension pipe, diving bottle holders, spot lights, glass fibre covers for pickups, secure storage bins and 12V cool boxes. Within the WIO region, South Africa has probably the greatest choice of suppliers.

## TE CE

The objective of regular preventive maintenance is to minimise the time the vehicle is non-functional and ensure a long service life. Lack of maintenance, and wear and tear, are the major causes of vehicle failure. Damage from accidents sometimes happens and cannot always be prevented, but breakdowns due to lack of maintenance can be minimised. Every vehicle manufacturer produces a maintenance manual and schedule that should be studied, understood and followed.

If vehicles are used in rough terrain, constantly working in mud, dust, and water, oil changes should be more frequent (including engine, gearbox and differential oils). The air filter should also be cleaned more frequently, and wheel bearings and drive shaft and steering joints more regularly re-packed with suitable grease.

As with any equipment used by the sea, washes with freshwater are an essential part of preventive maintenance. In addition, the main areas to inspect regularly are:

- Bodywork for rust
- Tyres
- Cooling systems
- Electrical systems

Another simple measure that can enhance the value and working life of vehicles is to fit removable seat covers. These can probably be locally made from heavy duty canvas.

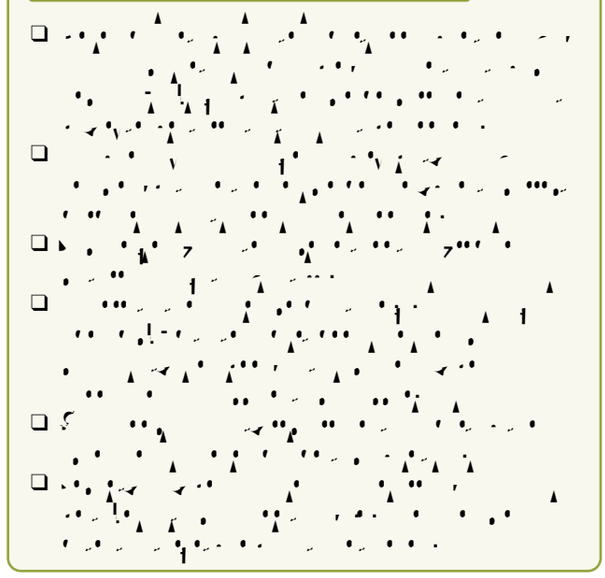
In remote areas the MPA may have to maintain a fully equipped workshop to service vehicles and other equipment. A range of spare parts needs to be kept to link with the servicing of the vehicle. Of these, oil and fuel filters will be the most regularly consumed. The standard recommendation is to buy genuine manufacturer's spare parts from an authorised dealer, although this may not always be practicable particularly in small islands or remote places where obtaining supplies is difficult. Planning ahead for the purchase of spare parts reduces the need for urgent spares when there is a breakdown. In some instances it may be possible to bring a specialist mechanic to the MPA for major servicing of certain components, but in general the MPA should have a trained mechanic, competent in the general maintenance of all MPA vehicles. The MPA should identify and list key workshop tools required, i.e. ramp where work can be carried out underneath the car, good lighting and security, and puncture repair kits.

## VE C E E

MPA drivers should have a valid local driving licence issued by the relevant authorities. Training in additional car handling skills may be necessary where difficult off road driving, including water crossing and sand driving, is a necessary and regular part of vehicle operations. A training programme for drivers should be built into the annual work plan where appropriate.

It is recommended that a logbook is kept with the vehicle and completed by the driver. Basic information to record, on a daily basis, includes; start and end of day kilometres, fuel taken, basic checks (oil, tyres, battery) carried out and punctures or other problems. A separate maintenance logbook should be kept by the MPA workshops, recording the date, kilometres and details of all servicing of the vehicle.

### KEY POINTS FOR THE MPA



MPAs need good communication links with:

- MPA staff in vehicles or boats or undertaking other field activities;
- Local and national government offices, the Police and the Navy;
- Villages within or adjacent to the MPA;
- Visiting vessels (e.g. yachts, commercial shipping or fishing vessels);
- Oil spill task force and/or emergency response contacts;
- Other MPAs, donors, NGOs and other external organisations.

## D C C

Radio communication is based on the reception and transmission of signals (electromagnetic waves) that travel through the air in a straight line or by reflection from the ionosphere or from a communications satellite. The radio-wave spectrum is divided into eight frequency bands, ranging from very low frequency (VLF) with a long wavelength, to extremely high frequency (EHF) with a very

- this comprises an electronic circuitry of transistors, printed circuits and dials. Modern radios are programmable and only specialised technicians should open or alter radio settings and components.

- these are generally more expensive but are essential for boat use. The units are non-corrosive materials, and waterproof.

- Mains electricity, wind-up dynamos and batteries can be used. Handsets are powered by rechargeable batteries or use adaptors to connect to vehicles, 12V batteries and solar panels. Base stations normally take 240V mains power.

Most radios do not require much maintenance, but an annual service by a qualified technician is recommended. The components should be kept clean and dry, and away from direct sunlight and heat. Rechargeable batteries last longer if they are regularly fully discharged. Electrical problems and lightning strikes are the main dangers but both can be prevented with qualified installation.

Fixed land telephone lines are cheapest and installation costs are generally low. Mobile, or cell, phone use is restricted by the location of the transmitter network, but is increasingly available, although it can be expensive. In remote areas with suitable satellite coverage, a satellite phone may be appropriate. These phones can be used anywhere, including in vehicles or boats but are expensive (user charges typically US$ 1 per minute; purchase costs is between US$ 500-1,000). Another potentially cost-effective option for low-quality voice communications is the Inmarsat-M communications service.

Email and the Internet allow remote locations to be connected to the rest of the world. Internet Service Providers (ISP), now available in most WIO cities, are companies that provide connections to the Internet and host email addresses. Connections to the Internet can be made by:

- **F** - The cheapest option.
- - More expensive, and so not very suitable for Internet browsing. Weak mobile signals can sometimes be boosted locally within the MPA.
- **F** - Suitable for email messages but not for large attached files or Internet access. This is particularly useful in remote locations due to the long range of short wave.
- **B** - A high-speed Internet connection through phone lines (ISDN and ADSL) with a special modem, via a wireless link in the VHF band, or with a direct satellite link.
- **D** - Sometimes the only possibility in remote areas but expensive.


Corfield, T. 1993. . African Wildlife Foundation/The David Sheldrick Wildlife Trust. Longman, Kenya. 701pp.

Gale, J.M 1992. . Fernhurst Books, Brighton, UK. 96pp.


Companies providing wireless and telecommunications services and relevant equipment: ;

- commercial company giving information on creating websites and getting on-line

## KEY POINTS FOR THE MPA

- ❑
- ❑
- ❑
- ❑

## CASE STUDY

### Use of radios in Menai Bay Conservation Area, Zanzibar

As part of a WWF-supported project, the Zanzibar Department of Fisheries has established a network of radio posts in the Menai Bay Conservation Area linking 19 villages within the MPA to the patrol base in Kizimkazi. The seven 'base' radios include several in villages, some powered by car batteries connected to solar panel, and others in a vehicle and a boat. These stations were initially operated by volunteers from village environment committees associated with the Conservation Area, and thus able to report potential violation of park regulations to Kizimkazi. Radio posts were strategically posted in villages with clear views of entry points to the MPA and were installed by a technician. Six hand-held radios were also bought for use on the fishing and patrol boats, providing a critical link with the radio base in case of emergencies, need for reinforcements, or for reporting on the location of alleged offenders.

Some lessons learned during the first phase of operations were:

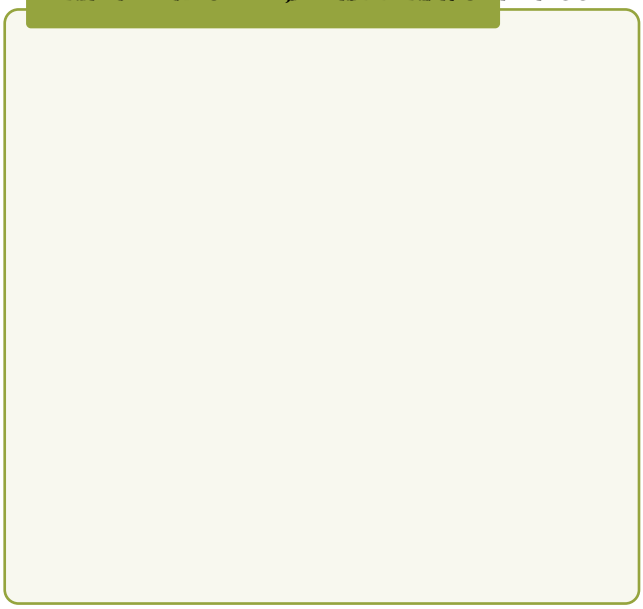
- The radio network was appreciated by those villages involved who actively reported illegal activities and were able to use the network in case of other community needs such as reporting on death or sickness of community members.
- A speedy response was required since violators could quickly move on, but the radio network did not adequately cover the large MPA. Three additional patrol bases are therefore being established, and the hand-held units have helped.
- Compensation to radio operators made them more reliable and it is hoped that they will eventually receive a government salary.
- Although marine radios are better they have not been used, as the costs are higher and frequencies are not compatible with the terrestrial units that were purchased first.

MPA staff, visitors and researchers may need to snorkel or dive for monitoring, research, recreation, underwater guiding and for a range of management activities such as installation and maintenance of mooring and boundary buoys, or even finding items that have been lost overboard.

Snorkelling, sometimes called skin diving, requires minimal skills and training, and just three main pieces of equipment: mask, fins and snorkel.

mandatory for divers using the PADI certification system. Regulators must be serviced every year by the manufacturer or a certified specialist. The first stage, in particular, is a delicate piece of equipment and dangerous malfunctions can arise from inappropriate handling. Furthermore, both the warranty and insurance may be void if uncertified people have opened or serviced regulators.

**C** - The MPA may have its own compressor for filling bottles, or may have to use the services of a local dive operator. Compressors range in size, weight and capacity, from those that are portable and fill a bottle in 20 minutes, to those that are fixed to the ground and fill five bottles in ten minutes. Power can be supplied by a petrol, diesel or electric engine. Proper installation and maintenance of the compressor is vital for safe SCUBA diving, particularly installation of an up-wind air intake to avoid contamination of the air by the exhaust fumes of the engine, and changing the carbon filters as per users' manual.



The main uses for buoys in an MPA are for:

- Marking navigation channels, and the boundary and zones of the MPA;
- Marking a specific location (e.g. a wreck);
- Mooring boats and thus eliminating the need to drop and haul anchors.

Colour is often used to indicate buoy purpose, and should conform to the International Association of Lighthouses (IALA) system. Colour and shape can also designate type of service, such as for short stays, day use only or overnight mooring, with spar or pole buoys to designate boundary marks or obstructions.

Moorings are particularly important in an MPA to protect the seabed from anchor damage, especially in coral areas, and to reduce overcrowding (e.g. at popular dive sites where anchoring is prohibited and the number of buoys can be limited). Fishers may use the moorings as well as tourist boats and competition over the buoys can be reduced by requiring different users to use different buoys or different times of day. The Great Barrier Reef Marine Park has both public and private moorings, the latter for regular and guaranteed access by users such as dive operators. Before installation, it is thus important to estimate expected frequency and type of use and to carry out a site survey (depth, seabed conditions, tidal range, currents, wave and wind factors).

### G E

Halas embedment moorings are strongly recommended for MPAs, and were designed specifically to prevent environmental damage whilst providing robust and safe mooring (see www.reefmoorings.com).

### C

- **F** - 46cm diameter, made from polypropylene plastic filled with polyurethane. Moulded medium density polyethylene floats with ultraviolet (UV) stabilisers can also be used; plastic containers are sometimes used, but UV damage significantly reduces their durability.
- **-** A small, floating, polypropylene pick-up line (with an eye-splice at the end) should be attached to the main float. The line should be 3m long (rather than the standard 5m) to encourge users to pass their own mooring line through the eye and pay out sufficient scope.
- **-** The main anchor line should be 20% longer than the maximum high tide depth. Three-strand, 20mm, polypropylene line is ideal. Chain can be used but is not recommended for the Halas system.

To minimise chafing, protective sheaths, thimbl7HfTuout be1©84©70

The principle reasons for developing an M&E programme are to (1) Assess the status of the key values (biodiversity and socio-economic aspects) of the MPA; and (2) Determine whether management is having its intended impact and is effective (see sheet G9). Because M&E terminology, methods and approaches can be confu-sing, thus it is useful to distinguish the following terms:

**M[illegible]** - A continuous systematic process of collecting and analyzing information, through the use of indicators. Ecosystem and biodiversity health (see sheet H5) and the well-being of local communities dependent on the MPA should be monitored, as well as the management process.

**E[illegible]** - A one-off activity (preferably repeated regularly e.g. every 2-3 years) that assesses how well the objectives of the MPA are being met. Individual projects may be evaluated, or the management effectiveness of the MPA as a whole may be assessed. The word 'assessment' also means a survey to establish a situation at any one point in time; for example, baseline assessments (see sheet C1) are essential when an MPA is first established.

Most MPAs in the WIO have monitoring activities [illegible]

Note that it may be difficult to attribute a change, or effect, to one particular cause. For example, an increase in nesting turtles could be due to good management of the beach or to a decline in harvesting of turtles outside the MPA.

A good indicator should be precise and unambiguous so that different people can measure it and get similarly reliable results. Each indicator should concern just one type of data (e.g. numbers of nesting turtles rather than numbers of turtles in general). Quantitative measurements (i.e. numerical) are most useful, but often only qualitative data (i.e. based on individual judgements) is available, and this has its own value. Selecting indicators for visible objectives or activities (e.g. mooring buoys installed, reef survey undertaken) is easier than for objectives concerning behavioural changes (e.g. awareness raised, women's empowerment increased).

Indicators must reflect the human capacity available; e.g. genera diversity would be more appropriate for corals if there is no one to identify species. An indicator must also be present frequently enough for meaningful data to be gathered; e.g. very rare species or events are generally not good indicators as there will be many 'zero' observations and trends will be difficult to determine. A few good indicators may therefore be better than many weak ones, even if this means, for example that it is not possible to monitor overall biodiversity health. WCPA-Marine has provided generic biophysical (physical conditions, species and ecosystems), socio-economic and governance indicators that can be used to help develop monitoring programmes in MPAs (see Pomeroy ., 2004).

## E E G &E G E

Given the complexity of M&E, a general plan should be developed for the MPA comprising:

- A timetable for the main activities and components;
- Indicators and data collection methods;
- Responsibilities for each component;
- Reporting requirements (i.e. formats, frequency) for the protected area agency, donor and other authorities;
- Budget (note that funding for different components may come from different sources).

Since monitoring often appears less immediately important than day-to-day management issues, M&E responsibilities must be clearly specified in the TOR of relevant staff, and adequate time made available for analysis and interpretation. Compliance with the tasks specified in the M&E plan should be monitored and adjustments made as appropriate. Separate plans may be required for particular components (e.g. for coral reef monitoring, which will involve specific methods, schedules and personnel). However, the various sectoral components must be integrated into the overall M&E plan.

Monitoring is best carried out by, or with the full involvement of, MPA personnel and relevant stakeholders. It may be necessary, and is often beneficial, to use external researchers (and in the case of evaluations, external consultants) but in such cases it is essential that results are passed back to the MPA and used for management decisions. Involvement of stakeholders such as local communities and tourism operators can raise awareness about the MPA and provide useful information and feedback.

The frequency of data gathering (e.g. annually, monthly, daily) depends on the parameter monitored. For example, annual monitoring of tree growth may be adequate, but monitoring of sediment levels in an estuary might need to be done weekly. Simple methods are often the best.

### KEY POINTS FOR THE MPA

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(see also sheets G9 and G10)

Gosling, L. & Edwards, M. 1995. . Development Manual 5. Save the Children. London, UK. 254pp.

Johnstone, R. & Mohammed, S. 2003. Monitoring and Evaluation in a Marine Protected Area. Module 9. : Francis, J. . (eds.) . CZMC/WIOMSA.

Larson, P. & Svendsen, D.S. 1996. . WWF, Washington D.C.

Maine, R.A., Cam, B. & Davis-Case, D. 1996. , . FAO Fisheries Technical Paper 364. FAO, Rome, 142pp.

Pomeroy, R.S., Parks, J.E. & Watson, L.M. 2004. . IUCN, Gland, Switzerland and Cambridge UK. 230pp. ://

Salzer, D. & Salafsky, N. 2003. Allocating resources between taking action, assessing status and measuring effectiveness. TNC/FOS Working Paper. Foundations of Success ://. (this website has other useful M&E materials and an online bibliography).

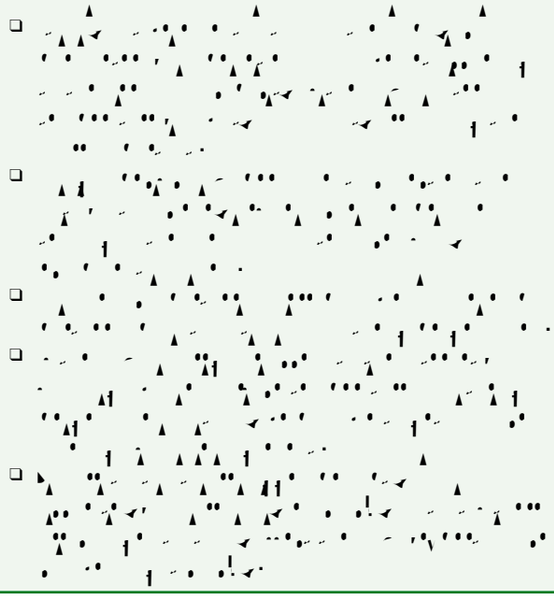
UNDP 1997. . Office of Evaluation and Strategic Planning, UNDP. / /

UNDP 2002. . UNDP Evaluation Office (in English and French). ://. /. /. /. 3/

measured with electrical probes, sensors, or chemical test kits, but are difficult to monitor accurately. Water samples can be screened for pathogens (faecal bacteria and viruses), hydrocarbons, heavy metals, pesticides, and other toxins. Samples must be clearly labelled and stored in refrigerated containers for rapid transfer to a qualified laboratory or test facility. Measurement of chlorophyll level gives an estimate of plankton quantities, which is an indicator of water quality; phytoplankton can be collected by towing a special net.

Tidal regime influences mangrove species distribution, abundance and growth, and simple methods are available to measure their inundation. Currents and waves influence the extent to which bleaching occurs and the speed of recovery. Plaster of Paris 'clod cards' can provide some information, as well as drifting current buoys and dye flow determination. Sea conditions can be determined according to the 'Beaufort Winds Scale and Sea Disturbance Table'.

## KEY POINTS FOR THE MPA

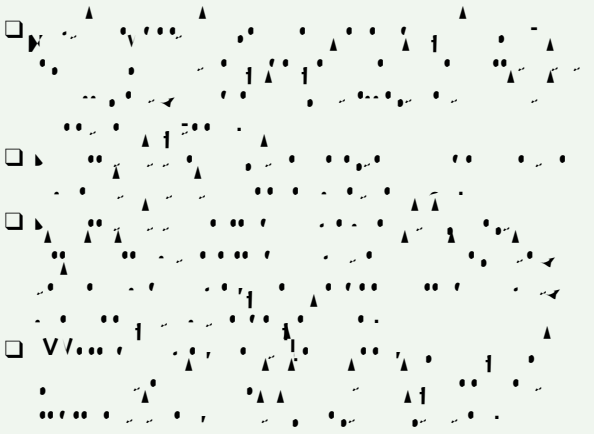



English, S., Wilkinson, C. & Baker, V. (eds.) 1997. , 2nd Ed. AIMS, Townsville, Australia. 390pp. ISBN: 0642259534.

Jokiel, P.L. & Morrissey, J.I. 1993. Water motion on reefs: evaluation of the clod card technique.

Some socio-economic parameters are difficult to measure as people may be reluctant to give accurate information. It is often not possible to collect data directly on income, and so another indicator will be needed to show trends in the economic status (relative wealth or poverty) of households, such as diet, or their assets.

## KEY POINTS FOR THE MPA




Bunce, L. & Pomeroy, B. 2003.

GCRMN and IUCN/WCPA, NOAA, Washington D.C. 82pp.

Bunce, L. . 2000.

. GCRMN/IUCN/AIMS/NOAA, AIMS, Townsville, 251pp.

Maine, R.A., Cam, B. & Davis-Case, D. 1996.

. FAO Fisheries Technical Paper 364. FAO, Rome, 142pp.

Pomeroy, R.S., Parks, J.E. & Watson, L.M. 2004.

. IUCN, Gland, Switzerland and Cambridge, UK. xv + 230pp.

CORDIO/GCRMN Socio Economic Monitoring Programme (SEMP) – Brochure, training sheets, manual and review of monitoring issues available from

National social science strategy for MPAs in the USA: – details priorities for social science research in relation to planning, management and evaluation of MPAs.


## CASE STUDY

### Socio-economic monitoring in Tanzania and Kenya

CORDIO's Socio-Economic Monitoring Project (SEMP) started in 2001 with funding from the Finnish Foreign Ministry, and aims to develop indicators and a method for monitoring socio-economic aspects of marine resource management at community and local government levels. Although not developed specifically for use in MPAs, three of the four pilot sites are MPAs or marine management areas: Diani (a National Marine Reserve but never implemented because of opposition from stakeholders) in Kenya, and Mnazi Bay-Ruvuma Estuary Marine Park (a multiple-use MPA) and Tanga Region (six collaborative fishery management programmes), both in Tanzania.

Parameters and indicators were selected to ensure that costs were within the expected budgets, that the monitoring would not take up too much time for MPA staff or community members, and that data would be easy to collect. The indicators had to have been tested elsewhere, so that their usefulness was known. The following three were selected:

- to determine trends in pressure on coastal resources; the indicators are how, where and when resources are used.

- to determine dependence on coastal resources; the indicators are the % of households involved in each activity.

- to provide information for management interventions, predict future problems and identify zoning needs; the indicators are conflicts and relations among user groups.

Monitoring teams, comprising community members and local government staff, were trained by technical advisors to conduct interviews and focus group sessions, and to manage data collection. Training notes and guide sheets are provided so that in the long term external technical assistance will not be necessary, although this should be accessible if needed. The frequency of data collection varies with the indicator, from 3-5 years (livelihood strategies) to seasonal (resource use patterns and conflict analysis) and remains constant unless an event occurs that accelerates change (e.g. a natural disaster or a major development, such as hotel construction). The data will be stored in a database and analy-sed at CORDIO, but sites are expected to develop their own capacity for this. Computer skills are lacking at the sites but if long-term technical support can be made available by government agencies or NGOs, this gap could be filled.

Although termed monitoring, the pilot phase is a baseline assessment for each site. The initial results have provided data on the numbers of households dependent on fishing, fish selling, glass-bottom boat and other tourism activities, and thus an indication of marine resource dependence. In Diani, for example, some villages depend significantly more on marine activities than others. Very few households have family members employed in tourism although this is the biggest single industry. While these patterns were generally known before, the assessment gives up-to-date quantified data that will help determine appropriate management interventions.

in one season will not be an accurate reflection of the total fishery if most fish are taken by traps in a different season.

Effort is harder than catch to measure accurately, and FAO guidelines recommend that three-times more fishers should be asked about their fishing effort compared with their catch. Data precision (measured as the Coefficient of Variation, CoV) relates to the variability of the samples. An estimate based on a small number of unrepresentative samples tends to show a high variability and thus gives low precision. Precision improves with increasing numbers of samples or measurements, but if these are not representative, the data will be inaccurate.

Annual estimates of catch and effort can be improved using fleet and boat activity surveys. Fleet activity surveys show the number of days fished each month for each vessel/gear combination. This information can be obtained by asking a sample of fishers how many boats went fishing in the previous month, and how many days were missed due to bad weather, illness or holidays. Since such events affect the whole fleet, the sample does not have to be large. A boat activity (BAC) survey records the number of days fishers fished in a month, which may vary between individuals depending on their other commitments.

Since fish caught within the MPA may be landed some distance away and since fishing outside the MPA may have an impact on stocks within its boundaries, the monitoring programme will need to incorporate data collection at fishing grounds and landing sites outside the MPA.

## G 1 E G 1 ED 1

Fishery catch and effort monitoring is generally done in one of the following three ways (in decreasing order of accuracy and cost):

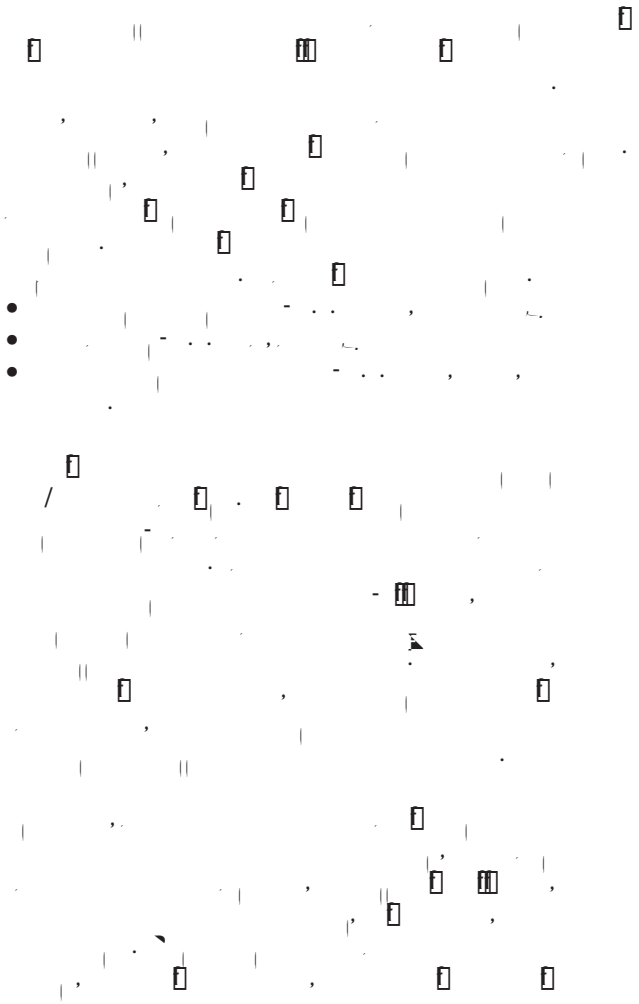
- on-board vessels, recording catch/effort during fishing;
- at landing sites, when fishers land catches; or
- through interviews with fishers after trips, and personal records.

Although data are likely to be collected by local fisheries departments, this may not be sufficiently detailed for MPA purposes. However, any separate monitoring programme should be closely linked with existing government programmes, preferably involving local staff. Fishers can also be involved in data collection, as long as training is provided, methods are well understood and there is regular checking and calibration.

Standardised classifications for vessels, gears and species being fished should be used, but also local names where appropriate. Use of both scientific and local names allows scientists, managers and others to understand the data and results of analyses. Since fish catches are often very diverse and species are difficult to identify, it may be necessary to use a family-level or more generic nomenclature.

Data on illegal fishing activities should be obtained where possible, to monitor compliance with regulations. It can be obtained from various sources including direct observations, particularly during patrols, and interviews with key informants.

### KEY POINTS FOR THE MPA



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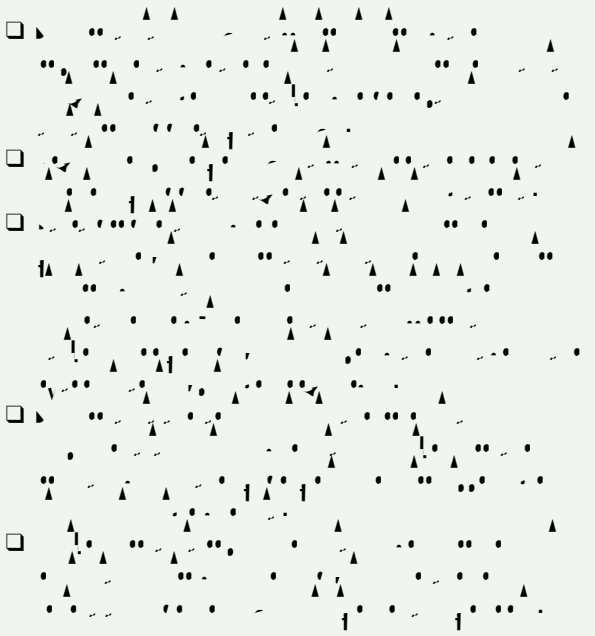
## C G EV

The timing of evaluations and reviews is generally laid out in project documents. Evaluations and reviews are usually carried out by a team (minimum of two people) that includes individuals external to the programme. Such people often provide useful insights to on-site staff who may be too close to problems, reluctant to acknowledge them, or too pre-occupied with day-to-day issues and activities. External teams can also bring in experiences from other areas to provide fresh perspectives on how to overcome obstacles. Teams should however also include someone very familiar with the project or programme, and certainly a member who is national to the country involved. The composition of the evaluation team should be such that it reflects a balance of views, and in its work it must consider the views of all stakeholders.

Preferably a participatory approach is used, with widespread consultation among partners, stakeholders and project beneficiaries. Most evaluations and reviews will involve:

- A review of the Project Document, work plans and progress reports, and other relevant documentation;
- Consultation with project partners and staff;
- A field or site visit;
- Presentation of preliminary results to all those involved, often to the Advisory Committee or Board.

### KEY POINTS FOR THE MPA




Gosling, L. & Edwards, M. 1995. . Development manual 5. Save the Children. London, UK. 254pp.

UNDP/GEF/ .

. Monitoring and Evaluation Initiative, IUCN, Gland, Switzerland.


### CASE STUDY

## Lessons learnt from evaluations of a coastal management programme in Tanzania

Since it started in 1994, the Tanga Coastal Zone Conservation and Development Programme (funded by Development Cooperation Ireland and with technical assistance from IUCN) has had to adapt to many changes, including the Local Government Reform Programme (LGRP) which decentralised decision making powers from the Region to Districts. An adaptive management approach was therefore adopted, which required a good understanding of the impacts of the Programme itself and of the political, social and economic context.

Much of the information required to support planning and decision-making came from the mid-term reviews and final evaluations undertaken during each of the three phases of the Programme. These were not only invaluable in guiding planning and improving management, but were also extremely useful in generating shared understanding amongst the Programme partners, motivating stakeholder groups and enhancing public and political support.

Examples of information and recommendations generated include:

- Confirmation that the Programme had helped to change the behaviour of key stakeholders, which in turn contributed to positive impacts on the environment (e.g. improved coral cover).
- Observations that while the Programme was successfully increasing support and capacity for collaborative coastal management, efforts to introduce alternative income generating activities were not so successful. It was thus recommended that the Programme should focus on fisheries issues.
- Given decentralisation, the evaluations recommended increased capacity building at District level, reaffirmed that the approach of participatory management and involvement of stakeholders was appropriate, and recommended greater focus on developing mechanisms to ensure long term sustainability.

The Programme also learnt crucial lessons about conducting evaluations efficiently so that they generate useful and accurate information. For example:

- Sufficient resources (people, time, money) must be available, to guarantee the quality and usefulness of the final product;
- TOR need to be clear and comprehensive;
- The evaluation team should have good technical knowledge of the programme area as well as good evaluation skills;
- The team must be given time to understand a programme and develop their methodology with the evaluation managers before the evaluation starts;
- All partners must understand their roles and responsibilities in an evaluation.

## KEY POINTS FOR THE MPA

Marine species were once thought to be so widespread and abundant that they would be unlikely to go extinct. New information is showing that many are now seriously threatened, undergoing more rapid declines in population size as a result of exploitation, and recovering much more slowly than previously understood. Furthermore, research is showing that many have more restricted distributions and are endemic to smaller areas than previously thought. MPAs are playing a crucial role in maintaining and restoring populations of many globally threatened species.

Information on %oTs

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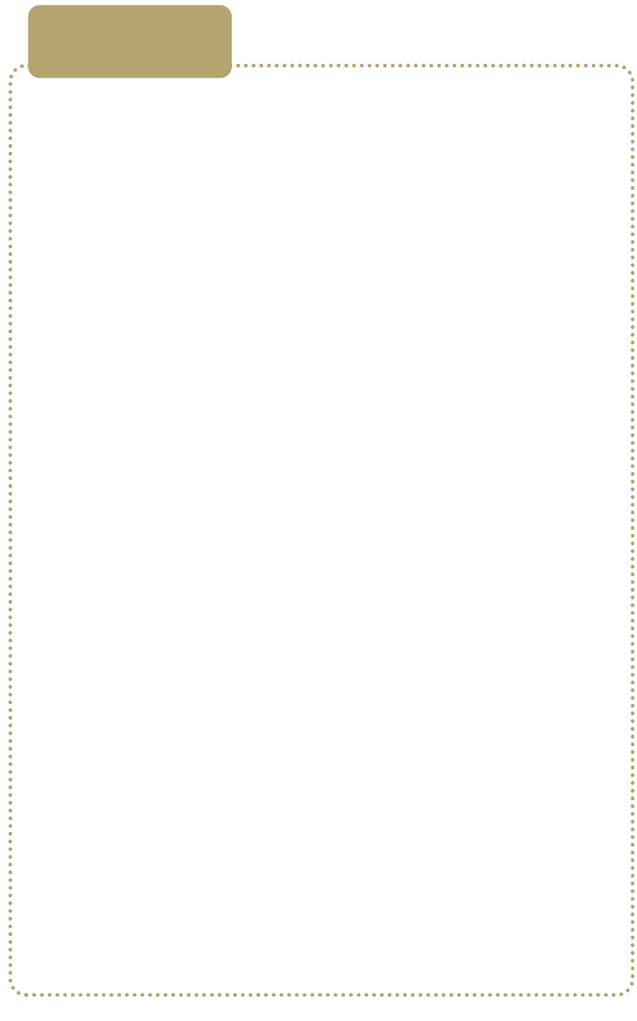
Marine species are poorly represented on the IUCN Red List, largely because of the lack of information about them. The status of most of the larger species (marine mammals, seabirds and turtles) has been assessed and many are considered globally threatened. Threatened marine fish are currently being assessed and many are being added to the Red List including swordfish, sawfish, all tuna species except Yellowfin and Skipjack, sharks (38 in the WIO), groupers, seahorses, manta rays and the coelacanth. Very few marine invertebrates are on the IUCN Red List, with the exception of six species of Giant clam. This dearth of information and general lack of awareness of the vulnerability of many marine species has been taken up by a campaign called 'Shatter the Myth', headed by IUCN's Species Survival Commision.

The Red List is used to help establish conservation priorities at international, regional and national levels, and provides the basis for listing species under environmental conventions. However, the listings under such conventions, such as the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), do not necessarily equate directly to the IUCN Red List, as conventions are developed to address specific threats (international trade in the case of CITES).

Some countries have their own national Red Lists of threatened species, but few if any include marine species JaCN DuI2'F509(E(F2'7'HFH2e DuIF'62F0(E(F2'78to on2001F2'78underF2'8egSome qF(BFyβtoF2'6q5EonmentalW}5t WGF2'78n2'78inyfDyHr8fish



## KEY POINTS FOR THE MPA

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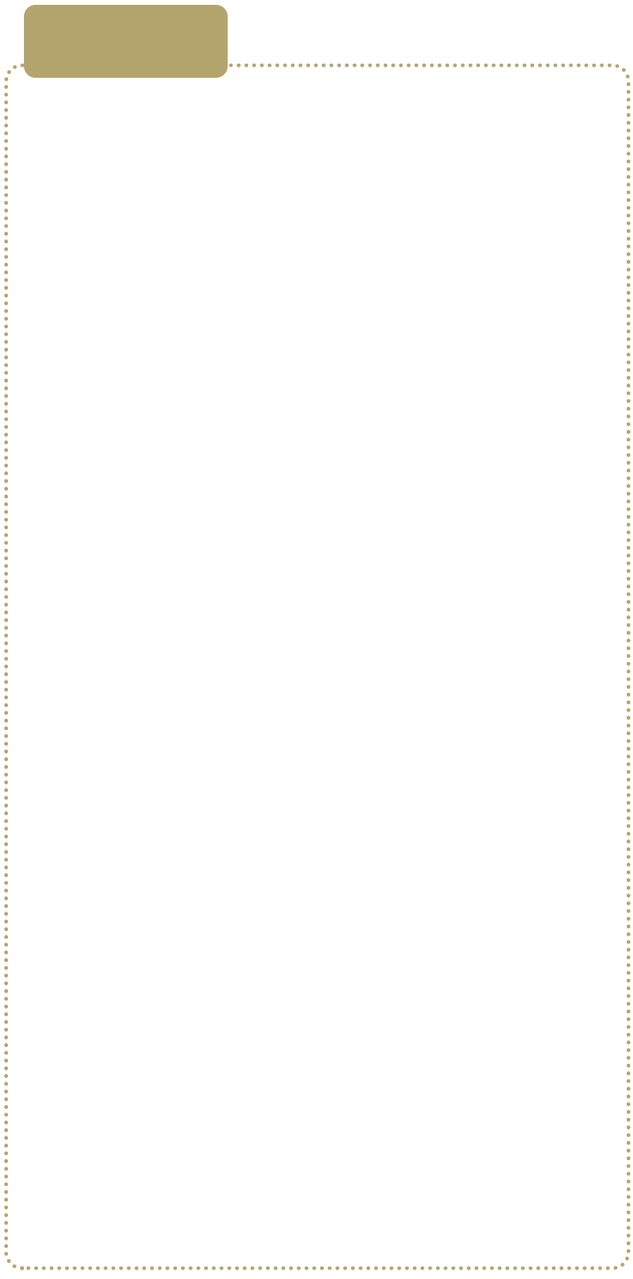

# C

C

Active rehabilitation can be used to aid recovery of damaged reefs by enhancing natural processes but is a controversial issue for three main reasons. Firstly, it can be expensive unless volunteer labour is available. Secondly, the activity may cause damage if coral colonies or fragments for transplantation are taken from healthy reefs, and finally, it has not yet proved effective on a large scale. Most attempts have been in areas of <100 m2, and have been experimental with little overall impact. Where rehabilitation is deemed necessary, the four approaches described below should be considered.

## E W G EG J VE C J

This should always be the first priority, as it will encourage natural recovery. Many of the other theme sheets will help with this. More active techniques for reducing stresses include removing 'pest' or predatory species, such as sea urchins or crown of thorns starfish (see sheet H8).

## C E G B J JE F E J J E E J

On a damaged reef, the availability of suitable substrate for larval settlement can rapidly decrease due to algal or soft coral overgrowth, and sedimentation. Minimising land-based sources of nutrient enrichment and maintaining algae-eating fish populations will help to reduce algae. Techniques for actively increasing suitable substrate, if essential, include:

- concrete blocks, wrecks or other purpose-designed structures. Such artificial reefs may have an additional benefit for fisheries management (see sheet J8) but the cost may be prohibitive for large areas.

**E** - This can be done by stabilising or removing loose substrate material (such as coral fragments) and removing algae and other organisms that might inhibit larval settlement or damage young recruits. Certain substrates, e.g. skeletons, appear to induce settlement and larval metamorphosis. This approach should only be taken if expert scientific advice is available.

**C** - This technique is not recommended, but has been tested in some WIO countries. Electrical currents are passed through a conductive material, such as chicken wire, causing calcium and magnesium minerals to precipitate from seawater to form a limestone framework. This requires considerable financial and human investment, and a source of permanent electrical current while the structure is being built. The long-term impact of the electrical current on marine life is not known.

## J GC

Coral fragments or colonies can be removed from a reef and transplanted to natural substrate on a damaged reef, or to artificial substrates such as concrete blocks (provided these are secured to the seabed). Many species survive transplantation provided environmental factors are favourable, but it is expensive in terms of labour, unless volunteers can be used. Also transplanted fragments are highly vulnerable to dislodgement by waves and human disturbance, and are easily buried or smothered. The source of corals for transplantation must be chosen with care, to avoid damage to other reefs (preferably choose reefs that are likely to be lost from dredging or land reclamation). Transplantation has been carried out at several MPAs in Kenya (see case study) and Tanzania (Izs9ia Marine Park, Dar es Salaam Marine Reserves and at several sites in Zanzibar) with variable success. It is of greatest value in shallow, accessible sites that are important for tourism.

## F GC

Attempts have been made to farm corals, mainly in SE Asia. Coral fragments are transplanted to a protected site and 'grown out' to a certain size before being used for rehabilitation and for creating new fragments. The source

## KEY POINTS FOR THE MPA

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of fragments must be chosen with care, to avoid damage to other reefs. Coral farms potentially have an additional benefit as an attraction for snorkellers. Further investigation is required to reduce costs and increase success rates.

(see also sheet J7 Artificial reefs)

Edwards, A.J. & Clark, S. 1999. Coral transplantation: a useful management tool or misguided meddling? **37**(8-1Le

Marshall, P. & Schuttenberg, H. 2004. . GBRMPA/NOAA.

Obura, D. & Mangubhai, S. 2003. Assessing environmental and ecological factors and their contributions to coral bleaching resistance and resilience of reefs in the Western Indian Ocean. : Obura, D., Payet, R. & Tamelander, J. (eds.) 2003. ( ) , 2001. ICRI/UNEP/ICRAN/CORDIO.

Salm, R.V. & Coles, S.L. (eds.) 2001. Coral Bleaching and Marine Protected Areas. . Bishop Museum, Honolulu, Hawaii, 29-31 May 2001. Asia Pacific Coastal Marine Program Report #0102, The Nature Conservancy, Honolulu, Hawaii, USA. 118pp. or available from: The Nature Conservancy, Asia Pacific Region, 923 Nu'uanu Avenue, Honolulu, HI 96817, USA.

The Nature Conservancy . 2004. . CD-ROM toolkit.

Schuttenberg, H.Z. (ed.) 2001. . Coastal Management Report #2230, Coastal Resources Center, University of Rhode Island, South Ferry Road, Narragansett, RI 02882, USA.

West, J.M. & Salm, R.V. 2003. Resistance and resilience to coral bleaching: implications for coral reef conservation and management. **17**(4): 956-967

Westmacott, S. . 2000. . IUCN, Gland, Switzerland and Cambridge, UK. 36pp. Also available in Kiswahili, French and Portuguese.

Australian Institute of Marine Science:

CORDIO Coral Reef Degradation in the Indian Ocean

CoralWatch charts information available on .C

Great Barrier Reef Marine Park Authority Coral Bleaching Response Program:

NOAA Sea Surface Temperature and Coral Bleaching Hotspots: and

ReefBase (gives seawater hot spot data):

Reefs at Risk:

Report on reefs and climate change:

Information on bleaching in French: 2.

## CASE STUDY

### Rapid response to a bleaching event in Réunion, 2001

Réunion has only about 12 km$^2$ of reef, all lying within the Parc Marin de La Réunion, and any major bleaching event could have a devastating impact. Fortunately, less than 10% of the coral communities were affected by the 1998 bleaching event, as a result of a cyclone that caused cloudy conditions at the time. However, in February-March 2001, a warm water spot resulted in localised but intense bleaching, although reefs on neighbouring Mauritius were not affected. Data loggers had been installed and these showed that SST was 0.5-1°C higher than the average for that period.

A rapid response monitoring programme was put in place immediately, starting with a survey of 80 sites by scientists from the organisations ARVAM and ECOMAR, and the MPA 'ecoguards', with financial support from the Ministry of Environment (DIREN). This showed that the La Saline lagoon area was most affected, with 50-90% of corals showing some bleaching. Pockets of resistant corals, with 5-10% mortality or less, were rare. A long-term monitoring programme was then set up to study the recovery, with 14 permanent monitoring stations in seven sites and using GCRMN methods.

The bleaching events, as well as two cyclones in early 2002, resulted in high levels of siltation and freshwater input causing further bleaching and mortality. Despite this, overall reef condition has been relatively stable. This demonstrates that natural recovery can occur quickly (in some cases, bleached areas recovered within 4 months) and also the value of a long-term monitoring programme that includes physical parameters. In this case it showed that bleaching occurred not only in response to elevated SST, but also to siltation and freshwater input, or a combination of these stresses.

Turquet, J. . 2002. 2001 bleaching on dominated reefs in Réunion. : Linden, O. . (eds.)

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Red tides or algal blooms are mass occurrences of a plankton species resulting from nutrient enrichment from intense upwellings, land runoff or other sources. About 300 species of algae are known to cause blooms, including dinoflagellates, diatoms, haptophytes and cyanobacteria, and some silicoflagellates. Algal blooms often occur in or adjacent to areas of upwelling when prevailing winds blow surface water offshore, causing cold, deep, nutrient-rich waters to rise up, bringing large quantities of phytoplankton with them that rapidly multiply due to favourable light and nutrient conditions. Algal blooms are most common in Eastern Africa around November and at the beginning of the north-east monsoon. For example, red tides were reported in Kenya (see case study), Zanzibar, Yemen, Oman and Mauritius in early 2002.

Blooms tend to look like streaks of reddish-brown to greenish-yellow floating debris, depending on the species involved, and may extend for several miles. The term 'Red Tide' is often used, because of dinoflagellate blooms, which can colour the water reddish-brown due to the carotenoid pigment in their cells.

### C  F  B

Many red tides are harmless but about one quarter of the known species that cause blooms produce toxins. HAB or 'harmful algal bloom' is a generic term for events that result in poisonings, although not all of these occur as 'blooms'. HABs can be divided into those that cause human poisoning and those that cause fish and other animal deaths. The toxins tend to accumulate up the food chain when the plankton are eaten, becoming more concentrated at higher taxonomic levels. In this way, toxicity can cause severe health hazards even at a low abundance of toxin producers (this is particularly the case with ciguatera), and even result in the meat of sharks and turtles becoming toxic.

The toxins are generally classified according to the symptoms they give rise to, some of which are among the strongest known. There are indications that the frequency and intensity of HABs are increasing, perhaps due to increased nutrient run-off from agriculture and sewage effluent, or even to climate change, although this apparent increase may be due to better documentation.

The primary vector for human poisoning is shellfish, particularly bivalves, which can accumulate toxins quickly as they are filter feeders. Human poisoning is caused by dinoflagellates (may cause Paralytic Shellfish Poisoning (PSP), Diarrhetic Shellfish Poisoning (DSP) and Neurotoxic Shellfish Poisoning (NSP)), diatoms (may cause Amnesic Shellfish Poisoning (ASP), and cyanobacteria

toxic hydrogen sulphide by anaerobic bacteria, with associated mortalities of marine animals from oxygen depletion and because their gills become clogged with plankton; strandings of crustaceans may also occur.

### E D G J B

The local Fisheries Department is usually responsible for dealing with a HAB. Fishers may be told that they can no longer catch or sell certain species and the general public and visitors may want to know if it is safe to eat marine products.

If historical data are not available, and there is no long term sampling programme, it will not be possible to identify the cause of a bloom definitively. However, samples should be taken immediately if there are signs of human poisoning, mortality of marine animals or discoloration of the water. Samples should be kept cold and in the dark, and sent for analysis preferably within 24 hours. Freezing samples can destroy cells and make species identification more difficult, but may be necessary if the analysis cannot be done quickly. Samples should include:

- water – several samples of at least one litre, from different locations and depths;
- tissue from dead animals (as fresh as possible), e.g. gills and livers, and entire animals can be taken if not too large;
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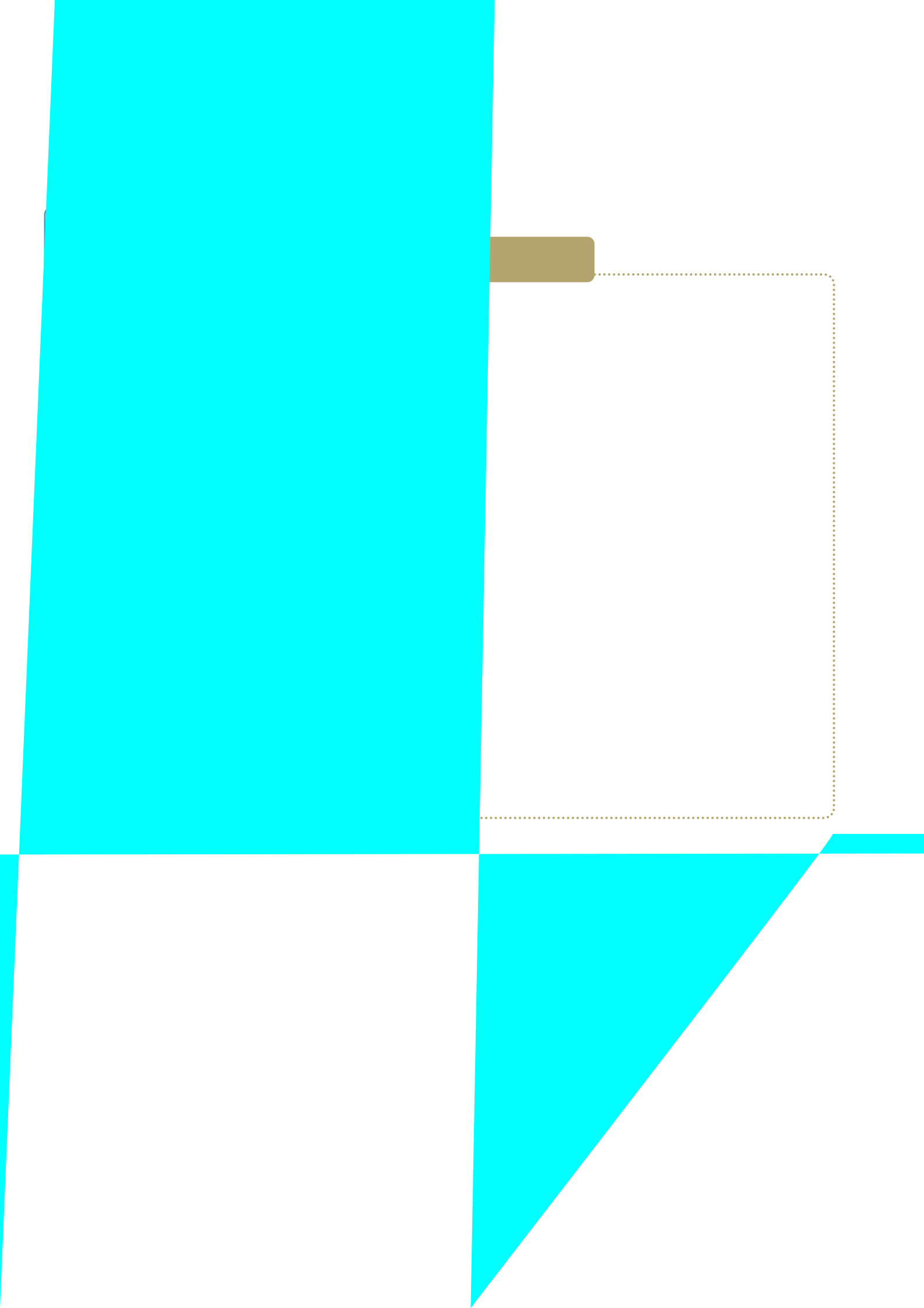


No-take areas (sometimes called marine reserves in the literature) are marine areas that are closed to all forms of extraction including fishing. In the WIO, they include the Marine Parks in Kenya and all the MPAs in Seychelles, as well as no-take zones within multiple use Marine Parks in Tanzania, Comores, Mozambique and Madagascar, and other management areas.

## BENEFITS FROM NO-TAKE AREAS

An extensive literature exists on the role of no-take areas in protecting biodiversity and contributing to fisheries production. The details are still being debated by the scientific and conservation specialists but no-take areas are nevertheless internationally accepted as an essential conservation and management tool.

### Increased biodiversity

Research around the world has shown that species richness, biomass, and size and abundance of organisms are higher inside no-take areas than outside, or compared with the area before it was closed, even after a period of as little as three years. In the WIO, the no-take MPAs of Chumbe (Zanzibar) and Kisite (Kenya) have larger fish and a higher diversity of fish species than fished reefs nearby. The abundance of triggerfish, surgeonfish and parrotfish in particular is higher. No-take areas at Malindi, Watamu, Mombasa, Kisite and Chumbe appear to have led to partial recovery of the heavily overfished triggerfish within 5-10 years.

Higher biomass and diversity could be because the MPAs were selected because they were naturally more species-rich, but similar effects have been seen in areas closed for other reasons. For example, the closed reefs in the six collaborative management areas in Tanga Region, Tanzania, were selected by local communities for fishery stock replenishment and reef recovery and now show higher biomass and biodiversity than surrounding areas. Terrestrial protected areas (e.g. many national parks) where extraction is prohibited have similar biodiversity benefits.

### Fisheries benefits

Common sense dictates that no-take areas should be beneficial for this purpose, and FAO recommends them as a tool. They allow fish to grow older and larger (thus producing more eggs and juveniles) and fish density to increase. Together, these should result in replenishment of adjacent fished areas through export of larvae and movement of adults (the 'spillover' effect) across the MPA boundary. A few studies have demonstrated spillover, but some have been inconclusive. However, many fishers perceive catches to increase following establishment of closed areas, for example in Tanga Region, Tanzania and Quirimbas National Park, Mozambique. The extent of spillover may depend on the size of the no-take area, the species taken outside, and the number of fishers displaced who may increase pressure on adjacent fishing grounds.

## ESTABLISHING NO-TAKE AREAS

The WIO closed areas have been implemented with varying degrees of ease and success. Three key points to consider are adequate consultation, location and size.

### Consultation

Closing an area to fishing inevitably means that some people will either have to cease fishing or move their fishing effort elsewhere. Without adequate sensitisation and participation, communities may view no-take zones as a form of disenfranchisement. This can lead to unrest and the situation can become politicised making it more difficult to resolve, as seen in some places in Kenya and Tanzania. Establishing no-take areas therefore needs to take account of the economic interests of fishers and other users. It is important, in advance, to spend time raising awareness of the potential economic benefits, such as increased fish catches or tourism revenue. Where stakeholders are receptive this process can be accomplished relatively quickly, but if there are entrenched negative perceptions it could take considerably longer. Either way, the time spent is an investment in conflict prevention. Study tours to meet fishers who already appreciate the benefits of closure are useful for communicating the message.

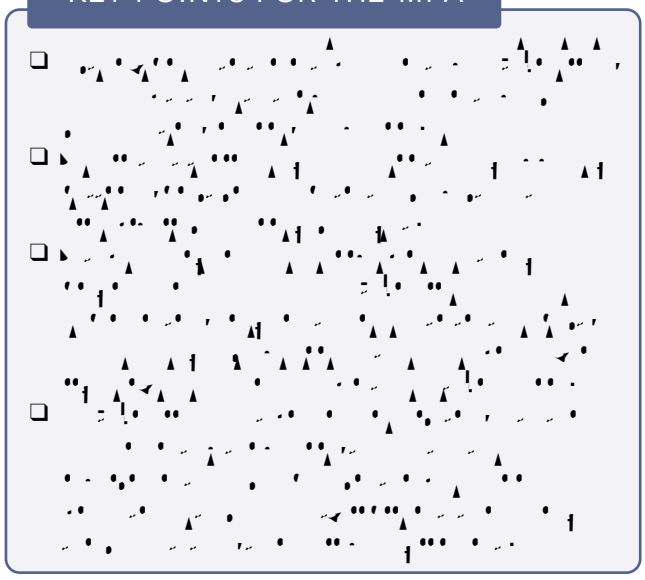
### Location

Protecting biodiversity versus enhancing fisheries productivity may involve closing different areas. For

fisheries, habitats important for the target species, such as spawning aggregation sites and nursery grounds, may be the priority (and will also contribute to biodiversity protection). A full scientific study is rarely possible but fishers may provide helpful information if they are confident that it will be used for good management (see sheet B4). For example, in Moheli Marine Park in the Comores, some of the no-take areas selected were subsequently found to be inappropriately located for protecting fish populations. Discussions were held with the fishers and the boundaries have now been changed.

The optimal area to close will probably depend on local conditions although scientists and conservation organizations have recommended that networks of no-take areas should cover 20-30% of all marine habitats. The research on which these figures are based is not yet conclusive, but nevertheless MPA managers should look at the feasibility of increasing no-take areas. It is essential to develop a clear plan for this in collaboration with stakeholders. Where closed areas exist already, it may be as important first to ensure that these are well managed and to gather data to demonstrate their positive impact. In addition, other forms of fishery management, such as eliminating the use of damaging gears (see sheet I2), must not be overlooked.

## KEY POINTS FOR THE MPA



Agardy, T. . 2003. Dangerous targets: differing perspectives, unresolved issues, and ideological clashes regarding marine protected areas. **13**: 1-15.

Many MPAs in the WIO have the dual objectives of improving coastal livelihoods and protecting biodiversity. Unsustainable fishing practices, such as the use of destructive fishing gears, dynamite and poison, prevents the achievement of both these aims. Some fishing gears are relatively benign when used in one way, but highly damaging when used in another, so attention must be paid to determining the most appropriate regulations. Some gears are used by groups of fishers, and control of their use may have an important social impact which will also need consideration.

## GE T E

This gear is generally benign as well as selective. However, it may be unsustainable if top-level predators are caught in large numbers. Although the MPA could encourage fishers to release such species alive, particularly if, like triggerfish, they are not high value species, putting a limit on the number of fishers may be more effective. If such fishing is done from boats anchored on coral reefs or seagrass beds, this should be discouraged, although permanent moorings (which reduce anchor damage – see sheet F9) may cause localised over-fishing at the site and could result in conflict for use of a buoy.

## Tra

When made with small mesh, traps tend to take large numbers of juvenile fish. Basket and fence traps (which

first instance) in exchange for destructive gears may be appropriate;

- improving post-harvest treatment and marketing of the catch so that more revenue is generated, provided this can be done without encouraging more intensive fishing.

These can be difficult to implement success)plement lly,N1Dh3NRqBqBq3ND,N1Dh3NRqBqBqLN5DsRePjaRi Pj2ON5DF2nsiveP

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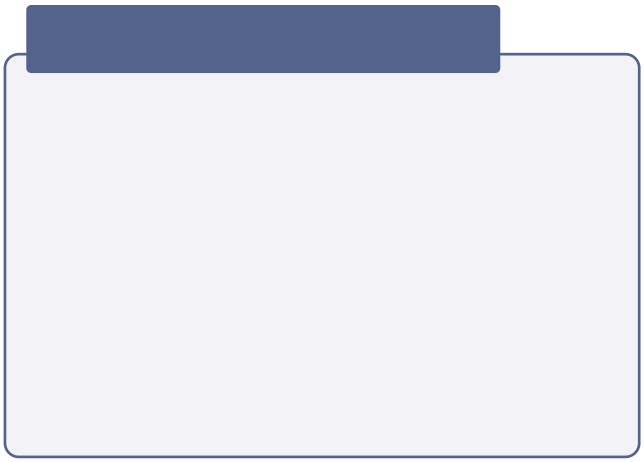
Mariculture is the farming of marine species, whereas aquaculture is the farming of any aquatic creature and often refers specifically to freshwater activities. The farming of a single species is called monoculture, and the growth of several species together is termed polyculture. The contribution to world fish production of farmed aquatic foods, particularly salmon, trout, carp and tilapia species, has been increasing rapidly over the last 20 years, and now exceeds 30%. Mariculture has been tried in the WIO in



Fishing could also be restricted to a maximum of six days over the spring tide with no fishing allowed during neap tides. This would ensure a minimum number of no-fishing days during which octopus and sea cucumbers could recover. Rotational fishing regimes with a different area exploited each day during the spring tide would also help to maintain a healthy size range and stock size. In Mafia Island Marine Park, Tanzania, octopus fishing is already prohibited during neap tides and there is a maximum size limit of 500g.

## KEY POINTS FOR THE MPA

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Boyle, P.R., & Rodhouse, P.G., (in press). . Iowa State University Press, 1st edition, 352pp.

Bruckner, A.W., Johnson, K.A. & Field, J.D. 2003. Conservation strategies for sea cucumbers: Can a CITES Appendix II listing promote sustainable international trade? . **18**.

Conand C, 1999. . PRE/COI: 39pp.

Conand, C. 2001. Overview of sea cucumbers fisheries over the last decade - what possibilities for a durable management? : Barker (ed.) *2000*, Swets & Zeitlinger: p. 339-344.

Guard, M. & Mgaya, Y.M. 2000. The artisanal fishery for Gray (1949) in Tanzania. **31** (7-8): 528-536.

Lovatelli, A. (eds.) In press. . FAO, Rome.

Marshall, N., Milledge, S.A.H. & Afonso, P.S. (eds.) 2001. . TRAFFIC East/ Southern Africa, Nairobi, Kenya.

Norman, M.D. 2000. . Conchbooks, Germany.

Samyn, Y. 2000. Conservation of aspidochirotid holothurians in the littoral waters of Kenya. . **13**: 12-17.

1-19. Noumea New Caledonia.(English and French)

Great Barrier Reef Marine Park Authority – information on sea cucumber fishery regulations.


## CASE STUDY

### Using an MPA to help manage invertebrate fisheries in Madagascar

Nosy Atafana Marine Park, in north-east Madagascar, is part of the UNESCO Biosphere Reserve of Mananara-Nord. The Marine Park is small (10 sq km), but covers three islands and their surrounding reefs. The area is important for artisanal fishing and reef fish, but also for a number of invertebrates including octopus, sea cucumbers, lobsters, and bait. All these activities were unregulated prior to gazettement of the Marine Park.

The Marine Park was established through an agreement between the Mananara Biosphere programme and the local community. It has a central core zone where no activities are allowed and a buffer zone were fishing is regulated. The agreement stipulates that the Marine Park is open to fishing on three days of the week only, that fishing is restricted to fishers from four adjacent villages, and that fishing for lobsters and sea cucumbers is prohibited throughout the area. Two park rangers patrol the Park on days when fishing is permitted to check that fishing gear and catches are in compliance with the regulations that are part of the joint agreement. Contravention of regulations is punished with a ban on fishing in the Park for two weeks to three months, depending on the nature of the offence. The catches are monitored from landings at the fishing villages.

Octopus is an important resource for many of the fishermen, and for some it is their sole source of income. They are collected on foot with a harpoon, and there were concerns that this was resulting in damage to live coral on the reef flat. With the reduction in the number of days that the area is fished, it is thought that some recovery of the reef flat is occurring, and that there has been an increase in reef fish catches. In addition, the Mananara Biosphere Programme is running trials with bamboo octopus traps with a view to introducing these as a less destructive fishing method.


Grandcourt, E., Andrianarivo, C., Rene de Roland, L. and Rajaonarison, R. . Report to Eastern African Component of ICRAN – International Coral Reef Action Network.


M. Richmond

*Thelenota ananas*, one of more than 20 species of sea cucumber collected in the WIO.

the address details to which the tag should be sent. The tags are generally made of a barbed nylon point which is embedded in the flesh or under the dorsal fin, although older tags were made of steel. Attachment of a tag generally does not harm the fish; there are instances where tagged fish have been re-caught, even on the same day there were tagged, indicating that they were fit enough to attack the bait. New aids, such as the Aquatic Release Conservation (ARC) de-hooker, also help to reduce mortality of released fish. The results of tagging programmes have contributed to knowledge about growth and mortality rates, and movements of these fish.

MPAs can potentially play an important role in the management of sport and recreational fishing. Those that are no-take areas (e.g. Marine Parks in Kenya and Seychelles) by definition prohibit such fishing, but in others, it may be allowed in certain zones under permit and in payment of a fee. A checklist of good practices in recreational and sport fishing is being produced by a consortium of conservation and tourism organisations and provides useful guidance for MPAs ( . . . . . ).

## KEY POINTS FOR THE MPA

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African Billfish Foundation - newsletter: available from Tina Harris, PO Box 342, Watamu, Kenya, Tel: 254 42 20394/31387, Fax: 254 42 31288; e-mail: . . . . . @ . . . . . .

American Sportfishing Association 2002. . . . . .

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Aquatic Release Conservation (ARC). . . . . .

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Tourism is one of the largest global industries, much of it focusing on the attractions of relatively pristine natural environments. A visit to an MPA is increasingly part of coastal holidays for foreign visitors, as well as an outing for local residents. Investors often want to construct tourism facilities near to an MPA, as this gives them additional marketing value. Visitors and tourism operators are thus key stakeholders in the MPA, bringing benefits through revenue and employment. Tourism can however have negative impacts through: increased resource use (for both food and souvenirs); habitat destruction and pollution from construction; social and cultural impacts; physical damage to sensitive habitats such as coral reefs and mangroves, and disturbance of wildlife.

Many MPAs in the WIO have the promotion of tourism and recreation as an objective and thus need a clear policy on the type of tourism (e.g. high value, low impact) and number of visitors to be encouraged. A plan for preventing and mitigating adverse impacts, whether these originate inside or outside the boundaries, is also required. There is much literature providing guidance on sustainable tourism, as well as international schemes that give recognition to initiatives adopting high environmental standards. An MPA may be able to link with one of these, or learn from the approach (see case study).

## CED

The policy should lay out how the MPA can maximise benefits from tourism while minimising environmental damage and conflict with local stakeholders; it should reflect national tourism policy and development plans.

A tourism plan may be part of the management plan, a stand-alone document, or combined with a site tourism development plan if tourism is important. It should give:

1. An explanation of the objectives of the MPA that relate to tourism and recreation, the activities to be encouraged or excluded in different zones, and the amenities to be provided;
2. The national context (e.g. tourism growth rates, impact of global or national socio-economic events) and policies concerning tourism development;
3. Carrying capacity and limits of acceptable change (see sheet J2);
4. User fees and other income from tourism and local visitors, recognising that the latter are likely to provide less revenue but that their support for the MPA is essential; and the extent to which tourism/ recreation is expected to provide income for the MPA and other protected areas in the national system;
5. Interpretation and education activities;
6. Recognition that tourism activities and infrastructure must respect MPA regulations and national legislation; these should meet required standards and demonstrate best practices; the MPA will benefit from this through good publicity and potentially tourism awards (see case study).
7. The roles of the MPA, government agencies, the private sector and local communities in tourism development in and adjacent to the MPA, and any potential or existing conflict between this and other economic activities e.g. fishing;
8. Monitoring (see sheet G6); key parameters to monitor include visitor trends, social and environmental impact of visitors, quality of the service provided, whether visitors' needs are being met, and their perceptions of the MPA (e.g. use questionnaires or a comments book).

## KEY POINTS FOR THE MPA

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Eagles, P.F.J., McCool, S.F. & Haynes, D.A. 2002.

Publicising and promoting an MPA is essential for many reasons, including:

- Raising awareness among stakeholders and encouraging their participation;
- Changing people's thinking and behaviour in relation to a particular issue (e.g. dynamite fishing);
- Informing people about the MPA and its achievements and any changes in regulations or management activities;
- Raising awareness about the MPA at regional and international levels to strengthen linkages;
- Assisting with fundraising.

Tools for communicating information about the MPA and its activities include printed materials, videos, websites, the media (TV, radio, newspapers) and exhibitions and special events.

## E E

Good oral communication is very important but is often difficult. Speaking in public and to the media requires skill and if unsuccessful can have negative impacts, but can be improved through training and practice. Some MPA staff, particularly the manager and public relations or community development officers, have to do this regularly and so training will be beneficial. Different types of presentations are required depending on the purpose and target audience (politicians, donors, visitors, scientists) and it is important that the contents are adapted as appropriate. It is often tempting to use a presentation prepared for another purpose to save time, but in the longer term this may not be effective (see the WIOMSA Training Manual for MPA managers for advice).


A 'communications strategy' is a useful tool for planning and fundraising, and is sometimes part of the management plan. It should define target audiences, the types of materials and products most suitable, the issues to be addressed and the time scale. Conservation International has developed a strategic planning tool (involving the '4-P Workshop'), which can be used to identify the Problems, Public, Products and Plan that are needed for effective awareness raising and communication (see WIOMSA Training manual). Note that environmental education (see sheet J4) includes similar activities to awareness raising but involves a more structured approach to help children and adults learn.

## B C J E

Relatively inexpensive and can be displayed in numerous locations, such as the MPA buildings, public buildings, community halls, and schools. Designs should be kept simple and eye-catching, with minimum text and a strong clear message.

Generally inexpensive and can be used for advertising events and short term activities; a general leaflet about the MPA is also useful.

Useful for describing the MPA in more detail, or for specific topics of interest.

Should be produced at regular intervals and on time. Choose a catchy, easy-to-remember name and use clear headings and pictures. Length and format should be as simple as possible, and costs kept low. Many newsletters are produced irregularly (sometimes just once) and give a poor image of the MPA.

**G** Have the advantage that they are displayed for at least a year and often have space for different messages and images. Mafia Island Marine Park produced a calendar in Swahili, giving both international and Muslim dates, which proved very popular with local fishing communities. Calendars have since been produced by other Tanzanian MPAs.

These can be sold to visitors and used as gifts and prizes. The quality of materials and whether the print is UV resistant, varies considerably, and samples should be assessed beforehand.

**D** Can be purpose made for use at exhibitions and events, or can be simple, locally made, weather-proof boards fixed in suitable locations and used

The management plan for the MPA may provide a framework for developing an educational programme, but this is often overlooked. By working with schools, fishing groups

A visitor centre is extremely useful in helping an MPA carry out the important task of interpretation. Good interpretation can affect the visitor's behaviour so that he/she can contribute to the conservation objectives that the MPA has been set up for, and has several aims. These include bringing alive the meaning of the MPA and its role, informing visitors about the marine environment and communicating to them its importance and value, as well as helping visitors to understand why the MPA is managed in certain ways and what any regulations mean.

A visitor centre may have several components, with separate areas for displays and exhibits, meetings, talks and slide shows, as well as childrens' activities. Refreshments and souvenirs or education materials may also be sold there, ensuring that any exhibits are well protected from the eating area.

Displays and exhibits might include the following topics:

- Natural history (e.g. using touch tanks, 'guess the object' games, models, photos, specimens);
- Socio-cultural issues related to the MPA;
- How the MPA is managed;
- A map of the MPA and surrounding area;
- Ways in which visitors can help with the management or funding of the MPA.

There are several issues to consider when designing a visitor centre and its displays, including:

- Type of visitor - the main visitors need to be identified as this will affect the style and content of the displays, e.g. whether these are tourists, children, or local adults;
- Language of displays – labels and information should include local languages and also the language of the main groups of tourists visiting the MPA;
- Weather-proofing - protection is needed from weather (sunlight, rain) and from human contact (children touching, salty water if visitors enter the centre from the beach);
- Durability - displays and exhibits generally need to be fairly robust and durable to survive time, handling and harsh environmental conditions.
- Portability - there may be a need for components of the exhibition to be portable, for temporary exhibitions in other parts of the MPA or for use elsewhere;
- Safety and security - theft possibilities (e.g. if exhibits such as shells are left uncovered) and threat from falling exhibits (and thus danger to visitors) need to be minimised;
- Location - siting of the centre is important to ensure that visitors are drawn to it quickly and easily.

Multi-media exhibits may be appropriate in some instances, but are expensive to install and maintain (especially in tropical coastal areas), risk breaking down, and sometimes create a 'barrier' to experiencing the real, natural environment. It is better to have something simple that is sure to work. Use the space, walls and surfaces in the display area carefully and order the exhibits so that they make sense to visitors, and perhaps follows a pattern, rather than displaying information randomly. Ensure there is good lighting of exhibits and displays, whether natural or artificial; if the exhibits receive a lot of natural light, printed materials will need to be UV proof to avoid rapid fading.

Visitors from developed countries may have high expectations of interpretation materials and visitor centres, as they are used to professional standards in their own countries. It is generally better to have a small, focused visitor centre that is well designed and of high quality, than a large one of poor quality. A mix of passive

there is a good balance of pictures and objects and text (the latter kept very brief and in large clear font so it can

### C  ]  ]EC]

Specially designed modular artificial reefs can be used as submerged breakwaters to protect coastal areas from erosion. This should only be considered if expert advice is available (see sheet K1).

### EEF  E  B  ]  ]

This may be necessary after impacts such as bleaching, ship groundings, and dynamite fishing and is described in sheet H6.

## KEY POINTS FOR THE MPA

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mangrove zone is half the tidal range, so at sites with a 4m spring tide range, deck height at the seaward end may need to be 2m. Overall pile length may need to be 3m, to

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Coastal dynamics are a complex and poorly understood issue, with river estuaries, beaches and other features constantly changing. Some changes are cyclical (e.g. due to seasonal weather patterns), some are sudden and unpredictable (e.g. due to cyclones), and others are long term, taking a decade or even generations. Sea level rise, one of the main consequences of global warming, and caused by thermal expansion of the oceans and melting glaciers and ice sheets, is also likely to have a major impact, and is already causing erosion in some areas. The International Panel on Climate Change has predicted that sea level will rise by 15-95cm by 2100, with a 'best estimate' of 50cm.

## E

Erosion can have serious economic and conservation consequences, such as damage to buildings and roads and loss of turtle nesting habitats. Is62anBWHAz;DjjbAz2e 0FWzA6ffigla stantly 0FWzs62l62pr0DHADWg0JTc62tes, 0FWzA62beaches

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Increasingly, there is a vast amount of debris floating in the oceans, comprising:

- **Plastics** - This is the most common material as it is very buoyant, does not degrade and can travel long distances across the ocean. About 50% of beach debris comprises food and drink containers; there are also large quantities of flip flops, bags, sheet wrapping, fishing floats and nets, ropes, condoms and syringes.
- **Glass** - Includes bottles, bulbs, TV and computer screens.
- **Metal** - Items such as tin cans, spray containers, and even shipping containers.
- **Wood** - Pallets, assorted timbers, logs.
- **Paper** - Newspapers, labels, cigarettes and cigarette stubs (30% of all beach litter is smoking-related materials).

Marine debris can be a major hazard to wildlife, entangling seabirds and turtles in particular. It is also hazardous to human health, as injuries and infections can be caused by glass and syringes. Its unpleasant appearance can have an economic impact if tourists are deterred from visiting. It can also be a hazard to shipping.

## DEBRIS FROM LAND-BASED SOURCES

Most marine debris originates from land-based sources such as coastal construction and land-fill sites, rubbish dumps, and river discharges. A large proportion also comes from shipping, drilling rigs and other marine sources, as both deliberate and accidental discards, although the International Convention for the Prevention of Marine Pollution from Ships (MARPOL) technically limits some of this. Some floating materials remain offshore for years and eventually sink, but many eventually wash ashore. An MPA has little control over this but can participate in activities to reduce it and to clean it up.

Few MPAs in the WIO are serviced by municipal solid waste agencies but it may be possible to raise awareness about the issue. Depending on the situation, the MPA or a local authority will be responsible for cleaning beaches. Through reporting of incidents and problems, and by creating publicity, the MPA can help to improve waste management. An MPA can also carry out, or help to promote, regular beach cleanups in collaboration with local communities and government agencies. The International Coastal Cleanup programme which has been running since 1986 and is organised by the US-based Ocean Conservancy, involves almost 5 million people from nearly 120 countries, who volunteer their services. In 2002, the annual cleanup resulted in 4000 tonnes of debris being collected around the world. Underwater clean-ups can similarly be organised, involving divers and snorkellers, but these need careful planning and organisation. If possible, debris from any clean-up should be recycled.

## DEBRIS FROM SITE OPERATIONS

Construction and maintenance of buildings and facilities, as well as day-to-day operations, generate a range of solid waste materials within the MPA. A waste management strategy should therefore be prepared, based on three guiding principles:

1. **Reduce** the amount of waste generated, e.g. by purchasing products with less packaging or that are long-lasting, even if they are more costly, or request borrowing or sharing of products, packages or bags.
2. **Reuse** materials, e.g. containers, bags, plastics and paper, and encourage the use of cloth or wicker, instead of plastic bags. Where possible, support commercial recycling facilities that purchase or accept materials such as metals, paper, glass, aluminium, oil and plastics.
3. **Buy** products that use recycled materials.

Once waste has been generated, it must be appropriately handled, sorted, stored, and transported to a suitable disposal site. Different kinds of waste should be stored in separate areas until in large enough quantities for economical transport and disposal. Some types of waste can be disposed of within the MPA but others will need removal.

Metals, plastics, and rubber should be recycled because of their slow natural degradation rates, and this may require storage and transport to an appropriate facility. Tyres can be re-used (e.g. for artificial reefs, sandals), as well as flipflops (see case study). Burning of plastics and rubber is not recommended because of the toxic gases produced, unless a facility is available for safe high temperature incineration. Recycling is most appropriate for glass; it can even be mixed with concrete, converted into blocks, and used in artificial reefs. Re-use and recycling is most suitable for paper, cardboard and wood, although these can also be used as fuel. Open air incineration should be a last resort.

Terrestrial, marine and freshwater ecosystems within an MPA can be affected by alien species from several sources. This sheet focuses more on marine species as this is a relatively new issue that may be unfamiliar to MPA practitioners.

## E J D C J

Marine plants and animals can be transported huge distances on the hulls of vessels or in ballast water. Most do not survive but many do, some with major consequences. Examples include: