Appendix 6

The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden

(PERSGA)

Sanganeb Marine National Park

Site-Specific Master Plan with Management Guidelines

DRAFT

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PERSGA

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EXECUTIVE SUMMARY

This management plan is a business plan. The single most important philosophy incorporated into this plan is that without sustainable funding there can be no effective conservation at Sanganeb Marine National Park (SNP), and the most important source of income for the Park[1] is derived from its visitors. Therefore it is true to say that without recreational use of the Park, there can be no active conservation of its natural resources.

The overall approach to the development of SNP, as presented here, conforms to the IUCN's vision of a Category II Protected Area (ANON 1994):

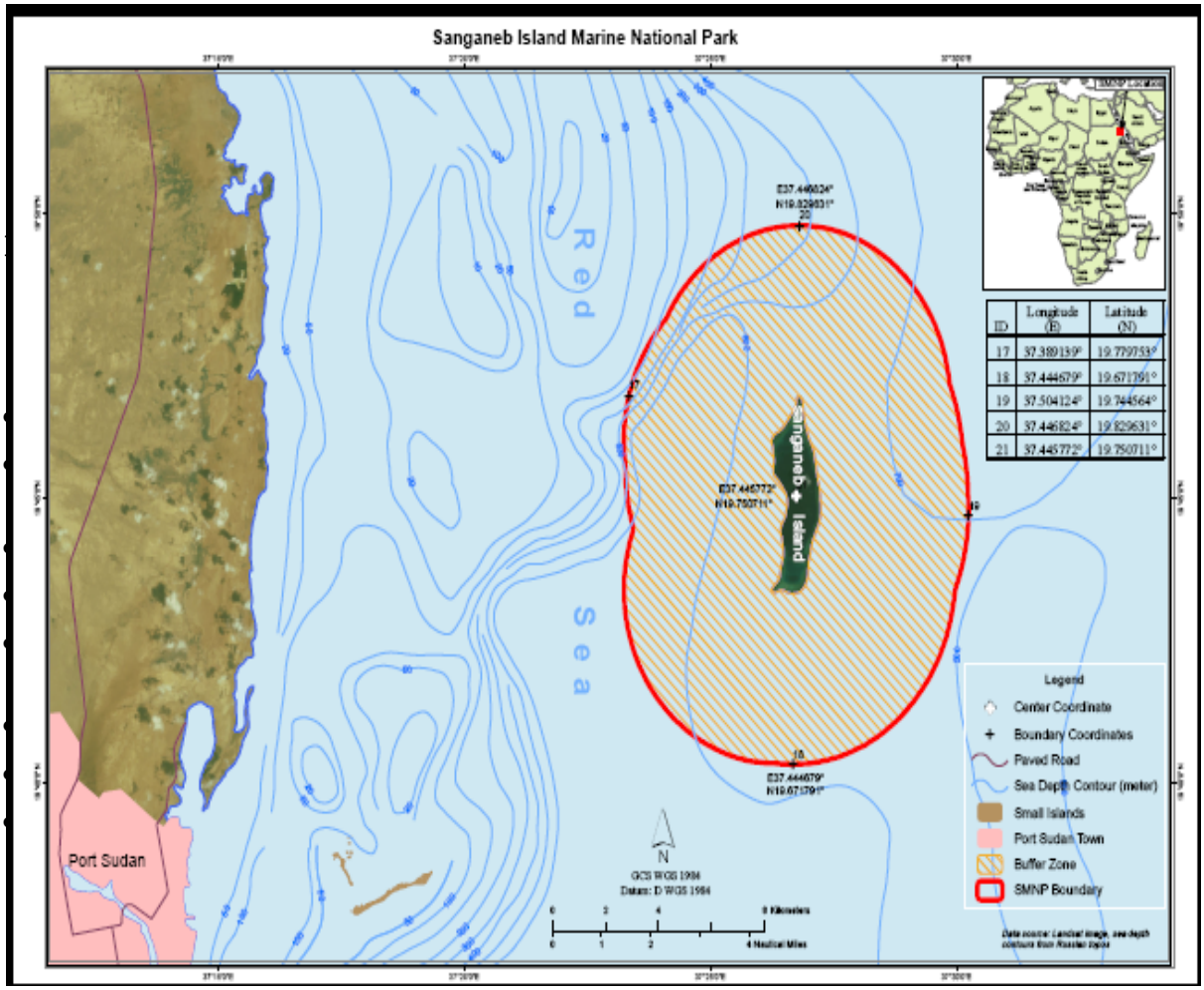
Category II: ***National Park: protected area managed mainly for ecosystem protection and recreation*** – natural area of land and/or sea designated to: (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area, and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.

SNP is designed to protect a unique geological structure, the only widely recognised atoll in the Red Sea, along with its pristine living reef and populations of associated fauna including commercially important fish stocks. The reef is located in the central Red Sea away from many human impacts and close to the Red Sea's centre of biodiversity. The atoll is entirely submerged, and the only part of SNP to occur above the sea's surface is the magnificent Sanganeb lighthouse and the few buildings that surround it. These features, along with its growing reputation as one of the best dive sites in the world, make SNP an excellent candidate for protection. This is largely because its potential for recreation and its conservation value are both very strong and compatible.

The plan presented here is almost entirely focused on what occurs within its boundaries, but it must be recognised that SNP must also fit into a wider context, a context that treats the entire Sudanese coast, indeed the entire Red Sea as a whole, integrated system. Although it has been written to integrate with a regional plan (PERSGA Master Plan for the Regional Network of MPAs) and two national plans (Biodiversity and Oil Spills), there are numerous other roles in which it may play a significant role, notably plans to manage marine fisheries, tourism, mineral exploration, security and defence.

These underpin the goals of this Master Plan, which in turn form the platform for the development of the Park's policy and strategies as given in Table 1. The Management Plan presented in Section 4 is in line with the policies and strategies, and once implemented will result in progress toward reaching the goals

[1] Park, capital 'P', refers in this document to Sanganeb Marine National Park.


Sanganeb Island Marine National Park
Red Sea
Sanganeb Island
Port Sudan
ID | Longitude (E) | Latitude (N)
17 | 37.389139° | 19.779753°
18 | 37.444679° | 19.671791°
19 | 37.504124° | 19.744564°
20 | 37.446824° | 19.829631°
21 | 37.445772° | 19.750711°
Legend
Center Coordinate
Boundary Coordinates
Paved Road
Sea Depth Contour (meter)
Small Islands
Port Sudan Town
Buffer Zone
SMNP Boundary
N
GCS WGS 1984
Datum: D WGS 1984

SMNP MAP

Table 1: Objectives, goals, strategies and policies of the SNP Site-Specific Master Plan

OBJECTIVES	GOALS	STRATEGIES AND POLICIES
1. To sustainably manage SNP	To secure sufficient, sustainable and flexible sources of financing To ensure that the carrying capacity of SNP is reached but not exceeded To respond appropriately to human induced changes detected in the environment and user profile To include the local community in all aspects of Park management as far as possible To reciprocate in sharing management experiences with other MPAs, and to learn from them To manage the conflicts between non-extractive use and conservation by implementing a zoning plan To maintain SNP infrastructure at a level that is necessary and sufficient for effective management. To ensure that SNP has the necessary legal basis for its operation	SNP will strive to become self-financing as far as possible using income from visitors and other non-extractive uses. Each year the Park's books will be audited and balanced. SNP's income will be ring-fenced for use in implementing the management plan, and will not be pooled in the federal budget. This will require establishing a proper legal system for SNP such as a trust fund. The number of tourists using SNP will not exceed the carrying capacity. Critical aspects of the Park's functioning and status of its natural resources and environment will be surveyed and monitored and the results fed back into the planning process. Visitors and tour operators will be encouraged to be self-policing and self-monitoring. Every second year the SNP management plan will be revised to incorporate the lessons learnt from the previous year and from scientific monitoring. The local community shall be invited to participate in business opportunities that SNP creates, become involved on the SNP committee and offer creative feedback to management at all levels. Visitors to the Park will be encouraged to report their observations and share their photographs. The Park's management will participate in regional and international discussions, conferences and workshops on MPA management. SNP's zoning plan will be implemented and periodically assessed and updated as necessary. Mooring buoys and anchorage areas will be installed and designated to protect coral from anchor damage. A buffer zone will be legally established to control remote impacts. SNP's equipment and infrastructure will be maintained at an appropriate level with care given to ensuring that their running and maintenance costs do not escalate beyond what is affordable and necessary. SNP will seek professional legal advice with regard to its legal standing and liabilities and where necessary take action to minimise its risks. SNP will agree to a memorandum of understanding with the Sea Ports Corporation (SPC) over the use of the lighthouse and associated buildings.

2. To maintain species diversity, retain habitats and the human built environment within SNP	To protect the habitats and ecological processes that sustain living marine resources at all stages of their life cycle To enforce a no fishing regulation within the Park (except from the jetty with hook and line) To protect and conserve the lighthouse and wrecks in SNP To consider the risks and threats that SNP faces from external forces, and to be prepared for all possible incidents	Viable populations of key species within the Park including bumphead parrotfish, Napoleon wrasse, spotted coral grouper, sea cucumbers and *Trochus* will be sustained, protected and encouraged. The mating, spawning and nursery areas of other important species including sharks, billfish and dolphins will be protected in special areas. SNP will draw up legally binding regulations concerning fishing and other issues, and these will be rigorously enforced. The lighthouse and wrecks will be cleaned, maintained and protected in co-ordination with SPC. SNP will prepare contingency plans that cover the incidents of CoTS outbreaks, oil spills, ship groundings etc. and co-ordinate with the navy and coastguard on matters of national security.
3. To promote sustainable tourism in SNP	To ensure that visitors do not directly or indirectly damage the natural and built resources within SNP To ensure that visitors and Park management behave responsibly and with respect to the natural environment and culture in which SNP is located To ensure that future tourism developments are undertaken in a sustainable way, and subjected to rigorous environmental and social impact assessment prior to implementation To become recognised as one of the world's premiere safe, dive sites To make SNP more attractive to non-diving visitors	Friendly but firm rangers will patrol SNP to inform visitors and protect the environment. A waste management plan will be drawn up and implemented, and the toilet facilities upgraded. Codes of conduct will be formulated and disseminated to SNP users to minimise their impact on the natural resources within the Park (codes for tour operators, diving, cetacean watching, etc.). The relationship between SNP and its visitors will continue after the visitor has left SNP to encourage return visits. This will be achieved by establishing a membership organisation, Friends of Sanganeb, which will distribute new information about the Park by e-mail. All future developments within SNP will be subject to impact studies. SNP will be promoted as a 'must see' location for international tourists visiting Sudan, and will also offer a rich and inspiring experience to non-diving national and international visitors. SNP will work with dive operators to develop an emergency response for divers and fishermen lost at sea. SNP will be promoted as a world class dive site to attract the required numbers of diving tourists. Visitor numbers, profiles and activities will be monitored and the results will feedback into the management planning process. SNP's aesthetic values will be protected. SNP will consider the development of more walkways and rest areas, and rehabilitation of

		the existing rest area (on the northern jetty) to increase the number of non-diving day-trippers that the Park can accommodate. A safe area will be designated for swimming and snorkelling. Park entrance fees will be in line with comparable sites elsewhere in the Red Sea and the world.
4. To educate and inspire	To be recognised as a prime site for school and university field trips for students to learn about the marine environment and its conservation To develop public education and awareness programmes that disseminate information and encourage active participation in the global conservation movement To develop a public awareness plan and communication policy that meets the needs of SNP, and reaches its major stakeholders To develop a visitor centre at SNP	SNP will accommodate and welcome school and university field trips. SNP will become a model MPA where it will be possible to test theories about the way MPAs function and conserve the environment. A range of information in a variety of media will be developed and presented imaginatively to visitors and the general public. SNP's research requirements will be advertised to encourage collaboration with Universities in Sudan and from around the world. SNP will develop a public awareness plan and communications policy that incorporates feedback from stakeholders. Services offering tours of the reef with glass-bottomed boat will be encouraged from the private sector to allow young children and non-swimmers to view the reef. SNP will develop a visitor centre in an imaginative and creative way that is designed to inspire and educate visitors, and a kiosk to inform the public about the Park.
5. To contribute to the development of a national capacity to plan and manage MPAs	To train Sudanese staff in MPA management and planning To procure equipment necessary to implement the management plan To work with other Sudanese MPAs to mutually benefit from shared experiences To encourage links with other MPAs in the region and globally in order to exchange views on best management practices	SNP will recruit, develop terms of reference, work plans, train its staff to appropriate international standards and offer training opportunities for staff from other MPAs in the region. Information regarding training opportunities will be gathered for use in cost planning. SNP will economically procure the necessary equipment and technical references from appropriate sources. SNP will be fully integrated into a national network of protected areas to maximise the possible synergy available including training opportunities and management lessons. SNP will actively participate in international discussions relating to MPA management in the region and globally. SNP will allocate budget, if available, for training, exercises, workshops and capacity building. SNP will encourage the Wildlife Conservation Administration to hold a regular workshop for all Sudanese protected areas staff to share their experiences.

6. To involve local communities as partners and stakeholders in SNP	To ensure that the local community participates in the success of SNP To ensure that the local community benefits economically from SNP through partnerships, participatory co-management and employment	The SNP committee will include representatives from all the major stakeholders and user groups. SNP management will be receptive to and consider suggestions offered by the local community. SNP will ensure that local businesses are given fair and equitable opportunities to participate in the business activities associated with the tourism industry.
7. To provide for the sustainable use of living marine resources	To protect and enhance the indirect fishery potential of the Park through replenishment of depleted areas outside the Park, and if necessary rehabilitation of viable populations of species within the Park To be used as a site for bio-prospecting for medicines and other compounds that might benefit mankind	SNP will draw up, disseminate and enforce regulations controlling all fishing within the Park boundaries. No poaching of marine products or any form of illegal fishing will occur within the Park boundary, including the buffer zone. SNP may serve as a platform for fisheries monitoring surveillance and control of Sudan's Exclusive Economic Zone. The status of various populations of commercially important species will be assessed and if necessary enhanced to ensure SNP maintains viable and protected populations. Where necessary, SNP will encourage research on the aquaculture potential of species found within the Park. Fish spawning and shark breeding areas will be fully protected in strict Nature Sanctuaries. There will be no fishing within SNP, except by hook and line from the jetty. There will be no collection of invertebrates whatsoever, except for research purposes. SNP will encourage research into the connectivity of the reef to the wider marine environment to understand the ecological links it has outside the Park. SNP will assist in drawing up a bio-prospecting contract and actively promote SNP as a site for bio-prospecting. SNP will encourage the necessary background research to promote the Park as a good bio-prospecting site.
8. To contribute to the effective operation of a network of MPAs throughout the Red Sea and Gulf of Aden	To effectively protect a set of habitats that are representative of the Red Sea To be a high profile MPA in the Red Sea that draws attention to conservation efforts being made in the region	SNP will be managed sustainably according to best management practices and current thinking. SNP will strive to attain the status of UNESCO World Heritage Site and will develop its own identity as a site within the network.

1.1 MANAGEMENT POLICY

The way the Master Plan is implemented is governed by a management policy based on five principles:

1. Sustainable funding based on business principles

In order to meet its goals, SNP must adopt a policy that is consistent with modern business practice. Visitors are the Park's customers on which its conservation success depends. The visitor should get a sense that SNP offers value for money, that its budget is well spent, and that it is run efficiently. The Park must also actively and imaginatively promote itself through a range of different media that appeal to its main users, and the user base must be expanded to include non-divers. This requires the clear dissemination of useful information before, during and after a visit to the Park both in SNP's role as a recreational area and as a site for education and learning.

2. Flexibility and feedback to improve plans

This plan is intended to be flexible, and not simply a formula that is applied to achieve the desired result. Incorporated into the planning process are channels that allow different user groups to communicate their views, and in this way it is hoped that the end result reflects the vision of the users. However, the overall management of the Park is the responsibility of the Park Manager. Every second year amendments and alterations will be made to the existing plan that take into account the new situation as it changes, whether that be changes in the numbers and types of visitors, or the results of the scientific monitoring programme.

3. Friendly, efficient and economical

The way in which the Park staff interacts with visitors should also be governed by policy. Park staff must see each encounter with visitors as an opportunity to make a friend, inform, or educate. This will produce a positive experience for the visitor, which in turn results in a sense of involvement in the future of the Park. This policy is aimed at increasing the likelihood of SNP being recommended by word of mouth, the most efficient way of increasing the reputation of a MPA and increasing the number of visitors it attracts each year.

4. Phased approach to learn from new experiences

It is necessary to start at the beginning by getting the essential foundations in place before further development of the Park's capacity can be achieved. The approach to implementing this plan is to be phased in line with income and experience available to the Park Manager.

- Phase I – Getting started (one year duration)
- Phase II – Capacity building and promotion (two year duration)
- Phase III – Self-sustaining management (five year duration)
- Phase IV – Expansion of the Park into a co-ordinated national and international network.

The expected income due in Phase I (year one) amounts to US$12,000, while that at the end of Phase III should be in excess of US$80,000. In order to move from one phase to the next visitor numbers must increase and the capacity of the Park's staff must be strengthened through international (e.g. voluntary) technical assistance, international and national exchange programmes, and formal training workshops.

5. Communication

Clear and timely communication is a vital ingredient to the success of the Master Plan. It is one of the Park's goals to develop a comprehensive public awareness and education plan that includes educational talks and visits by school groups, information leaflets, books, a website, interactive CD-ROM, and the provision of a visitor centre and glass-bottomed boat to maximise the educational potential of a visit to SNP. Each of these elements requires information to pass from the Park to the visitor, which is why clear communication is essential.

1.2 DEFINITIONS

Master Plan

The Master Plan (or Site-Specific Master Plan) is a framework that defines the overall objectives that govern the management of the Park: objectives that will not change as the environment responds to the intervention given in the management plan. These objectives are the ultimate targets that the Park should continue to strive for even once all the goals have been met. Therefore the Master Plan encapsulates the very purpose for which the SNP has been brought into existence.

Management Plan

The Management Plan, as presented in Section 4 of this document, is a plan of action based on the existing condition of the site that follows the strategies and policies necessary for achieving the goals of the Master Plan. The Management Plan will therefore change as actions are successfully implemented and the environmental context of the Park changes (i.e. as capacity develops, equipment is procured, visitor numbers rise and sustainable financing is made available). The Management Plan must be updated every two years to reflect the positive and negative changes that the Park experiences, as well as the feedback from its stakeholders and users. The Management Plan is therefore a set of instructions that move the Park towards meeting the goals that lie on the path towards the overall objectives.

Zones

The zones given in the zoning plan have names that reflect their objectives, and these need to be defined clearly at an early stage so that the reader can understand exactly the function of each.

Buffer zone

The 'buffer zone' is an area surrounding the Park that is necessary to control human activities that might impact on the Park either directly or indirectly. These activities include shipping, mineral prospecting and exploitation, industrial fishing, military exercises and any other activity that might negatively impact on the marine environment in such a way that the causal agent (e.g. spilt oil, turbidity, sediments rich in heavy metals, drifting nets and noise) may be carried inside the Park's boundary. The buffer zone extends 5km from the boundary of the 'core zone' in all directions.

Core zone

The 'core zone' is a multi-use area that allows the dual functions of SNP, conservation and recreation, to achieve their full combined potential. It is vital to realise that both of these objectives are mutually interdependent: without the conservation of habitats and natural resources the attraction of SNP to tourists is diminished, and without recreational use of the Park there would be insufficient funds to conserve the area for future generations. This may appear to lead to conflicts of interest if only one half of the goal is considered, but this plan has been designed with both objectives taken together. All activities in the core zone are controlled, while

some activities are banned altogether. Diving, snorkelling and yachting will be the main activities taking place in the core zone, while mooring and anchoring will be restricted to certain points and areas.

Nature Sanctuary

Nature Sanctuaries are areas where no human activity is permitted, with the exception of research. The rationale for fully protecting areas is to preserve the resources within them in their original, natural, undisturbed state. It is only against such pristine areas that the influence of human activities can be measured. Strict Nature Sanctuaries will protect about 30% of the total reef area.

4. THE MANAGEMENT PLAN

4.1 RESOURCE MANAGEMENT PLAN

RESOURCE USE		
Issue	**Task**	**Action By**
Lack of procedures for routine observations, visitor control and impacts	Establish a protocol for surveillance and control of visitors in the Park, including the reporting or apprehension of illegal fishing vessels. Ensure a particularly high level of surveillance on days during which live-aboard dive vessels are in Port Sudan. Develop and implement procedure for inspecting level of litter, solid waste and oil etc. within and around SNP. This should be incorporated into the work plan for rangers.	Assistant Park Manager with support from Park rangers
Lack of procedures for non-routine events	Develop a contingency plan in the case of a CoTS outbreak that incorporates success indicators. Guidelines developed by Ras Mohammed National Park should be adopted and applied to SNP. Develop a policy and contingency plan in the case of a ship grounding that incorporates success indicators. Develop a policy and contingency plan in the case of an oil spill that incorporates success indicators, that is compatible with the national oil spill contingency plan. This must be in line with the IOPC Fund's Claim Manual. Encourage dive operators and provide input to developing a contingency plan for a diver lost at sea or other diving related emergency.	Park Manager with support from Assistant Park Manager
Lack of visitors at SNP limits the income available from Park fees	Work with dive operators and other tourism sector stakeholders to promote SNP as one of Sudan's key tourist attractions. Consult with dive operators and diving visitors to establish a reasonable fee that divers are willing to pay in return for the continued conservation of SNP.	Assistant Park Manager
Diver carrying capacity of SNP is uncertain	Investigate the position and status of the pinnacle to the north of Sanganeb Atoll, and establish the potential for installing a mooring buoy at the site. Using the results of the visitor survey and the latest published research findings, refine the estimate for the carrying capacity of dive sites at SNP.	Assistant Park Manager, in co-ordination with dive operators Park Manager
Lack of guidelines for visitor conduct	Develop simple guidelines for divers in consultation with dive operators (e.g. no novice divers and no diving gloves allowed) and ensure that these are communicated to dive groups prior to them entering the water. Develop guidelines for whale, dolphin and turtle watching within SNP in consultation with specialist groups and tour operators. Develop guidance notes for captains of vessels entering SNP, including best operating practices for dive operators, mooring and anchoring protocols.	Assistant Park Manager supervised by Park Manager, with input from specialist interest groups
Lack of clear regulations relating to fishing	Develop a set of legally binding regulations and penalties as a basis for the SNP's fisheries management plan. Ensure that these regulations are enforceable using the resources available, and test them periodically using	Assistant Park Manager supervised by Park Manager, with input from

	unannounced field exercises. Ensure that the regulations are very widely disseminated amongst the fishing community and all government departments with an interest in fisheries issues. They should be made available on leaflets in Arabic and English for distribution to any fishing vessel that comes within the SNP buffer zone.	specialist interest groups
Lack of enforcement of regulations	Encourage dive tour operators to be self-reporting and self-policing. Conduct regular patrols to increase the visibility of Park rangers, and if necessary to inform and enforce visitors and operators of the Park's regulations.	Assistant Park Manager with support from Park rangers

BIODIVERSITY		
Lack of legal framework for bio-prospecting or other research or activities (e.g. filming) with possible commercial benefits	Consult national and legal experts on legal agreements of this sort (e.g. FIELD), and develop a flexible policy and standard contract/memorandum of understanding that must be signed for commercially orientated activities to be conducted within SNP.	Park Manager supported by Administrator
Lack of information about the resource base required to promote SNP as a site for bio-prospecting	Encourage research on the taxonomy and ecology of SNP's natural resources including algae, sponges, molluscs, and ascidians.	Co-ordinated by Park Manager, with support from management committee (Red Sea University representative)
Lack of contact with international organisations involved with marine natural resource management	Establish and maintain contact with the IUCN Wrasse and Grouper Specialist Working Group, and search for other specialist interest groups for SNP's natural resource base (e.g. GCRMN, Reefcheck, IUCN, Billfish and cetaceans).	Assistant Park Manager with support from management committee (Red Sea University representative)
Lack of promotion of SNP as a site for bio-prospecting	Once the necessary legal framework is in place, promote SNP as a bio-prospecting site on the internet (SNP website), direct marketing and industry newsletters etc.	Assistant Park Manager

4.2 ZONING PLAN

Issue	**Task**	**Action By**
Implement zoning plan within SNP	Designate and mark safe anchorage in case of emergencies. Designate and mark area around lighthouse jetty for swimming and snorkelling. Designate and mark strict Nature Sanctuaries. Ensure vessels use mooring points. Ensure adherence to SNP's policy relating to fishing.	Park Manager with support from Park rangers
There is currently no legal basis for the buffer zone around SNP	Establish the co-ordinates for the buffer zone. Secure legal basis for buffer zone around SNP, including area designated as a shipping lane. Take steps to ensure Admiralty charts show change of status and restrictions.	Park Manager to co-ordinate with Wildlife Department PERSGA mapping expert
There are no mooring buoys installed at SNP	Design and install mooring buoys at major dive sites and anchorages, and consider the installation of moorings for oil containment booms north and south of the lagoon entrance	Assistant Park Manager to co-ordinate with SPC

4.3 RESEARCH AND MONITORING

Issue	Task	Action By
Lack of formal agreement for conducting research within SNP	Draw up and agree on the terms of a memorandum of understanding between SNP and Red Sea University to conduct research in SNP. Draw up and agree on the terms of a memorandum of understanding between SNP, SPC and Red Sea University for the use of buildings and facilities at the lighthouse (visitor centre and research facilities).	Co-ordinated by Park Manager, with input from legal advisor and Wildlife Conservation Department
Lack of information about the resource base in SNP	Encourage the execution of baseline surveys for sediment characteristics (including hydrocarbon content and composition of heavy metals), speed and direction of currents around SNP (including in open water and at the major points/headlands, and the lagoons' entrances) and the distribution and extent of seagrass assemblages within the lagoon. Encourage research on specific flagship species including sailfish, turtles and cetaceans. Encourage research on the taxonomy and ecology, particularly reproductive ecology, of SNP's natural resources including algae, sponges, coral, molluscs, ascidians, fish, and cetaceans. Encourage research on the ecological connectivity of SNP with other reefs in the area. Encourage research on the natural dynamics of the different coral communities identified within SNP.	Co-ordinated by Park Manager, with support from management committee (Red Sea University representative)
Missed opportunities to support applied research with commercial potential	Encourage non-extractive basic research (excluding grow-out) on the aquaculture potential of natural resources threatened in Sudan that are presently found within SNP, including *Trochus*, *Lambis*, species of sea cucumber, najil and other reef fish.	Co-ordinated by Park Manager, with support from management committee (Red Sea University representative)
Lack of environmental data to support the interpretation of ecological monitoring data	Establish a recording weather station at the lighthouse that records wind speed and direction, air temperature, atmospheric pressure, global radiation and rainfall. Establish a network of seawater temperature monitoring stations using self-contained logging thermistors.	Assistant Park Manager with support from management committee (Red Sea University representative)
Lack of data on abundance of SNP's natural resources	Establish monitoring transects for commercially important invertebrates (*Trochus*, giant clams, *Lambis*, pearl oysters and species of sea cucumber). Establish a protocol and schedule for monitoring coral predators using the manta tow technique as a rapid assessment tool, and supplemented by more detailed survey methods as necessary. Establish a protocol and schedule for monitoring key species of reef fish including bumphead parrotfish, Napoleon wrasse, grouper and shark species. The design should include research on habitat preferences for each group. Reference should be made to the PERSGA Standard Survey Methods.	Co-ordinated by Park Manager, with support from management committee (Red Sea University representative)
Lack of information and guidance relating to	Conduct internet search for details and reports of other monitoring in MPAs elsewhere, particularly relating to visitor perceptions and feedback. Subscribe to the MPA	Assistant Park Manager

monitoring from other MPAs around the world	related Newsletters. Reference should be made to the PERSGA Standard Survey Methods during the design and implementation of all natural resource survey and monitoring tasks.	
Lack of information relating to the population dynamics and distribution of CoTS	Establish monitoring sites around SNP with the aim of monitoring CoTS population levels. The design and selection of survey techniques should be appropriate to the known dynamics of CoTS outbreaks. Reference should be made to the PERSGA Standard Survey Methods.	Assistant Park Manager
Lack of information regarding marine archaeological resources at SNP	Contact specialist marine archaeologist to obtain an opinion as to the potential for historic wrecks at SNP. Encourage marine archaeological research at SNP.	Assistant Park Manager

4.4 PUBLIC AWARENESS

Issue	**Task**	**Action By**
Lack of a public awareness strategy and a communication plan	Develop a strategy for disseminating information about SNP that identifies different user groups and recommends the most efficient media for reaching them.	Park Manager
Lack of information regarding user groups who would benefit from information about SNP	Develop a database of names and addresses of stakeholders, visitors, tour operators, travel agents, hotels, etc.	Assistant Park Manager
Lack of information available for visitors, general public and other user groups	Develop information leaflet describing the resources and importance of SNP. Develop booklet that contains information about SNP and the Dungonab Bay and Mukawwar Island protected area. Develop an interactive CD-ROM that describes SNP's resources, management policy etc. Develop a website for SNP that includes links to 'Friends of Sanganeb', outlines the opportunities for research at the Park particularly bio-prospecting and other non-extractive research. Train tour operators to give an introductory talk to visitors on arrival at SNP. Ensure that travel guides (e.g. Lonely Planet) covering Sudan include descriptions and relevant information for tourists. Ensure that main tourist hotels in Khartoum and Port Sudan have information leaflets and staff at the front desk and are aware of SNP.	Co-ordinated by Park Manager. Must include the Park Manager of Dungonab Bay and Mukawwar Island protected area
Lack of opportunity for interested parties to contribute to the welfare of SNP	Register 'Friends of Sanganeb' as a society/non-governmental organisation in Khartoum. Establish an appropriate subscription and design a newsletter for circulation primarily by e-mail. Facilitate systems for visitors to submit photographs to Park management for their use in promotional material. Design a system to allow comments from Park visitors that can feed back into Park management e.g. suggestion box and feedback form on website.	Park Manager with support from Assistant Park Manager and Administrator

Lack of awareness about SNP and its current state of development	Issue a press release to the Sudanese and international press and specialist press/newsletters announcing the release of the management plan and schedule for its implementation. Ensure that dive operators are informed about the upper limit being set for the carrying capacity of SNP.	Park Manager and Administrator Assistant Park Manager
Lack of facilities and opportunities for school children to visit and benefit from SNP	Solicit interest from the private sector for the provision of tours at SNP from a glass-bottomed boat, and negotiate an appropriate arrangement to facilitate easy access to the Park for school children. Develop visitor centre display materials, talks explaining basic coral reef ecology that are suitable for school children of different ages, as well as the general public.	Park Manager assisted by Administrator Assistant Park Manager
Lack of corporate identity of SNP	Develop logo for Park that uses the distinctive outline and lighthouse of Sanganeb as a feature.	Administrator in co-ordination with Park Manager
Lack of regular communication with other stakeholders	Advise other stakeholder organisations to appoint a member of staff as the point of contact with SNP, and encourage their participation in the SNP Management Committee.	Park Manager
Lack of information about visitor base or their perceptions regarding Park management	Develop questionnaire for Park visitors that acquires information regarding (amongst other topics) nationality of visitors, activities, length of stay, perception of Park management, and acceptability of Park fees.	Park Manager in consultation with staff from Red Sea University
Lack of branded merchandise for sale in visitor centre	Develop a range of branded merchandise incorporating SNP's logo for sale. Set appropriate prices for each item and design eye-catching method of presenting the material.	Assistant Park Manager with support from Administrator

4.5 TRAINING AND CAPACITY BUILDING

Issue	**Task**	**Action By**
Currently no staff to implement management plan	Recruit Park Manager, Assistant Park Manager, Administrator and rangers.	Wildlife Department
Lack of capacity within Sudan to manage a marine protected area	Recruit a technical trainer for the Park Manager or Assistant Park Manager.	Wildlife Department/PERSGA
Lack of marine experience amongst Wildlife Department staff	Recruit trainer to develop capacity to operate in a marine environment amongst Park rangers. Training should include use of marine radios, small boat handling and outboard maintenance, public relations, basic reef science, and oil spill containment and clean up. Develop and implement an exchange programme with other Parks in Sudan, the Red Sea and elsewhere. Develop performance criteria to assist in the selection of staff benefiting from exchange programmes and training opportunities.	Park Manager Wildlife Department in consultation with Park Manager Park Manager

Lack of budget for capacity building	Allocate sufficient budget each year for capacity building, workshops and training.	Park Manager
Experience gained at other protected areas within Sudan must be shared	Organise annual workshop or meeting for staff at all levels within the Wildlife Department at which experiences can be shared.	Wildlife Department
Lack of information regarding national or overseas training opportunities and their costs	Establish a database of appropriate organisations in the country (e.g. navy and police) and regions that offer exchange programmes, specialist training programmes, workshops and conferences, and maintain links with them.	Park Manager

Capacity building of the Park staff will be essential in order to make sure that the necessary skills and experience are available for the effective management of the Park. However, until individual staff members have been recruited and their capabilities assessed, it is not possible to provide a detailed schedule for capacity development. Tasks that each staff member are required to carry out are outlined above, and should the assessment show that training is required in certain fields then this should be implemented. In addition to the practical skills necessary, organisational skills, particularly of the Park Manager and Assistant Park Manager, should also be developed.

4.6 OIL SPILL CONTINGENCY PLANNING, DEFENSE AND SECURITY DEFENSE

Issue	**Task**	**Action By**
Currently there is no oil spill contingency plan	Develop an oil spill contingency plan that is consistent with the national oil spill contingency plan (NOSCP) and which clearly states the SNP stand on the use of dispersants within the Park at different times of year. Enquire as to the status of the (NOSCP) and track developments towards its implementation. Update the SNP oil spill contingency plan as modifications are made to the NOSCP.	Wildlife Department/PERSGA Natural Resources and Protected Areas Unit, SNP Park Manager
SNP staff are inexperienced in responding to oil spills	Ensure the participation of SNP staff in any oil spill exercises carried out by the relevant authority. Periodically (once a year) conduct exercises to ensure that SNP staff are familiar with the SNP oil spill contingency plan.	To be co-ordinated by Assistant Park Manager
There is no relevant data or equipment on which to base the site specific plan	Conduct surface current measurements across the mouth of the lagoon entrance. Install point of attachment on either end of the lagoon mouth, and consider installing a mooring buoy midway across the entrance. Ensure that the research and monitoring requirements relating to the site specific oil spill plan is included in the research and monitoring plan.	To be co-ordinated by the Park Manager and Red Sea University
No liaison with military or national defence forces	Establish links with the relevant military forces (navy, coastguards, marines and air force etc.) to inform and liaise about military exercises etc.	Park Manager

4.7 INFRASTRUCTURE AND MANAGEMENT STRUCTURE

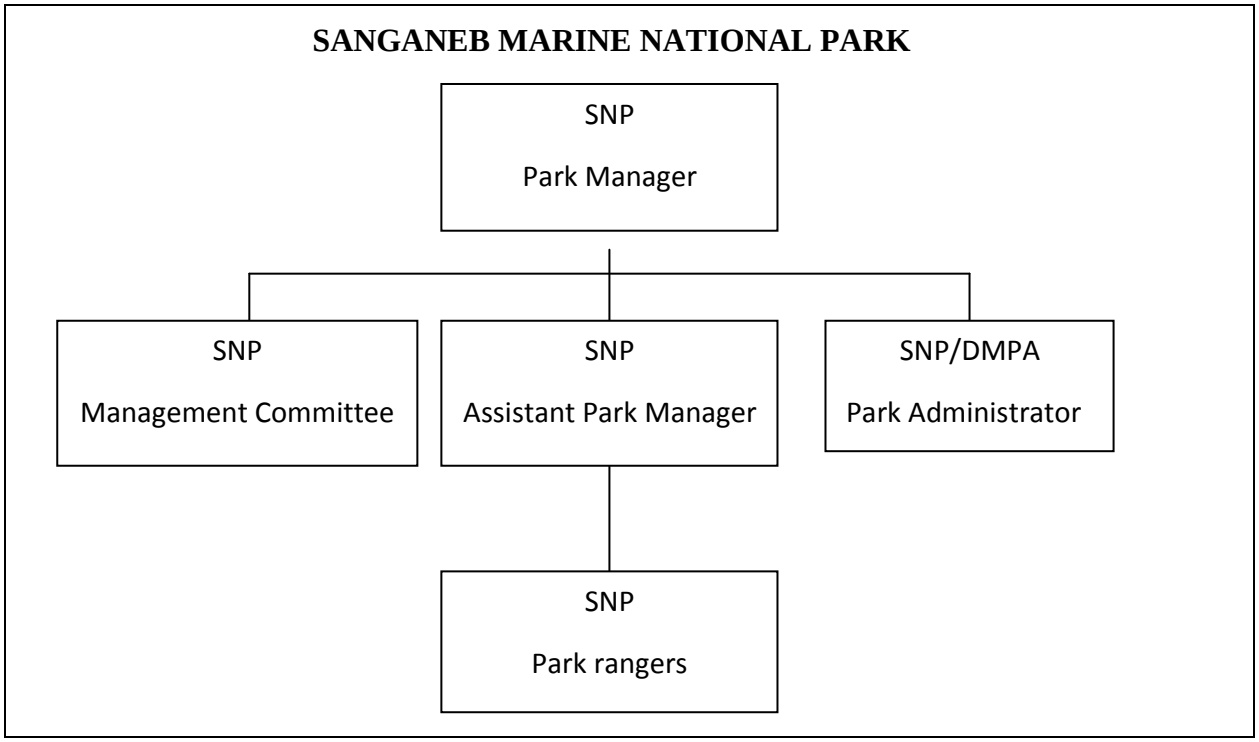
Issue	Task	Action By
Currently no budget available to implement management	Identify sources of funding to support technical assistance and equipment requirements during Phase I and II of SNP's management. An agreement must be reached with the Wildlife Department whereby all income from SNP is 'ring-fenced' for use only by the Park. This may require establishing a trust fund or other financial instrument.	Wildlife Department/PERSGA Natural Resources and Protected Areas Unit, SNP Park Manager
Currently no framework for updating and reviewing the existing management plan	Update and review this management plan every two years.	Park Manager in consultation and discussion with members of the SNP Committee
Currently no detailed terms of reference/work plans for Park staff	Develop terms of reference for Park Manager, Assistant Park Manager and Administrator. Develop work plan for Park rangers.	Park Manager
Currently no resources to implement management	Procure inflatable boat and 25hp engine, fuel storage and pump system, engine-washing facility at SNP. Procure marine VHF radios (x3 plus shore receiver) and other communication equipment (mobile telephones with extended external aerial). Procure digital camera and binoculars. Procure computers and printers for offices in Port Sudan and SNP, with internet capability (i.e. internet account and e-mail addresses). Procure office furniture for offices in Port Sudan and SNP (filing cabinets, bookcases, table, desks and chairs etc.). This office should be shared with Dungonab Bay and Mukawwar Island protected area. Procure essential technical reference manuals for use by the Park staff including; marine resource monitoring techniques, various IUCN and PERSGA publications and guidebooks for MPA management.	Park Manager and Assistant Park Manager supported by Administrator (in consultation with management of Dungonab Bay and Mukawwar Island protected area where appropriate)
Currently no office space for Park staff	Establish SNP Park office in Port Sudan. Tidy and clean lighthouse area including future visitor centre and store. Seek agreement with SPC for accommodation for 3-4 staff at lighthouse. Confirm arrangements for use of lighthouse buildings as visitor centre. Install office equipment, patrol boat, communications equipment in Port Sudan and visitor centre at SNP, following consultation with SPC and Red Sea University.	Park Manager Assistant Park Manager and rangers with contracted unskilled labour Park Manager Assistant Park Manager All SNP staff

Legal basis of Park regulations and liabilities uncertain (i.e. lack of legal framework)	Consult lawyer with regard to SNP's liabilities in general, and those relating to the structures associated with the lighthouse (e.g. staircase, jetties, moorings and bio-prospecting). Ensure that SNP has the legal right to charge entrance fees, permits and to control the development within its jurisdiction. Agree Park regulations. Setup bank account to accept income from visitor fees and sales. Contract firm of accountants to audit the Park's books. Make enquiries as to UNESCO's criteria for awarding World Heritage Site status and incorporate these criteria into the objectives of the Phase III management plan.	Park Manager supported by the Wildlife Department As above As above Administrator Contract let by Park Manager to local firm of accountants Assistant Park Manager with Park Manager's support
Upgrade infrastructure at SNP	Design and install mooring buoys. Survey lighthouse staircase and jetties for structural integrity and Implement any repairs and maintenance to buildings that are necessary (e.g. painting, replacing broken windows, remove rusted jetty supports from southern jetty corridor). Develop a waste management system for refuse generated by the Park, including the installation of refuse bins at the jetties and offshore disposal site for food wastes. Upgrade toilet facilities at the lighthouse. Conduct annual inspection of all buildings within SNP, and prepare and implement a maintenance schedule for all equipment used by Park staff. Procure RIB with twin 40hp engines. Conduct feasibility study for the operation of a larger sea-going vessel to service a MPA network.	Assistant Park Manager to co-ordinate with SPC As above Park Manager supported by Assistant Park Manager Assistant Park Manager to supervise contractor Assistant Park Manager in consultation with SPC Park Manager Wildlife Conservation Administration
Lack of space on dry land for recreation within SNP	Conduct feasibility study for development of recreational facilities. Design and Construct 'platforms' along jetty corridors to provide more recreational opportunities at SNP.	Park Manager to conduct feasibility study, supervise contract for design and construction
SNP management plan requires regular updating	Incorporate new information, government policies, and the results of scientific monitoring and research into the management plan each year.	Park Manager, supported by Assistant Park Manager
Lack of formal agreement between SPC, the University and SNP concerning the use of buildings at the lighthouse and transport of supplies to and from SNP	In consultation with a legal advisor, draw up a MOU for the use of space at the lighthouse, and the regular transport of materials and staff to and from SNP.	Park Manager in consultation with legal advisor

5 PERSONNEL AND FINANCES

5.1 PERSONNEL

The overall management of SNP will be implemented by a park manager and he will be advised and informed by a management committee. The organisational structure of SNP will therefore be as follows:



During Phase I of the management plan, the optimal number of staff for SNP is eight, consisting of:

- A Park Manager,
- An Assistant Park Manager,
- A Park Administrator (possibly to be shared with Dungonab Marine Protected Area initially), and
- Five rangers.

This number makes sufficient manpower available to manage the Park, and builds in the necessary flexibility to accommodate staff training/capacity building, annual and sick leave, as well as promotions or exchanges with other marine protected areas in Sudan (i.e. the Dungonab Bay and Mukawwar Island protected area). Given the remote location of SNP, it is imperative that all staff spend adequate time on the mainland to ensure that staff morale remains high, particularly amongst those staff with families. This has implications for the number of staff required to manage the Park since it will be necessary to rotate the staff at regular intervals. The Park rangers will operate in pairs

or small teams of three when at sea and be stationed at the lighthouse, while the others are on the mainland supporting the Park Manager or on leave.

Park Manager

The ideal Park Manager's profile and responsibilities are described in KELLEHER & KENCHINGTON (1992) as:

'An habitual broad perspective style of thinking; an orderly mind which can integrate a large number of factors into an harmonious whole; an ability to communicate lucidly and concisely; an ability to get things done quickly; an ability to resolve conflict; an ability to run a meeting effectively since meetings will be the principal communications and decision-making forum'.

The basic outline for the terms of reference for the Park Manager is as follows:

- To ensure sufficient and sustainable financing for the Park's continued operations;
- To implement and develop the Park's management plan;
- To ensure the effective operation of SNP by co-ordinating and liaising with user groups and stakeholders;
- To train the Assistant Park Manager in all aspects of the Park's operation;
- To be responsible for the overall smooth management of Park staff;
- To liaise with the managers of other MPAs in the regional MPA network throughout the Red Sea and Gulf of Aden region;
- Develop indicators as a means of tracking the effectiveness of the Park's management;
- Design and implement a reporting schedule, delegating reporting responsibilities to the most appropriate staff as necessary;

The requirement for reporting comes from the need to pass information up and down the management hierarchy as well as to maintain an accurate, comprehensive record of the Park's management from year to year.

Three types of reports are necessary:

- Incident Reports: these are written in response to a significant event (e.g. storm, visitor conflict, end of a development project, release of new information relating to SNP and award of funds).
- Quarterly Management Reports: these are produced by the Assistant Park Manager, and approved by the Park Manager summarising the activities and results of monitoring from the three month reporting period.
- Annual Reports: these are produced by the Park Manager and include all data on visitor numbers, the results of all research and monitoring, an outline of the work plan for the following year, and a report on the audited accounts.

Assistant Park Manager

The Assistant Park Manager is responsible for on-the-ground implementation of the management plan and is the Park rangers' operations manager. He will split his time between Port Sudan and SNP. He should be a graduate in marine science, or have more than 10 years experience of working with the marine environment and managing a small team, and ideally should have some teaching experience and/or experience in the tourism sector.

His main duties are:

- To assist the Park Manager to implement the Park's management plan;
- To train the ranger team in the necessary aspects of MPA management;
- To ensure good relations with tour operators and the other main user groups;
- To assist with group visits (e.g. school tours, guided tours of the lighthouse and visitor centre);
- To co-ordinate implementation of the research and monitoring strategy with staff from the Red Sea University and tour operators.

Park Administrator

The Park Administrator could be a shared post with Dungonab Bay Marine Protected Area, with overall responsibility for supporting the Park Managers in these two areas. This includes general office management, accounting and book keeping, acting as the personal assistant to the Park Managers, organising banking and salaries for Park staff, co-ordinating the maintenance schedules of the Park's resources (boats, and vehicles etc.), co-ordinating the supply of food and water to the Parks, and answering general enquires from the public. A background in office administration with additional experience in graphic design, accounting, law, and information technology would be an advantage.

The administrator's main duties should include:

- Day-to-day management of Park administration;
- Answering telephone enquiries and e-mails from the general public about the Parks;
- Assisting the Park Manager with procurement and contracting requirements;
- Registration of 'Friends of Sanganeb' as a charitable organisation;
- Book-keeping for the Parks and 'Friends of Sanganeb';
- Assisting the Park Manager in organising legal aspects of Park management;
- And assisting the Park Manager in developing a range of SNP branded merchandise.

Rangers

The rangers are the most important implementers of the management plan and the principal point of contact that visitors have with the human element of the Park's management. It is therefore imperative that a ranger can communicate well with the different categories of visitors, from school children to foreign tourists. They should therefore have a background where public relations formed a major part of their work. A ranger should have reasonable English language skills and be comfortable spending many hours at sea in a small boat. His secondary skills should be related to enforcement and surveillance, if possible at sea, and assuring that all Park users abide by the

regulations laid down by Park management. Rangers need not have SCUBA diving skills to fulfil their role at SNP, although they should be competent swimmers.

Given the lack of rangers with MPA experience in Sudan, it may be necessary to recruit rangers from the existing stock of terrestrial park managers and train them in the skills necessary to apply their knowledge and expertise in a marine setting. Priority should be given to those who have experience in working with the public in protected areas.

The Park Manager will develop a detailed work plan for the rangers that will include:

- Providing information about SNP to the Park's visitors and tour operators, both verbally and by distributing information leaflets;
- Enforcing the Park's regulations on a day to day basis;
- Assisting with the logistics of monitoring and research being carried out in SNP;
- Making general observations of the ecology around SNP using feedback from Park visitors, direct observations, etc. using GPS where possible.

SNP Management Committee

The SNP management committee will consist of a total of six senior staff drawn from the main stakeholder groups who can support the Park's management. The principle of such a committee is to keep the numbers to a realistic minimum and the quality of inputs to a maximum. The chairman of the committee should rotate yearly amongst the members. Committee meetings should be held at least twice a year, once in August and once in May, before the tourist season starts and again at the end. It is recommended that the following staff sit on the committee:

The **SNP Park Manager**: his role will be to guide meetings and offer his professional expert opinion in order that the committee can jointly decide on the matters under discussion in an informed and intelligent manner. The Park Manager will be responsible for maintaining links with other parks in the region and elsewhere internationally, as well as keeping abreast of the latest thinking and best management practices developing in the sector.

A representative from the **Wildlife Department** Headquarters in Khartoum; his responsibilities will include:

- Liaison with national policy and new national legislation relating to protected areas and management of biodiversity etc.;
- Co-ordination with other protected areas in Sudan including disseminating lessons learnt in other areas such as Dinder National Park;
- Co-ordination with national tourism authority and the relevant airlines to ensure developments in tourism policy and the expansion of the sector are incorporated into the ongoing evolution of this management plan;
- Securing and increasing the allocation of funds to SNP from the central government budget.

Representative from the Sea Ports Corporation; his responsibilities will include:

- Co-ordination with SPC over all issues relating to the installation and maintenance of mooring buoys, the fabric of the lighthouse and associated buildings etc.;

- Co-ordination with SPC over issues relating to oil spill contingency planning and all other pollution arising from shipping;
- Co-ordination with SPC over all issues arising from navigation, including any changes to the use of the lighthouse, installation of radar and beacons in the vicinity of SNP;
- Disseminating relevant information to mariners including notices to mariners, changes to navigation charts etc.;
- Co-ordination with the navy over all issues relating to national security, coast guard activities, fishing surveillance, anti-poaching and smuggling operations.

Representative from **The Red Sea University**; his responsibilities will include:

- Maintaining links with researchers around the world with an interest in Sanganeb Atoll and its ecology;
- Disseminating the results of best practices relating to the ecological management of protected areas to the Park Manager;
- Designing, executing and interpreting (with the Park Manager) the results of scientific monitoring and research conducted at SNP;
- Assisting the Park Manager in applying for international assistance to support SNP's management and operation;
- Co-ordinating all research activities in SNP;
- Co-ordinating with the Department of Fisheries and the Fisheries Research Institute on matters relating to fishing in and around the Park.

A representative from the **Tourism Sector**, preferably a dive tour operator; his responsibilities should be:

- To inform the Park Manager about developments in the dive tourism sector particularly that in Egypt;
- To assist the Wildlife Representative in the task of liaising with the tourism department;
- To maintain links with other dive tour operators using SNP to ensure that feedback is obtained from the users (operators as well as visitors). He will be the main point of contact between the Park and the Park's recreational user base;
- To support the Park Manager on all dive related issues pertaining to the Park;
- To liaise with the SPC representative on matters relating to the moorings within SNP.

A representative from the **Environmental NGO Sector**. His responsibilities will include:

- Liaison with national and international environmental NGOs with an interest in protected areas management and coastal zone management in general;
- To assist the Park Manager and the representative from the Red Sea University in the design and preparation of grant applications in support of the management of SNP;
- To maintain links with the international marine environmental NGO sector (particularly IUCN) and to disseminate information relating to the management of marine protected area and marine natural resources to the management committee;

- To lobby the necessary government departments and ministries to amend their policies in favour of the conservation of marine resources in general, and Sudanese marine protected areas in particular;
- To assist the Park Manager in the management and administration of 'Friends of Sanganeb'.

5.2 FINANCE

The financial scenario presented here is based on several assumptions, including: that the government will pay the salaries of all Park staff for the staffing levels given here; that prices of items obtainable in Sudan are realistic; that there are no costs associated with the provision of office space either in Port Sudan (to be provided by the Wildlife Department) or at SNP (to be provided by SPC); and that the costs of installing mooring buoys has already been accommodated by PERSGA. The figures are also based on assumptions regarding the additional revenue generated by increasing visitor numbers. Overall, these figures should be taken as being indicative, and for use in planning only, rather than firm figures or targets.

Expected Income

Current number of visitors Year 1 (1,000) multiplied by Park entrance and diving licence fees totalling US$10 per visitor: **US$10,000**.

Current number of yachts in Year 1 (100) multiplied by mooring and fishing licence fee totalling US$20 per yacht per visit: **US$2,000**.

Expected Operating Costs during Phase I

The expected operating costs for Phase I are given below. This figure will be need to be adjusted for subsequent years and phases, but can be used as a starting point for planning.

Item	US$	Notes
Fuel and oil for patrol boat and vehicle, maintenance costs	3,500	This item has potential to be reduced through commercial sponsorship by the oil industry
Communications	2,500	Telephone bills, internet and website registration fee
Incentives and bonuses	5,000	
Printing costs for information leaflets	1,000	Per year
Office operating costs (including consumables)	2,000	Paper, batteries and refreshments etc.
Accounting and auditing	1,000	Contracted to local firm
Maintenance of buildings	1,000	Painting and basic maintenance etc.
Reporting costs	1,000	Printing and postage costs
Committee costs (e.g. refreshments and local travel costs)	500	
Annual exchange programme	2,000	Cost of flight and subsistence
Capacity development	3,000	For workshops and training courses etc.
Contingency	3,500	
TOTAL	**25,000**	

Expected Capital Costs

The capital costs for the first three phases are given below. Capital costs required to establish the Park are spread out over the first three phases, while capital costs for improvements to be implemented during Phase IV are not given, as they are too far in the future to be able to estimate accurately.

Phase I		US$
	Costs associated with recruitment of Park staff	500
	Inflatable boat, 25hp engine, fuel cells and jerry cans, washing facilities and equipment (e.g. oars, life jackets, first aid kit and tools)	8,000
	Marine radios	2,000
	Digital camera and binoculars	1,000
	Computers (x2) and printers (x2) for Park offices	2,000
	Office furniture	2,000
	Reference books etc.	1,000
	Labour for cleaning lighthouse and removing solid wastes	500
	Installation of office equipment	300
	Lawyer's fees for advice on liabilities, MOU with SPC etc.	2,000
	Signage and radar reflectors	1,500
	Maintenance of lighthouse buildings, particularly the visitor centre	2,000
	Establish monitoring transects using manta tow board and rope	500
	Development of information leaflet	1,000
	Press release	500
	Develop Park logo	1,000
	TOTAL	**25,800**

Phase II		US$
	Implementation of solid waste management plan	500
	Development of bio-prospecting contract (consulting fees)	5,000
	Weather station	800
	Seawater temperature monitoring system	700
	Development of information booklet	5,000
	Development of interactive CD-ROM	5,000
	Development of website	5,000
	Registration of Friends of Sanganeb as society	500
	Press release	500
	Develop visitor centre	5,000
	Develop range of SNP merchandise and order initial stock	5,000
	TOTAL	**32,000**

Phase III		US$
	RIB with 40 hp engine (x2)	15,000
	Upgrade toilet facilities	5,000
	Feasibility study, design and construction of 'recreational platforms'	25,000
	Press release	500
	Further develop visitor centre	5,000
	TOTAL	**50,500**

Summary

The income expected in Year 1 (Phase I) totals **US$12,000**. As estimated below, the operating costs (excluding salaries or office rent) are **US$ 25,000** per year, leaving a short fall of **US$13,000** that must be met from grants or donations from government or non-governmental sources. This does not include any provision of international technical assistance.

The necessary minimum capital costs for the first three phases (covering an eight year period) are: Phase I **(US$25,800)**, Phase II **(US$32,000)** and Phase III **(US$50,500)**. As it is difficult to predict the numbers of visitors coming to SNP or the effectiveness of the promotion campaign it has not been possible to estimate revenue during Phases II and III. The maximum expected income from visitor fees is **US$71,000** (see section 3.12 on sustainable financing), which suggests that when operating at capacity SNP can become self-financing in the long-term. In the short- and medium-term it is clear that to meet its start-up funding requirements, SNP will need to attract grants from government or non-governmental sources, and this should be the main focus of the Park Manager.

6 IMPLEMENTATION

The implementation of the plan has been organised into four phases, with the greatest emphasis on the early years of implementation. The four phases are:

- Phase I – Getting started (one year duration)
- Phase II – Capacity building and promotion (two year duration)
- Phase III – Self-sustaining management (five year duration)
- Phase IV- Expansion of Park into a co-ordinated national and international network

The first phase is designed to achieve easy and early successes to build confidence and establish a management capacity that makes SNP functional. The second phase is designed to consolidate on the early achievements of the Park through the development of media necessary to promote the Park and through the development of capacity and training. The goal of Phase III is to take SNP into a situation where it has diversified its income generating strategy to such an extent that it becomes self-financing for its operating and capital investment costs. Phase IV should be implemented when this Park and others in Sudan have matured and can be integrated together more closely to form a coherent management unit with a significant role to play in a number of aspects of coastal zone management including fisheries enforcement. Since each phase is further into the future it becomes less possible to write an implementation schedule for each phase, so only details for Phase I are presented here. Implementation schedules for Phases II and III should be developed by the Park Manager after Phase I is complete.

The following table has been compiled from the tasks listed in the management plan. The column entitled ‘Timing’ gives the deadline by which the task should be complete (end of quarter).

IMPLEMENTATION PHASES

Phase I – Getting Started (Year 1) Issue	**Task**	**Timing (in Phase I)**	**Estimated Capital Budget**
Currently no budget available to implement management	• Identify sources of funding to support technical assistance and equipment requirements during Phase I and II of SNP's management.	Q1	
Currently no staff to implement management plan	• Recruit Park Manager, Assistant Park Manager, Administrator and rangers.	Q1	US$500
Currently no detailed terms of reference or work plans for Park staff	• Develop terms of reference for Park Manager, Assistant Park Manager and Administrator. • Develop work plan for Park rangers.	Q1	
Currently no resources to implement management	• Procure inflatable boat and 25hp engine, fuel storage and pump system, engine-washing facility at SNP. • Procure marine VHF radios (x3 plus shore receiver) and other communication equipment (e.g. mobile telephones with extended external aerial). • Procure digital camera and binoculars. • Procure computers and printers for offices in Port Sudan and SNP, with internet capability (i.e. internet account and e-mail addresses). • Procure office furniture for offices in Port Sudan and SNP (filing cabinets, bookcases, table, desks and chairs etc.). This office should be shared with Dungonab Bay and Mukawwar Island protected area management. • Procure essential technical reference manuals for use by the Park staff including marine resource monitoring techniques, various IUCN and PERSGA publications and guidebooks for MPA management.	Q1 Q1 Q1 Q1 Q1 Q1	US$8,000 US$2,000 US$1,000 US$2,000 US$2,000 US$1,000
Currently no office space for Park staff	• Tidy and clean lighthouse area including future visitor centre, toilets and store. • Seek agreement with SPC for accommodation of 3-4 staff at lighthouse. • Install office equipment, patrol boat and communications equipment in Port Sudan and at the visitor centre in SNP, following consultation with SPC and the Red Sea University.	Q2 Q1 Q1	US$500 US$300
Legal basis of Park regulations and liabilities uncertain	• Secure legal basis for buffer zone around SNP. • Agree Park regulations. • Set-up bank account to accept income from visitor fees and sales. • Contract firm of accountants to audit the Park's books. • Make enquiries as to UNESCO's criteria for awarding World Heritage Site status	Q3 Q2 Q1 Q3 Q4	US$1,000 per year

	and incorporate these criteria into the objectives of the Phase III management plan.		
Upgrade infrastructure at SNP	• Design and install mooring buoys. • Survey lighthouse staircase and jetties for structural integrity. • Conduct annual inspection of all buildings within SNP, and prepare and implement a maintenance schedule for all equipment used by Park staff.	Q3 Q3 Q4	Cost to be borne by PERSGA/SPC US$1,000 per year
SNP management plan requires regular updating	• Incorporate new information, government policies, and the results of scientific monitoring and research into the management plan each year.	Q4	Printing costs US$1,000
Lack of formal agreement between SPC, the University and SNP concerning the use of buildings at the lighthouse	• In consultation with a legal advisor, draw up a MOU for the use of space at the lighthouse.	Q1	Legal fees US$1,000
Implementation of zoning plan	• Designate area around lighthouse jetty for swimming and snorkelling. • Ensure vessels use mooring points. • Ensure adherence to SNP's policy relating to fishing.	Q2 Q4 Q2	US$500 for mooring buoys and fixings
Lack of procedures for routine observations visitor control and impacts	• Establish a protocol for surveillance and control of visitors in the Park, including the reporting or apprehension of illegal fishing vessels. • Ensure a particularly high level of surveillance on days during which live-aboard dive vessels are in Port Sudan. • Develop and implement procedure for inspecting level of litter, solid waste and oil etc. within SNP. This should be incorporated into the work plan for rangers.	Q2 Q2 Q1	
Lack of procedures for non-routine events	• Encourage dive operators to provide input into developing a contingency plan for a diver lost at sea or other diving-related emergency.	Q2	
Lack of guidelines for visitor conduct	• Develop simple guidelines for divers in consultation with dive operators (e.g. no novice divers and no diving gloves allowed). • Develop guidance notes for captains of vessels entering SNP.	Q2 Q2	
Lack of information concerning the resource base in SNP	• Encourage the collection of baseline survey data for sediment characteristics (including hydrocarbon content and composition of heavy metals), speed and direction of currents around SNP (including in open water and at the major points/headlands) and the distribution and extent of seagrass assemblages within the lagoon. • Encourage research on specific flagship species including sailfish, turtles, cetaceans. • Encourage research on the taxonomy and ecology, particularly reproductive ecology, of SNP's natural resources including algae, sponges, coral, molluscs,	Anytime Anytime Anytime	

	ascidians, fish, and cetaceans. • Encourage research on the ecological connectivity of SNP to and with other reefs.	Anytime	
Lack of data on the abundance of SNP's natural resources	• Establish monitoring transects for commercially important invertebrates (*Trochus*, giant clams, *Lambis*, pearl oysters and species of sea cucumber) • Establish a protocol and schedule for monitoring coral predators using the manta tow technique. • Establish a protocol and schedule for monitoring key species of reef fish including bumphead parrotfish, Napoleon wrasse, grouper and shark species.	Q2 Q1 Q1	
Lack of contact with international organisations involved with marine resource management	• Establish and maintain contact with the IUCN Species Survival Commission's Wrasse and Grouper Specialist Working Group, and search for other specialist interest groups for SNP's natural resource base (e.g. GCRMN, Reefcheck, IUCN, billfish and cetaceans).	Q2	
Lack of information and guidance relating to monitoring from other MPAs around the world	• Conduct internet search for details and reports of other monitoring in MPAs elsewhere, particularly relating to visitor perceptions and feedback. • Subscribe to the MPA Newsletter.	Q4	
Lack of information available for visitors, general public and other user groups	• Develop information leaflet describing the resources and importance of SNP. • Develop booklet that contains more information about SNP, and Dungonab Bay and Mukawwar Island protected area. • Develop an interactive CD-ROM that describes SNP's resources and management policy etc. • Develop a website for SNP that includes links to Friends of Sanganeb, outlines the opportunities for research at the Park particularly bio-prospecting and other non-extractive research.	Q2 Q4 Q4 Q4	US$2,000 US$5,000 US$5,000 US$5,000
Lack of awareness about SNP and its current state of development	• Issue a press release to the Sudanese and international press and specialist press/newsletters announcing the release of the management plan and schedule for its implementation. • Ensure that dive operators are informed about the upper limit being set for the carrying capacity of SNP.	Q1 Q1	US$500
Lack of facilities and opportunities for school children to visit and benefit from SNP	• Solicit interest from the private sector for the provision of tours at SNP from a glass-bottomed boat, and negotiate an appropriate arrangement to facilitate easy access to the Park for school children.	Q2	
Lack of corporate identity of SNP	• Develop logo for Park that uses the distinctive outline and lighthouse of Sanganeb as a feature.	Q1	US$1,000
Lack of regular communication with other stakeholders	• Advise other stakeholder organisations to appoint a member of staff as the point of contact with SNP and encourage their participation in the SNP Management Committee.	Q1	US$500

Lack of capacity within Sudan to manage a marine protected area	• Recruit a Park Manager or Assistant Park Manager from overseas.	Q2	US$10,000
Lack of marine experience amongst Wildlife Department staff	• Recruit trainer to develop capacity to operate in a marine environment amongst Park rangers.	Q2	US$5,000
Lack of budget for capacity building	• Allocate sufficient budget each year for capacity building, workshops and training.	Q4	
Lack of implementation plan for Phase II.	• Develop implementation plan for Phase II.	Q4	

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APPENDICES

LEGISLATION AND REGULATIONS

Sudan is party to the following relevant international conventions:

- Convention Concerning the Protection of the World Cultural and Natural Heritage (1974);
- United Nations Convention on the Law of the Sea (signed in 1982);
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) (ratified in 1982 and entered into force in 1983);
- Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment 1982 ('Jeddah Convention');
- Protocol to the Jeddah Convention Concerning Regional Co-operation in Combating Pollution by Oil and other Harmful Substances in Cases of Emergency (1982);
- Convention on Biological Diversity (signed in 1992, became party to in 1995).

Other conventions and programmes to which Sudan is party include:

- World Heritage Convention;
- African Convention on the Conservation of Nature and Natural Resources;
- UNESCO Man and the Biosphere Programme.

Relevant National Legislation

- Wildlife Protection Act, (1936);
- Sudanese Fishery Ordinances and Regulations: Dates back to 1937 and was amended in 1975 and 1978. Prohibits over-fishing, dumping of refuse, including oil, into the sea and the collection of corals, shells and aquarium fish;
- National Parks, Sanctuaries and Reserves Regulation, (1939);
- Harbours and Shipping Ordinance, (1961);
- Terrestrial Waters and Continental Shelf Act, (1970);
- General Regulations and Control of Merchant Shipping Act, (1971);
- Wildlife Conservation and National Park Act, (1987);

Proposed SNP Regulations

1. Between September and May, SNP will be open to visitors without the need for prior permission but subject to SNP regulations.
2. Staying overnight in SNP is permitted on moored or anchored vessels only, and in places designated by Park management.
3. It is forbidden to stand on, hold, break or collect corals and other attached or free-living marine life.
4. It is forbidden to catch or harm any animal life underwater other than fishes as controlled by specific rules for recreational fishing in SNP.
5. Fishing is permitted from the lighthouse jetty using a hook and line only.
6. It is forbidden to anchor or pole craft or to walk over coral communities and reefs.
7. Littering and discarding of foodstuffs anywhere within the core zone other than in the litter bins provided is prohibited.
8. It is forbidden to possess spear-guns, fish poisons, dead or live turtles, or coral within SNP.
9. It is forbidden to use jet skis and other fast moving or noisy craft in SNP.
10. The building of residences, catering facilities and other shelters or structures whether temporary or permanent shall be restricted to the area around the lighthouse unless by prior written amendment to the management plan by the management committee.
11. The building of piers, groynes, breakwaters, seawalls or other structures in, across or seawards of the reef is prohibited unless by prior written amendment to the management plan by the management committee.
12. The digging, blasting or dredging of channels is forbidden, unless by prior written amendment to the management plan by the management committee following their completion, review and acceptance of appropriate environmental impact assessment studies.

Appendix 7

The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden

(PERSGA)

Dungonab Bay–Mukawwar Island Proposed Marine Protected Area

Site-Specific Master Plan with Management Guidelines

Draft 28 June 2004 – waiting for four reference confirmations from author.

PERSGA

June 2004

PERSGA-'The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden' is an intergovernmental authority dedicated to the conservation of the coastal and marine environments in the region and the wise and sustainable use of their natural resources.

The Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment (Jeddah Convention) 1982 provides the legal foundation for PERSGA. The Secretariat of the Organization was formally established in Jeddah following the Cairo Declaration of September 1995. The PERSGA member states are Djibouti, Egypt, Jordan, Saudi Arabia, Somalia, Sudan, and Yemen.

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1. EXECUTIVE SUMMARY

This Master Plan has been prepared for the proposed marine protected area (MPA) at Dungonab Bay–Mukawwar Island, one of twelve MPAs within the Red Sea and Gulf of Aden regional network. The primary goal is the conservation of the biological diversity of this unique location, while allowing and facilitating sustainable resource use through the application of ecosystem-based management. The PERSGA Strategic Action Programme (SAP), through which this Master Plan was developed, supports and facilitates these goals at the regional level.

MPAs act as tools to provide for sustainable use of natural resources, economic development, and biodiversity and habitat conservation. The regional network of MPAs, of which Dungonab Bay is an important part, will constitute a regionally and globally important tool for *in-situ* conservation of species and habitats within the unique Red Sea and Gulf of Aden region.

The Red Sea and Gulf of Aden contain some of the world's most diverse and varied tropical marine habitats and communities. The combination of broad diversity, great biogeographic complexity, and high levels of endemism make the region of global importance for marine biodiversity conservation (CHIFFINGS 1995; PERSGA/GEF 2001).

The Dungonab–Mukawwar area lies on the western shore of the north-central Red Sea. The southern boundary of the proposed MPA is located approximately 120km north of Port Sudan; it extends almost 70km northwards and includes reefs, islands and all other marine habitats along this stretch of coast. The MPA contains an enormous diversity of habitats, many still in very good condition, and a diversity of species including populations of several globally threatened or endangered flagship species.

A number of ecological and socio-economic characteristics of the area mean that the Dungonab Bay MPA is of national, regional and international importance for biodiversity conservation, and for sustainable use of living marine resources. These characteristics include:

- A spectacular diversity of marine habitats and communities, including some extremely unusual coral and reef fish communities;
- Extensive and diverse coral and reef fish communities;
- Extensive seagrass beds of regional importance;
- Spectacular, unspoiled coastal landscapes;
- A large population of the globally endangered dugong;
- Regionally or globally important nesting areas for marine turtles and seabirds;
- Seasonal aggregations of whale sharks and manta rays that are unique in the entire western Indian Ocean region;
- A possible refuge for corals in the face of climatic and oceanographic changes attributable to global climate change;
- Potential for implementation of an ecosystem-based approach to fisheries management that will be important for sustainability of fisheries both within the MPA boundaries, and beyond;
- A significant resident human population that is almost entirely dependent upon extractive resource uses;
- Other important economic activities including aquaculture and salt production;

- Considerable potential for the development of sustainable high-value tourism.

The exceptional significance of the area is such that the designation of Dungonab Bay-Mukawwar Island MPA should become a conspicuous flagship project for conservation in Sudan and the Red Sea, and the regional network of which it is a part.

The area is currently relatively pristine but there are already indications that ecosystem-based management and MPA-based conservation are becoming an urgent necessity. For example:

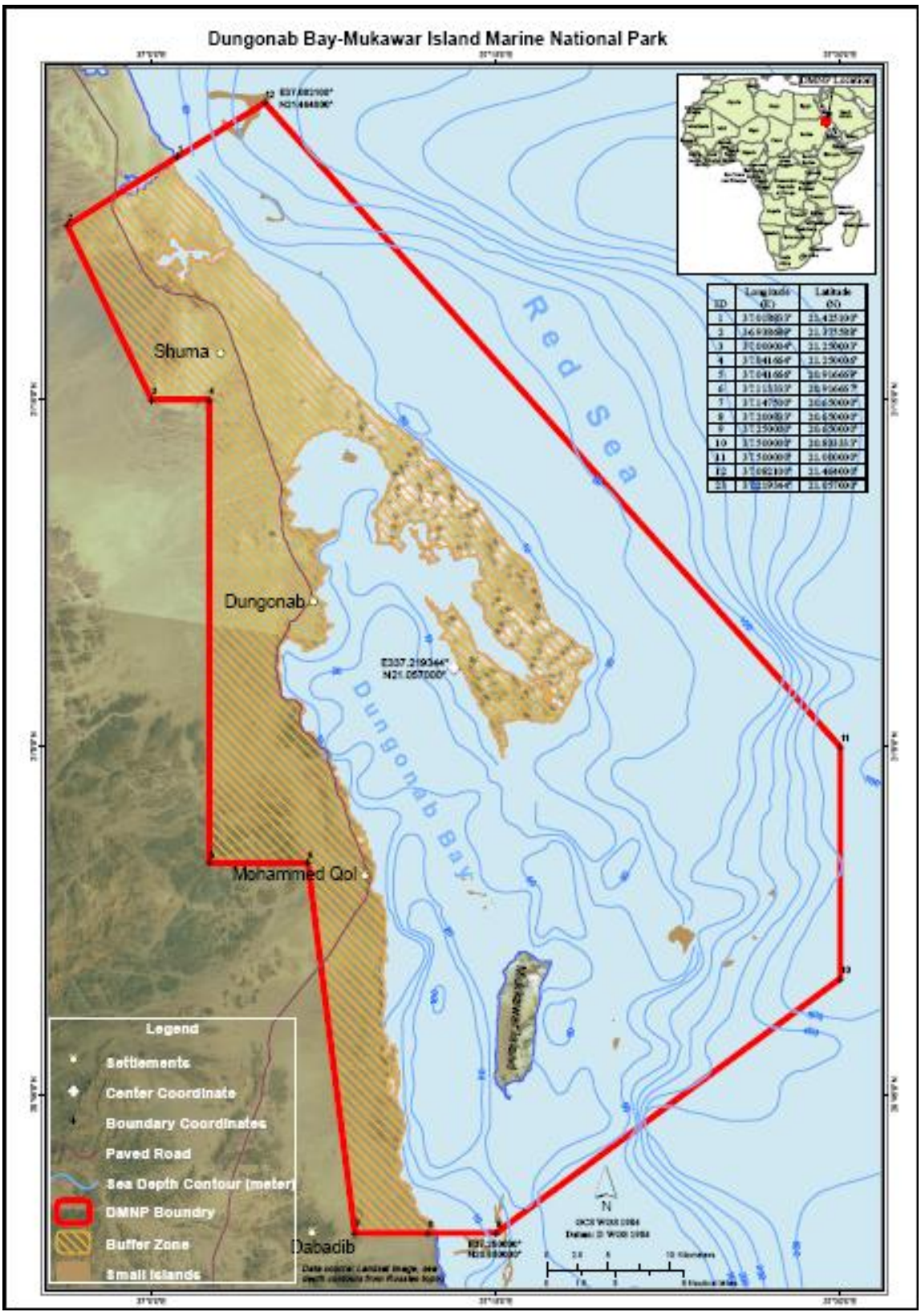
- Over-exploitation of fisheries resources is already apparent in some important groups.
- There are real and immediate threats to a number of endangered and flagship species within the MPA. For example, the population of globally endangered dugong in the area is rapidly declining due to use of inappropriate fishing methods in sensitive areas.
- Extensive areas of coral damaged in the 1998 global coral bleaching event require management of further impacts to enable recovery.

1.1 OBJECTIVES AND GOALS

The objectives for the Dungonab Bay – Mukawwar Island MPA are based upon those set out in the Regional Master Plan, and can be summarised as:

1) To conserve representative and prime examples of the biodiversity of the Red Sea and Gulf of Aden.
2) To provide for the sustainable use of living marine resources both within and beyond the MPA boundaries, by:
3) The development of a network of seasonal and permanent Fisheries Reserves that will provide for the conservation and replenishment of breeding stocks, and biomass; and
4) The promotion of sustainable and non-destructive fishing methods.
5) To support local and national economic and social development.
6) To protect the unique cultural heritage of the marine and coastal environments of the Red Sea and Gulf of Aden.
7) To develop regional capacity in all aspects of MPA planning and management.
8) To involve local communities and stakeholders as partners in MPA management.
9) To conduct research and monitoring programmes to inform MPA management.
10) To enhance public awareness of the marine resources and biodiversity of the Red Sea and Gulf of Aden, and the principles of sustainable use.
11) To implement a regional legal framework for protected areas and biodiversity (through Dungonab Bay and the other MPAs within the regional network).

Each of these primary objectives has a series of goals, as well as specific policies and strategies for achieving them.


Dungonab Bay-Mukawar Island Marine National Park
Red Sea
Dungonab Bay
Shuma
Dungonab
Mohammed Qol
Dabadib
Legend
Settlements
Center Coordinate
Boundary Coordinates
Paved Road
Sea Depth Contour (meter)
DMNP Boundry
Buffer Zone
Small Islands

DMNP MAP

1.2 MANAGEMENT POLICIES AND STRATEGIES

Management policies and strategies in this Master Plan provide a mechanism for ensuring that issues relevant to the management of the proposed MPA are dealt with. These policies and strategies cover: biodiversity; resource uses; zoning for management; cultural heritage; capacity building and technology transfer; community consultation and participation; research and monitoring; public awareness and education; infrastructure; defence; oil spill contingency planning; and sustainable financing mechanisms.

Central to the management approach is the adoption, as far as possible, of a collaborative and community-based approach. This requires that residents of the MPA are kept fully informed of management policies and approaches, and that effective consultation mechanisms are put in place and utilised from the earliest stages of implementation. The adoption of this approach will simplify management, reduce operating costs, encourage and increase the support and involvement of the local community, foster a 'self-policing and self-enforcement' approach, and greatly increase the medium to long-term success of the MPA in achieving its objectives.

The existence and further development of the Sanganeb National Park provides opportunities for co-operation and collaboration that will improve the management effectiveness of both areas, and has the potential to provide a very strong foundation upon which to build the Sudan national MPA network.

1.3 THE MANAGEMENT PLAN

This section of the Master Plan outlines specific activities to be implemented for management of the MPA. Issues and matters addressed match closely those addressed by the policies and strategies.

The use of zoning is central to the Management Plan. Zoning provides a powerful mechanism for reducing or eliminating conflicts and for combining compatible uses, often for mutual benefit. Within the proposed area a number of different zone types will be used, although changes to these may occur as the MPA develops. For each of the different zone types, the main purpose is described, together with the activities which are permitted and prohibited. The different zone types can be summarised as:

- Nature Sanctuaries: for strict protection and conservation of critical sites, and endangered or particularly vulnerable habitats and species.
- Fisheries Reserves (i.e. 'no-take' fishing areas): to allow maintenance and/or regeneration of fish and other marine populations, and to increase sustainability of fisheries within and outside the MPA by export of eggs and larvae, and emigration of adults.
- Nature Reserves: for non-extractive and non-destructive resource uses compatible with biodiversity, habitat and species conservation. In addition to conservation these areas will be made available for sustainable tourism uses that do not conflict with conservation.
- Resource Use Zones: for sustainable and non-destructive fisheries, and other fully sustainable uses (where these do not clash with fisheries) such as carefully controlled tourism.
- General Use Zones: for sustainable and carefully controlled infrastructure development.

This Master Plan provides an indicative preliminary zoning plan to be implemented, developed and extended throughout the first two to three years of implementation (Appendix 3). A number of general and specific requirements for zoning are provided to support this process.

It is essential that the residents are fully consulted about and involved in the full development and implementation of the zoning plans, as well as other aspects of the Management Plan.

4. GENERAL POLICIES AND STRATEGIES

This section lists the general policies and management strategies that apply throughout the MPA, for the various topics in the previous section (i.e. habitats, flora and fauna and resource uses). It also describes the content of the specific management strategies to be implemented.

The Dungonab Bay MPA is a multiple-use protected area. Within the outer boundaries the protected area is divided into a number of zones for different uses, with different levels and types of protection. The range of different zones allows for the full range of uses (including extractive resource uses, appropriate development, and sustainable tourism) compatible with sustainable development and biodiversity conservation.

The Dungonab Bay MPA differs significantly in several ways from Sanganeb Atoll, the other MPA currently under development in Sudan.

- Dungonab is very much larger than Sanganeb.
- Dungonab is more geographically and socio-economically complex than Sanganeb.
- Dungonab has a significant resident human population of long historical standing. This population is currently almost entirely dependent upon the extractive use of marine resources.
- Dungonab currently has no measurable tourist income, and it will take several years for any significant income from tourism to be generated. This point has important implications for funding, and is thus a central consideration in the earlier stages of implementation.

These differences are reflected to varying extents in the Site-Specific Master Plans for these two MPAs but, in spite of these differences, the similarities between the broad objectives and methods of the two parks are considerable. Between them, implementation of these two marine protected areas will provide Sudan with an array of techniques and approaches to marine environmental protection and conservation. These will provide an exceptionally strong basis for the successful development of a national network of MPAs, and consequently the successful management of marine and coastal biodiversity for long-term sustainability.

4.1 GUIDING PRINCIPLES FOR MARINE PROTECTED AREA MANAGEMENT

A number of guiding principles can help ensure that the concept of sustainability becomes embedded in decision-making processes that affect the Dungonab Bay MPA. These general measures (see box) serve as cornerstones for biodiversity conservation and sustainable resource use.

Guiding principles for successful MPA management

1) Understand that **management of renewable coastal and marine resources** is of *strategic importance* for social and economic development and is cost-effective in the long-term.
2) Recognise that **sustainability** requires the maintenance of the integrity of coastal systems, and that this implies limits to the use of resources generated by these systems.
3) Understand that the **carrying capacity** of coastal systems to support tourism, recreation and other human use is variable, and is not infinite.
4) Develop **integrated management actions** that allow **multiple uses** of natural resources, in which **complementary activities are integrated** and **conflicting activities are avoided or segregated** (i.e. undertaken in different areas).
5) Ensure good **co-ordination** in coastal management activities and involve local people. This is essential to ensure **effective management** and **equitable socio-economic development**.
6) Recognise that inadequate or lack of **implementation** and **enforcement** are often more of an obstacle to effective management than deficiencies in environmental legislation or scientific information.
7) Accept that **MPA management** should not be fixed, but is an **ongoing and adaptive process**, with adaptation and modification in the light of changed environmental conditions, updated information, and changing human needs.

4.2 BIODIVERSITY

Sudan is a signatory to the Convention on Biological Diversity (CBD), and ratified the convention in October 1995. To fulfil obligations of the CBD a National Biodiversity Strategy and Action Plan was developed by the Higher Council for Environment and Natural Resources (HCENR), providing an overarching national framework for biodiversity conservation within Sudan.

Other key international treaties or conventions relevant to marine biodiversity conservation and management that Sudan is party to are, the:

- African Eurasian Migratory Waterbird Agreement (AEWA), and the
- Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES).

Important or unique characteristics

Sudan lies in the central-northern Red Sea biogeographic zone, an area of high endemism and high overall biodiversity within the marine realm, making this park of great significance for marine biodiversity conservation. However, a number of other characteristics further enhance the value of Dungonab Bay MPA, making it globally important:

- Unusual coral communities;

- Unique 'biogeographically displaced' fish communities (i.e. fish communities characteristic of the southern Red Sea, here found in the north due to unusual environmental conditions);
- A high diversity of broad habitat types;
- Regionally or globally important concentrations of turtle nesting sites;
- Regionally or globally important sites for birds;
- Globally unusual and regionally unique aggregations of whale sharks and manta rays;
- The bay itself may constitute a regionally important refuge for coral communities, from global-warming induced coral bleaching.

Maintenance of process and populations

The primary objective of the proposed MPA is to ensure the conservation and sustainable use of the biodiversity of this nationally and regionally important area. The size, location and ecological diversity of the area mean that the ecological significance of the MPA extends well beyond its own boundaries. Both internally and more widely the protected area will help to maintain both ecological processes and populations in a number of ways, providing:

Refuges for endangered species. In particular these include marine turtles and dugong, both of which are found in large numbers and reproduce within the MPA boundaries. Although these groups, along with others such as sharks, will only spend a portion of their life history within the park, protection of critical areas and sites (such as turtle nesting beaches), and of such a large area, will make a significant regional contribution to the maintenance of viable populations.

Protection for both representative ('typical') and highly unusual habitats and communities. The wide range of habitats and associated plant and animal communities present will ensure long-term protection of a wide variety of biodiversity.

Reproductive refuges for marine species (including fisheries species), that will benefit areas both within and far beyond the MPA boundaries. The inclusion of zones for protection and maintenance of reproductive capacity will provide an insurance policy and a buffer to ensure the long-term security of the reproductive potential for ecologically and economically important species. In particular, the use of Fisheries Reserves (areas closed to all fishing) is now recognised to be a highly effective and valuable way to ensure the continued existence of viable fisheries (ROBERTS & HAWKINS 2001). Export of larvae from such reserves, as well as the emigration of adults, will benefit fisheries both close to the boundaries of such reserves, and much further afield.

4.3 RESOURCE USES

Tourism

The current lack of tourism within the park boundaries is important. As mentioned above, this has very considerable implications for the early stages of implementation of any Management Plan.

Tourism plays a significant role in the development and funding of many conservation areas or MPAs, and promotion of wider ecotourism within Dungonab Bay MPA, especially scuba diving, should be a high priority for management.

There are numerous excellent sites for scuba diving throughout the area, but these have yet to be fully identified and described. This makes the realistic determination of carrying capacity for dive tourism within the MPA impossible at the present time.

A tourism development plan should be drawn up by the park management, in consultation with major stakeholders under the guidance of the MPA management committee, and fully taking into account the wishes of the MPA's inhabitants.

The objectives of the tourism plan will be:

- To develop of sustainable tourism, in line with the overall objectives of biodiversity conservation and sustainable use, and strictly following all zoning and other regulations of the MPA. Compromising the conservation regulations of the MPA to maximise tourism (or other income generating uses) will undermine the MPA and ultimately lead to failure.
- To develop mechanisms that will increase the ability of the MPA to be self-financing, through the collection of tourism revenues. Mechanisms for revenue generation, and prices levied, should be based upon examples from elsewhere in the region (Ras Mohammed National Park in Egypt being a good example), and should be co-ordinated with other MPAs in Sudan.
- To develop alternative livelihoods for the inhabitants of the region through tourism. This should include:
    - All tourism developments must undertake to employ a minimum proportion of their staff from among the MPAs inhabitants. A minimum of 30% for small operations (up to 10 employees), and 20% for large operations (more than 10 employees), should be the minimum initially enforced, although this may be revised upwards).
    - Development of other, entirely locally generated, businesses to service tourism. For example, fishermen and others with good local knowledge who may want to become involved in ecotourism activities should be encouraged and supported.
    - Encouragement for the development of traditional handicraft skills by the local communities, especially women, for souvenir sales to tourists.

Carrying capacity

Many intense human activities, such as mass tourism, are known to be incompatible with conserving the diversity, productivity and beauty of important coastal areas. Sudan has so far avoided the perils of mass tourism.

To ensure that management does not fail due to excessive non-extractive uses, it is vital that carrying capacity is determined now. Cautious (precautionary) long-term limits to growth should be established and incorporated into the long-term management strategy for the MPA. In this way both natural resources and people will continue to coexist side by side.

A critical challenge will be ensuring that economic development does not deny to later or even present generations important future resource-use options that may currently be unknown. Loss of opportunity can happen unexpectedly following incremental and often unperceived environmental deterioration.

Fisheries

Dungonab Bay MPA policy towards fisheries and other extractive resource uses:

Dungonab Bay MPA recognises the importance of extractive resource uses within its boundaries to the resident population and to user groups based outside the MPA.

The overall policy of the Dungonab Bay MPA towards extractive resource uses is:

To ensure that the needs and requirements of the residents of the proposed MPA are met with regard to fisheries, but to ensure that fishing and other extractive activities are carried out in a fully equitable and sustainable manner, safeguarding those resources for future generations.

This will be achieved by adopting an ecosystem-based approach to fishery management. An ecosystem approach will ensure that extractive resource uses:

1) Do not damage or destroy habitats within the MPA.
2) Do not endanger or otherwise threaten non-target species within the MPA, including endangered or ecologically 'key' species such as dugong, turtles or sharks.
3) Do not reduce the abundance of any target or non-target species or groups to a level where that species or group faces ecological extinction (i.e. is reduced in numbers to a point where, although perhaps not threatened with complete local extinction, they are no longer capable of fulfilling their ecological role in the local ecosystem).
4) Do not unsustainably harvest any target species.

A number of measures will be used, all of which will be fully developed and implemented in co-operation with the resident communities of the MPA. These measures will include, but not be restricted to:

- The designation of permanent Fisheries Reserves, closed to all extractive uses, to serve as biomass and reproductive reserves for key fisheries species.
  - i) These reserves should be fully explained and discussed with the fishing communities of the MPA before implementation.
  - ii) The assistance and support of the fishermen should be actively sought to identify, designate and police such areas.
  - iii) It is recommended that a small number of fishery reserves (minimum of five) be introduced initially, to illustrate to the fishing communities the benefits of such reserves and to help gain acceptance for this management approach.
  - iv) Fishery reserves should initially be relatively small (each one covering a maximum of 1km of coast or reef).
  - v) Fishery Reserves should preferentially include areas where critical processes take place, and areas where habitats are very fragile.
  - vi) Fishery Reserves should be placed within existing reef fishing areas, including areas of recent or historic decline in catch. This will provide, within two or three years, a practical demonstration of how fish stocks can recover within such reserves, and how those reserves can then provide considerable 'overspill' benefits to adjacent areas, even while the Fisheries Reserves themselves remain closed.
  - vii) The ultimate objective should be to include a minimum of 20% of the MPA area within a network of Fisheries Reserves. This may seem a large figure, but extensive evidence shows that complete closure of 20% or more of an area to fisheries will provide a net benefit to fishermen in the medium and long-term.

viii) Careful reference to the extensive literature on the design and management of fisheries reserves should be made throughout the discussion, design and implementation phases. A key text will be ROBERTS & HAWKINS (2001): *Fully Protected Marine Reserves: A Guide*. Translation of this text into Arabic (with the full permission of the publishers) should be considered for use throughout Sudan and further afield in the PERSGA region.

- Seasonal reserves should be designated to protect spawning sites, spawning aggregations, or similar transitory critical features.
- Fishing methods that threaten a species survival should be phased out. For example, the use of fixed nets threatens the regionally important local population of dugong. The introduction of alternative non-destructive methods should be encouraged and as far as possible facilitated by the MPA. For example, an acceptable alternative for dugong may be the use of biodegradable traps in important areas instead of fixed nets.
- The prohibition of recreational fishing (e.g. fishing by non-park residents, including tourists).
- Trawling should be prohibited throughout the entire park area, including deep-water areas.
- Spear fishing is prohibited in Sudan. This ban is widely ignored, particularly by expatriates, tourists, and visiting yachtsmen. The ban must be rigorously enforced throughout the area and penalties must be severe enough to operate as a genuine deterrent (minimum fine suggested to be in the region of US$250 for non-Sudanese residents, with a lower figure, in the region of US$50, for Sudanese residents).

  i) Visiting yachts should be required to deposit spear guns with the MPA office on arrival, to be reclaimed upon departure.

  ii) Any spear guns in the possession of visitors based on land (who have no excuse for possession of spear guns in Sudan) should be permanently confiscated, in compliance with Sudanese laws on spear fishing.

- The use of scuba diving for sea-cucumber fisheries should be prohibited. Use of such equipment is a central factor in rapidly making such fisheries unsustainable.

Particular reference here is made to the fisheries and other coastal/marine plans and activities of ACORD, an NGO that has been active throughout the area since 1986, primarily through a pastoralist programme. The role of ACORD has grown to include three main elements (water, livestock and capacity building). ACORD has extensive experience of working with local communities in the rural areas of coastal Sudan, including the MPA, and has recently proposed extending its activities into the area of facilitating the exploitation of living marine resources in the Dungonab area. The close assistance and co-operation of ACORD should be sought by the MPA in these activities.

Aquaculture

Aquaculture carried out in the area to date (i.e. low impact oyster culture) need not conflict with the objectives of the MPA, and may provide sustainable livelihoods to park inhabitants.

If oyster farming remains an activity within the MPA it is recommended that:

a) Close and regular communication, both formal and informal, is maintained between the MPA management and oyster farm management. The park's management should be

consulted before any changes in aquaculture activities are implemented, and will have powers of veto over any potentially damaging activities.

b) If the activities of the farm have moved, these must be incorporated into the zoning plan for the MPA, after assessment to ensure that they are not conflicting with other significant permitted activities or with the zoning plan.

c) A monitoring programme to include water quality, substrate (coral, algae and invertebrates) and fish community monitoring be put in place around the farm to identify any adverse impacts. This should be funded by the oyster farm, following the 'polluter pays' principle, but should be incorporated within the wider park monitoring programme, and overseen by MPA management.

d) The importation, introduction, or use of any non-native species must be strictly prohibited.

e) The local communities should be provided with greater opportunities to benefit from such activities, i.e. recruitment of oyster farm workers should preferentially be from the local population rather than outside the MPA.

4.4 ZONING

Zoning provides a powerful mechanism for separating conflicting activities and combining compatible ones. Dungonab Bay MPA is a multiple use MPA and as such, zoning is central to its design, successful implementation and management.

The objectives of zoning within the Dungonab Bay MPA are:

- To enable the full range of user groups within the MPA to carry out their activities in a manner which is compatible with biodiversity conservation and sustainable use;
- To minimise conflicts between different user groups;
- To provide an overall spatial framework for planning and development within the MPA which is compatible with the long-term sustainable use and conservation of the biodiversity of the area;

This is to be achieved by:

- Physically separating mutually incompatible uses from each other;
- Providing areas within which essential natural processes (e.g. breeding of commercially/ecologically important or threatened/endangered species) can continue to take place undisturbed;
- Providing areas where endangered, vulnerable or critical species and habitats can exist undisturbed.

The preliminary zoning of the MPA has been kept relatively simple. Zoning of both terrestrial and marine components will become more complex as the MPA matures. It will be developed in consultation with the inhabitants and major stakeholders of the area through an iterative process. This plan describes initial zoning, and sets broad objectives for the further development of zoning schemes.

It is important to note that within the proposed area different zones will conform to different IUCN categories, particularly IUCN Categories I and II in the marine environment, and IUCN Categories II and V in the terrestrial environment.

The zones are defined and described in detail, and the zoning plan presented in section 5.2. Zoning maps for the MPA are given in Appendix 3.

Table 1. IUCN protected area categories relevant to Dungonab Bay protected area (KELLEHER 1999).

IUCN Category name	IUCN definition
Category I	Protected area managed mainly for science or wilderness protection.
Category II	Protected area managed mainly for ecosystem protection and recreation.
Category V	Protected area managed mainly for landscape/seascape conservation and recreation
Category VI	Protected area managed mainly for sustainable use of natural resources.

4.5 CULTURAL HERITAGE

Sheikh Okod

The shrine at Sheikh Okod has great cultural importance throughout the northern coast of Sudan and beyond. The policy of the MPA with respect to Sheikh Okod will be to safeguard this site and its cultural significance in the long-term through the protection of the site, the continuation of festivals, and protection of the surrounding environment. This is the only site in the MPA where encroachment of *Prosopis* (mesquite) was observed during the survey phase. The possibility of removing or controlling this invasive species should be fully investigated, and agreement reached with the relevant stakeholders about the best way to address this issue at this site.

Shipwrecks

Currently no historic shipwrecks have been identified within the MPA boundaries, although it is likely that such wrecks do exist. With the probable future importance of scuba diving in the MPA any wrecks discovered must be fully protected from plunder and souvenir hunting by divers. It is recommended that all except very recent (post-1945) shipwrecks be placed off limits to divers once they are discovered, until they can be fully assessed and, if necessary, properly excavated.

Other sites

There has been human activity within the MPA area for thousands of years, and it is likely that historic and/or prehistoric sites exist in the area. All such sites should be protected from looting and destruction, and incorporated within the Management Plan, as the managers become aware of their existence.

4.6 CAPACITY BUILDING AND TECHNOLOGY TRANSFER

Protection of Dungonab Bay MPA is, along with Sanganeb to the south, the first step towards the development of a national network of MPAs, and will constitute an important part of the foundation upon which marine conservation and management in Sudan is based. Currently, capacity within Sudan for management of marine protected areas is very low – as opposed to terrestrial protected areas, where Sudan has a long history and considerable experience.

A number of the fundamental aspects of the marine environment, and of the skills and processes necessary to protect that environment and the biodiversity that exists within it, are very different from those on land.

Recognising this, capacity building will be a central aspect of the initial implementation of park management for several years, at least to the end of Phase II and beyond. Indeed, capacity-building and training will be an ongoing activity to varying degrees, and for varying purposes, throughout the lifetime of the MPA. A model of this may be found within the Gulf of Aqaba Protectorates in Egypt.

Expert technical assistance will be essential to the successful development and management of the MPA throughout the early stages of implementation. To this end it is recommended that:

- An experienced park manager of international standing be recruited to lead the implementation, and to provide on-the-job training to a counterpart (the assistant park manager).
- An experienced and fully qualified scuba diving and marine safety trainer be recruited to provide all necessary swimming, snorkelling, scuba diving, boat handling and other marine safety and survival skills to park staff. This individual should be required to train selected staff in the effective maintenance and basic servicing of scuba equipment, boats and engines.

An early task will be, in consultation with the management of Sanganeb National Park, the development and implementation of a training policy and programme for MPA managers and rangers in Sudan. The careful co-ordination of this programme with that of Sanganeb (i.e. the development of a joint training programme) will provide considerable savings of time, money and other resources, and will also facilitate the development of the links necessary for an effective national network of MPAs.

Long-term successful park management will require access not only to practical skills, but also to scientific expertise. For this reason, a medium to long-term objective of capacity building should be the development of specialist academic training for park staff in marine biology, management and conservation.

The development and maintenance of links with other MPAs in the regional network

Dungonab Bay MPA and Sanganeb National Park will form part of the regional network of MPAs. This should provide an opportunity to benefit from the experience and skills already present in the region. The most important of these regional centres is currently Egypt, where the Gulf of Aqaba Protectorates in particular now have almost 20 years of experience of the implementation of all aspects of marine and coastal protected areas. Other member states of PERSGA also have active MPAs, or are developing them through the PERSGA executed Strategic Action Programme.

Links with the Egyptian parks have already been initiated, with three staff from Ras Mohammed National Park taking part in the initial ecological and resource use survey of the MPA in early 2002. These and other links should be developed and maintained. This may be achieved chiefly through:

- Exchange visits and placements, for both managers and rangers;
- Initiation of and participation in regional and international workshops, seminars and other forums, for the exchange of information, experience and ideas.

4.7 COMMUNITY CONSULTATION AND PARTICIPATION

The involvement of local people in all stages of management is critical to the success of the Dungonab Bay MPA. This includes planning and consultation at all stages, as well as operational activities. The views of the resident population on development concerns should take precedence over those of migrant fishermen or external fisheries (although those wishes should not be allowed to exclude other user groups unreasonably).

To this end the institution of formal communication and consultation mechanisms should be central to management, and local communities should be a focal point of the public awareness plan.

Community consultation should be formally incorporated into the finalisation of major design and implementation decisions. Practical steps taken to develop public understanding and acceptance of, and involvement in, the initial design process may include:

- The employment of extension officers, village meetings, an environmental education and awareness campaign, and regular meetings with local authorities;
- Development of a preliminary draft zoning plan (preliminary guidance is provided by this Management Plan) by the MPA management team. This plan should be based in the first instance on the results of the PERSGA survey;
- The draft zoning plan should be reviewed at a technical workshop attended by community and government representatives, international experts and the management team;
- Review of the draft zoning plan through public meetings held throughout the proposed area, open to all permanent park residents, and attended by local *omda*, fishermen's' leaders, technical specialists, and government representatives;
- Subsequent amendment to the draft zoning plan to reflect concerns raised during the meetings.

Collaborative and community based management

The Dungonab Bay MPA has several characteristics that make it particularly suited to the adoption of a collaborative, community-based approach to management, particularly for fisheries. These characteristics include:

1. A significant resident human population spread throughout the area of the MPA

This resident population is, until alternative livelihoods can be identified and put in place, almost entirely dependent upon extractive resource uses within the MPA. The agreement and support of the residents will therefore be a major factor determining whether the MPA is a success in the medium to long-term.

2. Size

The size of the MPA means that effective enforcement implemented entirely by MPA 'authorities' will be impractical, and possibly prohibitively expensive. Adoption of this authoritarian approach may also arouse the resentment and defiance of local residents, which may in itself lead to failure of MPA management.

In contrast, the active participation of the residents in the design and implementation phases, and the development of self-policing and self-enforcement approaches (so long as these are effective), will greatly simplify the management of the area in general and of fisheries in particular.

3. Complexity

The MPA will ultimately be a relatively complex one, with a range of different zone types throughout the terrestrial and marine areas. As described above, and elsewhere, successful development and implementation of the zoning plans will require input from, and ultimately the agreement of, the majority of the residents.

Collaborative management (also called co-management) is based on the participation of all groups with a stake in the resources being managed. The following are key elements in this approach (from White *et al*. 1994):

- All stakeholders within a park have a say in the management of the resource upon which they depend. This guarantees their commitment and participation, and permits the incorporation of their knowledge, aspirations and experience.
- The sharing of management responsibility varies according to the specific conditions. In some cases, much of the authority is in the hands of a government agency; in others a larger proportion may be in the hands of local community organisations. In virtually all cases, however, a level of government continues to assume responsibility for overall policy and co-ordination of functions.
- Social, cultural and economic objectives are an integral part of the management framework. Particular attention is paid to the needs of those who depend on the resource, and to equity and participation.

The form that collaborative management eventually takes within the MPA will be determined as part of the implementation process.

4.8 RESEARCH AND MONITORING

Institutions and individuals responsible for management need to recognise that the Convention on Biological Diversity (CBD), and other international agreements to which Sudan is a signatory, carry obligations for research and monitoring. These are not options or 'luxuries', but legally binding contractual requirements.

Research is carried out to answer specific questions, or resolve particular issues. In the present context, research will support ongoing management of the Dungonab Bay MPA through both proactive and reactive studies.

Research is undertaken to address issues such as:

1) The socio-economic significance of the area for local inhabitants, and the national economy;
2) Water movements and other hydrographic conditions;
3) Life history and population dynamics of exploited species, and in particular their use of specific habitats at different stages of their life cycle;
4) Life history and population dynamics of species that form important components of benthic habitats, especially corals and seagrasses;
5) Life history and population dynamics of species that may pose a threat to components of park diversity or ecosystems, such as crown of thorns starfish or *Drupella*;
6) Biodiversity inventories;

7) Community structure of key groups such as fish and corals, and factors affecting those communities.

Research programmes will for some time be beyond the capacity of park staff and management to implement. The full range of productive research opportunities, both applied and academic, presented by the MPA has the potential to attract researchers from throughout the PERSGA region and around the world.

A research policy for the MPA should be drawn up that will define priority research areas. Research programmes conducted within the proposed MPA should, where possible, contribute to the management of the area. Research may contribute to the sustainable financing of the park (see section on sustainable financing below).

Monitoring is undertaken in MPAs for a variety of reasons:

1) As part of the management evaluation process; monitoring will determine the baseline conditions at the time the MPA is established so that management performance can be assessed. The data from the 2002 survey will contribute to that baseline, with dedicated monitoring programmes developed during implementation of the MPA;
2) To understand the natural variations in the ecosystem so that impacts from human activities can be distinguished from normal, background variation;
3) To assess the impacts of particular activities (e.g. establishment of a tourist operation or port).

Monitoring should, from the earliest stages, be clearly and explicitly linked to management rather than merely being a routine, undirected activity. For example, any monitoring programme to sample/measure oil concentrations in the marine environment should be an integrated part of oil spill cleanup. This requires determination and setting of threshold criteria (e.g. not necessarily only minimum oil concentrations) before monitoring commences. In this way, it is known at what point oil spill cleanup should begin. Similarly, but often overlooked, the setting of 'endpoint' criteria is equally important, to determine at what point cleanup operations should cease.

Basic requirements of research and monitoring are set out in the Regional Master Plan.

4.9 PUBLIC AWARENESS AND EDUCATION

Public awareness is essential to the success of many conservation and environmental management activities. It helps to achieve a number of complementary objectives:

1) To increase support for and understanding of conservation and management for sustainable use, through increased awareness of the need for, and benefits from, all aspects of biodiversity;
2) To gain support for management activities that may otherwise be perceived by stakeholder groups as unnecessary, counterproductive or simply not clear;
3) To mitigate or prevent damaging human activities which result from misunderstanding, or a lack of understanding, of vulnerability or other characteristics of species, habitats, or the physical environment.

Achieving the goals and objectives of management requires the support and co-operation of a diverse range of people, including the people whose activities are being managed and key decision-makers in government agencies.

A public awareness programme is an integral component of the Management Plan. The objective of the public awareness programme is:

To achieve the support and co-operation of stakeholders for the goals of the Dungonab Bay MPA, by providing the information to:

i) support the concept of the MPA,

ii) comply with MPA regulations, and

iii) understand why those regulations are there in the first place.

The Regional Master Plan provides guidance on information needs, strategies for public awareness, and guidelines for planning a public awareness programme. The Regional Master Plan should be consulted during the development of the public awareness plan. Topics for public awareness should include, but not be limited to, the following:

- The concept of sustainable development,
- The benefits to be derived from MPAs and their importance in conservation,
- The nature of the major coastal ecosystems (coral reefs, seagrasses, mangroves, etc) and links between the health of the ecosystems and human activities (e.g. heavy fishing and poorly planned tourism),
- The link between long-term conservation of marine and coastal systems, and their value in generating income for developers,
- The value of biodiversity, and of rare and endangered species,
- Regulations relating to the MPA.

Design and implementation of a far-reaching and comprehensive public awareness programme should be a priority in the first full year of implementation.

Co-operation with Sanganeb National Park

Considerable advantages of time, cost, training, production, distribution, etc, may be gained by developing and implementing this programme in co-operation with Sanganeb National Park, in the form a national awareness programme. Much of the more generalised material needed can be utilised by both parks (and by any further parks designated in the future).

4.10 INFRASTRUCTURE

Infrastructure required for management of the Dungonab Bay MPA, and the locations where it will be required, need to be determined. An office, vehicles, boats, communication facilities, accommodation, and personnel will be among the initial priority requirements.

Later on in implementation there will be varied and complex requirements including but not limited to – visitor centres, roads, fencing, mooring buoys, information sources including panels and displays, rubbish collection and disposal facilities, toilet facilities, ranger stations, scuba equipment (including a dedicated store and workshop) and a range of technical and scientific equipment.

A full assessment of infrastructure needs is a high priority. An indicative list is provided in section 5.6. The needs and experiences of other MPAs in the regional network, particularly Ras Mohammed and the Gulf of Aqaba protectorates may also be studied to provide further insights in advance of full implementation.

4.11 DEFENCE

The Dungonab Bay MPA covers a large area of coastal land and sea. Security services are present in the area and there is great potential for harnessing the knowledge and logistics/skills of the coastguard and other security services to achieve management objectives within the park. This was very clear during the survey phase when security services provided invaluable help and support. Effective public awareness programmes should include these important groups and should help develop and strengthen relationships between the services and the proposed MPA. Development of strategies for liaising with defence authorities, and any requirements for management of defence activities within the MPA (e.g. timing of exercises in relation to nesting by sensitive species) should be a priority.

4.12 OIL SPILL CONTINGENCY

Oil pollution is a widespread threat to coastal and marine biodiversity, fisheries and tourism. The Dungonab Bay MPA, located on the coast of one of the world's major oil transport routes, is no exception. A major oil spill in the area will have the potential to cause extensive damage to the habitats, biodiversity and fisheries of the proposed MPA.

An oil spill contingency plan should be developed as part of the finalisation of the draft Management Plan. This contingency plan should be based upon, and fully compatible with the Sudan National Oil Contingency Plan (PERSGA/UNEP 2003). The Dungonab MPA will not have its own resources and facilities for combating oil, at least initially. In the event of a significant spillage in or near the MPA, management will need to draw on equipment and personnel from Port Sudan.

Assessment of the vulnerability (probability of an oiling event) and sensitivity (ecological/economic consequences of oiling) of different biological components within the proposed MPA is an important aspect of oil spill contingency planning. This helps determine priorities for protection in the event of an oil spill entering the MPA and threatening its biological features and resources.

4.13 SUSTAINABLE FINANCING

Implementation of the Dungonab Bay MPA will incur considerable costs, just as failure to conserve it will carry economic costs/losses. Costs will fall into two categories:

1) Initial set-up costs
2) Recurrent operating costs

Sustainable financing is a new field in the Red Sea and Gulf of Aden because, to date, there are few operational MPAs and costs associated with running them have tended to come from government operations or international donor agencies.

Tourism as a source of revenue for MPA operations has, after considerable development and investment, been successfully applied in Egypt at the Ras Mohammed National Park, where entrance fees to the National Park have allowed the Gulf of Aqaba Protectorates to be financially self-sustainable (at least nationally, as final mechanisms for returning revenues generated by the MPA to

the MPA management have not yet been established) and not to require subsidy from central government.

The development of tourism as a source of sustainable financing on the Ras Mohammed model should be a point of policy for the MPA management. However, Ras Mohammed National Park required donor support throughout the early years of implementation before it reached the stage of being self-financing. With limited infrastructure it is unlikely that sustainable financing based upon tourism will be an option for Dungonab Bay MPA in the near future.

Since the financial requirements of the Dungonab Bay MPA still need to be determined this section provides recommendations on the principles to be applied:

Recommended Financing Principles:

1) Financial transparency in collection, auditing and distribution is essential, with revenues raised for the proposed MPA clearly seen to be recycling back to the budgets of the organisations providing services.
2) Users should, where possible, pay in full for all physical resources they use, including the costs of the management of these resources.
3) Prices of services and supplies (e.g. water and utilities) should reflect true economic costs, including costs of sustainable environmental management where appropriate (polluter pays).
4) Users, including recreational divers, should carry a good proportion of the financing burden for marine protected areas.
5) All tourists entering the area, even if they do not dive or snorkel, impose costs on management. As a matter of principle they too should make a contribution to maintaining the overall quality of the environment in the coastal zone. A lower level of entry costs may be applied to Sudanese nationals, and a higher (but still modest) rate to non-Sudanese visitors.
6) Traditional uses of the MPA, such as the festival at Sheikh Okod should, while being required to conform to the broader requirements of sustainable use and conservation, be exempted from standard entry fees.

To these broad principles may be added the following potential financing mechanisms. These are derived from findings of the recent GEF Red Sea Coastal and Marine Resource Management Project in Egypt and other international tourism projects:

- Yachting (the numbers are forecast to increase substantially in the PERSGA region, and they can contribute through harbour charges, and charges for (mandatory) use of identified mooring buoys);
- Cruise ships (few at present, but it is customary to impose a charge, typically per person on the ship's manifest, as a contribution to associated infrastructure and other costs imposed);
- Medical (revenue from use of their recompression chamber is a significant income source in areas such as the Sabah Marine Park, Malaysia). This is an example of lessons that might be learned from outside the region; and similarly,
- Research (research teams contribute in Malaysia to the costs of the Sabah Marine Park when they are working there. They also provide research students with an opportunity to work on a cost-free basis).

5. THE MANAGEMENT PLAN

The Management Plan is a specific document that outlines strategies for implementing the objectives, goals, and general policies in the Master Plan. The Management Plan has a life of around five years and is evaluated and amended following the results of the monitoring programme. The Management Plan includes the following contents:

- Management of natural resources
- Zoning
- Research and monitoring
- Public awareness
- Oil spill contingency
- Infrastructure

5.1 MANAGEMENT OF NATURAL RESOURCES

Biodiversity

For the purposes of management, biodiversity may be defined as the full range of biological communities, species, and variation within species occurring at a site, in a locality or within a region.

This range of biological diversity provides the basis for the food chain and productivity, and also influences the capacity of ecosystems to perform these and other services. Biodiversity, in both type and quantity, is affected by fishing and a wide range of other human activities. Hence management measures for the conservation of biodiversity underpin and support actions directed at the harvesting of natural resources.

Key issues relating to biodiversity identified within the Dungonab Bay MPA are summarised in Table 1, but the list is not exhaustive. Further issues will be identified during the implementation of the MPA, and subsequently. Table 1 also highlights and prioritises conservation measures needed to address these issues.

Careful attention will be necessary to ensure compliance with international obligations (e.g. CBD) and regional agreements concerning the monitoring of biodiversity.

Special policies and guidelines to be developed for managing key habitats and species of conservational importance will need to be comprehensive. Habitats to be covered include:

- Coral reefs and coral communities
- Mangroves
- Seagrasses
- Algae
- Sabkha
- Beaches and intertidal areas
- Terrestrial habitats

Important species to be covered include (but may not be limited to):

- Turtles
- Dugong

- Birds
- Cetaceans (dolphins, whales)
- Elasmobranchs (sharks and rays)

Until these guidelines have been developed, 'broad-brush' conservation measures will be needed (e.g. avoiding/preventing disturbance or development in known feeding or breeding areas, and tackling clear and obvious existing threats). Conservation measures for habitats and species already developed in the PERSGA region (e.g. Egypt and Saudi Arabia), as well as further afield (e.g. turtle conservation guidelines from East Africa) will be helpful.

Table 2. Key issues and proposed activities relating to biodiversity.

Key Issues	
1. Knowledge of habitats and biodiversity in the MPA is adequate for initial implementation and management, but inadequate for long-term management. Details of species associated with habitats are generally insufficient. 2. Biodiversity of terrestrial habitats and associated flora and fauna is inadequately documented. 3. The MPA's habitats and species assemblages are however well-enough known to indicate that they are significant both nationally and internationally. 4. The marine and coastal ecosystems of the entire area are varied and diverse, with a number of the most important areas remaining in good or very good condition. 5. The area is of national and regional (possibly global) importance for a number of threatened, endangered and flagship species. 6. Recent impacts in the area include the 1998 coral bleaching event. There have also been sharp declines, due to fishing activities, in the abundance of some important fisheries species, and the globally threatened dugong.	
Proposed Activities	
Short-term (<12 months)	1. Compilation of existing biodiversity/species data for key marine (coral reefs, seagrasses, algae and mangroves) and terrestrial habitats. 2. Identify, in detail, key species groups and habitats for priority study. These should include all vulnerable and threatened species. 3. Immediately implement protection and management of key critical sites (e.g. turtle nesting beaches of Mukawwar Island). 4. Assess the extent and possible impact of bird and turtle egg collecting activities, and implement management if necessary, including directed public awareness programmes.
Medium-term (1-3 years)	1. Focused survey work on species of conservation importance (e.g. turtles, birds, cetaceans, corals and sharks), including naturally occurring but potentially damaging species such as crown of thorns starfish. 2. Undertake biodiversity surveys/inventories to augment information derived above. 3. Identify and initiate management processes that will incorporate new information about biodiversity and processes within the MPA into management actions (e.g. to adjust zoning plans, regulations within zones etc. and accommodate new information about environmental sensitivity).
Long-term (3-5 years)	1. Develop and implement detailed policies and guidelines for managing key habitats and species of conservational importance. 2. Develop information systems (GIS and databases, and human capacity to fully utilise them) to facilitate management. This should be done as a joint Dungonab–Sanganeb project.

Coral bleaching

A further point relevant to biodiversity conservation is coral bleaching. This is of considerable concern in the PERSGA region where it has caused extensive coral mortality for several years. Most notable was the bleaching event of 1998 – although large areas of coral on the eastern shore of the southern Red Sea (both Yemen and Saudi Arabia) were killed in a more localised event that probably

occurred in 1995 or 1996. Climate change is probably a major factor behind the increasing frequency and severity of coral bleaching events. Individual developing countries like Sudan can probably do little to influence the western nations largely responsible for the increasing emissions of greenhouse gases, climate change and sea level rise. However, national and local efforts can help to combat the more local impacts of global climate change because:

- Healthy coral reefs have the capacity for vertical growth to keep pace with sea level changes. The same is to some extent true of other key habitats including mangroves and seagrasses. Healthy communities tend to be more resilient than damaged ones.
- Healthy coral reefs and other communities/habitats have a greater capacity to respond to sea level rise and other impacts than degraded communities (although this will not provide immunity against instances of heavy bleaching).
- Maintenance of coral reefs, mangroves, seagrasses and other biological communities may help to mitigate the consequences of climate change locally by protecting shorelines and reducing erosion.

Resource Use

Extensive fishing pressure within the proposed MPA, impacting both target and non-target species to a possibly unsustainable degree, means that development and implementation of effective resource use strategies and guidelines are fundamental to management.

Key issues relating to resource use are summarised in Table 3, which also highlights and prioritises conservation measures needed. The early identification of the agency/agencies that will implement these measures is important. With commitment and sufficient resources, the fisheries within and around the proposed MPA can be successfully managed for sustainability in the long-term.

Other resource uses

Resource-use management guidelines are considered separately from fishery regulations, and need to address in particular the following aspects of development:

- The exact location (site) and other planning requirements of development including, but not restricted to: tourism facilities including recreational facilities of all kinds; residential, fishing and other accommodation; and any other infrastructure including roads. The issue of siting is broadly addressed in the terrestrial zoning plan presented in this Management Plan, but more detailed planning is required within those zones.
- Construction (choice of materials; avoiding loss/degradation of critical marine habitats for fishery species and fauna of conservational importance; control of sedimentation etc.).
- Operations (control of nutrient, sewage and effluents).
- The present position of the coast road allows easy access to extensive areas of mainland coast, including fragile and vulnerable fringing coral reefs, khors, sabkha and mangroves. The opportunity for uncontrolled access to the shore from the main road should be limited as much as possible to specifically designated areas of low sensitivity, which are easy to patrol/maintain. It is essential that when the new coast road is constructed it is set back from the shore outside the terrestrial buffer zone, or otherwise as far back as is practical from an engineering point of view. Off-road driving by non-residents should be prohibited. In this way access to the coast, particularly by non-resident visitors from outside the MPA can be managed.

Table 3. Key issues and proposed activities relating to extractive resource uses.

Key Issues	
1. Widespread and seemingly escalating fishery problems, including a combination of overfishing, and unsustainable fishing methods that may threaten the fishery's sustainability, and species affected by it (e.g. dugong). 2. Damage to corals and other benthic habitats by nets, including lost nets continuing to ghost fish, causing turtle mortality and/or damage to corals. 3. Anchor damage from fishing boats on corals.	
Proposed Activities	
Short-term (<12 months)	1. Undertake outreach activities and socio-economic studies to enable a full understanding of the nature, extent and importance of extractive resource uses, and begin to identify alternative livelihoods. 2. Prohibit trawling and other industrial fishing within the proposed MPA boundaries. 3. Initiate collaborative, community-based fisheries management for issues that can be addressed directly by the local communities. 4. Urgently implement management to protect endangered species (e.g. dugong) threatened by specific fisheries methods (in the case of dugongs, the use of fixed nets in or near areas of seagrasses, khor mouths etc). 5. Prohibit the use of scuba equipment for sea-cucumber fisheries.
Medium-term (1-3 years)	1. Fully develop collaborative and community-based fisheries management structures and approaches. 2. Urgently designate 'no-take' fisheries reserves, both permanent and seasonal. 3. Institute measures to monitor and if necessary regulate the numbers of fishermen, traps, boats and nets, particularly of non-local fishermen. 4. Initiate management measures to protect vulnerable target species, including nagil, sharks, kokian, sea-cucumbers etc. 5. Prohibit unsustainable or damaging methods. 6. Prohibit use of nets in coral areas.
Long-term (3-5 years)	1. Ongoing monitoring of fishing practices, fish catch and effort, and modification of regulations as necessary. 2. Ongoing monitoring of the impacts on the status of populations or species vulnerable to incidental fishing (e.g. as by-catch, including dugong and turtles). 3. Monitoring of the effectiveness of fishery reserves, with extension of Fisheries Reserves to at least 20% of the area (and including at least 20% of the reefs). 4. Develop more knowledge of critical life cycle phases (spawning and nursery areas) of important fishery species, and of the susceptibility of these to pollution and development pressures. 5. Formulate and apply guidelines/policies to manage coastal and marine uses (e.g. construction, development and tourism).

NOTE: There is considerable potential in the proposed MPA for inappropriate coastal development and coastal use. This has not yet happened to any appreciable extent, but unsustainable practices need to be prevented before they occur, rather than cured later. This is done through resource-use guidelines, zoning, and related measures.

General regulations within the MPA boundaries

This section provides an indicative list of general regulations that should be applied within the MPA. This list should be further developed and finalised during the first year of implementation.

- All extractive uses require a licence (see comments elsewhere about relative levels of charging, and eligibility of park residents for free licences).
- Removal of corals, shells, and other curios and souvenirs, whether living or dead, to be prohibited.
- All destructive fishing practices to be prohibited.
- All industrial fishing and trawling within the park boundaries to be prohibited.
- All bird and turtle nesting sites, nests and eggs to be fully protected.
- All juvenile and adult birds and turtles to be fully protected.
- All dugong to be fully protected.
- All mangroves to be fully protected.
- All elasmobranchs (sharks and rays) within the area to be fully protected.
- Anchoring or poling craft, or walking over corals and reefs to be prohibited.
- Driving anywhere except on designated routes and roads, to be prohibited (see more detailed comments elsewhere).
- Littering anywhere is prohibited.
- Feeding of fish within the MPA is prohibited.
- It is forbidden to possess fish poisons, nets, hooks and lines, traps, or any other fishing equipment without a licence.
- Possession of spear guns anywhere in the park at any time is prohibited.
- It is forbidden to use jet skis. Use of other fast moving or noisy craft within the MPA will be limited to permitted areas in order to protect vulnerable species including dugong, turtles and whale sharks.
- Building within 50m of the high tide line is prohibited.
- Landfill is prohibited.
- The building of residences, catering facilities and other shelters or structures whether temporary or permanent shall be restricted to the General Use Zones unless by prior written amendment to the Management Plan by the management committee, following the full completion, review and acceptance of appropriate EIA studies.
- The building of piers, groynes, breakwaters, seawalls or other structures on, across or seawards of the shore is prohibited unless by prior written amendment to the Management Plan by the management committee, following the full completion, review and acceptance of appropriate EIA studies.

- Digging, blasting or dredging on or seawards of the shore is forbidden, unless by prior written amendment to the Management Plan by the management committee following the full completion, review and acceptance of appropriate EIA studies.

5.2 ZONING

The proposed MPA, taken as a whole, is a multiple-use protected area. A preliminary zoning scheme has been developed (Tables 4 & 5). For each zone, the main purpose of the zone is given, together with a summary of the main areas/features represented. Activities which are permitted and forbidden are also given. In many cases, additional details of activities will need to be developed further. Preliminary maps showing the extent of the zones proposed are shown in zoning maps 1–4 in Appendix 3.

The zoning plan presented here is preliminary. Prior to implementation this plan is to be presented and discussed as part of a consultative process with the MPA residents. To be fully effective the zoning plan requires the support of the residents, and may be modified accordingly.

However, it must be stressed that a number of general and specific requirements for the 'final' zoning plan should be met, including:

General zoning requirements include but are not limited to:

- Implementation: the implementation of zoning will be:
  - Gradual over the first one to four years of implementation; and
  - Flexible, in order to respond to emerging conservation and management needs. Park management must be careful to ensure that flexibility does not allow zoning plans and objectives to be incrementally eroded to the detriment of conservation.
- Conflicting uses are to be, as far as possible, separated by the zoning plan;
- Where feasible Nature Sanctuaries should be nested within Nature Reserves, to provide a surrounding buffer zone of protection greater than that within General Use or Resource Use Zones;
- Zones within which extractive resource uses are disallowed (all Nature Sanctuaries, many Nature Reserves, and all Fishery Reserves) should:
  - Eventually encompass a minimum of 20% of the area of the MPA, including a minimum of 20% of the reef areas;
  - Include all significant spawning sites and other locations key to reproductive survival of target species; and
  - Form a network that will support fisheries throughout all other areas of the MPA by both dispersal of eggs and larvae, and by emigration or 'leakage' of adults. For detailed guidance on fishery reserve function and design see ROBERTS & HAWKINS (2001).
- The resident fishing community should be closely consulted about all aspects of fishery reserve location, size and function, and reassured about the motives of the MPA in designating such zones, and the medium to long-term benefits that should accrue to the residents as a result. This should be the focus of a carefully developed and highly targeted component of the public awareness programme. As described elsewhere in this plan, the network of Fisheries Reserves and of other restrictions on where fishing can be undertaken should be developed incrementally with the agreement of the park's residents.

- Marine and terrestrial Nature Reserves provide a basis for flexible levels and types of protection or management beyond the relatively simple designation of major zone types. Nature Reserve regulations and objectives should vary according to the specific objectives of each reserve. For example, it may prove necessary to designate a Nature Reserve area within the proposed MPA specifically to protect major dugong aggregations. Regulations applicable to that Nature Reserve will be tailored to that objective, and will thus be different from regulations in a different reserve zone designated for, for example, management of fragile coral communities.

Specific zoning requirements include but are not limited to:

- The turtle nesting beaches on Mukawwar should be within a Nature Sanctuary, but with the possibility of carefully controlled ecotourism specifically to see nesting turtles. All turtle nesting sites should be subject to protection from disturbance.
- The aggregations of whale sharks and manta rays are likely to need protection from harassment if and when tourism begins to take off in the MPA. Depending upon the spatial nature of those aggregations this may be suitable for application of seasonal zoning. However, general regulations about approaching or disturbing these animals will still be required.
- The possibility of including all or part of Khor Shanaab in a Nature Sanctuary (marine and terrestrial) or a Marine Reserve should be considered.
- The possibility of including all mangroves within Nature Reserves with appropriate regulations should be fully investigated. Detailed justification should be provided for not doing so.
- The possibility of creating a Nature Reserve for Mersa Inkefal and the inlets, reefs, mangroves, intertidal areas and shorelines associated with it should be considered.
- The mangroves, lagoons, reefs and seagrass beds at the southern end of Mukawwar merit a high level of protection.

Zoning definitions

The zones described here (Tables 4 & 5 below) are largely but not entirely based upon the IUCN definitions for protected area categories, with the addition of Fisheries Reserves, which are not easily included in any IUCN category (KELLEHER, 1999). Although the IUCN categories are intended to be applied to the overall objective or uses of entire protected areas rather than to zones within those protected areas, they may also be usefully adapted, and applied to different zone types within multiple-use protected areas such as Dungonab Bay MPA. With the addition of Fisheries Reserves, that is the approach adopted here.

Between them these zone types allow for the full range of activity types and levels of protection required for a multiple-use protected area of the size and complexity of the proposed MPA.

Table 4. Summary of proposed zoning categories for the Dungonab Bay–Mukawwar Island MPA.

Dungonab Bay–Mukawwar Island Proposed MPA Zone Types: Summary			
Dungonab MPA Category	**Terrestrial or Marine**	**Equivalent IUCN Category**	**Summary Description**
Nature Sanctuary	Both	Category I	Area with very strictly controlled access. Within the MPA this will include areas for species protection (e.g. marine turtles). Such sites will be off-limits for all human activities except patrolling and non-destructive monitoring by park staff, and strictly controlled non-destructive scientific research.
Nature Reserve	Both	Category II	Areas for non-extractive and non-destructive use, in which development is not permitted. This will be primarily recreational.
General Use Zone	Terrestrial	Category VI	Area providing for infrastructure and economic development under strict control.
Resource Use Zone	Marine	Category VI	Area providing for sustainable extractive resource use.
Fishery Reserve	Marine	None	Area permanently or seasonally closed to all extractive resource use, over and above those areas already included in marine Nature Sanctuaries and marine Nature Reserves. These are designated to provide reproductive refuges for vulnerable target species, and to ensure long-term security of fishery stocks.

Table 5. Key features of the zone types within the Dungonab Bay MPA.

Zone	Areas/Features Represented	Main Purpose	Activities Permitted	Activities Prohibited
Nature Sanctuary	Mukawwar Island (south and east): internationally important turtle nesting beaches; mangroves, lagoons, seagrasses and coral reefs. Southern end Khor Naitaib: pristine and highly unusual coral and fish communities in highly stressed environment, semi-enclosed or isolated. Western islands in Dungonab Bay: fragile but very healthy coral communities, diverse fish communities and nesting birds. One of the further offshore reefs (provisionally Abington): representative deep-water reef with communities of corals, reef fishes, and large pelagic fishes. Easily disturbed by visitors or low levels of fishing.	Preservation of key biological features of national/international significance, and protection of endangered species.	Patrolling by park staff. Non-destructive scientific research and monitoring.	Coastal development; all extractive resource uses; tourist activities[2]; anchoring over corals (further details to be determined).
Nature Reserve (Terrestrial)	All terrestrial areas outside General Use Zones: exceptional landscapes; representative coastal habitats and biodiversity; charismatic and threatened species. All islands not included in Nature Sanctuaries.	Safeguarding of important resources/features. Buffer zone for management of marine areas and shorelines. Protection of all vulnerable island sites.	Regulated, non-destructive activities, (except coastal development) further details to be determined.	Coastal development. Destructive resource uses (further details to be determined).
Nature Reserve (Marine)	Offshore reefs including Shambaya, Merlot and Angarush. Northern part of Khor Naitaib. Areas for non-destructive and non-extractive recreational use.	Providing buffer zones for Nature Sanctuaries, and/or providing an added level of protection above that within Resource Use Zones.	Regulated, non-destructive activities; diving may be allowed, but following guidelines (further details to be determined).	Extractive or destructive resource uses (further details to be determined).

[2] Eastern Mukawwar is the only exception. Turtle nesting beaches here may provide an important tourist attraction. All tourism here should be very strictly controlled, with no unsupervised access.

General Use Zone	Dungonab village and Mohammed Qol: principal centres of population in the proposed MPA. Sheikh Okod: principal cultural site. The Dungonab salt works. NOTE: this General Use Zone is only for activities related to the salt works. Any development within the salt works for any other purpose is prohibited, and any alterations in practices at the salt works will have to be notified to and cleared by the MPA management committee	Multiple human use in accordance with principles of environmental sustainability; conservation of traditional features and landscapes.	Regulated development. (further details to be determined).	Building within 50m of the high tide line; landfill; discharge of sewage (further details to be determined).
Resource Use Zone	All marine areas not included in other zone types	Management for sustainability and biodiversity conservation including protection of vulnerable, threatened or endangered species, and key or fragile habitats.	Sustainable and non-destructive fisheries; diving allowed but following guidelines (further details to be determined).	Destructive or unsustainable resource use; trawling; curio or souvenir collection; damage or disturbance to key habitats and species (further details to be determined).
Fishery (No-Take) Reserves	Southern Mukawwar Island: spawning area for nagil. Other reef areas (minimum five recommended initially): placed within reef fishing areas, including at least two or three with declining catch of one or more key species.	Maintenance and build-up of fish biomass, diversity and spawning capacity, facilitating dispersal of raised concentrations of fish eggs and larvae to fishing areas, and leakage/migration of adults to adjacent fishing areas. Protection of spawning areas and aggregations.	Non-extractive resource-use activities. May be seasonal or permanent; (further details to be determined).	All forms of extractive, destructive and non-sustainable resource use (further details to be determined).

Further aspects of zoning are considered in Table 6. This highlights conservation measures needed for key issues.

Table 6. Key issues and proposed activities related to zoning.

Key Issues	
1. Dungonab Bay MPA has outstanding landscapes and seascapes, and some of its biological features (coral reefs, seagrasses, mangroves, birds, turtles, dugong and sharks) are of major national and international significance. 2. The marine and coastal ecosystems of the entire area are varied and diverse. 3. Although some damage has occurred (largely due to coral bleaching) many important areas remain in good or very good condition. 4. The need to balance sustainable use with conservation is made imperative by the resident population who are almost entirely dependent upon extractive resource uses. 5. The need for zoning is central to management in order to safeguard the proposed MPA's natural resources, while allowing activities that do not threaten the sustainability or functioning of the MPA.	
Proposed Activities or Action	
Short-term (<12 months)	1. Refinement of present (preliminary) zoning scheme through consultation and review by stakeholders and others (to include specialist experts/advisors with extensive experience of multiple-use MPAs, including fishery reserves).
Medium-term (1-3 years)	1. Finalisation of primary zoning scheme (if necessary following further rounds of consultation). 2. Development of comprehensive guidelines on permitted and prohibited uses in Nature Sanctuaries, Nature Reserves, General Use Zones, Resource Use Zones and Fishery Reserves. 3. Implementation of the primary zoning scheme and application of the guidelines for each. 4. Development and implementation of regulations and policies about access routes into the MPA as a whole, and within and between different zones. Implement regulations on driving by designated and marked routes only.
Long-term (3-5 years)	1. Refinement of primary zoning scheme, and extension of network of Fishery Reserves to cover at least 20% of the marine area, including at least 20% of the coral reef area. 2. Ongoing monitoring of activities and environmental health within each of the zoning categories. 3. Periodic review of zoning schemes and their boundaries, modifications where necessary.

5.3 RESEARCH AND MONITORING

Research and monitoring programmes are essential to successful medium to long-term management of marine protected areas. Implementation of monitoring and applied research programmes will provide information to support improved planning and decision-making.

Links between research programmes and monitoring programmes are in many cases very close. Monitoring programmes can provide the basis for informative and useful applied research. Research programmes can, in turn, provide explanations and help to identify possible management actions for changes identified, but not explained, by monitoring.

Research

Key issues relating to research are summarised in Table 7, which also highlights and prioritises conservation measures needed.

Table 7. Key issues and proposed activities relating to research.

Key Issues	
1. The abundance, distribution and local ecology of key species groups (sharks and rays including whale sharks and manta rays; turtles; dugong; birds; key fisheries species; etc) are largely unknown. 2. Understanding of ecosystems and processes central to functioning of the Dungonab Bay MPA (and links to its surrounding marine ecosystems) is currently rudimentary. 3. There is very little available information on terrestrial habitats and species. 4. Uncertainties remain about marine habitat categories and their distribution.	
Proposed Activities	
Short-term (<12 months)	1. Acquire spatially and taxonomically more comprehensive biodiversity information using several measures and explore the suitability of indicator species (e.g. corals, coral fishes, seagrasses, echinoderms) and possible threat species (crown of thorns starfish, *Drupella*, etc). 2. Undertake terrestrial surveys to extend knowledge of species of socio-cultural and ecological significance. 3. Carry out baseline surveys of fishery reserve sites (pre-implementation).
Medium-term (1-3 years)	1. Verify satellite/other maps and charts for habitat types and boundaries, then decide which categories should be adopted for management purposes. To include considerations of species assemblages (e.g. inside/outside Dungonab Bay). 2. Initiate long-term studies of effectiveness of fishery reserves, and factors supporting or undermining that effectiveness.
Long-term (3-5 years)	1. Conduct studies of ecosystem resilience and robustness against natural events and human activities (coral bleaching/disease and fishing).

Monitoring

Monitoring of the biological and environmental parameters within and immediately adjacent to the MPA, and of the socio-economic activities taking place in the proposed MPA, or in association with it, is essential. Ecological/socio-economic monitoring will include a number of components or factors:

1) Definition of initial status (baseline),
2) Identification of environmental or socio-economic changes (from natural events or human activities),
3) The need for remedial action,
4) The effectiveness of any management measures implemented.

Key issues relating to monitoring are summarised in Table 8, which also highlights and prioritises conservation measures needed. The details of monitoring programmes, including aspects of design, will need to be developed during implementation of the MPA.

Table 8 Key issues/findings and proposed activities or actions relating to monitoring.

Key Issues	
1. Lack of detailed baseline data on habitats and species, and human activities. 2. Lack of fisheries catch and effort data, particularly uncertainties surrounding the fate of fish caught within the MPA but landed elsewhere. 3. No information on by-catch, or on indirect effects of fisheries on habitats and non-target species. 4. No implementation of EIA requirements for new developments, activities or infrastructures and their operations (including tourism). 5. No recent or detailed information on outbreaks of diseases or other biological threats in the MPA (e.g. crown of thorns starfish and *Drupella*).	
Proposed Activities	
Short-term (<12 months)	1. Develop preliminary plans for all monitoring programmes (e.g. methods, equipment and sampling frequency). 2. Implement the routine collection of detailed fisheries data, including by-catch, methods used, areas fished, etc. 3. Implement and fully enforce policy that fish caught in the MPA should be landed only in the MPA (not elsewhere), to facilitate monitoring of population/stocks and status. 4. Initiate baseline surveys (including but not limited to Fishery Reserves, nesting of turtles and birds, and key species/habitats).
Medium-term (1-3 years)	1. Finalise design of all primary monitoring programmes, and fully implement those programmes. 2. Complete baseline surveys. 3. Formulation and implementation of detailed EIA guidelines for all new infrastructure and developments, prior to construction, i.e. pro-actively. 4. Monitoring of CoT starfish and its natural predators (e.g. triton) to help track CoT outbreaks (links with Ras Mohammed will be useful in this respect).
Long-term (3-5 years)	1. Monitoring of human uses and their effects on the MPA's status and health. 2. Monitoring of the effectiveness of significant management interventions put in place (through use of success indicators and other project milestones, drawing on experiences elsewhere e.g. Ras Mohammed). 3. Initiate other monitoring as need arises, i.e. adopt a flexible approach.

Evaluation of success or failure of the proposed MPA

This Master Plan recognises the importance of tracking progress in a systematic and verifiable manner, to assess:

- The success of activities and expected outputs associated with the Dungonab Bay MPA.
- The extent to which overall objectives and requirements are met.

It is important that a monitoring system is established to provide a process for evaluation. Minimum requirements should include:

(1) Activities and outputs:

Summary of major project tasks as set out in the Master Plan, broken down into sub-tasks, activities and outputs.

(2) Operational history:
Brief historical review of task implementation and milestone achievements.

(3) Verifiable indicators:
Objectively Verifiable Indicators (OVIs) are direct and indirect indicators of outputs and action generated by the project, which can be validated. The sources of verification are documents, reports and other sources providing information that make it possible to gauge actual progress towards planned results and project purpose.

(4) Results:
Brief summary of main outputs and achievements in terms of tangible products (survey reports, electronic archives, reports, physical structures etc.).

(5) Extent of Achievement:
Ranked scale of the overall extent of success or achievement in respect of activities and outputs. A simple assessment can be based on a 3-point scale (+++ substantial; ++ partial; + negligible).

5.4 PUBLIC AWARENESS

The objectives of education and awareness programmes are to provide stakeholders with information about: the benefits of – and need for – marine and coastal biodiversity; the management arrangements of the proposed MPA; and to enhance their enjoyment and understanding of the marine environment. Successful achievement of these objectives will increase overall public and stakeholder support, and thus improve self-policing and voluntary compliance.

Linkages between all components of park management are important, and public awareness in particular can and should be built into many other areas of activity within the proposed MPA.

Key issues relating to public awareness are summarised in Table 9, which also highlights and prioritises conservation measures needed.

Table 9. Key issues and proposed activities relating to public awareness.

Key Issues	
1. Very limited awareness among many stakeholders of the benefits of MPAs, including the benefits to fisheries. 2. Variable but generally limited understanding among different users and beneficiaries of the values and vulnerability of resources within the MPA. 3. Absence of other fully implemented MPAs in Sudan, hence no national examples for drawing on past experiences (links with Sanganeb National Park to be fully developed).	
Key activities	
Short-term (<12 months)	1. Assessment of environmental education needs at all levels (school curricula and media options including press articles, radio, TV, leaflets and audiovisuals). 2. Assessment of information-related professional skills for environmental officers and others involved in information collation and dissemination. 3. Assessment of stakeholder needs (e.g. to ensure inclusion of their view in all stages of planning and management). 4. Assessment of feasibility of visitor centre for both national and international visitors, including possible sources of funding, as showcase for the proposed MPA and centre for on-site information dissemination. 5. Determine need for environmental workshops and consultative meetings, for exchange of ideas and information (to be linked with and facilitate/develop wider consultative aspects of collaborative management).
Medium-term (1-3 years)	1. In close consultation with Sanganeb National Park, and based on results of needs assessment above, develop a detailed public awareness plan for marine and coastal conservation and sustainable use (This may be one comprehensive master plan for both parks, or two plans closely linked and with common themes). 2. On the basis of the public Awareness plan, develop public awareness materials, programmes, infrastructures and facilities,. 3. Develop promotional materials on sustainable fishing practices, including benefits of buoys to prevent anchor damage to corals (One key reference will be ROBERTS & HAWKINS 2001). 4. Arrange environmental workshops and consultative meetings (e.g. to promote representation of all major stakeholders) based on results of needs assessment above.
Long-term (3-5 years)	1. Demonstrate value of Fishery Reserves for safeguarding harvested species and/or enhancing heavily exploited populations. 2. Maintain and enhance public awareness capacity for sustainability.

5.5 OIL SPILL CONTINGENCY

Key issues relating to oil spill contingency planning are summarised in Table 10, which also highlights and prioritises conservation measures needed. There is very considerable regional expertise in oil spill planning. The contingency plan for the MPA should be based upon and fully compatible with the Sudan National Oil Contingency Plan (PERSGA/UNEP 2003). The oil contingency planning for Ras Mohammed National Parks Sector should be assessed for relevance to the proposed MPA.

Table 10. Key issues and proposed activities relating to oil spill contingency planning.

Key Issues/Findings	
Limited awareness of the threats of oil spills and of approaches to combat oil spills. Absence of information on risks (probability of oiling event) and sensitivity of ecosystems/species/resources/ features vulnerable. Lack of resources (human and physical) for dealing with oil spills in the proposed MPA.	
Short-term (<12 months)	Assess risks of oil spills and sensitivity of vulnerable ecosystems/species/resources and features. Determine oil spill cleanup equipment needs, considering availability and accessibility of national resources (e.g. Port Sudan) and regional resources (Saudi Arabia and Egypt), and consistent with best international practice to ensure net environmental benefit (NEB). Evaluate human capacity requirements for combating oil spills.
Medium-term (1-3 years)	Develop oil spill cleanup guidelines, based on outcome of needs assessment above. Procure and/or ensure availability of oil spill cleanup equipment in event of oil spill in the MPA, based on outcome of needs assessment above. Ensure adequate capacity to deal with oil spill emergencies and cleanup, based on outcome of needs assessment above.
Long-term (3-5 years)	Develop threshold criteria (e.g. Total Petroleum Hydrocarbon (TPH) concentrations) to determine when oil spill cleanup should commence, and endpoint criteria to determine when oil spill cleanup should cease.

5.6 INFRASTRUCTURE

Little in the way of facilities, infrastructures and supporting staff is currently available in the Dungonab Bay MPA. Insights and lessons from Ras Mohammed and similar regional initiatives should provide helpful guidance on infrastructure requirements. Key issues relating to infrastructure are summarised in Table 11, which also highlights and prioritises conservation measures needed.

Table 11. Key issues and proposed activities relating to infrastructure.

Key Issues/Findings	
1. Virtual absence of office infrastructures and management capacity within the MPA. 2. Absence of required vehicles, boats, radio and other equipment.	
Short-term (<12 months)	1. Complete detailed needs assessment for office infrastructure and project management facilities, transport and other equipment. **2.** Develop system for acquisition and analysis of fish catch data for the proposed MPA.
Medium-term (1-3 years)	1. Acquisition of office infrastructure and project management facilities. 2. Acquisition of vehicles, boats and ancillary MPA equipment.
Long-term (3-5 years)	1. Encourage community based operation of MPA facilities and infrastructure as far as possible (with appropriate oversight and control), within the context of national institutions and international agreements.

The provision of an exhaustive project list of equipment needs at this stage is premature. However, an indicative list is provided below to give an indication of likely requirements (this is based on preliminary equipment needs identified for projects in Yemen and other regional countries).

Expendable equipment:

- Audio-visual materials
- Binoculars
- Charts and maps
- Equipment, spares and maintenance for laboratory equipment
- Equipment, spares and maintenance for vehicles
- Equipment, spares and maintenance for inflatables and outboards
- Stationery, data sheets and miscellaneous office supplies
- Tape recorders
- Thermometers

Non-expendable equipment:

- Analytical laboratory equipment and field equipment
- Boats (inflatable boats for close inshore work, and 6m Rigid Inflatable Boats (RIBs) for work and patrolling further offshore). Eventually the MPA is likely to need a substantial hard-hulled boat with capacity to work and patrol for more extended periods (overnight or longer) offshore.
- Communications equipment
- Diving equipment, plus spares and maintenance facilities
- Fax machines
- GIS equipment, including computers, plotters and hand-held GPS units
- Hand-held salinity refractometers
- Off-road vehicles
- Office equipment and furnishings
- Outboard motors
- Overhead projectors
- Personal computers/printers and software
- Photocopiers
- Slide projectors
- Telephones
- Video and stills (digital) cameras
- Video recorders/players
- Video monitors

Infrastructure:

- Park office buildings (on-site offices in the MPA, and office space in Port Sudan shared with Sanganeb National Park);

- Laboratory space (may be based in Port Sudan, and shared with Sanganeb National Park);
- Scuba and field equipment storage and basic maintenance facilities (more substantial maintenance facilities may be based in Port Sudan, and shared with Sanganeb National Park);
- Park accommodation for managers and rangers.

Constraints, issues and uncertainties

Constraints and uncertainties of immediate or particular concern for the Dungonab Bay MPA can be summarised as follows:

- **Information gaps** e.g. for species, habitats and biodiversity, including uncertainties about detailed distributions of marine communities derived from satellite imagery; however, enough is already known to implement MPA management;
- **Governance issues** e.g. lack of official recognition or registration of traditional land ownership patterns and local agreements; need to change prevailing ethos from 'maximise for short-term' to 'optimise for long-term sustainability' (creation of Fisheries Reserves will facilitate this;
- **Artisanal overfishing, particularly of nagil and some invertebrate groups**; largely due to external pressures;
- **Commercial/industrial fishing** i.e. trawling has probably caused significant damage to habitats and removal of some target species in the past. This should be prohibited throughout the MPA;
- **Improvement of the coast road** is likely to encourage/facilitate open access (unregulated) extractive and non-extractive resource use, and unplanned or inappropriate development; hence road should be set back from the coast, preferably to the west of the MPA's outer boundaries, and in all cases by a minimum of 2km. Off-road access should be banned except at prescribed locations.

6. PERSONNEL AND FINANCES

6.1 PERSONNEL

The Dungonab Bay MPA is to be implemented as a collaborative project, combining community-based approaches with more interventionist techniques. However, adoption of a fully flexible overall approach for identifying and dealing with problems as they arise is essential. This flexible collaborative approach and other factors, such as staffing policy, may change or develop as the MPA grows and strengthens.

Input and advice from technical and other steering committees will be important throughout implementation. These will include representation from local universities and research institutes as well as the fisheries sector, and tourism. However, the steering committees will be required to provide guidance that does not contradict the overall objective of the MPA – to conserve and sustainably manage coastal and marine biodiversity. As such, this management plan recognises that the advisory and learning process will be in both directions.

While non-local staff may be hired for some positions, local people should staff the project wherever possible, and required minimum levels of local recruitment should be established early in the implementation of the project. Among the many advantages of this approach are:

- Increased 'ownership' of and support for the project by local people.
- Immediate access to the detailed local knowledge held by local people of natural and socio-economic characteristics and processes in the MPA.

The need for flexibility means that it may be premature to provide precise descriptions of job requirements in this Management Plan. However, minimum staff requirements, at least during initial phases of MPA implementation include:

- Managers
- Field staff (technical, computer work, GIS, data analysis and interpretation, and report writing)
- Field staff: rangers (logistics, boat skills e.g. diving, placing of mooring buoys)
- Office/secretarial

It is likely that staffing experiences for other MPAs within the Red Sea and Gulf of Aden Regional Network will be valuable for the Dungonab Bay MPA. In particular, the experience of Ras Mohammed National Park in south Sinai (a park of comparable size and complexity to Dungonab Bay MPA) may be invaluable. Additional (tentative) staffing requirements, drawn largely from plans for Sanganeb National Park (SNP) in Sudan and Bir Ali-Belhaf in Yemen, are summarised below.

The overall management will be implemented by a park manager, who will be advised and informed by a management committee. During initial phases of the Management Plan, the minimum number of staff for Dungonab Bay might be around eight, consisting of:

- A senior park manager
- An assistant park manager
- A park administrator (this post may be shared with Sanganeb National Park, and based in Port Sudan, initially)
- Five rangers

This level of staffing should represent adequate human resources to manage the MPA effectively in the early phases of implementation. It also builds in the necessary flexibility to accommodate initial staff training/capacity building, annual and sick leave, as well as exchanges with other marine protected areas in Sudan and regionally (e.g. Sanganeb and Ras Mohammed).

Details of the broad range of activities that staff may be required to undertake and the skills that will need to be represented in the staff are provided in the Appendices (see indicative outline Terms of Reference).

6.2 CAPACITY BUILDING

Capacity building for marine environmental management/conservation must be recognised as a long-term investment. The Dungonab Bay MPA is proposed as the second MPA in Sudan (Sanganeb National Park was the first) and will be the only multiple-use coastal MPA in the country. Sanganeb National Park management plan is only now in the process of being implemented. There is a shortage of experience in Sudan covering many of the important aspects of MPA management and the use of collaborative approaches.

Given these factors, the availability of technical assistance will be extremely important during implementation of the MPA management plan, and for successful establishment of all aspects of management policies, structures and activities.

An experienced marine park manager should be recruited (perhaps from overseas) to oversee and advise on implementation, to provide guidance on all aspects of capacity building, and to provide on-the-job training in MPA management to counterpart(s). Since this job has both training and park management elements it will be important that the selected candidate has teaching and capacity building skills and experience, as well as practical fieldwork skills, particularly in an MPA context.

Training for rangers falls into a number of broad categories including practical field skills, ecological/wildlife management skills, and public awareness/public relations. An indicative list of the wide range of practical training for park rangers includes but is not limited to:

- Basic ecology and wildlife management skills;
- Basic fisheries monitoring, surveillance and control (to be supported and guided by expert fisheries monitoring personnel from relevant agencies);
- Scuba diving, snorkelling and small boat handling;
- Search and rescue, and safety;
- English language;
- Public relations, teaching, and tour guiding.

A detailed training and capacity building programme should be developed and implemented following a comprehensive training needs assessment. This provides an ideal opportunity for co-operation and collaboration with Sanganeb National Park, and this training programme should be a joint venture between the two parks.

It is recommended that a full-time expert scuba trainer be recruited during the first year of implementation, and retained for two years to design, implement and oversee all aspects of scuba training, boat handling and marine safety training for all rangers. This person will need to be a fully qualified scuba instructor with long-standing experience in the Arabian region, fluent in Arabic and preferably also in English.

Initial training must be targeted at achieving a level that enables effective management of the MPA during its early implementation. However, training and capacity building will be an ongoing process beyond initial implementation, and investment in skills maintenance and development will continue. This should include workshops and specialist training courses both in-country and overseas for all rangers, and academic training of selected senior rangers and managers to postgraduate level both nationally and in centres of excellence overseas.

The development and implementation of exchange programmes with other protected areas in the region, including the marine and coastal protected areas of the Egyptian Environmental Affairs Agency will provide invaluable lessons, examples, and experience to park staff. This will simultaneously allow less experienced staff to gain valuable exposure to the more established parks and park staff in the region, and will bring experienced overseas park staff to Dungonab. Full use should be made of the PERSGA regional network of MPAs for this purpose.

A tentative outline of schemes to expand capacity to manage the Dungonab Bay MPA is outlined below. These encompass marine environmental management, particularly in information collection and analysis, EIA and monitoring, and public awareness, through appropriate professional development of counterparts during on-the-job training and by designing and delivering in-service marine environmental training.

The full exploitation of linkages and support available via the regional network, or that can be developed within the framework of the regional network, should be a high priority for both park management, and senior management at the marine branch of the Sudan Wildlife Administration. Maintenance of links with PERSGA should, for this reason, be a high priority.

Target groups

In order to obtain a broad spectrum of expertise in MPA management, at least one staff member from each of the following will be selected for long-term study abroad and/or in-country training:

- Dungonab Bay area (as appropriate: taking care to avoid the appearance of favouritism between villages/tribal groups),
- Wildlife Administration
- Ministry of Fisheries
- Red Sea University
- Societies/NGOs

Further details of target groups and individuals will depend on qualifications including language skills, prior levels of academic training, and requirements of the various government agencies and other organisations, as determined by the technical steering committee.

A more detailed overview of recommended training is provided in Appendix 5.

Co-ordination between Dungonab Bay MPA and Sanganeb National Park

Development and implementation of a policy of co-ordination and co-operation between the MPAs of Sudan (initially Dungonab Bay MPA and Sanganeb National Park) will provide invaluable opportunities to benefit from economies of scale, shared objectives, and shared experience.

In the early stages of implementation of both MPAs these benefits will be most clearly felt in the field of training and capacity building. There will also be opportunities to economise from the development of shared facilities, in particular of a shared marine parks office in Port Sudan.

The Inter-Park Co-ordinating Committee will initially consist of:

- Marine parks officer (Wildlife Administration)
- Representative of the Red Sea University
- Park managers: Dungonab & Sanganeb
- Park administrators: Dungonab & Sanganeb
- Marine parks trainer (Years 1 & 2)

6.3 FINANCES

Possible financing options were outlined in section 4.13. It is critical that the Dungonab Bay MPA is conceived and implemented, at least initially, as a collaborative, community-based project. Tourism in and around the MPA are minimal at present and so (unlike Sanganeb National Park) little funding may be available from this sector early on. There will probably be a heavy reliance on external funding, at least in early years. However, successful use of the collaborative and community-based approach may mean that only modest levels of funding are necessary.

Later, the MPA may be able to draw on and operate using a mixture of funding sources. These might be acquired largely from industry (particularly tourism) and government sources, with donor agencies then making up a smaller and shrinking proportion of funds.

A further assessment of the financing needs is required (set-up costs and recurrent expenses), together with projections of the balance between income and expenditure, and the development of plans and targets/markers to be aimed for. Insufficient information is presently available to undertake these, even in a rudimentary manner. However, a brief outline of costs that will need to be financed can be provided. These include:

Capital costs and major expenditure:

- Park staff
- Infrastructure (offices and associated facilities, visitor centre, workshops and equipment stores, staff accommodation, etc.)
- Mooring buoy costs and installation
- Expendable equipment (as outlined above)
- Non-expendable equipment (as outlined above)
- Training, linkages, and other capacity building initiatives.

Other capital costs:

- Recruitment of staff
- Ancillary equipment for boats and outboards (fuel cells and jerry cans, washing facilities, oars, life jackets, first aid kit, tools etc.)
- Reference materials etc.
- Miscellaneous labour
- Installation of office equipment
- Lawyer’s fees
- Infrastructure, boat and diving gear maintenance

- Establishment of monitoring transects and systems
- Public awareness and publicity (leaflets, posters, MPA logo, website, etc.)
- Toilet, rubbish disposal and other public facilities.

Possible initial operating costs:

- Maintenance, fuel and oil for boats and vehicles
- Incentives and bonuses
- Office operating costs (including consumables)
- Accounting and auditing
- Maintenance of infrastructure
- Reporting costs
- Committee costs (e.g. refreshments and local travel costs)
- Capacity building
- Contingency fund

Further considerations include:

- Licences for extractive uses will be issued to park residents in order to monitor and control levels of resource use within the MPA. Such licences to residents will be issued free, but obviously will be contingent upon adherence to park rules, as drawn up in agreement with residents' representatives.
- Licensing of extractive uses for non-park residents will be set at levels commensurate to the level of use (contingent upon adherence to park rules and regulations).
- Licensing of non-extractive uses (e.g. tourism operations) will be applied to both residents and non-residents. Park residents will be charged only a small percentage of the charge levied on non-residents.

7. IMPLEMENTATION

As is implied in the tables of priority actions in section 5, the implementation of the plan is organised into three phases:

Table 12. Summary of implementation phases.

Phase	Summary	Timing
Phase I	Getting started: • Development of primary infrastructure • Recruitment • Initiation of priority management practices • Initiation of national and international publicity and awareness	Year 1
Phase II	Full implementation of priority management practices: • Completion of initial capacity building • Development of community-based management for selected areas and resource uses • Extension of active management and enforcement throughout the MPA • Finalisation of Management Plan	Years 2-5
Phase III	Achievement of self-sustaining management, and expansion into a functional and integral part of a co-ordinated national, regional and international network.	Begin year 5

Implementation of the objectives and activities of different phases may, in practice, overlap. Activities of one phase should not be unnecessarily delayed in order to wait for full achievement of the objectives of the previous phase, if those earlier objectives are not a prerequisite for specific activities of the later phase(s).

The Inter-Park Co-ordinating Committee (to be initiated in Year 1) and the links between Dungonab Bay MPA and Sanganeb National Park for training and capacity will, in effect, ensure that the development of a national network of MPAs will begin almost immediately.

Overall objectives of the Phases:

Phase I: To establish a management capacity that makes Dungonab Bay MPA functional.

Phase II: To consolidate on the early achievements of the MPA through:

- Full development of the infrastructure necessary to successfully manage the MPA;
- Development of the minimum necessary capacity to manage the MPA through full implementation of training programmes;
- Widely promote the MPA nationally and internationally;

Phase III: To consolidate the MPA as a self-sustaining entity through:

- Diversifying the income generating strategy to such an extent that it becomes self-financing for its operating and future capital investment costs;
- Full development of the capacity of the Dungonab Bay MPA, along with Sanganeb National Park, to fully support the development and implementation of the national network of MPAs.

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Appendix 8

The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden

The Red Sea and Gulf of Aden Regional Network of Marine Protected Areas

Regional Master Plan

Executive Summary

The Red Sea and Gulf of Aden are known throughout the world for their outstandingly beautiful marine and coastal environments, the diversity of species, including many endemics, and their value for human development. The local resources have been used in a sustainable manner by the inhabitants of the region for thousands of years. However, more recently the pressure on these environments and resources has substantially increased, with the development in several countries of petroleum-based economies that require sea transport for petroleum exports, the expansion of international dive tourism and general population growth in the coastal zone.

Marine protected areas (MPAs) have been established in many parts of the Red Sea and Gulf of Aden as tools to provide for sustainable resource use, economic development and conservation. Of particular importance is the need to conserve areas that represent the range of the region's unique habitats and biodiversity and to support national development. This has been initiated through the integration of 12 MPAs from throughout the region into a Regional Network of MPAs for the Red Sea and Gulf of Aden. These 12 MPAs are: Iles des Sept Frères and Ras Siyan (Djibouti); Ras Mohammed National Park; Giftun Islands and Straits of Gubal (Egypt); Aqaba coral reefs (Jordan); Straits of Tiran; Wajh Bank, Sharm Habban and Sharm Munaybirah; Farasan Islands (Saudi Arabia); Aibat and Saad ad-Din Islands, Saba Wanak (Somalia); Sanganeb Marine National Park; Mukkawar Island and Dungonab Bay (Sudan); Socotra Islands; Belhaf and Bir Ali area (Yemen).

This Regional Master Plan is a regionally agreed framework for the planning and management of each of the MPAs in the Regional Network that will facilitate the achievement of regional objectives for sustainable resource usage, conservation of biodiversity and for economic development. The Objectives, Goals, General Policies and Strategies presented here are regionally applicable and will facilitate regional consistency in the management of MPAs in the Network. Within each of the MPAs in the Regional Network a regionally standardised, site-specific Master Plan will be developed, which will serve as the long-term policy document for that MPA. This site-specific Master Plan will guide the development of a site-specific Management Plan for each MPA. This Regional Master Plan will also serve as a framework for the planning and management of other MPAs in each country that are not part of the Regional Network and where national planning and management have not yet commenced.

The development of a Regional Master Plan for MPAs in the Red Sea and Gulf of Aden is consistent with the objectives of the Convention on Biological Diversity (1992) and also parallels developments in a number of other regional sea areas (e.g. the Caribbean and Mediterranean) where similar regional networks of MPAs have been established.

The objectives of the Regional Master Plan are:

- to develop regional capacity in all aspects of MPA planning and management

- to provide for the sustainable use of living marine resources
- to support local and national economic and social development
- to involve local communities and stakeholders as partners in MPA management
- to conserve representative and prime examples of the biodiversity of the Red Sea and Gulf of Aden
- to conduct research and monitoring programmes for the benefit of MPA management
- to enhance public awareness of the marine resources and biodiversity of the Red Sea and Gulf of Aden and the principles of sustainable use
- to protect the unique cultural heritage of the marine and coastal environments of the Red Sea and Gulf of Aden
- to implement a regional legal framework for protected areas and biodiversity.

This Regional Master Plan includes guidelines based on currently accepted best practice in the planning and management of MPAs that have been adapted to suit the specific situations found in the Red Sea and Gulf of Aden. These guidelines include:

- the planning process
- the development of zoning plans
- research and monitoring
- public awareness
- stakeholder consultation and participation
- sustainable financing
- capacity building
- personnel requirements.

There are significant differences between the countries surrounding the Red Sea and Gulf of Aden in their level of technical and scientific capacity for planning and managing MPAs. This is due in part to differences in economic development and assistance from

the international donor community. This Regional Master Plan outlines the strengthening required in national legal and institutional mechanisms, as well as the need for a regional protocol on MPAs to guide the development of national MPA legislation where it is lacking. The establishment of a Regional Activity Centre for MPAs will allow for the effective coordination of the Regional Network. Additional mechanisms are described for coordination among the MPAs in the Network, information exchange, capacity building, institutional strengthening and the establishment of linkages with other regional networks.

It is envisaged that the development of a strong Regional Network of MPAs, and growth of national capacity in the planning and management of MPAs, will foster the establishment of other MPAs in each country of the region. To further support this process, this Regional Master Plan includes guidelines for the identification and selection of other MPAs.

Introduction

The Red Sea and Gulf of Aden are globally renowned for their unique and beautiful marine and coastal environments, the diversity of species inhabiting them, the value of these resources for human development and as part of the cultural heritage of the region. The coastal and marine environments, and the animals and plants within them, have been used by the inhabitants of the Red Sea and Gulf of Aden in a sustainable manner for thousands of years. In more recent years the use of these environments and resources has substantially increased, with the development in several countries of petroleum-based economies that require sea transport for petroleum exports, the growth of international dive tourism in the region and general population growth in the coastal zone. Despite the enormous economic development that has occurred in some of the countries of the region in recent decades, many coastal communities continue to rely for their livelihood on the small-scale use of marine resources, especially fisheries.

Running parallel to the economic and social development that has occurred in the region, there has been a growing awareness of the regional and international significance of its environmental value, in particular:

- the diversity of coral reef habitats in the central Red Sea of Saudi Arabia and Sudan
- the distinct zoogeography and abundance of endemics within the Red Sea and Gulf of Aden
- the unique coral reefs around the Sinai
- the atoll-like formation of Sanganeb Atoll in Sudan
- the extensive stands of mangroves and populations of dugong and turtle in the southern Red Sea
- the unique biodiversity of the Socotra Archipelago
- the extensive stocks of commercial fishes in the Gulf of Aden.

There are gaps in our knowledge of many parts of the region, especially the coastal areas of the Gulf of Aden in both Yemen and Somalia, the reefs of the southern Red Sea and the Socotra Archipelago. Scientific surveys and research in recent years, especially in the latter areas, have provided more extensive and detailed information on the impressive conservation significance of the Red Sea and Gulf of Aden.

In some parts of the region, the rapidly growing population and rate of development threaten the sustainability of current patterns of resource use. Issues of particular concern include oil pollution from shipping; over-fishing; habitat destruction associated with coastal developments; tourism (PERSGA, 1998a; Gladstone et al., 1999; Wilkinson, 2000). Marine protected areas (MPAs) have been established in many parts of the Red Sea and Gulf of Aden as tools to manage these activities, to provide for sustainability and economic development and for conservation. Of particular importance is the need to conserve areas that represent the full range of unique habitats and biodiversity and also to support national development. This will be achieved through the integration of 12 MPAs into the Regional Network of MPAs for the Red Sea and Gulf of Aden (Appendix 1). The current status of these MPAs varies from those that have been established for many years with legal standing and well-defined management plans, to those that have

been proposed but not officially declared by their national government. This Master Plan is the long-term policy document that provides the framework for planning and managing the Regional Network in a consistent manner. It is also intended for similar purposes in other MPAs in the region, as well as for the identification and selection of additional sites for protection.

A synthesis is provided of current information on the physical and biological environments of the Red Sea and Gulf of Aden, their conservation significance, the socio-economic context, current human uses and impacts. The Master Plan aims to achieve a number of objectives and the means for achieving these are detailed in specific goals, policies and strategies for implementation. Important tools for planning and managing each MPA in the Regional Network are the site specific Master Plan and Management Plan. Guidelines for preparing these documents have been developed from internationally accepted procedures (e.g. Kelleher and Kenchington, 1992; Kelleher, 1999) to suit the context and accepted practices of the Red Sea and Gulf of Aden. The MPAs in the Regional Network vary in their current legal and management status. There is also a range of technical capabilities among staff and in scientific and socio-economic knowledge about the MPAs in the Network. Suitable mechanisms to strengthen the Network are included in this Master Plan.

where special measures need to be taken to conserve biological diversity (Glowka et al., 1994).

The first meeting of the Conference of the Parties to the Convention on Biological Diversity selected marine and coastal biodiversity as the first major theme to be addressed systematically in the Conference of the Parties' medium term work programme. Under the Jakarta Mandate on Marine and Coastal Biological Diversity (adopted by the second meeting of the Conference of the Parties, COP), a number of specific action items were approved for implementation that are relevant to this Regional Master Plan, notably:

Marine and Coastal Protected Areas

"…conservation measures should emphasise the protection of ecosystem functioning, in addition to protecting specific stocks"

"Parties should encourage local communities and resource users to participate in the planning, management, and conservation of coastal and marine protected areas"

"…enhance linkages and information exchange among the sites"

"Parties should promote the research and monitoring of MPAs to assess their value for the conservation and sustainable management of biodiversity" (de Fontaubert et al., 1996 p. 71)

This Regional Master Plan will facilitate the implementation of these actions in the Red Sea and Gulf of Aden, by providing a framework for a representative system of MPAs and by providing mechanisms for networking and coordination amongst the MPAs.

Regional Networks of Marine Protected Areas

Systems, or networks of protected areas, are established for the purposes of conserving representative examples of biodiversity, or protecting a set of unique and high profile features (McNeely and Thorsell, 1991; Lucas, 1992; Davey, 1998; Salm et al., 2000). Located and managed appropriately, a network of MPAs also has the potential to benefit both migratory species that require scattered habitats (e.g. sea turtles, sea birds) and transboundary or straddling stocks. In semi-enclosed seas shared by several countries, a coordinated approach to the selection and management of MPAs has the potential to prevent the transboundary spread of pollution and development impacts.

There are several important ecological reasons for ensuring a uniform approach to, and capability for, MPA management in the Red Sea and Gulf of Aden. The Red Sea is a semi-enclosed regional sea having a restricted exchange with the Indian Ocean and Mediterranean Sea (Sheppard et al., 1992). Large-scale pollution events could potentially travel across national borders, affecting habitats away from the source of the pollution event. Effective MPA management (that includes oil spill contingency plans) that limits the risk of these events in one country will reduce the chances of impacts to ecosystems and resources in neighbouring countries.

Most marine organisms have a dispersive
larval stage lasting for periods that vary from a few days to several months. During this time larvae may cross national boundaries. A consequence of this is that unsustainable resource use has the potential to reduce stocks in neighbouring countries because of a reduction in parental stocks. In addition, species important for fisheries (e.g. tuna) often travel large distances, regularly taking them across national boundaries. A regional approach to sustainable resource usage (with MPAs as a key strategy) will facilitate regional sharing of benefits.

The regional benefits from a network of MPAs will only be realised if there is a coordination mechanism in place. There are good reasons for establishing such a mechanism:

- it allows for information and experiences to be shared amongst managers and their agencies and therefore facilitates more efficient management
- it facilitates more efficient use of limited financial and human resources
- it increases the chances of a consistent approach to management, with corresponding regional benefits for management of resource use and biodiversity conservation. Standard reporting procedures and monitoring systems will provide for reliable comparisons and data evaluation on a regional scale.

Regional networks of MPAs, networking and coordinating mechanisms, and regional protocols, have been developed in several regional seas and other shared water bodies (Table 1). For example:

The Mediterranean Sea: As part of the Mediterranean Action Plan a Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean was adopted by the Contracting Parties in June 1995. The Protocol calls for the establishment of a list of Specially Protected Areas of Mediterranean Importance (SPAMI), with the objectives of biodiversity conservation and protection of specific Mediterranean ecosystems. The Protocol also calls for species conservation, regulation of non-indigenous and genetically modified species and research relevant to the Specially Protected Areas. MEDPAN, the Mediterranean Protected Areas Network, was established in 1991 to facilitate the exchange of experience between protected area managers. This level of contact was missing in the initial system, the protected areas being represented in any meeting by the national authority for nature conservation. MEDPAN allows each manager to benefit from the knowledge, failures and success of any activity in the region.

The Wadden Sea: To protect the internationally significant tidal wetlands and dependent species of the Wadden Sea, a Joint Declaration on the Protection of the Wadden Sea was signed by the Netherlands, Germany and Denmark in 1982. The Common Wadden Sea Secretariat was established in 1987. About two-thirds of the Wadden Sea area is legally protected in the Trilateral Conservation Area, which includes an almost continuous series of protected areas, national parks and wildlife reserves. Cooperative management of the Trilateral Conservation Area occurs via the Wadden Sea Plan (1997), which includes common management principles, common management objectives for human activities, common ecological targets for the management of six major habitat types and programmes of shared research, monitoring and assessment (Enemark et al., 1998).

The Caribbean Sea: The Contracting Parties to the Wider Caribbean Seas programme adopted a Specially Protected Areas and Wildlife (SPAW) protocol that establishes a regional network of marine protected areas to conserve and restore regional ecosystems. Networking activities include the Wider Caribbean MPA Managers network and a supporting database, a regional guide to funding protected areas in the wider Caribbean, and common guidelines and criteria for protected areas (UNEP, 1996; Vanzella-Khouri, 1998).

Asia Pacific Region: One of the Indicative Actions of the APEC (Asia Pacific Economic Cooperation) Action Plan for Sustainability of the Marine Environment under the objective of Sustainable Management of Marine Resources is to "Establish an APEC network of marine protected areas" (Source: Internet site for APEC Action Plan for Sustainability of the Marine Environment).

Table 1. Regional sea areas containing representative networks of MPAs

Regional Sea	Convention	Relevant Protocol	Networking Mechanisms
Red Sea and Gulf of Aden	Jeddah Convention (1982)	Protocol Concerning Biological Diversity and Establishment of Protected Areas (in preparation)	Under development
Wider Caribbean	Cartagena Convention (1981)	Specially Protected Areas and Wildlife Protocol	Wider Caribbean MPA Managers network and a supporting database, a regional guide to funding protected areas in the wider Caribbean, and common guidelines and criteria for protected areas
South East Pacific	Lima Convention (1981)	Protocol for the Conservation and Management of Protected Marine and Coastal Areas	None
East African Seas	Nairobi Convention	Protocol Concerning Protected Areas and Wild Fauna and Flora in the Eastern African Region	None
Wadden Sea	Joint Declaration on the Protection of the Wadden Sea	No relevant protocol	Not Applicable
Gulf	Kuwait Convention (1978)	Protocol Concerning Biological Diversity and Establishment of Protected Areas (in preparation)	Not Applicable
Mediterranean	Barcelona Convention (1976)	Protocol Concerning Specially Protected Areas and Biological Diversity in the Mediterranean	Regional Activity Centres, including one on Specially Protected Areas (Tunisia)

The Red Sea and Gulf of Aden Regional Network of Marine Protected Areas

The Red Sea and Gulf of Aden region has many sites of unique beauty, which support populations of globally important species or contain ecologically critical habitats. These require management of human activities, to maintain their ecological importance and their availability to be appreciated and enjoyed by the region's inhabitants. If protected, they can also serve as areas for scientific research and as valuable assets for raising public awareness.

The SAP process identified 12 proposed or declared MPAs that were of regional or global significance, for inclusion in a regional network of MPAs (Figure 1 and Appendix 1). The network includes representatives of all major biogeographical sub-units, major habitat types within each sub-unit, prime examples of all types of coastal and marine habitats and species communities. These are outlined for each MPA in the representative network in Appendix 1. The regional network consists of the following MPAs:

Djibouti (Iles des Sept Frères and Ras Siyan)

Egypt (Ras Mohammed National Park; Giftun Islands and Straits of Gubal)

Jordan (Aqaba coral reefs)

Saudi Arabia (Sharm Habban and Sharm Munaybirah - Wajh Bank; Farasan Islands)

Saudi Arabia/Egypt (Straits of Tiran)

Somalia (Aibat and Saad ad-Din Islands, Saba Wanak)

Sudan (Sanganeb Marine National Park; Mukkawar [Magarsam] Island - Dungonab Bay)

Yemen (Socotra Islands Group; Belhaf and Bir Ali Area).

The legal and institutional framework for MPAs in the Regional Network is outlined in Appendix 2.

Figure 1. Red Sea and Gulf of Aden Regional Network of Marine Protected Areas

1. **Aqaba Marine Park (Jordan);**
2. **Straits of Tiran (Saudi Arabia/Egypt);**
3. **Ras Mohammed National Park (Egypt);**
4. **Giftun Islands and Straits of Gubal (Egypt);**
5. **Wajh Bank - Sharm Habban and Sharm Munaybirah (Saudi Arabia);**
6. **Mukkawar Island [Magarsam] and Dungonab Bay (Sudan);**
7. **Sanganeb Marine National Park (Sudan);**
8. **Farasan Islands Protected Area (Saudi Arabia);**
9. **Iles des Sept Frères and Ras Siyan (Djibouti);**
10. **Aibat and Saad ad-Din Islands, Saba Wanak (Somalia);**
11. **Belhaf and Bir Ali Area (Yemen)**
12. **Socotra Islands Group National Protected Area (Yemen);**

Purpose of the Regional Master Plan

This Regional Master Plan is a long-term policy document that will be used as a basis for the development of site-specific Master Plans and Management Plans in each of the MPAs in the regional network, where these do not already exist. The objectives, goals, general policies and strategies presented here are regionally applicable and will facilitate regional consistency in the management of MPAs in the Regional Network (see Figure 2).

Within each of the MPAs in the Regional Network a regionally standardised, site-specific Master Plan will be developed, which will serve as the long-term policy document for that MPA. This site-specific Master Plan will guide the development of a site-specific Management Plan for each MPA. These site-specific Management Plans are short-term, practical documents that describe the specific management actions required to achieve the objectives and goals listed in the Master Plan. The Management Plan is purposefully designed to be short-term (e.g. for a period of five years) so that it can be reviewed and updated in response to the results of monitoring of indicators of management success, scientific research and changes in local conditions.

This Regional Master Plan provides regionally standardised guidelines for the preparation of Master Plans and Management Plans, which can also be used as the basis for the development of both Master and Management Plans for MPAs outside the Regional Network. The guidelines for identifying and selecting MPAs provide a systematic and objective basis for the development of national system plans of MPAs in each country in the network.

In summary, a major long-term outcome of the establishment and operation of the Regional Network and the application of this Master Plan will be the development of experience that can be applied to all the MPAs in each country.

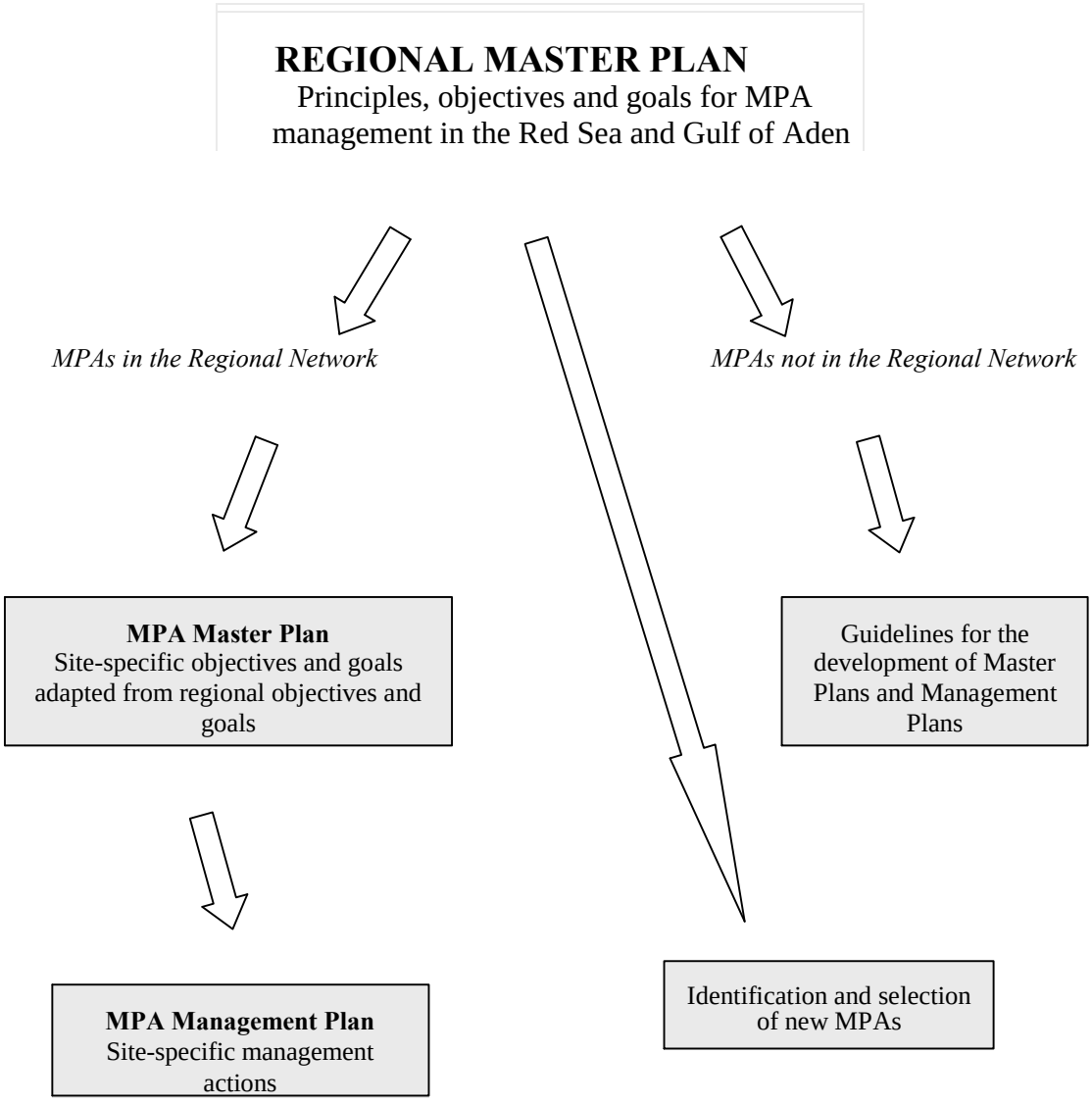

Figure 2. The relationship of this Regional Master Plan to MPAs in the Regional Network and its potential contribution to other MPAs in the region not represented in the Regional Network

Development of the Regional Master Plan

This Regional Master Plan was developed following review of the master and management plans of a number of established MPAs in the Regional Network, in particular Ras Mohammed National Park in Egypt (Jeudy de Grissac et al., 1998; Pearson and Shehata, 1998; TDA/EEAA/RSG, 1998) and the Farasan Islands Marine Protected Area in Saudi Arabia (Gladstone, 1994, 2000). The National System Plan for Saudi Arabia (Child and Grainger, 1990) provided information on zoning systems and the basis for developing representative networks. The Strategic Action Programme for the Red Sea and Gulf of Aden (PERSGA, 1998a; Gladstone et al., 1999) and supporting documents from that programme (Abdellatif et al., 1997; Ali et al., 1997; Haddad et al., 1997; ICED, 1997; PERSGA, 1998b) provided background information on the status of ecological systems. Internationally accepted practices and guidelines for planning and managing MPAs (Kelleher and Kenchington, 1992; Kelleher, 1999; Salm et al., 2000) provided the framework for the regionally adopted guidelines included here. The draft of the Regional Master Plan was reviewed at the PERSGA office in Jeddah and during a regional MPA workshop at Ras Mohammed National Park, in November 2000. The workshop was attended by MPA experts and representatives from all countries participating in the Regional Network. Their comments and suggestions were incorporated in the final document.

The Principles Underlying Management of Marine Protected Areas in the Regional Network

A number of principles, which have been adapted from principles of ecologically sustainable development and natural resource management, underlie this Regional Master Plan. These principles have guided the development of the objectives and goals. They provide planners and managers with a philosophical framework for the process of elaborating site-specific objectives and goals, or for discriminating between alternatives of each.

Intergenerational Equity

Future generations are entitled to inherit marine resources and biodiversity in a state that is as good as, or better than, their current state.

Ecological Sustainability

Ecological sustainability is the foundation of both social and economic development. Key elements of management and planning for ecological sustainability include ecosystem-based management, conservation of ecological processes, protection of critical habitats, use not to exceed maximum sustainable yield or carrying capacity, conservation of biodiversity in general and conservation of rare and endangered species in particular.

The Precautionary Principle

The absence of scientific certainty should not be a reason for postponing management of these MPAs. If an activity is assessed as having a low risk of causing serious or irreversible adverse impacts, or if there is insufficient information with which to assess fully and with certainty the magnitude and nature of impacts, decision-making should proceed in a conservative and cautious manner.

Integrated Planning and Management

Many of the activities that can potentially threaten MPAs occur outside their borders, including terrestrial areas, and often come under the jurisdiction of other management agencies. Management of MPAs should consider all potential sources of threats and develop management that addresses these threats. In order to achieve this, management of the MPA will need to be integrated with

the management responsibilities of the relevant agencies.

Stakeholder Consultation and Participation

MPAs in the Regional Network are used by a range of stakeholders, many of whom derive their livelihood from the MPA and have no alternative sources of livelihood. They are likely to be affected by management of the MPA and have the right to be consulted and to play an active part in the decision-making process. Many stakeholders also possess much knowledge and experience that will assist in planning and management.

Capacity Building and Technology Transfer

A key element to the successful implementation of MPA management is skilled and knowledgeable staff. Where skills and knowledge are limited, capacity building of staff will form a critical element in the long-term management of MPAs. Considerable technology is available that facilitates decision-making and the evaluation of management actions. A modern and appropriate technology base is a central component of MPA management. This includes computing and communication facilities, information resources and geographic information systems.

Adaptive Management

Management of MPAs needs to be viewed as an adaptive process or experiment that varies in response to changes in the character and intensity of threats, increased knowledge and changes in the composition of the local community. Adaptive management requires the establishment of performance measures at the outset of management. The results of systematic monitoring of key indicators are evaluated against the agreed performance measures, and management varied (if necessary) to ensure objectives and goals are being achieved.

Regional Master Plan

This Master Plan identifies the objectives and goals of the Regional Network and describes the policies and strategies to be used for achieving them. These objectives and goals reflect the fact that the Regional Network includes sites that are not only representative of the major habitats and ecosystems of the Red Sea and Gulf of Aden, but are also regionally and internationally unique and are therefore worthy of protection.

These sites also support a diversity of human uses, including artisanal and commercial fisheries, tourism, recreation and maritime transport, which are significant for local and national economies. For example, by the end of 1998 the estimated value of hotels and shops built by the private sector in the Sharm El Sheikh area (part of Ras Mohammed National Park, Egypt) was US$ 5 billion and the annual income associated with tourism activities for 1998 was US$6 billion (Jeudy de Grissac et al., 1998). The majority of Saudi Arabia's commercial fishing activity in the Red Sea occurs in the southern areas in the vicinity of the Farasan Islands Marine Protected Area (Gladstone, 2000). Fisheries, tourism and recreation depend on healthy ecosystems and the returns from these uses are vulnerable to the effects of over-exploitation. A primary objective of the Regional Master Plan is the protection of the resources that sustain these uses, which will in turn provide a basis for sustainable development of these activities and the provision of future use options that may arise.

A potential constraint to achieving the objectives and goals is the limited technical capacity and experience in MPA management that currently exists in the region. In some cases, individual countries lack experts with the necessary knowledge, training and skills required for MPA management. Much of the available experience currently resides within the Ras Mohammed National Park (Egypt) and is available for training of staff from other countries. A major objective of the Regional Master Plan is therefore capacity building of staff, which will occur through the implementation of the various activities associated with the establishment of the Regional Network.

A major regional initiative in the near future will be the development of a regional legal framework for protected areas and biodiversity. This is planned as a new protocol to the Jeddah Convention. The Regional Network of MPAs will play a major role in implementing the principles of this legal framework.

Objectives of the Regional Network of Marine Protected Areas

The objectives of the Red Sea and Gulf of Aden Regional Network of Marine Protected Areas are:

1. To develop regional capacity in all aspects of MPA planning and management.

2. To provide for the sustainable use of living marine resources.

3. To support local and national economic and social development.

4. To involve local communities and stakeholders as partners in MPA management.

5. To conserve representative and prime examples of the biodiversity of the Red Sea and Gulf of Aden.

6. To conduct monitoring and research programmes for the benefit of MPA management.

7. To enhance public awareness for the marine resources and biodiversity of the Red Sea and Gulf of Aden and the principles of sustainable use.

8. To protect the unique cultural heritage of the marine and coastal environments of the Red Sea and Gulf of Aden.

Goals, Strategies and Policies of the Red Sea and Gulf of Aden Regional Network of MPAs

Each of the objectives of the Regional Network has its related goals and specific strategies and policies for achieving them. These are outlined in Table 2 as shown opposite.

Table 2. Objectives, Goals, Strategies and Policies of the Red Sea and Gulf of Aden Regional Network of Marine Protected Areas

Objectives	Goals	Strategies and Policies
1. To develop regional capacity in all aspects of MPA planning and management	To increase staff capacity in the planning, establishment and management of MPAs. To establish a regional group of MPA experts. To establish communication networks and the exchange of information and experiences amongst MPAs in the Regional Network, and with regional networks in other parts of the world. To develop site-specific master plans and management plans for each MPA in the Regional Network where these do not already exist. To monitor and review management performance.	MPA staff to be trained in MPA selection, planning and management and in the relevant aspects of biodiversity conservation, fisheries, tourism, public awareness and marine ecology. This training to occur through formal courses and on-the-job training by staff participating in surveys and monitoring programmes. Relevant and up-to-date technology to be used for planning and management, such as GIS and remote sensing. Where this technology is not available, procedures are to be developed to seek funding and infrastructure support for its acquisition. Staff to be trained in the application of this technology in the planning and management of MPAs.
2. To provide for the sustainable use of living marine resources	To protect the habitats and ecological processes that sustain living marine resources at all stages of their life cycle. To manage the use of living marine resources, in consultation with local communities and commercial enterprises, and to ensure its sustainability. To establish monitoring programmes for species caught within the MPA. To re-establish traditional, community-based conservation practices. To coordinate with, and use the outcomes of, the relevant components of PERSGA's long-term programme of action.	Habitats critical for the support of living marine resources, such as breeding and nursery areas, and larval sources, to be protected. Fishing activities to be excluded from parts of each MPA so these areas can support fishing in surrounding areas of the MPA, through the emigration of adult fish and enhancement of reproductive output. Fishing activities in other parts of the MPA may be regulated from time to time in consultation with, or on the advice of, the traditional and commercial users e.g. via seasonal or temporary closures. Inventories of species caught within the MPA to be developed and stock assessments of key fisheries species undertaken. Stocks of key species caught within the MPA to be monitored using standardised techniques, to evaluate the effectiveness of management strategies. Areas within the MPA that have a high connectivity to other areas (in terms of their larval supply) to be protected. The construction of aquaculture facilities within the MPA to require a sound environmental assessment. National regulations relating to the capture of living marine resources to be enforced. All tourism operations to be ecologically and socially sustainable and subject to sound environmental and social impact assessment. Collection of curios to be forbidden within the MPA.

Table 2 cont'd.

Objectives	**Goals**	**Strategies and Policies**
3. To support local and national economic and social development	To encourage economic development activities based on the resources of the marine and coastal environments of the MPA, which are compatible with the objectives of the MPA. To ensure that all economic development activities and uses of the resources of the MPA are sustainable and subject to environmental and social impact assessment, according to the relevant legal instruments.	Where relevant and feasible, zoning plans to provide for areas to be set aside for development purposes. Options for alternative livelihoods to be investigated for members of the local community who will be significantly affected by the establishment of the MPA. Mechanisms for sustainable financing to be utilised to support the operations of the MPA. Cost-recovery mechanisms to be used to restore the resources of the MPA that are damaged by unlawful use. MPA staff to be available to provide free advice to developers on minimising the environmental effects of their activities.
4. To involve local communities and stakeholders as partners in MPA management	To involve the local community and stakeholders in a participatory manner in the development of management plans and in day-to-day management activities of the MPA. To engender within the local community a sense of partnership and commitment to the objectives of the MPA and its management activities. To provide employment opportunities for the local community in the operations of the MPA.	Local community members and stakeholders (or their representatives) to be invited to review and comment on draft zoning plans, management strategies and available information about the MPA. The comments of community members and stakeholders to be used in amending draft zoning plans and management plans. Local community members to be trained to undertake tasks that support the management of the MPA, such as community ranger duties, the collection of fisheries data, monitoring of key groups of flora and fauna, liaison with tourists.

Table 2 cont'd.

Objectives	Goals	Strategies and Policies
5. To conserve representative examples of the biodiversity of the Red Sea and Gulf of Aden	To conserve representative samples of the range of habitats, communities, species, landscapes and seascapes occurring within each MPA in the network, and the ecological processes upon which each of them depend. To maintain the natural coastlines within each of the MPAs in the network, because of their role in conserving the integrity of coastal ecosystems and habitats. To maintain water quality within each of the MPAs in the network, in recognition of the primary importance of water quality to the maintenance of ecosystem structure and function. To protect critical habitats within each of the MPAs in the network and, where necessary, restore those that have been degraded. To protect significant, rare and endangered species occurring within each of the MPAs in the network, and the habitats upon which they are dependent. To use the best available information for planning and management decision-making. To coordinate with, and use the outcomes of, the relevant components of PERSGA's long-term programme of action.	Comprehensive inventories and maps of all habitats to be compiled for each MPA where this has not already been done, using methods outlined in the Standard Survey Methods Manual. Representative examples of all habitats and the varieties of community types within them to be conserved by including them in protective zoning. Areas of high conservation value to be conserved by protective zoning. These areas include: areas of high species richness; areas with a number of different community types in close proximity to one another; areas important as sources of larval recruits; and areas of high aesthetic value. Activities occurring outside the MPA (including activities in adjacent terrestrial systems) that are causing, or likely to cause, damage to habitats within the MPA to be managed to reduce their impacts on the MPA. This needs to occur by coordination with the relevant agencies. The status of the major habitats within the MPA to be monitored annually using methods outlined in the Standard Survey Methods Manual. There are to be no alterations to natural shorelines, with the exception of development activities permitted in specified zones. Mooring buoys to be provided in areas of high recreational usage to prevent anchor damage to corals. Activities that remove or degrade mangroves not to be allowed. Restoration of cleared mangrove stands to be undertaken after the responsible activity has ceased, using local stocks for replanting. Surveys to be undertaken to determine the status of marine turtles, sea birds, and marine mammals occurring in the MPA and the areas important for these groups. Areas important for marine turtles, sea birds and marine mammals within the MPA to be conserved by protective zoning. Surveys of the use of marine turtles, sea birds and marine mammals by the local community to be undertaken to determine the magnitude of current threats to their status within the MPA. National legislation relating to the conservation of marine turtles, sea birds and marine mammals to be enforced. The status of marine turtles, sea birds and marine mammals within the MPA to be monitored annually using standard techniques outlined in the *Standard Survey Methods Manual*. Introductions of non-indigenous or genetically modified species into the waters of the MPA or adjacent land areas (i.e. in aquaculture facilities) to be forbidden.

		All developments within the MPA and in adjacent waters and terrestrial areas to require an environmental assessment, in accordance with the relevant legislation. Where this legislation does not exist, MPA staff to liaise with key decision-makes for its development and enactment. Pollution from shipping in the waters of the MPA, and in surrounding waters, not to be permitted. Surveillance for pollution incidents to be developed and implemented. The legislation and regulations relating to pollution to be enforced. Discharges from land-based and sea-based sources into the waters within or adjacent to the MPA to be forbidden. Oil spill contingency plans to be developed for the MPA and integrated with the relevant Marine Emergency Mutual Aid Centre
6. To conduct research and monitoring programmes for the benefit of MPA management	To support and facilitate management-related research and incorporate the results of this research in improved management practices. To establish monitoring programmes for key indicators and undertake regular evaluations of management against performance targets. To provide reference locations for research and monitoring that are undisturbed by human activities.	Monitoring programmes in each MPA to target the status of habitats, key fisheries species, marine turtles, sea birds and marine mammals. Standard monitoring techniques to be used and the programmes to have an appropriate statistical design incorporating levels of detectable change. Monitoring also to target public awareness and attitudes towards management, and infringements of MPA regulations. Data collected during monitoring to be added to a database within each MPA and also in a centralised, relational database within PERSGA. Results of monitoring to be compiled and reported annually and compared against performance targets during the evaluation and review process. At the end of each year the PERSGA MPA Coordinator to be responsible for producing a Status Report for the Regional MPA Network, summarising the results of the monitoring in each MPA. Programmes of applied research to be developed to support management, in consultation with local researchers. University researchers and students to be encouraged to participate in the research and monitoring programme. Results of the monitoring and research programmes to be made available to managers and to be included in public awareness programmes to demonstrate the benefits arising from the MPA.

Table 2 cont'd

Objectives	**Goals**	**Strategies and Policies**
7. To enhance public awareness for the marine resources and biodiversity of the Red Sea and Gulf of Aden and the principles of sustainable use	To develop public awareness programmes for the local community and all stakeholders. To provide opportunities for the public to appreciate the natural beauty of each MPA in an undisturbed setting. To conserve reference locations which contain the complete diversity of ecosystems, habitats and species in each MPA for their potential to educate the public. To coordinate with, and use the outcomes of, the relevant components of PERSGA's long-term programme of action.	Public awareness programmes to target the local community, all stakeholder groups and their employees, local educators (e.g. primary and high school teachers) and also key decision-makers in government. Public awareness programmes to provide the community with information on the following topics related to the MPA: the regional significance of the MPA; its management objectives and the reasons for its establishment; the results of research and monitoring programmes; the natural values and ecology of the marine and coastal environments; and the relationships between human activities and the health of these environments. In particular, public awareness programmes developed for investors and their staff to stress the close association between resource conservation and sustainable economic returns. The content of the public awareness programmes to be delivered through a variety of means, including brochures; articles in newspapers; feature stories on television and radio; home pages on the Internet; articles in *Al Sanbouk*; and visitor centres. Areas of the MPA that have a high aesthetic value or public appeal (e.g. especially beautiful coral reefs, impressive sections of coastline) to be conserved through protective zoning and to be a focus for public awareness activities. Where MPAs are used for recreational and tourist activities, the public awareness programme to include guidelines for recreational users to avoid damage to coral reefs through anchoring, littering, reef walking and diving.
8. To protect the unique cultural heritage of the marine and coastal environments of the Red Sea and Gulf of Aden	To provide for the maintenance of the traditional livelihoods of the inhabitants of the MPA. To protect areas that are culturally significant. To protect species that have a cultural significance, their habitats and to facilitate their sustainable use.	An inventory of culturally important sites to be prepared for the MPA and these sites to be protected. Traditional conservation practices used within the MPA to be documented and their continuation to be encouraged by integrating them into the MPA management. Social impact assessments to be undertaken prior to the establishment of MPAs and as part of the assessment process for developments within MPAs. Habitats and resources required by species that are exploited for cultural purposes to be conserved.

Guidelines for Developing Master Plans and Management Plans for MPAs in the Red Sea and Gulf of Aden Regional Network

The purpose of this section is to provide guidelines for the planning and management of MPAs in the Regional Network, where such plans do not already exist. Specifically, this section provides guidelines for the planning process (including the establishment of a management team); the development of zoning plans; research and monitoring programmes; the content of master and management plans; community awareness; stakeholder consultation and participation; and sustainable financing. These guidelines have been adapted from accepted international procedures (Kelleher and Kenchington, 1992; Kenchington and Ch'ng, 1994; English et al., 1997; Kay and Alder, 1999; Kelleher, 1999; Salm et al., 2000) to suit the context of the Red Sea and Gulf of Aden.

Effective establishment and management of MPAs need to be based on a systematic approach to defining management objectives and their implementation. Planning provides the foundation for decisions about how the resources of the organization will be allocated and why. Management involves implementing those decisions (i.e. the objectives of the management plan) and includes all those operations that collectively constitute day-to-day management. The outcome of the planning process is a site-specific master and management plan for the MPA.

The Planning Team

An important first step in planning the management of the MPA is to assemble an inter-disciplinary planning team. The planning team needs to be led by a project manager (who represents the agency charged with developing the plan and implementing the management) and include individuals with both expertise in the relevant disciplines and familiarity with the area. Members could potentially include marine scientists, ecologists and biologists, social scientists, lawyers, economists and information specialists. The terms of reference for the planning team include the following:

1. To assemble and synthesise all existing information on the MPA and assess the need for any additional information that is necessary for planning the management of the MPA.
2. To identify the stakeholder groups within the MPA and all relevant agencies that need to be consulted during the planning process.
3. To develop a draft master plan and management plan for the MPA.
4. To develop a community consultation process for the draft master plan and management plan and incorporate the outcomes of this process.
5. To develop the master plan and management plan and a process for its implementation.
6. To review the outcomes of the monitoring programme and assess the need for changes to management of the MPA.

The Planning Process

1. Initial Information Gathering

The planning team assembles and reviews existing information on the nature, use and conditions of the area. This information will be drawn from existing reports, scientific papers, previous surveys, knowledgeable individuals, maps and GIS databases. In addition, the planning team will seek out stakeholders in the MPA and interview them to gather knowledge and keep them informed of proceedings. If field surveys are required, they should occur at an early stage. The categories of information necessary will depend on the size of the MPA and its level of usage, but will be drawn from the following:

Bio-physical Information

- types, and extent, of ecosystems and habitats occurring within the MPA, including open water, coral reefs, other subtidal habitats, beaches, rocky shores, sabkha, mangrove, seagrass, intertidal, saltmarsh, wetland
- the flora and fauna of each of these habitats
- the structure and extent of coral communities and other benthic communities
- the composition of fish assemblages associated with the coral communities and other benthic communities
- areas that are unusually rich in biodiversity within the boundaries of the MPA, i.e. areas with a high diversity and richness in a particular, or several, groups
- areas used by fishes for spawning and as juvenile nursery areas
- the distribution of sea turtles, dugong and marine mammals and of habitats used by these groups
- seabirds and the areas used by them for feeding and nesting

Resource Use Information

- the types of use made of the living marine resources occurring in the area, the locations where these uses occur and the intensity of use of each of these locations
- species caught by fishermen and any seasonal patterns in species targeted
- historical records of catch and effort for species caught
- the types of fishing equipment used by fishermen
- the locations of fishing camps
- seasonal patterns in the use of living marine resources
- areas important for recreation and tourism and their levels of use
- areas important for research and education
- use of the area for navigation, shipping (including anchorages and ports), defence
- areas with traditional and cultural significance

Socio-Economic Information

- locations of towns, settlements and their populations, within the MPA or adjacent to the MPA
- numbers of people engaged in each of the resource uses and whether they work seasonally or full-time in these activities
- the economic significance of the area for each of the uses
- the income derived by users of resources within the MPA
- population growth rates and levels of education
- the use of customary or traditional management practices
- the role of local *sheikhs* in the local community and in resource usage
- the presence of other significant individuals (such as chief fishermen)

Adjacent Areas

MPAs do not occur in isolation from the surrounding environment. MPAs with a coastal component are vulnerable to impacts from unsustainable land-use practices (e.g. soil erosion leading to sedimentation) and nutrient pollution, and MPAs away from the coast are also vulnerable to unsustainable exploitation of nearby reefs and pollution events. However, experience in other parts of the world has shown that even MPAs located some distance from the coast are vulnerable to sedimentation and freshwater bleaching following large flood events. Although located outside the management responsibilities of the MPA, the managers will reduce the likelihood of these events by coordinating their activities with the relevant agencies. The following information will need to be collected:

- major coastal landscapes and drainage patterns
- the uses of these areas and an assessment of the state of the land
- the human uses occurring outside, but in the vicinity of, the MPA on land and on water

In addition to those groups already mentioned, the planning team will identify the stakeholder groups who may have an interest in the management of the MPA. These other stakeholders might include: scientists, community leaders, non-government environmental organisations, dive clubs and local businesses. The nature of the interest in the MPA of each of these stakeholder groups is determined, along with their contact details. Stakeholders also include other government agencies whose management responsibilities overlap with the management roles of the MPA e.g. wildlife, conservation, fisheries, water, local development, military, ports authorities and municipalities.

2. Surveys

In some areas the existing information might be limited or unavailable. In this situation it is important to identify the information gaps and, if time and resources permit, arrange for surveys to obtain the necessary information. If surveys are required the 'Guide to Standard Survey Methods for Key Habitats and Species' will be used for surveying the bio-physical parameters.

All information collected during this preliminary phase, and also during surveys, will be entered into a relational database and GIS. Maps will be produced to display all of the information.

3. Preparation of a Draft Plan

The planning team prepares a draft Master Plan and Management Plan based on the information gathered. The required content of these Plans is outlined in Appendix 3.

An important step at this stage is the elaboration of the objectives, goals and general policies and strategies for the master plan. These are defined by the planning team to reflect agency priorities, as well as national and regional goals for biodiversity conservation and sustainable use of living marine resources. These goals will be based on the same broad goals outlined in this Regional Master Plan.

At this stage the planning team considers the range of strategies available to it to manage human use in the MPA in order to achieve the objectives and goals for the MPA. These options can include:

- zoning
- the use of traditional management practices, including the involvement of significant individuals in the society
- collaborative and community-based management

- public education and awareness
- research and monitoring
- environmental assessment for possible commercial uses of the MPA
- surveillance and enforcement
- economic instruments
- specific regulations, that might include:
  - seasonal closures of ecologically important areas (e.g. fish spawning locations, or when birds and turtles are nesting) or for the recovery of damaged habitats
  - controls on the use of specific types of equipment (e.g. dynamite for fishing; spear guns; limitations on net mesh; numbers of fish traps). In some cases this will simply be an extension of existing national fisheries regulations
  - quotas (including fisheries and tourism)
  - development controls (e.g. the establishment of a minimum set back for coastal constructions).

After the draft management plan has been compiled, the planning team prepares the necessary materials to present the draft plan to stakeholders. This will include the management plan document, as well as any maps showing the locations of proposed zones and options for management.

4. Development of a Zoning Plan

A zoning plan is a common component of management plans for MPAs and is appropriate for MPAs that include a range of human uses, conservation values and conflicts. The zoning plan is used to separate conflicting uses within the MPA and includes a range of zone types, each with a specific management objective. Box 1 provides examples from the region of zoning systems and the management objectives of different zones. The management objectives for each zone type need to be specified, along with the range of uses that will be permitted and prohibited within each one. The following guidelines for the development of zoning plans are based on general guidelines (e.g. Kelleher and Kenchington, 1992; Kelleher, 1999; Salm et al., 2000) and specific case studies from the region (Child and Grainger, 1990; Pearson and Shehata, 1998; EPC, 1999; Gladstone, 2000).

The following are guidelines for developing zoning plans:

1. The zoning plan should be clear, simple and understood by the range of users of the MPA. Where users have little or no experience in interpreting maps (e.g. some indigenous fishermen), the boundaries of the zones should be explained during public meetings. To aid compliance and interpretation, the boundaries of zones should coincide with obvious geographic features (e.g. distinct headlands, the edges of reefs).

2. The zoning plan should use a system of buffering to minimise sudden transitions from highly protected zones to general use zones. Zones providing a high degree of protection should be adjacent to zones providing a moderate degree of protection.

3. A single zone type should be used around a discrete geographic entity (e.g. an island or reef). However, where enforcement is possible, split zones may be appropriate to support fisheries-related activities.

4. Zoning plans should complement, rather than duplicate, existing regulations and management practices.

5. Protective zoning should be considered for areas within the MPA that:

- are of world, regional or national significance (e.g. areas important for significant species)

- contain critical habitat (e.g. seagrass, mangroves) or significant breeding or nursery sites (e.g. for fish, birds, turtles)
- contain representative samples of characteristic habitat types. Where possible, multiple samples or large areas of each habitat type should be protected. This will reduce the risks of a single sample of a habitat in pristine condition being damaged by a catastrophic event e.g. oil spill
- are important for non-extractive activities (e.g. SCUBA diving, snorkelling, recreation) and will provide a focus for public awareness activities
- have a high connectivity to other parts of the MPA (via larval transport) and are therefore likely to act as important sources of recruits to these areas, and thereby sustainable extractive activities (e.g. fishing).

6. National and local development needs should be provided for in the zoning plan. General use zones should be considered for areas of the MPA that were modified by development prior to the establishment of the MPA, or to focus development activities (that might involve habitat modification) in specific areas that will have minimal impact on the conservation values of the MPA.

7. Zoning of reefs and waters adjacent to existing terrestrial national parks or reserves should complement the management objectives of these areas.

8. Areas recognised and/or used for reasonable extractive activities and have a long-term significance for the livelihood of local inhabitants should be zoned to allow these activities to continue.

9. Traditional or cultural uses of an area, that are likely to remain sustainable, should be zoned so that they can continue.

10. Areas used as anchorages should be zoned to allow most of the activities associated with anchoring to continue. However these zones should not allow for the disposal of wastes or habitat damage.

11. The zoning plan should not impede shipping access to recognised navigation routes or to existing or potential ports.

12. Public awareness, monitoring and scientific research are essential activities in MPAs. Areas of the MPA that can play an important role in public awareness (e.g. areas of beauty or high species richness that are easily accessible) should be given a form of protective zoning. The zoning plan should allow scientific research throughout the MPA. Areas of the MPA should be zoned as reference areas (i.e. from which all use and visits are excluded, apart from monitoring and research) to gauge the effectiveness of MPA management.

13. The zoning plan should provide for areas to be temporarily closed to all activities to allow restoration.

Box 1: Zoning Systems currently in place, or recommended, for MPAs in the Red Sea and Gulf of Aden.

Ras Mohammed National Park Sector (Egypt). Source: Pearson and Shehata (1998)

Name	National Zoning Category	Management Objectives
Ras Mohammed	National Park	Conservation of national and internationally significant coral reef ecosystems and of representative examples of biodiversity.
Tiran-Senafir	National Park	Conservation of national and internationally significant coral reef ecosystems and of representative examples of biodiversity.
Sharm-el Sheikh	Protected Coastline	To provide for infrastructure and economic development under strict control.
Nabq	Managed Resource Protected Area	Conservation of ecosystems and biodiversity, while providing for sustainable use by local fishermen.
Abu Galum	Managed Resource Protected Area	Conservation of ecosystems and biodiversity, while providing for sustainable use by local fishermen.
Taba Coast	Protected Coastline	To provide for infrastructure and economic development under strict control.
Taba	Natural Monument	Conservation of unique natural features.

Zoning Plan for Socotra Archipelago (Yemen). Source: EPC (1999)

Name of Zone	Management Objectives
Resource Use Reserve	Long-term protection of the biodiversity of the Socotra Archipelago, while providing for sustainable use by the local community.
General Use Zone (occurring within the Resource Use Reserve)	To include sites where habitats have already been modified by development and/or resource exploitation and to allow for the development of essential infrastructure.
National Park	To protect the unique natural habitats and landscapes; to support the needs of the local community, especially subsistence users; to protect representative examples of biodiversity.
Nature Sanctuary	To preserve rare and fragile habitats, ecosystems, species and unique landscapes in an undisturbed state; to provide opportunities for future generations to experience and enjoy undisturbed areas; to maintain natural attributes of the environment; to enable the existing local community to maintain their lifestyle.

Farasan Islands Marine Protected Area (Saudi Arabia). Source: Gladstone (2000)

Name of Zone	Management Objectives
Resource Use Hima	Relatively large areas in which the emphasis is on sustainable resource management.
Biological Hima	Small areas set aside to protect critical habitats e.g. seagrass, mangroves, turtle nesting beaches.
Natural Hima	Small areas of high natural excellence established for the conservation of particular species (e.g. waterbirds) and for public education, low impact recreation and scientific research.
Special Natural Hima	Areas important for the conservation of biological diversity, which contain representative examples of biodiversity; habitat required for significant species; fish nurseries.
Recreational Hima	Areas of high scenic and amenity value managed for their educational and recreational values.

Aqaba Marine Park (Jordan). Source: Al-Saifi (2000)

Name of Zone	Management Objectives
Strict Reserve Zone	Preservation of marine communities in their natural state; reference areas for monitoring and scientific research.
Beach Recreation and Swimming Zone	Safe beach recreation, by excluding fishing and motorised boat activities.
Multi Use and Boat Access Corridors	Safe boating passages and access to the beach for boats, without endangering people using the beach.
Diving and Snorkelling Zone	Safe diving and snorkelling, for the observation and study of marine life.
Bait Fishing Zones	Capture of bait by licensed fishermen.
Beach Zone	Management of beach activities; development control near beaches.

5. Review of Draft Plan

The planning team publishes or distributes the draft plan and seeks comment from stakeholders. Stakeholders are invited to identify alternative solutions that are consistent with the goals and objectives for the MPA.

The process of the review can consist of public meetings where all stakeholders are invited to attend and at which the draft plan is presented and discussed, or meetings with representatives of the different stakeholder groups, or written submissions. Whatever process is used, comments of support or objection to specific components of the plan are noted and summarised and referred to when assessing the need to revise the plan. A detailed analysis of the review is produced within a few weeks of the completion of the public consultation.

6. Plan Finalisation

Using the report of the public consultations on the draft plan, the planning team meets to discuss and evaluate possible changes to the plan. Substantial changes to the draft plan should be discussed with stakeholder groups likely to be affected and the reasons for the changes discussed at length.

After all the necessary changes have been made to the detail of the plan, the content of the management plan is determined by the planning team (see the next section) and all the necessary information is compiled. The precise cartography of the MPA and any zones are completed and checked. The plan must also be checked by the agency's legal officer. The final management plan is submitted to the responsible Minister or agency official for final approval or endorsement as required.

7. Monitoring and Evaluation

According to the principle of adaptive management, the management plan is not a fixed document, but should be viewed as an experiment that is varied according to the results of the monitoring programme. Evaluation of the plan is undertaken regularly (e.g. every 5-7 years) as a result of information from the monitoring programme on impacts of activities, usage patterns and the effectiveness of specific management activities (such as zoning, development controls, public awareness programmes). It will also be necessary as a result of improved scientific understanding of the MPA and the activities occurring there.

Box 2. Case Study: Management of Traditional Fishing in Nabq Managed Resource Protected Area, National Parks of Egypt, South Sinai, Egypt.

The management of fisheries activities in Nabq Protected Area is conducted both by National Parks of Egypt Environmental Officers and by Bedouins associated with the Park's activities for negotiation, follow-up and daily data collection.

Nabq Protected Area, within the Ras Mohammed National Park Sector, is one of the most important fishing areas of the Egyptian coast of the Gulf of Aqaba due to the presence of large nursery grounds including mangroves, seagrass beds and areas of coral reefs. Nabq also has the largest lagoon system of the Gulf of Aqaba with a width of about 1km. The Nabq fishing village of Ghargana consists of 12 resident families with nearly 70 fishermen.

In order to conserve the marine resources and to maintain sustainable exploitation within Nabq Protected Area, the National Parks Sector has prepared a management policy for traditional fishing in Nabq. A management plan began in 1994 after discussion and agreement with the Bedouins who had been informed about the long-term role of the Protected Area and the potential benefits from management for the Bedouins.

In 1995, a survey was conducted of the Bedouin experience and exploitation of the area. Following this survey, the National Parks Sector prepared a management agreement that included regulations concerning fishing methods, equipment, fish catch, fishing location and period of fishing. In 1996, a meeting with all the fishermen of Nabq was held in their village to adopt a new management policy of opening and closing specific fishing grounds. The Bedouin fishermen accepted the new policy and about 50 % of the Nabq Protected Area coast has been closed for fishing. Studies have shown the effectiveness of this management tool for conserving both the fish stocks and also the coral reef ecosystem.

Since 1996, National Parks Sector management has been monitoring the coral reefs and fishes of the closed and opened areas using visual census techniques. Fishing activities and environmental data are monitored daily. Bedouins have been trained to identify fish species, to collect data and to report on changes in the environment or on the importance of catches. A major result of this cooperation has been a better understanding of the fishing policy amongst the Bedouins and the Bedouins have recently proposed reductions in the catches of some species due to a slow turnover of the stock.

The involvement of Bedouin fishermen in the management of marine resources in Nabq has allowed the National Parks Sector to implement its fishing management policy successfully within traditional fisheries.

This case study was prepared by Ayman Mabrouk, Mohamed El Helw, Marwan Abdellatif, Selmi Soliman, Auda Ali, Ottayeg Auda and Mohammed Soubayel of the Ras Mohammed National Park Sector.

Research and Monitoring

Research

Information is required to support the ongoing management of protected areas (Rodgers, 1991; Kenchington and Ch'ng, 1994; Kelleher, 1999). Although information is normally collected as part of the planning process, research will also continue after the MPA has been established to gather information that will assist in continued management. Research needs will be highlighted during the regular reviews of the performance of the MPA. It is important that additional information needs are prioritised and focused.

Research priorities to support ongoing management should be determined by collaboration between managers and scientists and ought to be reviewed regularly. Research commissioned by management agencies should include specific objectives and the management agency should ensure that the research has a sound design with appropriate statistical analysis of the results. The results (in the form of a draft report) should undergo peer review prior to final acceptance by the agency. A project manager within the management agency is nominated to initiate, oversee and manage the research, and is also responsible for arranging peer review and acceptance or rejection of the final report. This is best accomplished through regular liaison between the project manager and scientists.

The contents of the research programme will depend on the particular MPA (its size, management objectives etc.), the information already available and the technical expertise and funding available. Information that supports management and might not be available in the early stages of the planning process includes:

- patterns of water movement within the MPA, and between the MPA and surrounding waters, which can be used to predict patterns of connectivity and the likely spread of pollutants
- life history and population dynamics of exploited species and, in particular, their use of specific habitats at different stages of their life cycle or breeding
- life history and population dynamics of species that form important components of benthic habitats, especially corals and seagrasses
- biodiversity inventories
- socio-economic significance of the area covered by the MPA for local inhabitants and for the national economy.

Monitoring

Monitoring is undertaken in MPAs for a variety of reasons:

- as part of the management evaluation process; monitoring will determine the baseline conditions at the time the MPA is established so that management performance can be assessed
- to understand the natural variations in the ecosystem so that impacts from human activities can be distinguished from normal, background variation
- to assess the impacts of particular activities (e.g. establishment of a tourist operation or port).

Long-term monitoring is a critical part of the assessment and review of MPA performance, i.e. in determining whether the MPA is achieving its goals and objectives as specified in the management plan. It is therefore essential that the monitoring programme be designed during the planning for the MPA and that it commence prior to, or at the time of, establishment of the MPA and be used as a baseline study.

The monitoring programme will include the objectives of the monitoring, a list of the indicators to be measured, the methods, a

sampling regime (i.e. where and how often they will be measured), who will undertake the monitoring, how the data will be assembled into a database and reporting procedures.

The following points need to be considered in the design and implementation of a long-term monitoring programme used to review and assess the effectiveness of MPA management:

1. Identification of the specific objectives of the monitoring programme.

2. The choice of indicators that are likely to be responsive to changes in critical pressures and can be easily measured (e.g. abundance of fish species, coral cover, water quality, awareness and attitudes); critical pressures can include fishing, tourism, pollution and development.

3. The design of the sampling programme takes account of natural variations in the indicators being measured and is capable of discriminating changes due to human activity (including management) from natural changes.

4. The appropriate choice of sites for monitoring. Sites should be representative of the habitats found in the MPA; the design should include a range of control or pristine sites that are similar in all ways to the impacted sites. Site selection can proceed following a pilot programme, in which all potential sites are identified, possibly through the use of aerial photos, satellite images and charts. The number of sites chosen will be a compromise between the amount of information that is required and the resources available to undertake the monitoring.

5. The limits of acceptable change in the indicators need to be discussed and agreed upon at the beginning of the monitoring programme. This information can be obtained from existing studies on the limits of acceptable change and can be modified as more information becomes available in the local situation.

6. The design of the monitoring programme needs to be statistically sound and include adequate replication and an assessment of the programme's power to detect specified amounts of change in the indicators being monitored. This may require a number of pilot studies to determine the amount of replication needed to detect the specified change.

7. Staff undertaking the surveys need to be appropriately trained and to receive regular training updates. Where possible, it is most desirable for the same team of people to undertake the monitoring from year to year.

8. Monitoring needs to be conducted over a long time period using standard techniques.

9. The intensity of monitoring may vary from detailed monitoring of small areas by specialists, to broadscale monitoring of larger areas by trained non-specialists (e.g. interested dive clubs). Where non-specialists are used, they should receive appropriate training prior to participating and their performance should be assessed regularly.

10. Results of the monitoring programme need to be entered into a relational database at the conclusion of each survey and checked for the accuracy of data entry. The database needs to be designed so that information can be retrieved quickly and analysed.

11. Annual reports of the monitoring programme should be prepared to summarise the results in relation to the MPA goals and objectives. These results should form part of the regular review and evaluation of the MPA (e.g. at intervals of 5-7 years).

Box 3: Current Monitoring and Research Programmes in MPAs in the Regional Network

Farasan Islands Marine Protected Area (Saudi Arabia)

The management plan for the Farasan Islands MPA includes a monitoring programme, with baseline information that has been collected on a range of indicators. The monitoring programme is designed to: (1) gather baseline information on natural variations in the abundance of a range of indicators, against which impacts caused by human activities can be evaluated, (2) test the effectiveness of management of the MPA. The following indicators were selected: benthic lifeform coverage, Tridacna clams, coral predators and their effects (specifically crown-of-thorns starfish *Acanthaster planci*, and *Drupella* sp. snails), seagrass coverage and fish stocks (Gladstone, 1994). The monitoring was repeated in 2000 and revealed declines in the coverage of live coral (possibly associated with a wide scale bleaching event in the southern Red Sea), a decrease in the numbers of recently dead Tridacna clams and inconsistent changes in the densities of fishes (Rouphael and Al-Yami, 2000).

Monitoring and Research by the National Parks of Egypt of Five Egyptian Offshore Islands before Opening to Tourism and Underwater Activities

An exploratory survey of five offshore islands in the Egyptian Red Sea (Small and Big Brothers, 26º 18' N, 34º 52' E, Abu El Kizan, 24º 56' N, 35º52' E, El Zabarghad, 23º 36' N, 36º 12' E, Rocky Island, 23º 33 N, 36º 15'E) was undertaken in December 1997 by the Egyptian Environmental Affairs Agency, Nature Conservation Sector. The objectives of the survey were to evaluate the importance of natural resources in terms of their biodiversity values and to provide baseline data for monitoring studies, prior to the opening of these areas on 30 May 1998 to recreational diving.

The benthic ecology of these offshore islands, which were declared protected in 1985, had not been previously investigated. The expedition of J.Y. Cousteau in 1951-52 focused primarily on the islands' geomorphology. A particular study on coral bioerosion and bioaccretion was made in El Zabarghad by Hassan in 1997. In the present study, line transects were laid on the leeward SE reef side of each island at 3 m, 8 m and 15 m depth along an 80 m line. Quadrats (2 x 2 m) were placed every 10 m along the transect to describe patterns quantitatively in coral communities and to evaluate the variability of coral cover and distribution along a depth gradient.

Results of the survey confirmed that these islands are of great interest to science and to underwater tourism and that the leeward SE reef side of each island is more suitable for mooring. The results of the survey confirmed that in sheltered areas coral cover exceeds 60 % and on the leeward side of Abu El Kizan Island it reached 72 %. There was also a relatively high cover of soft coral (46 %), probably due to its topography as a massive intertidal reef flat totally exposed to currents and swell. The fact that the leeward sides of Small Brother and El Zabarghad Islands displayed a higher percentage cover of hard corals than the other islands was probably linked to the fact that these sites are relatively more sheltered and on gentle slopes, thus more suitable to hard coral colonies in shallower depths (3 and 8 m). The richness of hard coral genera was highest in Small Brother and Abu El Kizan and was lowest in Rocky Island. Depth was not a significant parameter controlling these coral assemblages. Cluster analysis returned 2 clusters (based on pooled data on hard and soft coral cover percentages) and was used to describe epi-benthic assemblages at different depths for each island.

The results showed that these pristine islands are of major interest to science and to underwater tourism. The observations confirmed the literature although several trends are particular to these specific areas. More than depth, topography and exposure to wind, currents and swell exert strong controls on coral assemblages. These assemblages appear fragile when impacted by natural disturbances such as crown-of-thorns starfish outbreaks as observed on Rocky Island.

The baseline data collected at the planned mooring sites of each island allows the monitoring programme to detect impacts from anthropogenic and natural phenomena on the reefs. The future monitoring work will include: a more specific evaluation of the carrying capacity of the sites for visitor numbers and related infrastructure (e.g. moorings); extending the survey to all sub-habitats of each island including windward sides; to sample at a standard series of depths up to 40 m for both benthic and pelagic resources in order to make inter-site comparisons; to include associated species assemblages and comprehensive fish census monitoring with selected key families or groups used as indicators; to monitor the crown-of-thorns starfish outbreaks and bleaching events in the area.

This case study is an extract from Tilot. et al., (in press).

Case Study: Monitoring Coral Reefs and Fishes along the Egyptian Coast of the Gulf of Aqaba by the National Parks of Egypt, South Sinai Region

Monitoring is conducted by the National Parks of Egypt Environmental Officers with the assistance of international researchers and institutions such Suez Canal University, York, Newcastle and Essen Universities.

Previous studies have been undertaken along the coast of the Gulf of Aqaba at Eilat (Israel) by Loya in 1972, at Aqaba (Jordan) by Mergner in 1971, Mergner and Schumacher in 1974 and Bouchon in 1980. Quantitative work was undertaken at Sharm El Sheikh and Ras Mohammed (Egypt) by Kotb in 1991, Medio in 1997 and Riegl in 1993-1994.

A first extensive marine monitoring programme was undertaken on the Egyptian coast of the Gulf of Aqaba during the summer of 1996 by the Egyptian Environmental Affairs Agency (National Parks of Egypt) and the Tropical Marine Research Unit of the University of York. This monitoring programme was initiated in reaction to the very rapid development of several parts of the Sinai coastline and diving tourism in the past 5-10 years. A total of 22 stations are sampled from Taba to Ras Mohammed along the Gulf of Aqaba. Basic information on each site was initially collected and an overall assessment undertaken. Coral assemblages were then surveyed using a photo quadrat method laying 3 transects at the reef edge and at 8 and 15 m depths, with 12 x 1 m^2 quadrats at intervals of 5 m. Separately, quadrats along the same transect were surveyed for signs of coral damage or mortality. Counts were also made of large sea-urchin species, large molluscs and, if present, crown-of-thorns (*Acanthaster planci*). The monitoring was completed by underwater visual counts of fish belonging to selected key families or groups along 200 m length transects at depths of 3 m, 10 m and 17 m.

Results indicated that the form and extent of development of reefs varied in a relatively systematic manner from north to south. In the northernmost Gulf of Aqaba, the reef face has a sea bed which slopes more steeply away and develops a coral cover often higher, up to 80 %, than on the upper reef face. By contrast, in the south, the reef form changes in that below the upper reef face there is only a fairly narrow, partly sandy, reef terrace sloping from 10-20 m. Around Ras Mohammed the fringing reef becomes even narrower and the reef face larger. The results show no clear-cut classification of assemblages on different transects into separate groups, although there is a slight tendency for northern and southern sites to cluster out separately from each other. This pattern probably reflects the fact that while there is no marked pattern of dominance by different genera or species, there is a slight tendency for reefs to be dominated either by *Porites* sp. and *Millepora* sp. or by *Acropora* sp. The overall hard coral cover varied from 11 % to 64 %, which is comparable with the range of values found by other researchers who have used quantitative techniques in the same region. There was a typical pattern of recently dead coral, the greatest amounts of which were due to algal turf, sediment damage, physical damage from human activities and, to a lesser extent, *Drupella* and to white-band disease.

The 2001 monitoring programme along the Gulf of Aqaba will include:
*An experimental protocol surveying the former 22 stations and additional ones when necessary (such as lagoons and wadi mouths), using different techniques including video transects, in comparison to the photo-quadrat method along 3 transects at 1, 8 and 15 m depths and fish counts along 200 m lengths at the same depths.
*A comprehensive survey of Marsa Bareika (inside Ras Mohammed National Park) chosen as pilot site for the use of monitoring techniques in shallow waters (using diving techniques) and deep water to 250 m (using ROV with a camera video coupled to a sonar system).

This case study was prepared by Dr. Nasser Galal, Dr. Mohamed Salem, Essam Saadalla, Belal Saleh, Yasser Awadalla, Ayman Mabrouk and Dr. Virginie Tilot.

Public Awareness

Achieving the goals and objectives of management requires the support and cooperation of a diverse range of people, including the people whose activities are being managed and the key decision-makers in other government agencies. A public awareness programme is an integral component of the management plan. The role of the public awareness programme is to achieve the support and cooperation of stakeholders for the goals of the MPA, by providing them with the information to:

- "support the concept of the MPA
- comply with MPA regulations
- understand why those regulations are there in the first place" (Kenchington and Ch'ng, 1994).

Support for the establishment and management of the MPA will be most successful when trust is developed within the community and the community understands the reasons for management and the potential benefits from the MPA. This will occur when the community is informed at all stages of the process and continuously throughout the life of the MPA. In general terms, management will benefit if the community is informed about the MPA and the reasons for its establishment, the significance of the area covered by the MPA and the management process. Support will also develop when the community experiences the benefits derived from the MPA, in employment, income, business opportunities and a sustainable resource base.

The goals of the public awareness programme are to:

- provide the information required by all stakeholders
- solve conflicts of use within the MPA and in adjacent areas
- develop and strengthen support for conservation and sustainable use.

Information Needs

- Stakeholders will require the following information:
- a description of the MPA, its boundaries and its objectives
- the significance of the area covered by the MPA, including any unique features
- the ways in which they will have to modify their activities and behaviour to comply with management objectives
- the benefits to stakeholders from the MPA
- the costs of infringement.

Particular groups may require more specific information about the MPA. Examples of these groups, and their information needs, include:

- the wider community: the nature of the coral reef and other tropical ecosystems, including their requirements and significance; important species; the sensitivity of these ecosystems to human disturbances
- fishermen: the boundaries of the MPA and zones; the potential benefits to fisheries; specific management provisions relating to fishing
- tourist operators: the long-term benefits to them from sustainable use of the resource they depend on; relevant zones and their provisions; more specific information on the nature of the coral reef ecosystem that they can deliver to tourists
- high level decision makers in other relevant government agencies and at different levels of government (e.g. national, provincial, municipal): the wider benefits and outcomes for the country; especially linkages between the conservation of resources and natural

systems; the long-term provision of economic and social benefits

- other government agencies: linkages between MPA management and other forms of resource and environmental management; the roles of MPAs in strategies for integrated coastal zone management; the range of activities occurring within the MPA; the values of the MPA that are relevant to the different agencies.

Guidelines for Planning a Public Awareness Programme

1. A public awareness expert should be an integral member of the planning team and also a staff member of the management agency. The role of the public awareness expert will be to plan, coordinate and implement the programme.

2. Determine the community's information needs and the management issues within the MPA. The management issues will be determined from information provided by the planning team and also from workshops or meetings with rangers and stakeholders. A critical step is to understand the background and underlying causes of the issues, so that the potential contribution of public awareness programmes can be assessed. All stakeholder groups will need information and these information needs will differ between the various stakeholder groups.

3. Determine the goals of the programme, which will reflect the goals of the MPA.

4. Develop specific objectives for the programme. These will be based on an analysis of the issues and the users' needs for information and will be a specific elaboration of the programme's goals. A specific objective might be "To have local fishermen use the MPA in accordance with the zoning plan".

5. Understand the audience. The review of management issues and stakeholders' needs for information will identify the major groups involved in the MPA and their different characteristics, e.g. education, awareness and attitudes. This information can be used to design the content of the programme and the most effective way to present it.

6. Develop specific strategies to achieve the objectives of the public awareness programme. The specific strategies can be built using understanding of the community (e.g. level of education and literacy, venues for public meetings, the role of village or religious leaders) and the range of subject matter that might be used as vehicles for information.

7. Develop a monitoring and evaluation process. The success of the programme in achieving the goals and objectives will be assessed by appropriate monitoring and evaluation. This can be achieved by surveys, questionnaires and interviews conducted before the programme begins and again at the conclusion. The results should be used to evaluate the success of the programme and as a guide to improving or changing future programmes. Monitoring should be based on standard methods and a statistically sound sampling design.

Topics for Public Awareness Programmes

- the benefits to be derived from MPAs and their importance in conservation
- the concept of sustainable development
- the nature of the coral reef ecosystem and links between the health of the ecosystems and human activities
- the link between long-term conservation of coral reefs and their value in generating income for developers
- the value of biodiversity, rare and endangered species
- regulations relating to the MPA.

Strategies for Public Awareness Programmes

- use religious and tribal leaders as spokespersons
- hold public meetings, field visits, school visits and workshops
- information programmes on TV, radio and in newspapers
- provide messages on handicrafts, such as t-shirts and mugs, postcards, stamps, brochures
- provide signage in prominent public places
- target NGOs and involve them in the delivery of educational material
- establish a visitor information centre
- provide free information to developers and conduct education sessions for the staff of local businesses and tourist operations
- use special event days (e.g. World Environment Day, Eid festivals) as a focus for education and awareness about the MPA
- use contact with the local community during surveys and research as an opportunity to educate and increase awareness about the MPA
- present papers at scientific conferences and international meetings to inform the wider, international community about the MPA.

Stakeholder Consultation and Participation

Background

A range of individuals and stakeholder groups within the local community is likely to be affected by the decision to establish an MPA, including local artisanal fishermen, industrial fishing operators and tourist operators. These effects will occur through some form of restrictions on the activities of these stakeholders (e.g. through declaration of protective zoning) or requirements (e.g. environmental assessment, the need for permits) or controls (e.g. development controls). Other stakeholders in the MPA include a range of government agencies. Successful planning and management of MPAs relies on the active participation of a range of government agencies whose responsibilities coincide with the objectives of the MPA, including fisheries, tourism, municipalities, development authorities, ports and shipping, and the military. MPAs will have a greater chance of success if they have the participation of all stakeholders in the planning and implementation and if they are aware of the advantages arising from the declaration and management of a MPA (Davey, 1998; Kelleher, 1999).

There are a number of potential advantages for the MPA to be gained from involving stakeholders in management (Kelleher, 1999), including:

- more effective management, resulting from the use of local knowledge and skills
- reduced enforcement costs and a reduction in the burden of management for the management agency
- more effective means of preventing the entry of outside groups into the MPA for illegal exploitation
- development of greater trust between managers and stakeholders and the prevention of disputes between management and stakeholders
- an increased sense of stability and confidence in the long-term future of the MPA, which will facilitate investment decisions
- greater awareness of the MPA and conservation within the local community
- support for the integration of conservation issues in other planning decisions

- the overall development of a more participatory approach to management and decision-making.

Stakeholder involvement in MPA planning and management needs to occur at two levels: consultation and participation. Stakeholders should be consulted at various stages in the planning process - during the initial information-gathering phase, the identification of issues for management and for comments on drafts of the management plan. MPA planning staff may need to be trained in the techniques of stakeholder consultation, in particular in the techniques of communication skills, running meetings, resolving conflicts and dealing with difficult people.

Opportunities for Consultation and Participation

There are many opportunities for involving stakeholders in the planning and management of the MPA (some examples are provided in Box 4). These opportunities will depend on the management objective of the MPA and the level of willingness of stakeholders to be involved. Some potential opportunities include:

- preliminary surveys for the accumulation and synthesis of existing information and knowledge about the area. Local stakeholders should be consulted at this stage because they can be a significant source of valuable planning information e.g. fishing practices and trends in catch and effort; the range of habitat types; the locations of areas important for fish spawning, turtle and bird nesting; traditional management practices. This information may help focus subsequent detailed surveys. This early consultation will also engage stakeholders at the outset of the planning process and should occur through a number of meetings.
- discussions and negotiations during the development of zoning plans and management strategies through consultative workshops;
- the training and recruitment of local residents as staff for the MPA, possibly as community rangers, for technical assistance (e.g. during surveys and monitoring), or as guides and extension officers
- support for cooperative business ventures involving the local community
- involving representatives of stakeholder groups as members of committees that provide oversight and strategic advice on the management of the MPA. These might include steering committees, scientific advisory committees and boards of management.

Box 4: Stakeholder Consultation and Participation in MPAs in the Red Sea and Gulf of Aden

The following examples illustrate a number of different approaches, which reflect differences in the usual level of involvement of the community in decision-making, and the support available during the MPA planning process.

Farasan Islands Marine Protected Area (Saudi Arabia)

As part of the development of the management plan for the Farasan Islands MPA by the National Commission for Wildlife Conservation and Development, interviews were conducted with individual representatives of all stakeholders (including traditional and commercial users) about their use of the MPA and their opinions of a range of proposed management options. The most numerous users of the MPA are artisanal fishermen and meetings were held with groups of fishermen and with the representatives of the fishermen from each village, the so-called 'chief fishermen'. These meetings were especially useful for gaining additional information on their knowledge of important species and habitats and traditional management practices. The approach taken, especially with the artisanal fishermen, reflected the importance of the chief fishermen in village fishing activities, the mistrust of the fishermen towards government management, the primary management goal of supporting the sustainable use of the MPA by the traditional users.

Socotra Islands Group National Protected Area (Yemen)

An integrated programme of community consultation and participation occurred during the development of the zoning plan for the conservation and sustainable use of the natural resources of the Socotra Archipelago. Practical steps taken to develop public understanding of the zoning process included the employment of extension officers, village meetings, an environmental education and awareness campaign, and regular meetings with local authorities. A preliminary draft zoning plan was developed by the project team (from the results of extensive scientific studies throughout the Archipelago), which was reviewed at a technical workshop in Sana'a attended by community and government representatives, international experts and the project team. The resulting draft zoning plan was reviewed through 12 public meetings held throughout the Archipelago and attended by about 500 local *sheikhs*, *muqaddams* and government representatives. The draft zoning plan was amended to reflect concerns raised during the meetings and most of the changes reflected the community desire for a more conservation-oriented approach (EPC, 1999).

Gulf of Aqaba Protectorates (Egypt)

Having established the network of MPAs along the Gulf of Aqaba coastline of Egypt, there is a need to maintain functional partnerships with financial investors in the tourism sector (the largest stakeholder group) and the local Bedouin communities. Parks staff maintain continuous dialogue with all stakeholders, provide services (such as free advice on minimising the environmental impacts of developments) and allow local Bedouin communities to participate in management. The latter has occurred through the establishment of zones closed to fishing, which are nominated and enforced by the local Bedouin fishermen (Pearson and Shehata, 1998).

Sustainable Financing

Financing of the operations of MPAs has largely been the responsibility of governments. Economic constraints, and other development priorities, have limited the amount of funding available for establishment and management of MPAs. This has been a global trend in protected area management (Geoghegan, 1995; Davey, 1998; Kelleher, 1999) and limits the ability of MPAs to achieve their objectives. Managed properly, MPAs have the potential to provide significant economic benefits to the local community and national government. A sustainable stream of income can potentially be generated through ventures in tourism, fishing, biotechnology and aquaculture that are ecologically and socially sustainable. The ecological integrity of the MPA and the social structure of local communities should not be jeopardised by these ventures. Stakeholders need to be aware of the benefits for them that arise from the management they are financing.

- In developing a sustainable financing mechanism, MPA planners and managers will need to address the following:
- the anticipated costs of establishing an MPA and implementing the management plan
- the amount of funding that can be expected from government to do this
- additional funding that might be possible from donor agencies in the establishment of the MPA
- the identification of fund-raising opportunities associated with the MPA (e.g. tourism, fishing, biotechnology and aquaculture)
- the need to ensure that revenue collected within the MPA returns to the relevant management agency and is used for visible management activities
- a study demonstrating the economic benefits arising from the MPA.

Opportunities for Sustainable Financing

This is a very new field in the Red Sea and Gulf of Aden because, to date, there are very few operational MPAs and costs associated with running them have come from government operations or international donor agencies. The use of tourism as a source of revenue for MPA operations has been successfully applied in Egypt in the Ras Mohammed National Park. In this case the collection of visitor entrance fees to the National Park has allowed the Gulf of Aqaba Protectorates to be financially sustainable and not to require a subsidy from central government (Pearson and Shehata, 1998). However, elsewhere in the region there has been minimal development of tourism and, with limited infrastructure, it is unlikely that such an option will be transferable to other MPAs in the Regional Network in the near future.

Potential opportunities for sustainable financing and cost recovery include:

- Fees collected from visiting live-aboard dive boats that stop in the MPA
- A licensing system for commercial operations using the resources of the MPA e.g. tourist diving and fishing operations
- Fines for violations and infringements of the MPA regulations
- Payment for damages caused to resources of the MPA that act as a source of revenue (e.g. damage to coral reefs by ships' grounding).

Capacity Building

The planning and management of MPAs are complex tasks requiring a wide range of skills. In addition to formal education and experience in planning and management, staff require regular training updates through seminars, workshops and short courses. For many MPAs in the Regional Network, training will be required at all levels i.e. from

rangers to managers. It will be the function of the MPA manager to identify the training needs of the staff. Also, for many MPAs in the Regional Network it will be necessary to employ new staff such as rangers, who will require training in their relevant duties and also information about the management agency and its operations.

There are presently four centres in the region that may provide some of the training needs for the Regional Training Network: Ras Mohammed National Park (Egypt); the National Commission for Wildlife Conservation and Development Training Centre in Riyadh (Saudi Arabia); the Train-Sea-Coast Regional Training Centre (Port Sudan); the Fisheries Training Centre in Aden (Yemen).

Training Needs in the Regional Network

- General need for skills in MPA planning, management, monitoring and evaluation, with specific needs for communication, negotiation, conflict resolution, project management, development of annual workplans, running meetings, public speaking, public relations
- Ranger duties and associated field skills, law enforcement
- Marine biology, ecology and biodiversity
- Conservation and resource management
- Programme evaluation and monitoring
- Socio-economic aspects of MPA management
- English language
- Technical skills including SCUBA diving, boat handling, mapping, standard survey and monitoring techniques, identification of species of flora and fauna within the MPA, database design and operation, GPS and GIS.

Training Options

- Short, intensive training courses conducted regionally
- Specialist courses through international training organisations
- On-the-job training by participation in surveys and monitoring
- Job exchanges with other MPAs in the Regional Network and internationally
- Internet-based training programmes.

Personnel and Organizational Structure

The planning, management and day-to-day activities carried out within the MPAs in the Regional Network will involve a great variety of tasks, skills and experience. The personnel required to run the MPA will assume the core responsibilities, which include planning and management, public awareness and community participation, monitoring and evaluation, and ranger duties. In addition, there are the associated support activities of information technology, finance and administration.

The following Organizational structure reflects the key management activities undertaken. The number of staff involved in each section or department will depend on local circumstances.

MPA Management

- Overall management and responsibility for the operations of the MPA
- Strategic, long-term management of the MPA
- Coordination and direction of the activities of each section within the MPA management structure
- Liaison with the lead agency and other relevant government agencies

- Representation of the MPA on advisory councils, stakeholder groups, community groups
- Financial planning for MPA operations
- Initiation and coordination of management reviews and evaluations
- Coordination of staff training and capacity building.

Planning and Management

- Development of the MPA master plan and management plan and their regular review and evaluation
- Coordination of the MPA planning team
- Provision of planning advice to the MPA management team
- Overall responsibility for assessment of impact of activities and developments within the MPA and provision of advice to MPA management relating to development approvals
- Development of options for sustainable financing of the MPA.

Public Awareness, Consultation and Participation

- Development and implementation of the public awareness programme, its regular review and evaluation
- Liaison with community leaders and stakeholder representatives
- Implementation of the community consultation phase and incorporation of the results
- Development of opportunities for continued community participation and coordination of implementation
- Provision of educational programmes and materials about the MPA for local stakeholders, community leaders, school teachers and interested individuals.

Monitoring, Research and Evaluation

- Development and implementation of the MPA monitoring programme and the evaluation of its results in light of management targets
- Development and implementation of the research programme of the MPA
- Provision of technical advice to management with regards to the biodiversity and ecosystems of the MPA and their relationship to human uses.

Rangers

- Daily local enforcement of the regulations of the MPA
- Day-to-day liaison with the local community, stakeholders and traditional users of the MPA
- Provision of information about the MPA to the local community, stakeholders and users of the MPA
- Participation in monitoring and surveys.

Information Technology

- Management of computer systems, databases and GIS facilities that support management of the MPA
- Incorporation of results from monitoring into the MPA database
- Provision of computing support to staff
- Planning and implementation of staff training, and training updates, in relevant aspects of information technology.

Personnel, Finance, Administration

- Financial management of the MPA according to the budget designed by the MPA Manager
- Purchasing and travel
- Recruitment process for new staff
- Administration of the MPA office.

Strengthening the MPA Network

Achieving the aims of the Regional Network of MPAs will be greatly facilitated by strengthening of the legal framework, coordination of activities and networking amongst the individual MPAs. This will ensure that regional goals are being addressed through local management actions. A coordination and networking mechanism that facilitates communication and the sharing of knowledge and experiences amongst MPAs will strengthen overall regional capability in MPA management and the achievement of regional goals for sustainable resource use, development and conservation. In addition, regional coordination and networking will strengthen the management capabilities of individual MPAs. A coordinated approach to the activities of the Regional Network will produce substantial benefits to individual countries and the managers of the MPAs in the Regional Network. This will arise as a result of the proposed training initiatives, the opportunities that arise from networking with experienced individuals and exposure to a range of management approaches.

There are many other MPAs in the Red Sea and Gulf of Aden, in addition to those in the Regional Network. It is essential that any strategies developed to facilitate coordinated management of MPAs in the Regional Network include all other MPAs in the region, given that the same agency in each nation is responsible for management of the MPA in the Regional Network and other MPAs not in the network. To this end, the following mechanisms for strengthening, coordination and networking apply to all MPAs in the Red Sea and Gulf of Aden.

National Legal and Institutional Frameworks and Development of a Regional MPA Protocol

1. The majority of countries in the region have enacted legislation relevant to environmental management and possess the necessary institutional framework for implementing this legislation (Appendix 2). Most countries of the region have also enacted site-specific legislation related to the establishment of specific MPAs. Only two countries (Egypt and Saudi Arabia) have enacted framework laws to support the establishment and management of protected areas throughout the country. In Egypt, Law 102 Concerning Natural Protectorates (1983) includes articles that: define a protected area; forbid certain activities within a protected area; control activities in adjacent areas; specify the administrative body responsible for enforcement. In Saudi Arabia, Royal Decree M/12 of 1995 enacted the Protected Areas Act, which sets out the requirement for a network of protected areas to be established and managed and sets out the range of activities prohibited within all protected areas. Such framework legislation, necessary for the establishment and management of MPAs in other countries, is missing.

2. As Appendix 1 shows, only the following MPAs in the Regional Network have been established with appropriate legislation: Ras Mohammed National Park (Egypt); Farasan Islands Protected Area (Saudi Arabia); Sanganeb Marine Park (Sudan); Socotra Islands Group National Protected Area (Yemen). There is a need to develop national legal frameworks that provide for the establishment and management of the remaining MPAs in the Regional Network, and provide a general legal basis for the establishment and

management of MPAs throughout each country.

3. A regional framework for cooperative management of the marine and coastal environments of the Red Sea and Gulf of Aden came into effect in 1982, with the signing in Jeddah of the Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment (the "Jeddah Convention"). The Jeddah Convention contained a number of articles relating to the need for measures to prevent and combat oil pollution. The Action Plan for the Conservation of the Marine Environment and Coastal Areas in the Red Sea and Gulf of Aden was also signed in Jeddah at the same time. The Action Plan outlined a programme for environmental assessment throughout the region to gather information on the distribution of habitats and important species. The Action Plan also outlined a programme of environmental management, which included the establishment of MPAs as tools for the sustainable use of living marine resources. Much information has been collected since the signing of the Jeddah Convention and the implementation of the Action Plan and many MPAs have been established as a result (as outlined earlier in this document).

4. Efforts of individual countries to establish MPAs in the Regional Network will be facilitated by the development of a regional protocol that provides a legal framework for governments to prepare legislation for the establishment and management of MPAs. The proposed Protocol Concerning Biological Diversity and the Establishment of Protected Areas for the PERSGA region will provide this legal framework. The protocol will oblige contracting states to protect regionally representative areas, as well as areas that are unique and highly sensitive. The implementation of the proposed protocol will significantly strengthen national and regional efforts to establish the Regional Network.

Coordination

The following activities should take place to aid coordination between the MPAs:

1. The establishment of a Regional Coordinating Committee. The PERSGA MPA Coordinator may act as Chair of the Committee, which will meet annually in one of the network countries. The Committee will be comprised of national MPA Focal Points; scientists with leading experience in MPAs, sustainable use and biodiversity; experts in socio-economic and public awareness aspects of MPAs. The terms of reference for the Committee will be:

- to assist countries in implementing the Protocol Concerning Biological Diversity and the Establishment of Protected Areas
- to review progress in establishment and management of MPAs in the Regional Network and other MPAs in each country
- to facilitate, where necessary, the processes occurring in each country to establish and manage MPAs in the Regional Network and elsewhere by providing advice and by facilitating access to technical support and resources
- to foster capacity building and training for MPA staff
- to promote government and community awareness about the value of MPAs
- to act as a management committee for the activities of the Regional Activity Centre for MPAs
- to oversee the establishment of linkages between the Regional Activity Centre and other similar centres throughout the world
- to initiate, monitor and review the implementation of the other networking and coordinating mechanisms.

2. The establishment of a Regional Activity Centre for MPAs at the PERSGA headquarters in Jeddah. The PERSGA MPA Coordinator may be the Coordinator of this

Regional Activity Centre. The functions of the Regional Activity Centre will be:

- to provide assistance to countries in establishing and managing their Network MPAs and other MPAs. In particular, the staff of the Regional Activity Centre will provide advice on the identification and selection of MPAs, the development of management plans, monitoring and research programmes, and community education and awareness programmes
- to prepare reports and technical studies on MPAs, as directed by the Regional Coordinating Committee
- to develop, coordinate and provide training programmes and staff exchanges;
- to provide the physical location and resources for the web page and electronic databases
- to provide a regional library of resource material on MPAs
- to carry out other functions as directed by the Regional Coordinating Committee.

3. The establishment of MPA Focal Points in each country. The MPA Focal Points will be appointed by the relevant national authority in each country that is responsible for MPA establishment and management. They will sit as members of the MPA Coordinating Committee and will act as the national contact person for the PERSGA MPA Coordinator. MPA Focal Points will provide the PERSGA MPA Coordinator and staff of the Regional Activity Centre with technical and management information on MPAs in their country. The Focal Points will be official representatives of the national authority for nature conservation, senior MPA managers or planners.

Information Exchange

The following activities will be undertaken by the Regional Activity Centre for MPAs:

1. The establishment of an Association of Red Sea and Gulf of Aden MPA Managers and Scientists, to function as an active, professional society. The Association will stage an annual conference and meeting at which management, monitoring and research relating to MPAs are presented and discussed, and a series of proceedings produced.

2. The establishment of an MPA web site in the Regional Activity Centre that will serve as a source of information for, and about, MPAs in the region. The web site will contain links to all the MPAs in the Regional Network and other national MPAs, an electronic document database with reports and publications and links relevant to the management of MPAs. For countries with restricted access to the Internet the Regional MPA Coordinating Committee will act as the vehicle for securing international development funds to assist in the establishment of these facilities.

3. The establishment of a regular MPA feature in the PERSGA newsletter *Al Sanbouk*. This newsletter is distributed throughout the region to marine scientists and environmental managers and is an important medium for regional information exchange. This MPA feature could also contain some of the information housed on the MPA web page, thereby supporting MPAs in countries with limited/no access to the Internet.

4. The preparation, and update as necessary, of a booklet/CD on the Regional MPA Network and other MPAs in the region.
Topics to be covered will include: the biodiversity of the Red Sea and Gulf of Aden; the role of MPAs in sustainable resource use and conservation; the unique characteristics of the MPAs in the region; current management activities within the MPAs. Distribute the booklet/CD to all environmental management agencies, NGOs, major stakeholder groups and donor agencies
in the region. Funding for production and

distribution could come from stakeholder groups (e.g. tourism, fishing operations).

5. The development and publication of a directory of regional specialists in MPA planning and management, socio-economics, living marine resources and their management, biodiversity, public awareness, GIS, research and monitoring.

6. The development of collaboration with the proposed Protected Areas Learning Network. This web-based resource will be a collaboration of the World Resources Institute (WRI), the World Conservation Union (IUCN) and the United Nations Education, Scientific and Cultural Organization (UNESCO). The aim of the Learning Network is to provide current information via the Internet on management issues in protected areas.

Capacity Building and Institutional Strengthening

1. Staff exchanges are an important means of training and of gaining experience in alternative approaches to MPA planning and management. A process of exchanging staff amongst MPAs in the region, and with MPAs in other regions, should be formulated and implemented by the Coordinating Committee. As a first priority, MPA planners and managers from countries with limited experience (Djibouti, Somalia, Sudan and Yemen) should undertake supervised apprenticeships in MPAs in Egypt, Jordan or Saudi Arabia. Subsequently, a programme of work placements should be organized with MPA management agencies in other countries outside the region (e.g. with the Great Barrier Reef Marine Park Authority in Australia) as a means of exposing staff to alternative approaches to management and technological developments. The Coordinating Committee should source funding for this programme from regional and international donor agencies e.g. Islamic Development Bank, European Union.

2. The formal training requirements of MPA planners and managers will be identified by the Coordinating Committee. Potential training priorities include the development of master and management plans, processes of public consultation and participation, sustainable financing, GIS, the use of web pages as a support tool for management and community awareness. Potential international training initiatives that could be investigated include IW: Learn; Train-Sea-Coast; the Strategic Initiative in Coastal Area Management.

3. The Regional Activity Centre should assess the infrastructure requirements of the relevant agencies in each country and, with the support of the Coordinating Committee, secure international funding to provide it.

Wider Linkages

There are a number of regional networks of MPAs in other parts of the world that have been established for some time and have experience in cooperative and coordinated activities. These include networks in the Mediterranean, Wadden Sea and the wider Caribbean. The Regional Activity Centre, under the guidance of the Coordinating Committee, should establish relationships with each of these networks and arrange for exchange visits by staff of the Regional Activity Centre to investigate the operation of these networks and their associated activity centres.

An Expanded Network

1. The original concept for the Regional Network was for a network of MPAs that were representative of major habitats and bio-regions throughout the Red Sea and Gulf of Aden. The Regional Network includes a single MPA from each participating country in the region. In addition, there are many other MPAs in each country that represent nationally significant examples of unique and pristine habitats and areas important for economic development. These additional

MPAs are not included in the activities of this Master Plan, although the guidelines are applicable to any MPA.

2. The long-term management of all MPAs in the Red Sea and Gulf of Aden will be facilitated by their inclusion in the Regional Network. As a first step, the Regional Activity Centre should be established for MPAs in the representative Regional Network. With the development of experience and capabilities of staff in the Regional Activity Centre, and in the MPAs of the Regional Network, the activities of the Regional Activity Centre should be expanded to include all MPAs in the Red Sea and Gulf of Aden. The timing for this should be determined by a review of the activities of the Regional Activity Centre by the Coordinating Committee.

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Internet Resources

APEC (Asia Pacific Economic Cooperation) Action Plan for Sustainability of the Marine Environment
http://www.apecnetwork.org/marine_plan.html

Caribbean Seas Programme
http://www.unep.org/regseas/carib.htm
http://www.cep.unep.org

Common Guidelines and Criteria for Protected Areas in the Wider Caribbean Region: Identification, Selection, Establishment and Management
http://www.cep.unep.org/pubs/techreports/tr37en/content.html

Convention on Biological Diversity
http://www.biodiv.org/index.html

Convention on Biological Diversity: Jakarta Mandate
http://www.biodiv.org/jm.html

Coral Health and Monitoring Program (NOAA)
http://coral.aoml.noaa.gov/index.html

Global Coral Reef Monitoring Network
http://coral.aoml.noaa.gov/gcrmn/

IUCN: World Conservation Union
http://iucn.org/

Mediterranean Action Plan
http://www.unep.org/regseas/medu.htm
http://www.unepmap.org

Mediterranean: Regional Activity Centre for Specially Protected Areas
http://www.rac-spa.org.tn/

PERSGA: Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden
http://www.unep.ch/seas/main/persga/red.htm

Reef Check
http://www.reefcheck.org/

Wadden Sea Programme
http://cwss.www.de/trilat/brochure/brochure.html

World Commission on Protected Areas
http://wcpa.iucn.org/wcpainfo/aboutwcpa.html

Appendix 9

The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden

Regional Action Plan for the Conservation of Coral Reefs in the Red Sea and Gulf of Aden

PERSGA Technical Report Series No. 3

PERSGA Jeddah 2003

EXECUTIVE SUMMARY

This Plan, specific to the Red Sea and Gulf of Aden, was drafted directly from the *Regional Action Plan for the Conservation of Coral Reefs in the Arabian Seas Region* that was prepared as an outcome of the "International Symposium on the Extent and Impact of Coral Bleaching in the Arabian Seas Region" hosted by NCWCD under the patronage of H.R.H. Prince Salman bin Abdulaziz Al-Saud, with the participation of ROPME and UNEP-ROWA, and the valuable assistance of IUCN, IDB and all participating countries.

This Regional Action Plan (RAP) provides a set of priority actions for the conservation and sustainable development of coral reefs in the Red Sea and Gulf of Aden. The region supports a wide variety of reefs and coastal habitats, much of high ecological value, and globally significant levels of endemism and biodiversity. Additionally, it provides a wide range of renewable resources for human use.

The Plan was developed in recognition of the great economic, ecological, and aesthetic importance that these ecosystems provide and in response to the serious threats posed by increasing human and natural impacts. These threats range from local to global events and include uncontrolled coastal development, various forms of coastal and marine pollution, destructive fishing methods, over-fishing, unnatural increase in predator numbers, impacts from shipping and disturbances associated with predicted future climate change. Many of the region's reefs are growing near the climatic extremes of reef development and are particularly vulnerable to any increase in disturbance. The seriousness of the threat was demonstrated by major coral reef bleaching in 1997 and 1998, causing massive death of corals and other reef organisms in the Gulf of Aden and parts of the Red Sea. Over the next several decades, predicted increases in these disturbances may cause major disruptions in reef function and the loss of associated resources for human use.

This RAP for the PERSGA region defines a set of priority actions pertaining to six major objectives aimed at ameliorating the predicted impacts to reefs:

1. Integrated Coastal Zone Management (ICZM): Many of the region's reefs fringe the coastline and are particularly sensitive to changes in coastal land-use patterns including development, land-fill, raw sewage, other forms of pollution and alterations to wadi or mersa drainage patterns. Most nations have taken important steps towards effective ICZM, developing national strategies, plans, policies and legislation. The Priority Objective is the implementation by all participating nations of Integrated Coastal Zone Management Planning for conservation of coastal reefs, supported by appropriate legislation, land planning, participatory approaches, socio-economic and environmental impact assessment, monitoring and enforcement.

2. Education and Awareness: To be most effective, the priority actions require dedicated and continued support across all governmental and inter-governmental levels and from the public at large. The Priority Objective is to increase government and public awareness through the implementation of education and awareness programmes; these are to be disseminated through communication networks (electronic mail) to decision-makers, the mass media, schools, universities and local communities.

3. Marine Protected Areas (MPAs): Establishment of a biologically interconnected network of MPAs is crucial to the long-term maintenance of reef ecosystems and viability of populations of endemic, rare, threatened or endangered and

harvested species. Most nations in the region have taken important steps towards developing MPAs, although considerable national differences in management capacity exist and capacity-building in all aspects of MPAs is a priority. The Priority Objective is the development of 'flag-ship' demonstration MPA sites as examples of effective coral reef management practices in the region (north to south):

- Aqaba Marine National Park, (Gulf of Aqaba, Jordan)
- Straits of Tiran, (Northern Red Sea, Saudi Arabia/Egypt)
- Ras Mohammed National Park, (Northern Red Sea, Egypt)
- Giftun Islands and Straits of Gubal, (Northern Red Sea, Egypt)
- Dungonab Bay and Mukawwar Island, (Central Red Sea, Sudan)
- Sanganeb Atoll, (Central Red Sea, Sudan)
- Farasan Islands Marine Park, (S-central Red Sea, Saudi Arabia)
- Belhaf - Bir Ali, (Gulf of Aden, Yemen)
- Iles des Sept Frères, (Gulf of Aden, Djibouti)
- Socotra Islands, (Gulf of Aden, Yemen)
- Aibat and Saad ad Din, (Gulf of Aden, NE Somalia).

See map page 7.

As MPA management capacity increases during the RAP, other MPAs will join these initial sites.

4. Ecologically Sustainable Reef Fisheries: Reef fisheries provide essential sustenance to artisanal fisherman and their communities throughout the region. Reef fisheries also play an increasingly important role in supplying commercial quantities of high value reef fish and other products for export to expanding national, regional and global markets. As reef fish stocks are particularly prone to over-fishing, a precautionary approach to the continued exploitation of the resource-base is essential for stock protection and replenishment. The Priority Objective is the implementation by participating nations of accurate stock assessment and monitoring, effective regulation of fishing effort through licensing and other methods, protected areas with "no take" zones, seasonal closures to protect spawning stocks, surveillance and enforcement.

5. Impacts of Shipping and Marine Pollution: The region is one of the major global thoroughfares for international maritime traffic and is also the world's largest producer and exporter of oil, most of which is transported by sea. These factors place the region's reefs and other coastal and marine ecosystems at high risk from major ecological disruption through ship groundings or collisions, the introduction of alien species in uncontrolled ballast water discharges and other forms of marine pollution. The Priority Objective is the implementation by participating nations of obligations under regional and international conventions, adoption of Port State Control, improved navigation systems and oil spill response capacities (particularly in sensitive reef areas), surveillance and enforcement.

6. Research, Monitoring and Economic Valuation: Effective integrated coastal zone and MPA management, and sustainable reef fisheries, require accurate information on status and trends collected through management-related research and monitoring. A second crucial element of monitoring is an assessment of the effectiveness of the management itself. Effective lobbying for conservation and development of coral reefs at government and inter-government levels benefits by providing realistic comparisons of the various costs and benefits of different courses of action, be they development proposals or conservation plans. The

Priority Objective is the implementation by participating nations of standardised methods of biophysical and socio-economic survey and monitoring, data-storage, analysis and reporting, using regional (PERSGA) and international (e.g. ReefCheck, GCRMN) protocols.

SCOPE OF THE PLAN

For each of the six priority actions, regional and national priority actions are identified, expected results, desired outcomes and time frames are defined and performance indicators and methods of quality assurance are outlined. Each component will be co-ordinated at the regional level through PERSGA in liaison with other national and international agencies. In individual countries, implementation will occur through integrated networks of national and local working groups, Task-Force members, government departments, agencies and personnel, non-governmental organisations and other stake-holders. The designation of a level of urgency to each specific priority action in the major objectives allows a phased approach to implementation, such as budget and capacity building. The levels of urgency do not necessarily indicate the sequence of priority.

To assist effective implementation, a Steering Committee will be formed to co-ordinate the RAP over its initial period of implementation. This committee will be composed of representatives from each participating nation and the major regional and national organizations. The committee will act as the interface between government, major donor agencies and other international coral reef initiatives.

Overall Objective: ***The conservation and sustainable development of coral reefs of the Red Sea and Gulf of Aden to maintain their intrinsic biodiversity, ecological, aesthetic and other values. Safeguarding the viability of the reefs will also ensure the continued use (fishing) and enjoyment (tourism) of reefs by future generations of mankind.***

INTRODUCTION

Human and natural impacts on coral reefs and associated habitats and biota have continued to escalate, both globally and within the Red Sea and Gulf of Aden. Increasing habitat destruction, over-exploitation, pollution, bleaching and climate change threaten the continued functioning of the coral reef ecosystem. This became evident in 1997 and 1998, when elevated sea surface temperatures caused mass coral bleaching and mortality in many parts of the Arabian Seas Region (Fig. 1), with serious adverse effects to humans through declining fisheries, tourism and other ecosystem services.

Recent research on the extent and effects of coral bleaching and other reef impacts alerted reef scientists, managers and political decision makers to the urgency of protecting these ecosystems. Subsequently, under the patronage of H.R.H. Prince Salman bin Abdulaziz Al-Saud, a major international symposium was organised by the National Commission for Wildlife Conservation and Development (NCWCD) to review the extent and impact of bleaching and other threats to the Region's reefs. The meeting initiated the '*Regional Action Plan for the Conservation of Coral Reefs in the Arabian Seas Region*' from which this PERSGA-specific Regional Action Plan for the Red Sea and Gulf of Aden (RAP-RSGA) was derived.

At a regional workshop addressing conservation and development issues in the Arabian Seas, held in Aqaba, Jordan in 1997 under the auspices of the International Coral Reef Initiative (ICRI), key goals for achieving effective reef management were identified. They are listed in Appendix 1. Major issues to be addressed, if success is to be achieved, are listed in Appendix 2. These issues have provided the basis for both the '*RAP for Coral Reefs in the Arabian Seas Region'* and this subregional document. The RAP-RSGA involves commitment from a large number of coral reef professionals, national and regional environmental organisations and other stake-holders representing the public and private sectors. It indicates regional commitment, which, to be effective, requires dedicated support across all governmental and inter-governmental levels and from the public at large. The process will be facilitated through co-ordination and integration with other programmes and conventions (see Appendix 3).

Reefs in the RSGA region face increasing levels of threat at local, regional and global scales. As many reefs are growing near the extremes of reef development, they are particularly vulnerable to increases in disturbance. Localised threats include various forms of pollution from shipping, urban, industrial and tourism developments, raw sewage, dredging and land-fill. Uncontrolled coastal development adjacent to fringing reefs and reef-based tourism have already damaged or destroyed reefs in some areas.

At the regional level, threats to reefs include destructive fishing methods and over-fishing, with direct physical impacts and indirect impacts to trophic structure and ecological function. Over-fishing and major pollution events, such as those associated with massive oil spills, have serious trans-boundary implications.

Predicted climate changes over the next several decades are expected to cause substantial coral death and lower the capacity of reefs to recover. This loss of resilience is linked with projected increases in sea surface temperature, causing continued coral bleaching and death. Under worse case scenarios, the synergistic combination of impacts threatens the continued existence of reef ecosystems in the region.

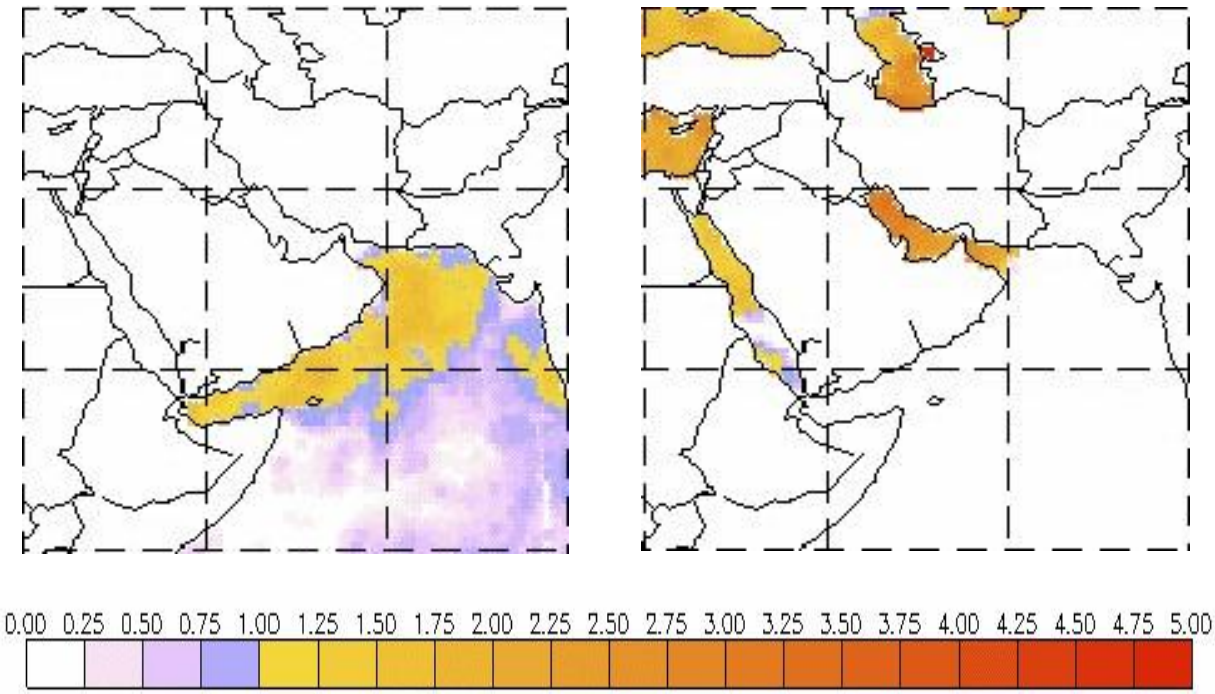

Figure 1. Images of sea surface temperature (SST) anomalies for the Arabian Region in May and August 1998, from the NOAA/NESDIS WWW site. Colours indicate degrees Celsius above 20 year averages. Most reef areas with elevated SSTs experienced intense coral bleaching and subsequent mortality, notably the Yemeni island of Socotra and NE Gulf of Aden, the ROPME Sea Area (Arabian Gulf) and parts of the Red Sea.

Bleached coral

Fortunately, through a unique combination of natural and human factors, some of the region's reefs (Fig. 2) remain in good to excellent condition at the beginning of the 21st century. According to the WORLD RESOURCES INSTITUTE (BRYANT *et al*. 1998) the Arabian Seas Region as a whole harbours some of the best remaining reefs globally. However, a large-scale risk analysis has indicated that about two-thirds of the Region's reefs are at medium or high risk from human activities.

The regional, national and local approach developed here, focusing on a common goal and responsibility throughout the region, will benefit from collaboration and information sharing, particularly with the ICRI partnership (Appendix 4).

Capacities to implement the priority actions vary greatly among countries within the region; there is a pressing need to build capacity in aspects of ICZM, MPAs, fisheries, navigation, research and monitoring. Thus capacity-building and training programmes to improve the national human resource bases, from which the RAP-RSGA will be implemented, are crucial to its overall success. It has been designed as a dynamic approach towards coral reef conservation, which requires regular evaluation and updating as conditions on regional reefs change. If fully implemented, the actions identified here will help to ensure that coral reefs continue to provide valuable ecological, social and economic resources to future generations.

Figure 2. Map of the Red Sea and Gulf of Aden showing coral reefs and marine protected areas**.**

FRAMEWORK FOR ACTION

To be most effective, actions need to be prioritised and integrated into a logical framework (Fig. 3), where strong interconnections and positive feedback among the key components enhance the likelihood of overall success.

This framework for action is constructed of six key components:

1. Integrated coastal zone management,
2. Education and awareness,
3. Marine protected areas,
4. Ecologically sustainable reef fisheries,
5. Impact of shipping and marine pollution,
6. Research, monitoring and economic valuation.

These components were identified through extensive consultation both nationally and regionally. For each component, priority actions are identified, expected results, desired outcomes and time frames are defined and performance indicators and methods of quality assurance outlined. Several of the priority actions are already well advanced in parts of the region. Designation of an urgency level to each specific priority action allows a phased approach to implementation, as budget and capacity allow. The effectiveness of implementation of the priority actions can be optimised through adherence to 12 general principles (see Appendix 5). Although focusing on coral reefs, the Plan is also applicable to associated coastal and marine ecosystems, particularly mangroves and seagrass beds, in light of the strong degree of biological and ecological interconnectedness among them.

Objective independent assessment of the success of implementation of the RAP-RAGA is crucial for adaptive management. This can be achieved through a co-ordinated approach based on the use of performance indicators for results, outcomes and impact of the RAP. Indicators are listed in Appendix 6.

USING THIS DOCUMENT

The RAP-RSGA addresses complex problems with complex solutions. The Executive Summary and Introduction provide a general overview of the background and long-term approach. Operational principles and conservation are outlined under each component of the RAP. The level of urgency for each action is indicated as:

*** - very urgent action, where immediate action or intervention is required, as for example to protect habitats and ecosystems under severe threat;

** - urgent action, where intervention is required to ensure the continued viability of species, communities or ecosystems of regional or global importance;

* - priority action, where there is an institutional set-up or there are on-going projects and opportunities for co-operation with existing efforts.

Time frames under “expected results and outcomes” indicate the number of months required to achieve the result or outcome, starting from the launching of the corresponding activity.

Additional details can be found in tables and appendices. For further reading, a list of literature is provided.

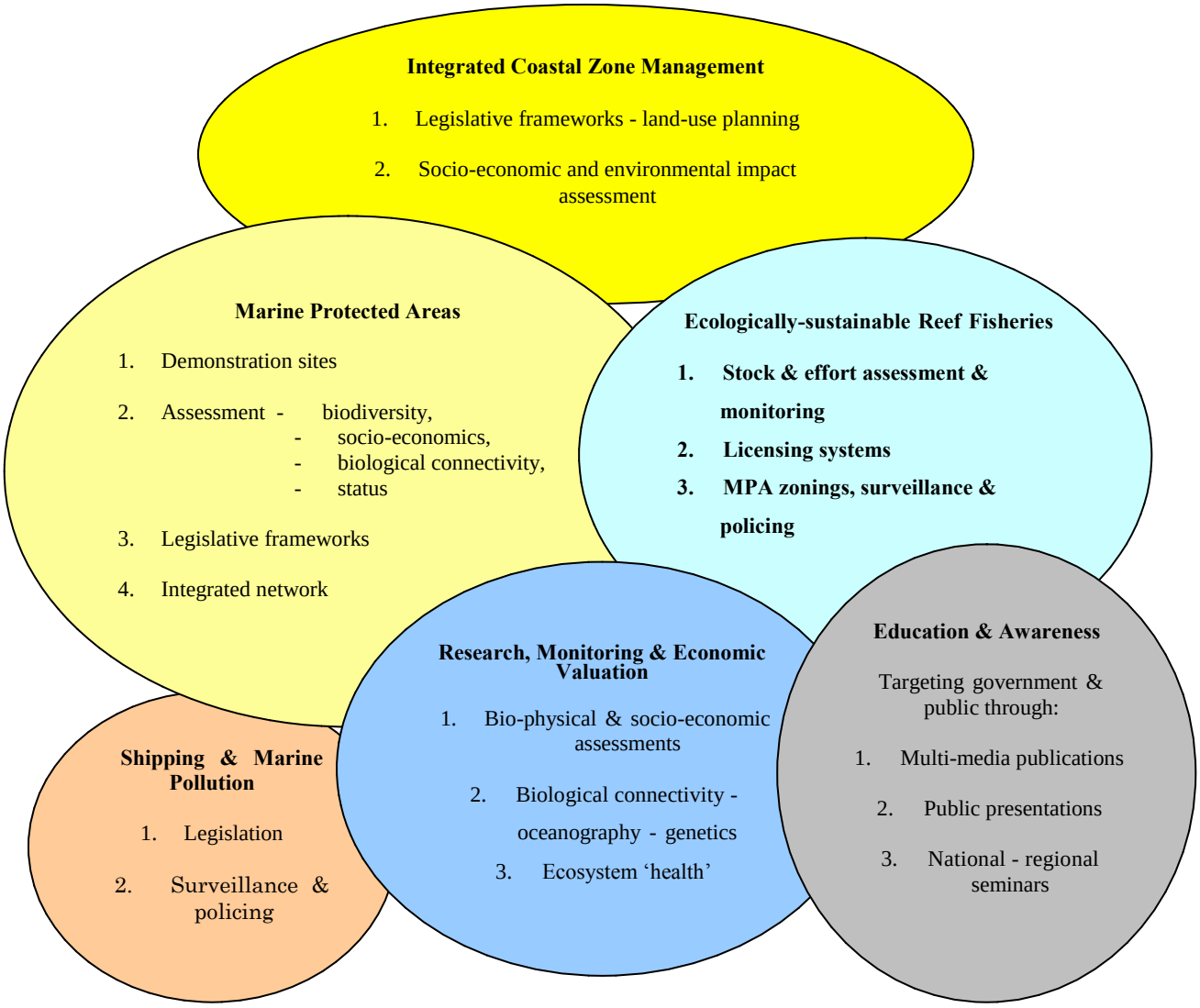

Figure 3. Set of Priority Action components for conservation and ecologically sustainable development of coral reefs and associated ecosystems in the Red Sea and Gulf of Aden. Overlapping ellipses indicate the strong level of interconnection and feedback among the different components.

COMPONENT 1: INTEGRATED COASTAL ZONE MANAGEMENT (ICZM)

The high degree of connectedness among coastal and marine ecosystems is well known (e.g. KENCHINGTON 1990, KELLEHER ET AL. 1995). Land-based sources (industrial, agricultural and municipal wastes and run-off) account for ca. 70 % of coastal and marine pollution and are particularly problematic in estuaries and other partially-enclosed waters (GESAMP 1990).

Most nations in the Red Sea and Gulf of Aden (RSGA) region have recognized that effective management for conservation of reefs requires successful management of adjacent coastal areas. As many reefs fringe the coastline, they are particularly sensitive to changes in coastal land-use patterns (PERSGA 1998a). Their conservation requires appropriate integrated management, based on sound legislative frameworks, land-use planning, participatory approaches, *a priori* socio-economic and environmental impact assessments (EIA) and, where necessary, remedial actions.

Some nations in the region have taken major steps towards managing their coastal zones, with implementation of ICZM plans and their integration into national development plans. For example, the Kingdom of Saudi Arabia has prepared an ICZM plan for its coastal areas and a National Biodiversity Strategy and Action Plan; Egypt has developed a Coastal Zone Management Plan for the Red Sea coast defining areas for urban and tourism development and other major infrastructures, and EIA is obligatory for any development project. ICZM plans for Sudan are under preparation through the Strategic Action Programme (SAP). At the regional level, PERSGA and ROPME have organized several ICZM workshops and ROPME has published "Integrated Coastal Area Management Guidelines for the ROPME Region" (March 2000).

Priority Objective: Implementation by all participating nations of Integrated Coastal Zone Management Planning for conservation of coral reefs and associated ecosystems and species, supported by appropriate legislation, land-use planning, participatory approaches, socio-economic and environmental impact assessment, monitoring and enforcement.

Actions:

i. For each country, identify the relative importance of different types of coastal and catchment development and their impact on coral reefs (***);

ii. Where not already completed, develop national ICZM plans incorporating requirements for reef conservation in land-use planning, socio-economic and environmental impact assessments (***);

iii. Where not already completed, develop policy and legislation relevant to coastal reefs (***);

iv. For each country, identify and develop consultative processes with the key stake-holders with relevance to reefs (**);

v. Develop regional and national Guidelines for ICZM assessment with regards to environmental impacts on reefs (**);

vi. Train national teams to conduct EIA on reefs (*);

vii. Develop key demonstration sites using best practice ICZM of reefs within the region (*).

Expected results - outcomes and time frame:

i. National meetings among the key stakeholders to identify the relative importance of different types of coastal and catchment development and their impact on reefs (after 12 months);

ii. Consultative meetings among the key stake-holders to develop national ICZM plans covering coastal reefs (where not already completed) and to build capacity and co-ordination (after 18 months);

iii. Review of ICZM plans and recommendations on amendments (where necessary) to national ICZM policy and legislation regarding reefs (after 18 months);

iv. Publication of regional guidelines for socio-economic and environmental impact assessment (after 12 months);

v. Publication of national socio-economic and EIA guidelines (after 12 months);

vi. Training courses for national teams to carry out EIA on reefs (after 18 months).

Performance Indicators and Quality Assurance:

i. Publication of regional and national guidelines for ICZM, socio-economic and environmental impact assessments;

ii. Development of policy and enactment of legislative amendments;

iii. Implementation of ICZM and EIA in decision making;

iv. Independent assessment of the effectiveness of ICZM.

COMPONENT 2: EDUCATION AND AWARENESS

The raising of public and government awareness of the importance of reefs and of their current threats is crucial to their long-term conservation. PERSGA has already taken important steps in raising awareness, through regular publication of its newsletter '*Al Sanbouk*' and other material and through the development and enhancement of regional and national communication networks.

There are many approaches to education and raising awareness (see Appendix 7), ranging from talks in remote coastal communities to the WorldWideWeb. Several of these methods are already employed routinely within the region (see e.g. FLEMING 1996), notably by NCWCD in Saudi Arabia and by the Egyptian Environmental Affairs Agency (EEAA) as an integral part of management of the Ras Mohammed National Park in Egypt.

Priority Objective: Increased government and public awareness through the implementation of education and awareness programmes to be disseminated through communication networks to decision makers, the mass media, schools, universities and local communities.

Actions:

i. Produce, publish and disseminate education and awareness materials, using electronic media, information sheets, brochures, booklets, videos, CDs and other media (***);

ii. Make results of research, surveys, monitoring and economic valuations available, in suitable format, to decision makers and the general public (***);

iii. Liase with ICRI (ICRIN) regarding the development of public awareness materials and campaigns for the region (*);

iv. Develop strong links with key government departments to provide important findings to decision-makers (***);

v. Develop strong links with the mass media for the dissemination of major newsworthy items (**).

Expected results - outcomes and time frame:

i. Production of a wide range of education and awareness materials within the next 10 years;

ii. Development of teaching materials for schools and universities (after six months);

iii. Improved links with government agencies and mass media (after 18 months);

iv. Improved media skills through training courses in media presentation (after 6 months).

Performance Indicators and Quality Assurance:

i. Production of education and awareness materials;

ii. Demonstrable increase in government and public awareness and in mass media coverage of reef issues.

COMPONENT 3: MARINE PROTECTED AREAS

The value of marine protected areas (MPAs) in conservation and the sustainable development of coral reefs is well established, both from the perspectives of conserving biodiversity and of sustaining nutritional, economic and other benefits to humans (Box 1, DIXON & SHERMAN 1990, KENCHINGTON 1990, DIXON 1993, AGARDY 1994a, b, DE FONTAUBERT ET AL. 1996). For example, numerous case-studies have conclusively demonstrated the 'flow-on' and 'spill-over' benefits to reef fisheries of even small 'no-take' reserves, *provided* such reserves are not themselves exploited or suffer through ineffective policing (e.g. RUSS 1985, RUSS & ALCALA 1996a, b).

Other economic benefits best obtained from MPAs include the generation of employment and sustainable finances through well-managed reef tourism. Such tourism-based revenue has proven a viable source of funding for reef management and research on Australia's Great Barrier Reef, and there is great potential for implementation of similar systems of 'users-pay' in the region (also see HOOTEN & HATZIOLOS 1995). Following the successful integration of environmental protection and sustainable development along the Gulf of Aqaba, Egypt is now considering that a balance between protected areas and development along the coast of the Red Sea is the only opportunity for long-term sustainability of tourism. Measures implemented to date to protect reefs include entrance fees for protected areas and user fees for mooring installations. Additional means of generating revenue include the establishment of non-profit conservation funds and private-sector grants.

Conservation of biodiversity is more complex, requiring the long-term maintenance of overall ecological integrity, community structure and viable populations of the species of interest (SOULÉ 1987). This may prove particularly challenging in the region, where globally significant levels of endemism, complex biogeographic patterns and the presence of partial barriers to gene flow (SHEPPARD ET AL. 1992, DEVANTIER ET AL. 2000c) pose significant and unique challenges to the development of an effective regional MPA network (also see ROBERTS 1998 and Convention on Biological Diversity (CBD), Articles 2 and 8).

BOX 1. Major reef conservation objectives achievable through MPAs (after DE FONTAUBERT ET AL. 1996):

1. Protection of endangered reef species,
2. Maintenance or restoration of viable populations of reef species,
3. Maintenance or restoration of reef communities, habitats, nesting and breeding areas and genetic diversity,
4. Exclusion of species introductions by humans,
5. Provision of space to allow species distributions to shift in response to environmental or climate changes,
6. Provision of examples of the social, economic and ecological benefits that can accrue from well managed reef resources.

Over the past decade, most nations in the region have taken important initial steps towards establishing MPAs, encompassing a wide variety of reef types and other marine and coastal habitats (CHIFFINGS 1995, KELLEHER ET AL. 1995, PERSGA 1998a). Most reef MPAs in the region (Fig. 2) follow the IUCN multiple-use model, where different reefs or reef areas are afforded various levels of protection and use through the application of a zoning plan (see CHILD & GRAINGER 1990).

Priority Objective: Development of marine protected areas which are representative of the major sub-regional sea areas, into 'flag-ship' demonstration MPA sites, as examples of effective MPA management practices in the region.

Actions:

i. Identify and/or upgrade key MPAs to develop integrated regional and national MPA networks with adequate representation of coral reefs (***);

ii. Develop specific management and, where applicable, zoning plans for all MPAs (***);

iii. Develop capacities for day-to-day management, monitoring, surveillance and enforcement, through training courses (***;)

iv. Assist in developing or improving performance of demonstration MPAs using best management practice (***);

v. Create a regional network of MPA managers and researchers in regular communication for information-sharing (***);

vi. Develop policy and legislation (where required) to safeguard reef MPAs in sound legislative frameworks (**);

vii. Draft regional and national guidelines for achieving sustainable sources of funding for MPAs with important reefs (**);

viii. Develop regional and national guidelines for assessment of MPA management effectiveness in conserving coral reefs (**).

Proposed 'Flag-ship' Demonstration MPA Sites

An initial set of key demonstration MPA sites has been identified for the region (north-south):

- Aqaba Marine National Park, (Gulf of Aqaba, Jordan)
- Straits of Tiran, (Northern Red Sea, Saudi Arabia/Egypt)
- Ras Mohammed National Park, (Northern Red Sea, Egypt)
- Giftun Islands and Straits of Gubal, (Northern Red Sea, Egypt)
- Dungonab Bay and Mukawwar Island, (Central Red Sea, Sudan)
- Sanganeb Atoll, (Central Red Sea, Sudan)
- Farasan Islands Marine Park, (S-central Red Sea, Saudi Arabia)
- Belhaf - Bir Ali, (Gulf of Aden, Yemen)
- Iles des Sept Frères, (Gulf of Aden, Djibouti)
- Socotra Islands, (Gulf of Aden, Yemen)
- Aibat and Saad ad Din, (Gulf of Aden, NE Somalia).

Selection of these sites was based on their relative similarity with the selection criteria (Appendix 8 and Table 1), following comparison with the large number of existing and proposed MPAs in the region (see Table 2). Each of the sites provides relevant models for specific stages in the development of MPAs, including:

1. Initial biodiversity and socio-economic assessment and habitat mapping;
2. Involvement of local stake-holders in all stages of the planning process, including protection of traditional uses where these are compatible with the overall objectives of the MPA;
3. Selection of appropriate zones;
4. Development of draft zoning plans;
5. Public and government consultation re draft zones;
6. Development of management plans;
7. Development of day-to-day management capacity, including staffing and infrastructure;
8. Establishment of bio-physical, ecological and socio-economic monitoring programmes;
9. Development of surveillance and enforcement capacities;
10. Development of sustainable funding mechanisms.

The proposed demonstration MPAs are in different stages of planning and implementation (Table 1). Thus, they will require different levels of support to supply adequate management capacities for the effective implementation of management plans and zoning plans, day-to-day monitoring, surveillance, enforcement and sustained finance. Each country is encouraged to nominate additional MPAs as demonstration sites as these become functional.

Expected results - outcomes and time frame:

i. Development of a protocol for sustained funding for MPAs (to be published after 18 months);

ii. Development of a protocol for assessment of MPA management effectiveness (after 18 months);

iii. Identification of key MPAs and boundaries within the region, with recommendations for additional sites based on reef complexity, biodiversity, fisheries, oceanography, habitat distribution or other considerations, to be published as a regional report (after 12 months);

iv. Demonstrated assistance towards refinement and /or development of sound legislative frameworks for MPAs (after 12 months, including published legislative amendments);

v. Demonstrated enhancement of capacity in the various aspects of reef MPA management, through the provision of training courses (after 12 months);

vi. Demonstrated enhancement of communication networks and information sharing among reef managers and scientists in the region, through fostering both formal information exchange (workshops or conferences) and via electronic mailing lists (after 18 months);

vii. Demonstrated assistance towards improving management effectiveness and performance of the six demonstration MPAs, including appropriate policy and practice (after 30 months);

viii. Demonstrated assistance in the development of at least one additional demonstration reef MPA in each signatory country using best management practice (after five years);

ix. Demonstrated assistance in the development of an integrated network of reef MPAs at national and regional levels supported by best management practice (after 10 years).

Performance Indicators and Quality Assurance:

i. Demonstrable advances in management of the six initial demonstration MPAs;

ii. Independent evaluation of the management effectiveness of the demonstration MPAs (see Appendix 9);

iii. Publications on advancements in research and management of the demonstration sites in the regional reef MPA network, legislative frameworks and sustained funding protocols;

iv. Demonstrable improvements in information-sharing among MPA managers, scientists and other stake-holders through workshops and publication of proceedings.

Table 1. Summary statistics for four of the proposed demonstration sites

Attribute	Ras Mohammed National Park	Farasan Islands Marine Park	Socotra Islands	Belhaf - Bir Ali
Location	Southernmost tip of Sinai Peninsula, Northern Red Sea, Egypt	South - Central Red Sea, Saudi Arabia	Gulf of Aden/Arabian Sea, Yemen	NE Gulf of Aden coast, Yemen
Area	sea area: 672 km^2 land area: 233 km^2	3,310 km^2	sea area: ca 12,000 km^2 land area: ca 3,600 km^2	Undefined
Reef types	Coastal fringing reefs, patch reefs, coastal lagoons	Island fringing reefs, patch reefs, coral cays	Extensive and diverse non-reefal coral communities	Mainly non-reefal coral communities fringing island, patchy coral communities in coastal area
Significant features	Highly diverse reef assemblages, major tourism destination, strong management, research and training capacity for MPAs	Key location in transition area between central and southern Red Sea, large range of reef communities, key monitoring site for local - global threats	Unique biogeographic position, very high coral diversity, minimal human disturbance, key monitoring site for local - global threats	Highly diverse coral communities with unique biogeographic affinities, "stepping stone" for dispersal of reef-associated fauna
Country with management responsibility	Egypt	Saudi Arabia	Yemen	Yemen
Management agency	Egyptian Environmental Affairs Agency (EEAA)	National Commission for Wildlife Conservation and Development	Environment Protection Authority (EPA)	Environment Protection Authority (EPA)
Designation date	1983, extended to Strait of Tiran in 1992	1996	2000	Proposed
Specific MPA legislation	Yes (law 102 of 1983)	Yes	Yes	To be developed
Type of MPA	National Park/Marine Park	Multiple-use, zoned MPA	Multiple-use, zoned MPA	To be decided
Management plan	Yes	Yes	Yes	To be developed

MPA headquarters	Yes	Yes	Yes (under construction)	To be developed
MPA staff	Yes	Yes	Yes	To be developed
Surveillance & enforcement	Yes	Minimal	No	To be developed
Research & monitoring	Yes	Yes	Yes	To be developed
Funding sources	Gov. of Egypt, European Union	Gov. of Saudi Arabia - NCWCD	Gov. of Yemen (EPA), GEF-UNDP Project, Socotra Conservation Fund (being established)	Potential GEF - UNDP support
Major stake-holders	Gov. of Egypt, local community, tourism industry incl. hotels and dive operators	Gov. of Saudi Arabia, local community, particularly fishermen, tourism operators	Gov. of Yemen, local communities - particularly fishermen and fishermen co-operatives, national and international fish buyers, tourism agencies	Gov. of Yemen, local communities, fisherman
Uses	SCUBA-diving and shore-based tourism, research	Commercial and artisanal fishing, diving tourism	Artisanal and expanding commercial fisheries, research, tourism under development	Fishing, tourism to be developed
Impacts	Tourism, crown-of-thorns starfish outbreak 1994-1998	Fishing, coral bleaching, tourism	Coral bleaching, increasing fishing pressure	Fishing, anchor damage, coral bleaching

Table 2. Existing and proposed MPAs that may form part of an integrated regional MPA network. The table includes coastal, island and marine parks conserving reefs and/or associated habitats and biota for all PERSGA member nations and Eritrea. * indicates strong potential for trans-boundary parks fostering international co-operation in management.

Country	Functioning MPAs	Location of proposed MPAs
Djibouti	1. Maskali Sud Integral Reserve 2. Musha Territorial Park	1. Iles des Sept Frères and Ras Siyyan 2. Godoriya
Egypt	1. Ras Mohammed National Park 2. Nabq Managed Resource, Protected Area MNPA 3. Abu Gallum MNPA 4. Gabal Elba Conservation Area * 5. Giftun Islands 6. El-Akhawein / Brothers Islands 7. Abu el-Kizan / Dedalus Island 8. Zabargad / St John Island 9. Rocky Island	1. Red Sea Marine Protected Area from Hurghada to Gebel Elba
Eritrea		1. Dahlak Islands (partially) 2. Dur Gaam & Dur Gella Islands 3. Fatuma Islands 4. Museri Islands
Jordan	1. Aqaba National Park	
Saudi Arabia	RED SEA: 1. Farasan Islands 2. Yanbu Royal Commission Protected Area 3. Umm al-Qamari	RED SEA: 1. Strait of Tiran * 2. Ras Suwayhil (Gulf of Aqaba) 3. Sharm Zubayr 4. Ghubbat Bal'Aksh 5. Sharm Dumagyh - Sharm Antar 6. Al-Wajh Bank - Qalib Islands - Sharm Habban & Sharm Munaybirah 7. Al-Hasani, Libanah Islands - Ras Abu Madd - Sharm Hasi 8. Ras Baridi - Sharm al-Khawr 9. Sharm Yanbu 10. Shi'b al-Qirin reef 11. Marsa al-Usalla, Marsa Tawil 12. Marsa as-Sarraj 13. Ras Hatiba 14. Ash-Shu'aybah - Masturah 15. Marsa Umm Misk 16. Haramil Island 17. Jeddah Salt March 18. Qishran 19. Inner Farasan Bank 20. Outer Farasan Bank 21. Marka Island 22. Ra's Tarfa 23. Khawr Amiq, Khawr Raqa 24. Khawr Nahoud 25. Khawr Itwad 26. Shi'b Abu al-Liqa - Shi'b al-Kabir 27. Khawr Wahlan 28. Duwayyimah

Somalia		1. Aibat & Saad ad-Din Islands, Saba Wanak 2. Daloh Forest Reserve and Maydh Island
Sudan	1. Sanganeb Marine National Park 2. Dungonab Bay & Mukkawar Island	1. Shuab Rumi 2. Suakin Archipelago 3. Khor Kilab Bird Sanctuary 4. Abu Hashish Recreational Park
Yemen	1. Socotra Islands	1. Ras Sharma 2. Dhobbab (Shihr) 3. Belhaf and Bir Ali 4. Ras Isa and Kamaran Island 5. Khor Umaira 6. Aden Wetland 7. Bab al-Mandeb and Perim Island 8. Al-Urg 9. Al-Luhaiyah

COMPONENT 4: ECOLOGICALLY SUSTAINABLE REEF FISHERIES

Reef fisheries provide essential sustenance to artisanal fisherman and their families throughout the region. They also play an increasingly important role in supplying commercial quantities of high value products for expanding national, regional and global markets.

Levels of fishing pressure on reefs in the region vary from virtually non-existent to severe, providing a complex management challenge, with important links to the application of MPAs in stock replenishment. Although destructive fishing activities such as dynamite and poison fishing are less widespread than in other reef areas, dumping of litter, lost or abandoned nets and anchor damage are already causing problems to some reefs. Benthic trawling occurs in close proximity to reefs with direct adverse effects on community structure and by-catch (PERSGA 1998a, GLADSTONE ET AL. 1999). Collecting of ornamental reef fishes and other organisms for the global aquarium market is expanding in the region and has already caused serious damage to reefs in some areas.

The region's demersal reef fish, holothurian, molluscan and crustacean stocks are particularly prone to over-fishing (see Box 2) and careful stewardship of these resources is necessary to ensure their sustainable utilization. For this to be achieved, reef fisheries management must shift from the traditional focus on stocks, methods and increasing catches to concentrate on sustaining both the fisheries and the ecosystems on which they depend (KENCHINGTON 2000). This requires both reliable stock assessment and monitoring and improved understanding of the population biology of the target species. There is a large potential for well-planned mariculture of some ornamental and food species, with an urgent need for the simultaneous development of appropriate legislation and guidelines.

BOX 2. *Over-fishing on coral reefs*

Recent evidence has changed the once widespread belief that reef fisheries were virtually inexhaustible. Many reef areas, both in the region and elsewhere, have been chronically and heavily over-fished over the past several decades, with major loss of production and serious adverse 'cascading' effects to other components of the ecosystems (JACKSON 1997, CARLTON 1998). For example, destructive population outbreaks of crown-of-thorns starfish in the region may be linked with over-fishing of fish predators (ORMOND ET AL. 1990). The level of understanding of these effects, or indeed of many of the target fish species' population dynamics, remains rudimentary. JACKSON (1998) strongly recommends the adoption of a precautionary approach to reef fisheries and notes that:

"… virtually all fisheries … models and data are inadequate to reliably predict the responses of low population levels to any subsequent manipulation or to chance …".

Sustainable reef fisheries are a major corner-stone of the Convention on Biological Diversity (CBD Articles 6b, 8c, 8j, 10b, 10c and 11). This provides several recommendations for action, which are very applicable to the RSGA region (after DE FONTAUBERT ET AL. 1996):

1. Set ecologically sustainable levels of use,
2. Manage the ecosystems as a unit, rather than single harvested stocks,
3. Minimize by-catch and incidental impacts on non-target species and habitats,
4. Eliminate subsidies that encourage over-fishing,
5. Protect traditional sustainable management systems through legal recognition of the systems and any associated sea tenure rights.

Traditional artisanal reef fisheries are of great importance in many parts of the region. They deserve high priority for sustainability and should over-ride any competing commercial exploitation. This has added benefits in building co-operation among local stake-holders and managers, particularly important where the artisanal fisheries are developed in multiple-use MPAs (e.g. Socotra Islands, Yemen, see CHEUNG ET AL. in press).

Priority Objective: Maintenance of sustainable reef fisheries through the implementation of accurate stock assessment and monitoring, effective regulation of fishing effort, protected areas with "no-fishing" zones, seasonal closures to protect spawning stocks, surveillance and enforcement.

Actions:

i. Conduct surveys and interview fishermen to identify important spawning aggregation sites of reef fishes (***);

ii. Develop 'no-fishing' zones in MPAs for the protection of important reproductive stocks, particularly in areas of spawning aggregations (***);

iii. Introduce closed fishing seasons during spawning periods of reef fishes to protect reproductive stocks (***);

iv. Assist in increasing national capacities for the assessment and monitoring of reef fish stock, by organizing training courses (***);

v. Assist in building national capacities for surveillance and enforcement of

reef fisheries regulations, particularly in relation to MPA zonings (***);

vi. Develop regional and national guidelines for responsible and ecologically sustainable collecting of ornamental reef species for the aquarium trade (**);

vii. Through liaison with other programmes and agencies, develop relevant national policy and legislation (where necessary), based on FAO and CBD recommendations for sustainable reef fisheries management (*);

viii. Develop regional and national guidelines for responsible and ecologically sustainable reef mariculture operations for ornamental and food fishes and other organisms (*).

Expected results - outcomes and time frame:

i. Continued implementation of MPA zoning and other regulations incorporating 'no-fishing' replenishment areas and seasonal spawning closures (after four years);

ii. Organization of training courses in reef fisheries management, including stock assessment and monitoring, surveillance and enforcement, particularly in relation to MPA zonings (after 18 months);

iii. Demonstrated improvement in assessment capacity for catch and effort, monitoring, surveillance and enforcement (after 18 months);

iv. Publication of regional and national guidelines for collecting reef ornamentals and for mariculture (after 18 months).

Performance Indicators and Quality Assurance:

i. Incorporation of 'no-fishing' replenishment areas in MPA zoning or other regulations, included in each specific MPA management plan;

ii. Relevant fisheries regulations, based on FAO and CBD recommendations for sustainable reef fisheries management, incorporated in national and local policy and legislation;

iii. Demonstrable improvement in local and national capacities for reef fisheries assessment, monitoring, surveillance and enforcement;

iv. Independent review of the status of the reef fisheries, through stock assessment and monitoring.

COMPONENT 5: IMPACT FROM SHIPPING AND MARINE POLLUTION

The RSGA region forms one of the major thoroughfares for international maritime traffic between Asia-Pacific and Europe. It is also the world's largest producer and exporter of oil, most of which is transported by sea. These factors place the region's reefs at high risk. PERSGA (1998a) identified five major regional threats associated with shipping, navigation, petroleum transport and production:

1. Extensive risk of ship collision and grounding in major traffic lanes, 2. Discharge of sewage from vessels,
3. Ship discharge of solid waste,
4. Oil spills from exploration, production and transport,
5. Illegal disposal of toxic wastes.

The sometimes-complex mazes of reefs, narrow navigation channels, insufficient navigational markers and human error have

all contributed to the numerous ship groundings that have already caused damage to reefs in the region.

Several important measures to minimize the impact to reefs and other coastal ecosystems from oil spills have already been implemented, including the development of local and national oil spill contingency plans. At the national level several countries, including Egypt, Jordan and Saudi Arabia, have developed national oil spill response plans, and a national oil spill contingency plan for Sudan is awaiting government approval. In Egypt three oil spill response units are operational.

The threat from introduced species is less obvious, but perhaps more insidious in the medium to long term, given the enormous amount of ship traffic, loading and unloading of cargo and associated ballast flushing, the major source of alien species introductions worldwide (U.S. NATIONAL RESEARCH COUNCIL 1995).

Priority Objective: Implementation by participating nations of obligations under regional and international conventions, adoption of Port State Control, improved navigation systems and oil spill response capacities, surveillance and enforcement.

Actions:

i. Support implementation of Port State Control throughout the region (***);

ii. Contribute to the development of the regional Navigation Risk Assessment and Management Plan (***);

iii. Support the development and implementation of regional and sub-regional vessel traffic systems, with special emphasis on reef protection (***);

iv. Upgrade existing marine navigation aids, particularly in the vicinity of sensitive reef areas (***);

v. Develop, upgrade and implement local, national and regional contingency plans and assure their adequacy for reef protection (***);

vi. Foster the development of relevant national legislation to define safe shipping routes and passages and, if necessary, compulsory pilotage of vessels carrying high risk cargo through critical reef areas (**);

vii. Assist in building national capacities for surveillance and enforcement of regulations, ensuring legislation has appropriate punitive clauses for legislative breaches on reefs (**);

viii. Ensure ratification of relevant conventions, such as UNCLOS, MARPOL, Civil Liability Convention, Convention on Hazardous and Noxious Substances and Limitation of Liability, and Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (**).

Expected results - outcomes and time frame:

i. Implementation of Port State Control procedures throughout the region (after three years);

ii. Contribution to the development of the regional Navigation Risk Assessment and Management Plan (after six months);

iii. Upgrading of existing marine navigation aids in the region, particularly in narrow reef passages and other high risk reef areas (after 18 months);

iv. Completion of desk-top studies and liaison with other programmes and government agencies to ensure standardization of regional protocols and regulations for shipping and ballast water discharge (after 18 months);

v. Preparation (where necessary) of national oil spill contingency plans (after 18 months);

vi. Development of relevant national legislation defining safe shipping routes and passages and, if necessary, compulsory pilotage of vessels carrying potentially high risk cargo through critical reef areas (after 18 months);

vii. Development of emergency and contingency plans incorporating trans-boundary co-operation in the event of ship grounding, collision, pollution spill or accidental release of alien species on reefs (after three years);

viii. Ratification of all relevant conventions (after three years).

Performance Indicators and Quality Assurance:

i. Demonstrable improvements in response capacity to shipping accidents and emergencies on reefs by the end of 2003;

ii. Demonstrated improvements in national capacities for surveillance and enforcement of shipping regulations with relevance to reefs by the end of 2003;

iii. Notable reduction in the number of ship groundings, pollution spills, collisions or species introductions on reefs through demonstrable compliance with relevant regulations.

COMPONENT 6: RESEARCH, MONITORING, AND ECONOMIC VALUATION

Effective reef management needs the provision of accurate information on the present status of the ecosystems, both for ICZM and MPA planning and for the assessment and monitoring of reef status and reef fisheries and of the effectiveness of management itself. To be most effective, research and monitoring are integrated into a logical overall framework of action (Fig. 3) providing scientifically robust management-oriented information (Fig. 4), including data for:

1. Planning and development of MPAs, such as distribution of habitats, biodiversity and socio-economics;
2. Monitoring ecosystem properties and the status of biological, ecological, oceanographic and socio-economic parameters for ICZM and MPA management;
3. Environmental and socio-economic impact assessment, both before and after development takes place, and economic valuations of different courses of action;
4. Assessing health status of the ecosystems in terms of global-scale disturbances, such as occurred with coral bleaching in 1997 and 1998;
5. Reef fisheries stock assessment and monitoring.

Most nations in the region have initiated reef research and monitoring programmes (WILKINSON 2000, ABUZINADA in press), although major differences exist in national logistics capacities in relation to different levels of finance, manpower and expertise. Until recently, there had been only limited success in pooling national data to provide regional insights. This is being addressed through regional initiatives to develop standard protocols linked with extensive training programmes (see Box 3). These methods are as simple and inexpensive as practicable (ARONSON ET AL. 1994), to be equally applicable in all nations of the region. Consistent application of standard methods will provide scientifically robust information on reef status to local and national management agencies, and facilitate regional and global comparisons.

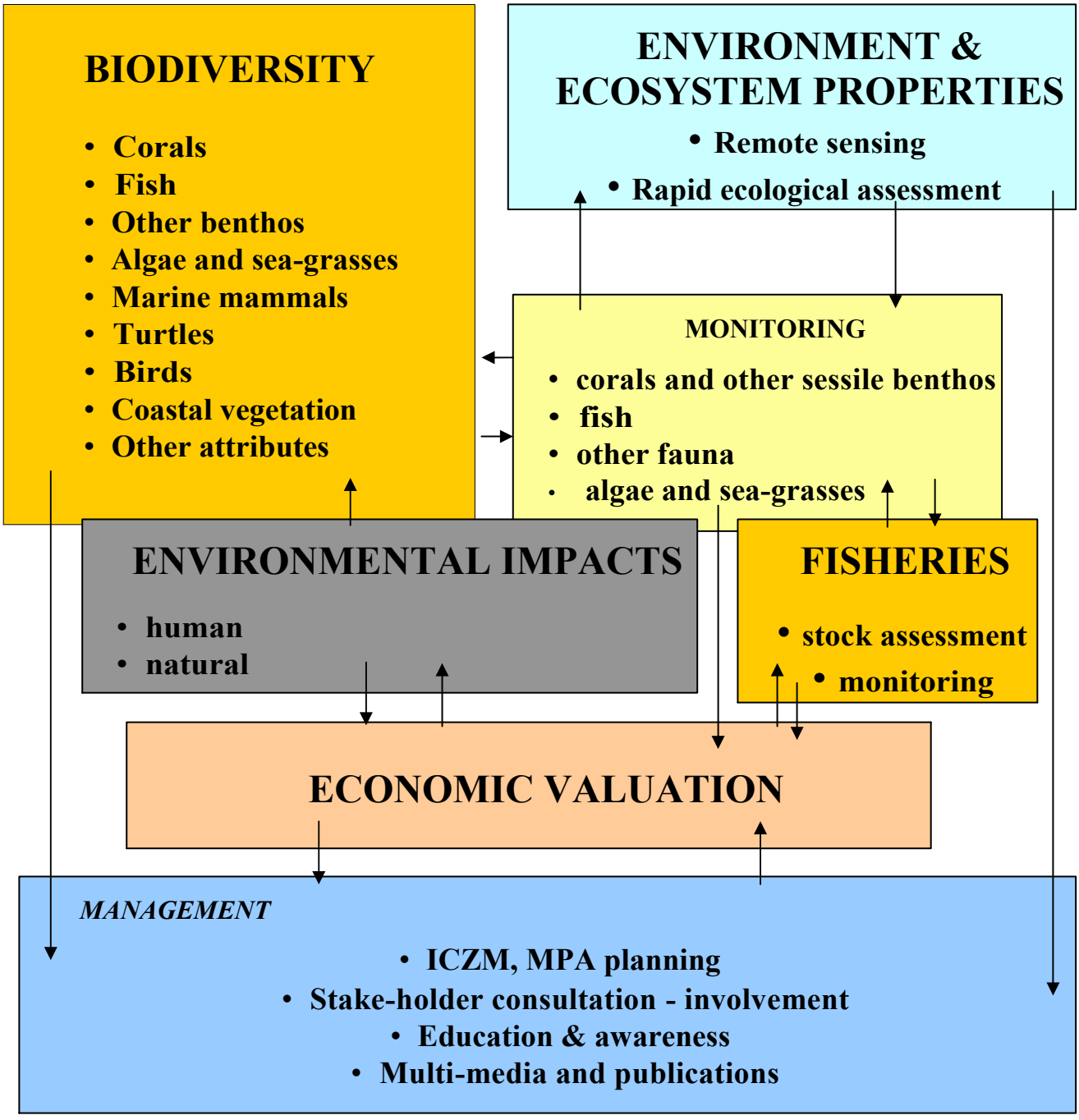

Figure 4. Flow-chart of survey and monitoring designed to provide suitable management support on coral reefs (adapted from DEVANTIER ET AL. in press).

BOX 3. *Standardized research and monitoring protocols*

Application of standard protocols has already facilitated national and regional comparisons, both within the region and elsewhere (CARICOMP - OGDON ET AL. 1997, the ASEAN-Australia Living Coastal Resources Project - CHOU & WILKINSON 1992, ReefCheck - HODGSON 1999, and the Global Coral Reef Monitoring Network GCRMN - WILKINSON 1998, 2000, ABUZINADA in press). These programmes have each produced status reports that have proved highly valuable in informing management agencies and raising awareness at government and inter-government levels.

In the RSGA region, PERSGA is standardizing biological and ecological survey and monitoring methods. The core survey methods for coral reefs include those recommended by ReefCheck and the Global Coral Reef Monitoring Network (GCRMN), as adapted for maximum utility in the region.

Remotely sensed data from satellite-borne sensors are also being used in interpreting large-scale climatic and oceanographic phenomena affecting reefs of the region. Graphical interpretation of anomalies in sea surface temperature are now routinely available on the World Wide Web (e.g. Fig. 1 from NOAA-NESDIS: http://psbsgi1.nesdis.noaa.gov:8080/psb/eps/sst/climohot.html) and have proven highly valuable in predicting coral reef bleaching.

Data generated from the protocols will be stored and analysed at PERSGA. The organization will bear responsibility for data quality assurance, archiving and reporting.

Monitoring data will be valuable in alerting governments to disturbances affecting reefs of the region (Fig. 1). A wide range of recently launched satellite-borne sensors should provide understanding of regional and global effects.

Effective lobbying for reef conservation at government and inter-government levels requires making realistic comparisons of the various financial costs and benefits that can accrue from different courses of action. Such analyses of the various economic values of reefs are at a preliminary stage (e.g. see Box 4, DIXON & SHERMAN 1990, DIXON 1993, CESAR 1996). Most governments rely on economic valuations in prioritising development options.

BOX 4. *Economic valuation of reefs*

Conventional economic procedures for modelling cost-effectiveness can result in sub-optimal policy choices when applied to complex systems such as reefs, where non-linear responses to various kinds and levels of human impact are common. However, the application of fuzzy logic and non-linear economic analysis proved useful in optimising economic policies and maintaining reef quality in a Caribbean reef MPA (RUITENBEEK & CARTIER 1999, RUITENBEEK ET AL. 1999, and http://www.island.net/~hjr).

Standard economic evaluation methods for coral reefs are also being developed within the ICRAN partnership by ICLARM. The RSGA region can benefit from this standard approach, adapting the ICLARM protocols as appropriate.

General concepts, methods and applications of economic valuation of ecosystems are available on the WWW at: http://www.ecosystemvaluation.org, a website developed by the U.S. Natural Resources Conservation Service (U.S. Department of Agriculture) and the National Oceanographic and Atmospheric Administration (NOAA - U.S. Department of Commerce). The website provides information on different valuation methods, their various strengths and weaknesses, and provides links to other relevant websites.

Priority Objective: Implementation by participating nations of standardized methods of biophysical and socio-economic survey and monitoring, data-storage, analysis and reporting, using regional (PERSGA and ROPME) and international protocols (e.g. ReefCheck and GCRMN).

Actions:

i. Conduct biodiversity, socio-economic, oceanographic and genetic assessments of key sites, including likely larval sources and sinks, in support of an interconnected network of MPAs (***);

ii. Develop national survey and monitoring capacities, by organizing training courses in collaboration with ReefCheck, GCRMN, ICRI and ICRAN (***);

iii. Establish and maintain a network of long-term monitoring sites, in collaboration with ReefCheck and GCRMN (***);

iv. Establish a regional node in the RSGA for ReefCheck and GCRMN co-ordination (***);

v. Establish national and regional reporting guidelines, linked to GCRMN schedules (**);

vi. Establish sustainable sources of funding to maintain the monitoring network (**);

vii. Develop capacity for economic valuations (*);

viii. In liaison with other agencies, develop standard regional and national guidelines, policy and legislation regarding bio-prospecting and other forms of research in reef areas, in terms of ethical considerations and benefit-sharing (see Box 5) (*).

BOX 5. *Biodiversity and bio-prospecting*

Biodiversity research and monitoring form a key component of national obligations under the CBD (Articles 7a, 7b) and a crucial initial step in the development of effective MPAs. In conjunction with biodiversity surveys, the CBD identifies protection of traditional knowledge, the rights of local stake-holders and the equitable sharing of benefits derived from exploitation of biodiversity (CBD Articles 7a, 7b, 8j) through bio-prospecting or other means (also relevant under CITES).

Parts of the RSGA region have already been subjected to uncontrolled bio-prospecting by unscrupulous international pharmaceutical companies. There is an urgent need for the development of standard policies and legislation regarding ethical considerations and benefit-sharing from any future bio-prospecting, or indeed from research generally (see DE FONTAUBERT ET AL. 1996 for further information).

Expected results - outcomes and time frame:

i. Survey and monitoring training courses (after 18 months);

ii. Demonstrable increase in national capacities in research, survey and monitoring (after 18 months);

iii. Completion of site assessments for MPAs (after 18 months);

iv. Establishment of regional monitoring network (after 18 months);

v. Establishment of regional node for ReefCheck and GCRMN (after 18 months);

vi. Demonstrable improvement in national contributions to regional and global reef status reporting, such as GCRMN reports (after nine months);

vii. Establishment of sustained funding for monitoring network (after three years);

viii. Establishment of regional node for remote sensing data (after 18 months).

INTEGRATION OF THE RAP

The Plan has both 'top-down' and 'bottom-up' aspects to its structure and operation. It represents a regional approach co-ordinated and supported by the regional Organization but mostly conducted at local and national levels by all countries within the RSGA region.

The Plan also aims to fulfil the regional goals of larger global initiatives for the conservation and sustainable use of coral reefs, including those of the various United Nations Organisations, major non-government organisations (e.g. IUCN and WWF) and, more recently, ICRI and ICRAN.

To assist effective implementation, a steering committee composed of representatives from each participating nation and the major international, regional and national organisations will be formed to co-ordinate the RSGA RAP over its initial period of implementation. The committee will also act as the interface between government, major donor agencies and international coral reef initiatives.

Effective communication among these various bodies in relation to recent advances in methods and findings, and in the presentation of a co-ordinated consistent 'picture' of reef status to the global community will help to achieve the overall objective of the Plan.

ACTIONS REQUIRING BUDGET SUPPORT

1. Integrated Coastal Zone Management

Budget code	Budget item
ICZM-1	Publication of regional and national guidelines for ICZM and EIA
ICZM-2	Organization of national meetings among key stake-holders
ICZM-3	Review of existing laws and regulations; development of recommendations on policy and legislative amendments
ICZM-4	Assistance in development of key demonstration ICZM sites
ICZM-5	Independent assessment of the effectiveness of ICZM

2. Education and Awareness

Budget code	Budget item
EAW-1	Production, publication and dissemination of education and awareness materials
EAW-2	Coral reef awareness campaigns
EAW-3	Organization of mass-media training courses

3. Marine Protected Areas

Budget code	Budget item
MPA-1	Establishment and upgrading of regional demonstration reef MPA sites
MPA-2	Establishment/upgrading of national demonstration reef MPA
MPA-3	Support for integrated network of reef MPAs
MPA-4	Production of publications relevant to key reef MPA sites
MPA-5	Review and refinement of policy and legislative frameworks for MPAs
MPA-6	Information exchange and meetings

4. Ecologically sustainable reef fisheries

Budget code	Budget item
ESF-1	Review and upgrading of relevant laws and regulations
ESF-2	Training in reef fisheries assessment, monitoring, surveillance and enforcement
ESF-3	Reef fish stock assessment and monitoring in MPAs
ESF-4	Production of guidelines for management of ornamental fishery and mariculture
ESF-5	Independent review of MPA effectiveness in relation to reef fisheries

5. Impact of Shipping and Marine Pollution

Budget code	Budget item
SMP-1	Support for implementation of Port State Control
SMP-2	Development of regional navigation risk assessment and management plan for reefs
SMP-3	Establishment of regional and sub-regional vessel traffic systems around reefs
SMP-4	Upgrading of navigational aids near sensitive reef areas
SMP-5	Preparation / upgrading of oil spill contingency plans
SMP-6	Review and upgrading of relevant legislation
SMP-7	Building national capacities for surveillance and enforcement of shipping regulations around reefs

6. Research, Monitoring and Economic Valuation

Budget code	Budget item
RME-1	Surveys and site assessments, especially in MPA areas
RME-2	Establishment of a monitoring network
RME-3	Establishment of regional nodes for monitoring, GIS and remote sensing
RME-4	Training in economic valuation techniques

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The RAP (Arabian Seas Region) builds on the substantial base of previous work by the regional and national organizations, and covers the coral reefs and associated habitats of all member nations of PERSGA, ROPME plus Eritrea**.**

The RAP (Arabian Seas Region) was prepared by Dr. Lyndon DeVantier, AIMS, Australia, and reviewed by the following: Dr. Fareed Krupp and Dr. Eugene Joubert, NCWCD, Riyadh, Saudi Arabia; Dr. Richard Kenchington, Jamison, Australia; Dr. Clive Wilkinson, AIMS, Australia; Dr. Gregor Hodgson, ReefCheck, USA; Dr. Hassan Mohammadi, ROPME, Kuwait; Mr. Abdullah Alsuhaibany, PERSGA, Jeddah; Dr. Abu Gassem Al-Assiri, UNEP-ROWA, Bahrain; Dr. Abdul-Majeid Haddad, UNDP, Riyadh; Dr. Mohammed Abu Zaid, Alexandria, Egypt; Dr. Salim Al-Moghrabi, Aqaba Marine Science Station, Aqaba, Jordan and Dr. Mohammed Abu Bakr, PERSGA-SAP, Sana'a, Yemen.

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Appendix 10

The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden

(PERSGA)

Regional Action Plan for the Conservation of Breeding Seabirds and their Habitats in the Red Sea and Gulf of Aden

Draft 27 April 2004

1. EXECUTIVE SUMMARY

This Plan provides a set of priority actions for the conservation and sustainable development of seabirds and associated habitats in the Red Sea and Gulf of Aden (RSGA). The Region[1] is recognised as being important for its seabirds, with 17 species of true seabirds breeding regularly. One species and two sub-species are endemic to the Region. A further group of taxa, at both specific and sub-specific levels, is endemic to the northwest of the Indian Ocean area and important sub-populations breed in the RSGA Region. Of the seabirds in the Region, one species is Globally Threatened and three are considered to be Near Threatened. However, the population status of most species is poorly known.

The RSGA has a wide range of suitable habitats for breeding seabirds, but there are many well documented threats to seabirds and their habitats within the Region. Of these, the principal threats are considered to be from:

- Human disturbance of nest sites
- Human exploitation of seabirds
- Habitat destruction and degradation
- Pollution, both terrestrial and marine
- Impacts of fishing and associated activities
- Introduced and invasive species

In most cases the threats occur across the Region but vary in intensity between and within countries. An attempt has therefore been made to predict and quantify the impacts of these threats to seabird populations in the RSGA over the next twenty years. Particular attention is then given to identifying actions that can be taken to alleviate those threats that are considered to be most severe.

The RAP identifies and prioritises a set of actions related to the following seven key seabird conservation components:

- Integrated Coastal Zone Management (ICZM) Planning for Seabirds
- Education, public awareness and community participation
- Site and habitat protection and management
- Regulation of human exploitation
- Research and monitoring
- Legislation
- Institutional capacity building and training

The actions identified in the plan have been prioritised into three levels, based on their potential impacts on the prioritised threats to seabirds. It is suggested that a Steering Committee should be established to coordinate the implementation of all of the RAPs. The Steering Committee should include representatives from each participating nation and other major regional and national organisations. These will act as the interface between government, major donor agencies and international mangrove initiatives, and will identify national responsibilities and priorities for actions in relation to the needs of all the RAPs and available funding.

[1] The Region (capital 'R') denotes the geographical coverage of the Red Sea and Gulf of Aden region as defined in Article II of the Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment, 1982.

2. INTRODUCTION

2.1 The Red Sea and Gulf of Aden Region

The Red Sea and Gulf of Aden (RSGA) region, herein referred to as the Region, is a complex and unique tropical marine ecosystem, with extraordinary biological diversity and a remarkably high degree of endemism.

The Red Sea is one of the most important repositories of marine biodiversity on a global scale and supports a particularly high diversity of corals (PILCHER 2003). It lies within a deep trench (depths exceeding 2,000 m) formed by the northerly extension of the African rift valley system, is 1,932 km long and has a surface area of approximately 435,000 km^2.

The Gulf of Aden (1,400 km long) is one of the least well known areas of the Indian Ocean in terms of its biology. It holds fishery resources of international importance due to the upwelling of cool, nutrient-rich water during the southwest and northeast monsoons and is characterised by a prevailing high-energy climate. Rocky cliffs, alternating with long stretches of littoral and sub-littoral sand along coastal plains, dominate Yemen's coastline. Little is known about the coastal and marine resources of the Gulf of Aden off Somalia.

The Socotra Island Group, consisting of Socotra Island and three outlying islands (Abd al-Kuri, Samha and Darsa, with the two rocky outcrops of Sabonyiah and Ka'l Farun), is situated at the eastern extreme of the Gulf of Aden, some 400 km south of the Arabian Peninsula. It contains unique aquatic and terrestrial ecosystems and species, with limited impacts from human activities. The World Wide Fund for Nature (WWF) has described the archipelago as an "Indian Ocean version of the Galapagos" based on the high degree of endemism and unique vegetation types on the islands and it is thought to be an extremely important area for marine biogeography (PERSGA/GEF 1998).

2.2 Breeding seabirds of the RSGA Region

Although the fauna of the RSGA have been relatively poorly studied, the Region is recognised as important for its seabirds, with 17 species of true seabirds breeding regularly. Several endemic taxa occur, including the White-eyed Gull (*Larus leucophthalmus*) and sub-species of the Red-billed Tropicbird (*Phaeton aethereus indicus*) and Brown Noddy (*Anous stolidus plumbeigularus*). A further group of taxa, at both specific and sub-specific levels, is endemic to the northwest of the Indian Ocean area and important sub-populations of many breed in the RSGA Region, including Jouanin's Petrel (*Bulweria fallax*), Sooty Gull (*Larus hemprichii*), Swift Tern (*Sterna bergii velox*), White-cheeked Tern (*Sterna repressa*) and Socotra Cormorant (*Phalacrocorax nigrogularis*). Many of these populations face human threats and therefore need conservation.

3. DEVELOPMENT AND SCOPE OF THE REGIONAL ACTION PLAN

3.1 Background to the Regional Action Plan

PERSGA, the "Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden", is an intergovernmental body responsible for the development and implementation of regional programmes for the protection and conservation of the marine environment of the RSGA. The PERSGA member states are: Djibouti, Egypt, Jordan, Saudi Arabia, Somalia, Sudan and Yemen.

Figure 1. Map of the Red Sea and Gulf of Aden

PERSGA's Strategic Action Programme (SAP), funded through the Global Environmental Facility (GEF) implementing agencies (United Nations Development Programme, United Nations Environment Programme and the World Bank), the Islamic Development Bank and the PERSGA member states, aims to protect biodiversity and the wider environment of the RSGA. It was formally launched in 1998 and comprises eight Components, one of which is "Habitat and Biodiversity Conservation" (Component 4). One of the main activities under Component 4 is the

preparation of Regional Action Plans (RAPs) for the conservation of key taxa and habitats, such as coral reefs, mangroves, seabirds and sea turtles.

Prior to the development of the RAP for breeding seabirds, PERSGA initiated a programme to collect, collate and update information on the Region's seabirds. This involved:

- Development of Standard Survey Methods (SSM) for surveying the Region's breeding seabirds
- Training of national seabird specialists in the use of the SSM
- Field surveys to assess population sizes and collect additional information on habitats and threats and
- Preparation of National Reports presenting the current status of seabirds in PERSGA countries.

Field surveys were carried out in Djibouti, Sudan and Yemen, including the Socotra Island Group (AL-SAGHIER et al. 1999; AL-SAGHIER 2002b; SHOBRAK et al. 2002a, 2002b). In addition, regional experts compiled national reports to document the status of seabirds in three PERSGA countries that were not surveyed: Egypt, Saudi Arabia and Somalia (SHOBRAK 2002; SHOBRAK et al. 2002c; BAHA EL DIN et al. 2003). Jordan was not surveyed as there are no islands within the Jordanian Red Sea territory and there are no documented records of seabirds currently breeding in the country. From these reports and other relevant literature, a report titled *Status of Breeding Seabirds in the Red Sea and Gulf of Aden* was produced (PERSGA/GEF 2003a). The background information in this RAP is largely drawn from these regional and national reports.

3.2 Scope of the Regional Action Plan

This RAP presents a summary of the current knowledge of the status of the breeding seabirds of the RSGA Region, a review of the threats facing these species and their key breeding sites, and information on current national and international legislation influencing seabirds and their habitats. This information is used to assign conservation priorities for each seabird species and to quantify the significance of the threats to them. Building on this the RAP then presents a prioritised Framework for Action that consists of seven components:

1. Integrated coastal zone management planning for seabirds
2. Education, public awareness and community participation
3. Site and habitat protection, and management
4. Regulation of human exploitation
5. Research and monitoring
6. Legislation
7. Institutional capacity building and training

For each of the components, regional priority actions are identified by relating the actions to their potential impacts on the prioritised 'threats to species'. Finally, an outline strategy for implementing the actions, in relation to other RAPs and national priorities, is proposed.

4. STATUS OF BREEDING SEABIRDS IN THE RED SEA AND GULF OF ADEN

4.1 Status of species

Seventeen species of true seabirds have been recorded breeding in the Red Sea and Gulf of Aden. True seabirds are those that are dependent on the sea for the majority of their food and usually breed on islands or along coasts. These include petrels, tropicbirds, boobies, cormorants, gulls and terns. Other species in the Region, notably pelicans, herons, egrets, osprey (*Pandion haliaetus*), Crab Plover (*Dromas ardeola*) and Kentish Plover (*Charadrius alexandrinus*), also use the coastal marine environment but are not restricted to it. Only true seabirds are covered here.

The most common of the 17 species is the Bridled Tern (*Sterna anaethetus fuligula*) with an estimated population of 240,000 pairs (Table 1). The rarest, in terms of numbers breeding in the RSGA Region, is the Little Tern (*Sterna albifrons*), which is believed to nest (still to be confirmed) in very small numbers in the northern Egyptian Red Sea, but is on the very edge of its Palaearctic range.

Estimates of the number of breeding seabirds in each of the PERSGA countries are given in Annex 1.

4.2 Ecology of breeding seabirds in the RSGA Region

Most of the breeding seabirds in the RSGA Region, particularly the terns, feed largely on small fish and invertebrates such as squid and shrimp in shallow water coastal habitats, such as lagoons and around islands. The exceptions are Jouanin's Petrel (about which little is known), Persian Shearwater (*Puffinus persicus*), Masked Booby (*Sula dactylatra*), Socotra Cormorant, Sooty Gull, Sooty Tern (*Sterna fuscata*) and Brown Noddy. However, these species probably feed mostly in coastal waters during the breeding season.

All 17 species usually nest in colonies, some in association with other species. For many species, notably the terns and gulls, nests are located on sandy or coral offshore islands or beaches.

Annex 2 gives a summary of the main feeding and nesting habits of the 17 seabird species breeding in the Red Sea and Gulf of Aden. More details can be found in PERSGA/GEF (2003a) and the various national seabird status reports (AL-SAGHIER et al. 1999; AL-SAGHIER 2002b; BAHA EL-DIN et al. 2002; SHOBRAK et al. 2002a, 2002b, 2002c).

4.3 Priority bird species

Of the true seabirds that occur in the Region, only the Socotra Cormorant is recognised as Globally Threatened by BirdLife International (on behalf of IUCN), and is classified as Vulnerable (Table 2). However, three other species are considered to be Near Threatened: Jouanin's Petrel, Persian Shearwater and White-eyed Gull. Some species are also listed under the Convention on Migratory Species (see Annex 3).

Table 2 gives a 'priority' coding for each species based on their national and international threat status and their distributions. Species that are both internationally threatened and have a restricted range (top right-hand corner), such as White-eyed Gull, rank higher and are in greater need of conservation action than species that are common and widespread (bottom left-hand corner), such as Brown Booby or Bridled Tern.

Table 1. Distribution and population of breeding seabirds in the RSGA

Species	Distribution of species or subspecies	RSGA population estimate (pairs)	Reference PERSGA/GEF 2003a and others as given
Jouanin's Petrel *Bulweria fallax*	Endemic to northwest Indian Ocean	3,000 **	AL-SAGHIER et al. (unpublished)
Persian Shearwater *Puffinus persicus*	Endemic to the Indian Ocean and Gulf of Aden	10,000 **	
Red-billed Tropicbird *Phaethon aethereus indicus*	Subspecies endemic to RSGA and Arabian Sea to Arabian Gulf	700	
Brown Booby *Sula leucogaster plotus*	Subspecies occurs throughout Indo-Pacific	15,000*	
Masked Booby *Sula dactylatra melanops*	Subspecies endemic to western Indian Ocean	1,000	
Socotra Cormorant *Phalacrocorax nigrogularis*	Endemic to Arabian Sea and Gulf of Aden	15,000***	JENNINGS 2003 and AL-SAGHIER 2002a
Sooty Gull *Larus hemprichii*	North-west Indian Ocean	4,000	
White-eyed Gull *Larus leucophthalmus*	Endemic to RSGA Region	11,000*	
Caspian Tern *Sterna caspia*	Widespread beyond Region	500*	
Swift Tern *Sterna bergii velox*	Subspecies endemic to RSGA Region	3,500*	
Lesser Crested Tern *Sterna bengalensis*	North African coast, Arabian Sea, Indo-Pacific	14,000	
White-cheeked Tern *Sterna repressa*	RSGA Region, Arabian Sea, northwest Indian Ocean	27,000*	
Sooty Tern *Sterna fuscata*	Tropical and subtropical zones of Pacific, Indian and Atlantic oceans	7,000	DELANY & SCOTT 2002
Bridled Tern *Sterna anaethetus fuligula*	RSGA, Arabian Gulf, Arabian Sea, Indo-Pacific and locally West Africa	240,000*	
Little Tern *Sterna albifrons albifrons*	Widespread, west Palaearctic, India, Pacific, West Africa, North America and Caribbean	-	-
Saunder's Little Tern *Sterna saundersi*	RSGA, northwest Indian Ocean and east African and north-west Indian coasts	200*	DELANY & SCOTT 2002
Brown Noddy *Anous stolidus*	Widespread in tropical and subtropical zones in Atlantic, Indian and Pacific Oceans	26,000*	

* = Count of breeding birds from surveyed coasts and islands; ** = Estimated breeding population on Socotra Island Group; *** = Estimated breeding population on islands off Bir Ali and Socotra

Table 2. Conservation priorities for seabirds in the RSGA Region based on their global and regional conservation status and the biogeographical importance of their RSGA populations

	Wide distribution	Near endemic species or endemic sub-species	Endemic species to RSGA Region
Globally Threatened[1]	PRIORITY B	PRIORITY A Socotra Comorant	PRIORITY A
Regionally Threatened[2] **or globally "Near Threatened"**[1]	PRIORITY C	PRIORITY B Jouanin's Petrel Persian Shearwater Masked Booby	PRIORITY A White-eyed Gull
Insufficiently Known	PRIORITY C	PRIORITY B Swift Tern	PRIORITY A
Non-threatened	PRIORITY D Brown Booby Caspian Tern Lesser Crested Tern White-cheeked Tern Sooty Tern Bridled Tern Saunder's Little Tern Little Tern * Brown Noddy	PRIORITY C Sooty Gull Red-billed Tropicbird	PRIORITY B

Sources: [1] BIRDLIFE INTERNATIONAL (2000) *Threatened Birds of the World.* & BIRDLIFE INTERNATIONAL 2003 *BirdLife's Online World Bird Database: the site for bird conservation*. Version 2.0. Cambridge, UK: BirdLife International. Available: http://www.birdlife.org (accessed 29/9/2003). 'Globally Threatened' is given according to the IUCN status of the species.

[2] 'Regionally Threatened' species were identified at the PERSGA Seabird RAP workshop taking into account information provided in this RAP and the Regional Status Report (PERSGA/GEF 2003a). 'Insufficiently known' signifies that there is not enough data to be able to determine the threat status for the species, but it is assumed to be regionally or nationally threatened.

* - Red Sea is on the very edge of its range.

4.4 Key sites for breeding seabirds - Important Bird Areas

The regional report on the status of breeding seabirds in the RSGA (PERSGA/GEF 2003a) lists 31 Important Bird Areas (IBAs), identified through consultation with seabird experts at national and regional levels, that are particularly important for (true) breeding seabirds in the Region (Annex 4). IBAs are sites of high importance for their avifauna and are selected using internationally accepted criteria developed by BirdLife International's Important Bird Areas Programme (see EVANS 1994 and FISHPOOL & EVANS 2001). The sites listed in Annex 4 should be considered priority targets for protection. Unfortunately, only 11 of the 31 IBAs (35%) are currently fully protected.

Further information on the most important IBAs for breeding seabirds in the Red Sea and Gulf of Aden Region is given in PERSGA/GEF (2003a). Additional IBAs have been identified during recent seabird surveys in Yemen.

5. THREATS FACING BREEDING SEABIRDS IN THE RSGA REGION

The Red Sea and Gulf of Aden, their coastal areas and islands, offer ideal habitats for breeding seabirds. However, as noted by several authors there are many threats to the marine environment in the RSGA (UNEP/PERSGA 1997) and to seabirds (e.g. GALLAGHER et al. 1984; EVANS 1987). The national and regional seabird status reports for the RSGA Region also identified threats to species and sites. These sources suggest that the principal threats are from:

- Human disturbance of nest sites
- Human exploitation of seabirds
- Habitat destruction and degradation
- Pollution, both terrestrial and marine
- Impacts of fishing and associated activities
- Introduced and invasive species.

In most cases, the threats occur across the Region but vary in intensity between and within countries. Impacts on individual species also vary according to their distribution, their use of habitats and their ecological requirements. The threats to seabirds in the Region are therefore described in more detail below, and this is followed by an assessment of impacts on individual species.

5.1 Human disturbance at nest sites

Most of the seabird species of the RSGA Region breed in colonies and are therefore susceptible to disturbance. Furthermore, because many species are concentrated in relatively few colonies, harmful activities at one site may have a major impact on national or even regional populations. Disturbance affects birds and colonies in a number of ways. Disturbed incubating birds can leave their nest exposed to predators and heat, and 'stampeding' birds can crush eggs. Chicks of small species like terns are very susceptible to heat-stress and can die from heat-stroke and dehydration if they are not protected by their parents. Once the chicks are able to move independently, disturbance may cause them to break cover and range out of their natal territory, making them vulnerable to predation and harassment from other birds. Excess disturbance in other parts of the world have been shown to result in adults abandoning nests, shifts in colony location, interruption of feeding patterns, and delayed breeding (e.g. TUCKER & EVANS 1997; GREAT BARRIER REEF MARINE PARK AUTHORITY 1997).

Human disturbance is, of course, most intense in coastal areas and islands close to urban and tourist centres but takes a number of forms.

Tourists and recreational users

Disturbance and damage to nesting and feeding habitats of breeding seabirds by tourists and recreational users is a major and now permanent problem in some areas of the Region, particularly in the northern Red Sea (GRIEVE AND MILLINGTON 1999; BAHA EL-DIN 2001). Numbers of weekend and casual urban visitors to once isolated beaches, islands and reefs have increased as old urban centres have expanded or new ones have been established along the coasts, with access to offshore islands made easier by the availability of high-powered boats.

In some countries, such as Saudi Arabia, access to islands is forbidden and controlled by the coastguard in order to reduce human pressure on sites important for biodiversity. However, disturbance by tourists and recreational users (and fishermen) still occurs (SHOBRAK 2001). Even relatively brief visits to breeding seabird colonies by wildlife-aware tourists, with no deliberate interference, can cause significant disturbance to nesting birds and result in lowered reproductive success (GREAT BARRIER REEF MARINE PARK AUTHORITY 1997).

Other causes of disturbance

On some Red Sea islands fishermen have established semi-permanent dwellings or erected summer camps leading to disturbance of nesting seabirds. Sheep and goats are also kept on some islands and these have been known to disturb breeding seabirds and trample nests and eggs (SHOBRAK 2002b).

5.2 Human exploitation of seabirds

Egg collecting

Collection of seabird eggs for human consumption is a traditional activity among fishermen in the RSGA Region (SHOBRAK et al. 2002). In the past, seabirds' eggs formed an important addition to the diets of fishermen and coastal populations (GALLAGHER et al. 1984), and this is still the case today, particularly in areas with low fish stocks or among poorer communities. Soldiers stationed on islands with seabird colonies also take eggs to supplement their diet. Today, any known offshore breeding site is easily accessible with the availability of powerful motors fitted to even small boats in most countries in the Region.

Egg collecting is not uniform across the Region. In Saudi Arabia, evidence indicates a decline in egg collecting among fishermen and local people, whilst in Egypt the situation is not clear (BAHA EL-DIN 2003). The activity still occurs in Sudan, is reported to be common in Djibouti and is considered severe in Somalia, where the economic situation has probably led to an increase in the activity in recent years (WELCH AND WELCH 1998; SHOBRAK 2002; SHOBRAK et al. 2002a, 2002b). In Yemen, egg collecting is still practiced and could be significant on the mainland but in the Socotra Island Group, where eggs and chicks were an important food during the monsoon season, it has been largely abandoned due to improved availability of imported foods and the difficulty and risk of collecting from cliffs and islets (TALEB 2002; JENNINGS 2003).

The impact of egg collecting has not been well documented in the Region but it is clear that the combined impacts of fishermen and soldiers may significantly affect the distribution and overall breeding success of seabirds. The numbers of eggs collected may be significant even where small numbers of collectors are involved.

In Yemen, fishermen have been observed eating Socotra Cormorant and Persian Shearwater chicks (TALEB 2002).

Hunting and trapping

None of the national seabird reports indicated serious hunting of adult seabirds in RSGA countries for food or for sport. This is probably because of the wide availability of cheap poultry and the generally poor taste of seabird meat. However, shooting/trapping of terrestrial birds such as warblers, orioles, shrikes, wheatears and robins for food in coastal areas and on islands of southern Saudi Arabia and Yemen is a common practice during their spring migration, and there

is always a risk that some seabirds may be caught accidentally in nets or 'limed' vegetation at the same time.

5.3 Introduced predators and invasive species

The introduction of alien species into new environments, especially onto islands, has probably had the single biggest impact on seabird populations on a global scale (MOORS & ATKINSON 1984; ATKINSON 1985; PRIMACK 1993; BURGER & GOCHFIELD 1994). A variety of predators, chiefly mammals, deliberately or accidentally brought to the islands of the RSGA, threaten nesting seabirds, especially ground nesting species. They may prey on eggs, chicks and, if possible, adult birds. Several other species that have spread into the Region due to land use changes and possibly climate change also pose a direct threat. The impacts of mammalian predators may not be serious in population terms if there is a surplus of suitable mammal predator-free islands for nesting. However, it is not known if this is the case for any seabirds in the Region. Furthermore, expansion of predators may eventually deplete such sites so that, even if predation does not limit seabird populations now, it may do so in the future, potentially leading to a rapid and catastrophic population crash.

Introduced mammals

Introduced mammalian predators were reported to cause severe impacts on breeding seabirds in all RSGA countries (PERSGA/GEF 2003a). Fishermen or coastguards deliberately brought cats and dogs to offshore islands, whereas rats and mice were probably introduced accidentally.

A severe infestation of rats was reported on Darsa Island in the Socotra Island Group resulting in heavy mortality among Sooty Gull chicks and the abandonment of the breeding colony. High populations of island rats have led to the introduction of cats on some Red Sea islands when military bases have been established (NEWTON & AL SUHAIBANI 1996; PERSGA/GEF 2003a). In Sudan, rats appear to be the main mammalian predator in the coastal areas and islands.

The White-tailed Mongoose (*Ichneumia albicauda*) is probably the principal reason ground nesting seabirds do not occur on certain islands in the Red Sea and it has been shown to have a severe adverse effect on the breeding success of the Osprey in the Farasan Islands (FISHER 2001). Similarly, the introduction of the Lesser Indian Civet Cat (*Viverricula indica*) to Socotra along with feral cats resulted in the disappearance of ground nesting seabird species, apart from a small number of Saunders Little Tern (AL-SAGHIER 2000).

Invasive species

The spread of the Indian House Crow (*Corvus splendens*) to all major cites and many small villages along the RSGA coast, and recently to offshore islands such as the Socotra Island Group, poses a major threat to breeding seabirds and is a cause of deep concern among the local conservation community (AL-SAGHIER et al. 1999; SHOBRAK et al. 2002a, 2002b). In the last ten years the range and population of this species has expanded dramatically to cover all coastal habitats along the Red Sea and parts of the Gulf of Aden (in the Red Sea it is believed to have first arrived at Port Sudan).

The species will prey on other birds' eggs and chicks, is a strong competitor for food, is highly adaptable, a strong flier and breeds quickly. In 1996 a pair was transported by ship to Socotra and within three years there were 26. Trapping and shooting have proven relatively unsuccessful. An attempt at control in the Yemeni city of Aden in the mid 1980s killed 250,000

birds but the population recovered within a few years. Destroying chicks while in the nest may offer a more effective population control technique. Along with mainland seabird nesting sites, islands close offshore are the most vulnerable and have been targets of Indian House Crow predation (SHOBRAK 2002; AL-SAGHIER 2002a).

As yet there is no evidence that breeding seabirds on Socotra have been affected (although terrestrial species have been predated) and a control campaign has had some success (AL-SAGHIER 2000). However, if the species does become well established, breeding colonies of Brown Booby (*Sula leucogaster*), Masked Booby and Socotra Cormorant could suffer heavy losses.

5.4 Habitat destruction and degradation

The Region's seabirds are threatened by a direct destruction of nesting and feeding sites, particularly by uncontrolled development, and indirectly through a gradual degradation of their key habitats through a variety of human activities.

Land use change and uncontrolled economic development

In recent years there has been an enormous surge in development of urban, industrial and tourist areas along some parts of the Red Sea and, to a lesser extent, Gulf of Aden coasts. This has been associated with an inevitable increase in transport infrastructure such as roads and ports. Over the past three decades Saudi Arabia has undergone a rapid transformation into a modern industrialised country (PERSGA/GEF 2001). By the mid 1990's, over 15.2 % of the population were living along the Red Sea coast (MINISTRY OF PLANNING 1995), and a considerable number of large scale projects - recreational facilities, hotels and restaurants - had been developed, particularly around the Jeddah area.

Development in some countries has been undertaken with little planning, control or foresight and usually without any form of environmental impact assessment conducted prior to construction. In many cases this has led to the direct destruction of seabird nesting sites and, to a lesser extent, feeding areas. In Egypt, for instance, the national policy to shift the concentration of population from along the Nile to Red Sea coastal areas has led to the loss of large areas of coastal and reef habitats through the development of urban infrastructure. In addition, construction of associated roads has altered surrounding hydrology, impacting mangrove stands along the Egyptian Red Sea coast.

The attractive marine life and favourable climate have encouraged the rapid development of a major tourist industry on the coasts of the Red Sea. Tourism in Egypt, a large proportion of which is nature-based, represents the main economic activity along the Red Sea coast and is a growing sector in the nation's tourism industry (PERSGA/GEF 2001). Large expanses of the coast have been developed into beach resorts, particularly around Hurghada and Sharm el Sheikh but also at Dahab, Nuweiba and Taba on the Gulf of Aqaba coast, at Safaga and Quseir on the Red Sea coast, and along the northern sector of the Gulf of Suez. It has been reported that areas such as Hurghada and Sharm el Sheikh have been developed and exploited beyond their ecological and social carrying capacities and are already showing signs of environmental degradation, even in protected areas such as the Ras Mohammad National Park in Egypt. Tourist pressure has already caused a negative impact on breeding terns on some inshore islands (HOATH et al. 1997) and a similar situation is reported on Moucha and Maskali Islands protected area in Djibouti (SHOBRAK et al. 2002a).

Development does not need to occur at an actual breeding site to have an impact. The increased noise, pollution, visitor disturbance, and predation by cats and rats from nearby developments can lead to nesting sites being abandoned. For instance, urban expansion on the mainland has caused breeding failure of seabirds at the nearby Sa'adadin (Saad ad-Din) Islands. Similar situations have been recorded from the Moucha and Maskali Islands off Djibouti, Zuqar Island, the Hanish Islands, and Al-Zubayr Island off Yemen (some of these due to occupation by military bases).

Habitat degradation

Many coastal marine habitats such as shallow bays, mangroves and seagrass are of considerable importance to the seabirds of the Region because they are key feeding grounds or habitats. Seagrass beds are particularly important because they occur in shallow and sheltered waters throughout much of the Region and their productivity is greater than comparable areas of both coral reefs and mangroves. Many species of fish and crustaceans, including commercially important species, use seagrass beds as nursery grounds. Seagrass beds are therefore a major feeding habitat for nesting seabirds, especially terns and gulls, but their location in shallow waters close to the shoreline renders them susceptible to urban, industrial, tourism, and fishing related impacts. These problems are compounded by a lack of awareness about the importance of seagrasses, and a lack of information on their distribution. Although seagrass beds are legally protected from trawling, they are destroyed by illegal trawling due to poor law enforcement.

Mangroves are also important for seabirds as they are nurseries and feeding grounds for many marine fish and crustacean food sources. However, they are also subject to significant degradation and are, therefore, themselves the subject of a PERSGA RAP (KHALIL 2003). Although there are still healthy stands of mangroves fringing many parts of the RSGA coasts and islands, particularly in the southern Red Sea, many areas are threatened by overgrazing of livestock such as camels and extensive cutting and collection for firewood (PERSGA/GEF 2001). Apart from damage to mangroves around urban areas, establishment of military bases (which has increased in recent years) and new settlements of fishermen, have led to a dramatic increase in fuel wood collection and damage to fragile vegetation on some islands in the Region. Wood may also be cut for construction purposes and fish traps. In addition, the damming of rivers and wadis has reduced natural freshwater inputs to the coast and degraded mangrove stands, and causeways constructed across bays have reduced the tidal exchange of seawater leading to extensive mangrove death.

The number of shrimp farms is growing in the Region and this poses a potential threat to marine life including seabirds. Shrimp farming activities are often very damaging to the ecological equilibrium of neighbouring lagoons. Shrimp farms are usually sited in low tide and mangrove areas and inevitably affect these fragile ecosystems.

In addition to direct destruction of coastal areas, suspended fine sediments from dredging and infilling operations in shallow water areas, excavation of artificial lagoons, construction of huge marine structures and coastal mining and quarrying can inflict widespread damage to important seabird feeding habitats many kilometres from the source.

5.5 Pollution

Pollution in the Region comes from oil production and transportation accidents, sewage discharges and the disposal of solid, industrial and agricultural waste, all of which impact on seabird populations. The situation may be made worse by inadequate or insufficient use of Integrated Coastal Zone Management (ICZM) and Environmental Impact Assessments (EIAs), together with the lack of national environmental strategies and action plans in some RSGA countries. Such measures could help considerably to reduce pollution from land-based sources.

Pollution in small or semi-enclosed seas where there is little water exchange, such as the Red Sea, can cause severe damage to the marine environment. The situation is most serious in the Gulf of Aqaba where retention time of the water is about two years. Hence, the pollutants that enter the Gulf will remain, with little dispersion, for long periods of time and consequently will have particularly detrimental effects on marine life and habitats.

Oil pollution

Oil pollution is major hazard to the RSGA environment. Much of the world's crude and refined oil cargoes pass through the Region, with between 20,000 and 35,000 oil tankers entering the Region each year (PERSGA/GEF 1998); thus the likelihood of an accidental oil spill is high. The Red Sea receives 6,836 mt or 14.61 kg of oil per square kilometre per year from shipping (AWAD 1995). Dirty ballast water dumped from ships results in the formation of tar balls and these have been found along the coastline of both the Red Sea and Gulf of Aden (RUSHDIE et al. 1991; EC & MFW 1995; PERSGA/GEF 2001). Globally, average pollution from oil refineries amounts to 0.56 kg per square kilometre per year, whereas the Red Sea receives 6.64 kg per square kilometre per year, nearly 11 times higher.

The impact of oil on seabirds and other marine life can be devastating as evident from major spills in other parts of the world (for example, see review by NISBET 1994), and the RSGA Region has had its fair share of 'tragedies'. In 1960, for instance, more than 800 Socotra Cormorants were found near Aden killed by oil pollution (GALLAGHER et al. 1984). Although there has been no formal assessment of the recent Limburg oil spill that occurred between Al Mukalla and Bir Ali in the Gulf of Aden, a tour party reported that beaches were badly fouled with oil and covered with thousands of feathers (JENNINGS 2003).

Although oil pollution mostly affects diving birds such as cormorants, auks and divers, it can also cause damage to other seabirds at various stages of their life cycle. Large numbers of adults can be killed by oil-fouling and washed up oil can have a severe impact on flightless chicks on beaches near the colonies. Oiling of eggs by contaminated incubating birds can also cause serious problems (FREEDMAN 1989). Oil spills also affect seabirds indirectly through the food chain, as toxic hydrocarbons can damage the ecosystems which support the birds' food resources, and can disrupt the breeding cycles of prey fish species.

Sewage

Sewage is an important environmental problem in some parts of the Region. Sewage is generally only treated from major urban areas and many, if not most, of the treatment plants along the Red Sea and Gulf of Aden are overloaded and inadequate. Most small towns and many tourist facilities along the Red Sea and Gulf of Aden discharge directly to the sea, although this varies by country and location. Considerable amounts of sewage are also discharged directly into the Red Sea and Gulf of Aden by cargo vessels, tour boats, ferries and private yachts, which typically do not store sewage for later treatment on land.

In high concentrations sewage can negatively impact fish and invertebrates in important feeding areas for seabirds, such as mudflats, and can kill off mangroves. However, overall impacts on seabirds are likely to be slight, or even beneficial for some scavenging species, such as gulls.

Solid, industrial and agricultural wastes

Solid waste is another (largely indirect) threat to breeding seabirds in coastal areas and islands of the RSGA Region. This originates from domestic and industrial materials washed out to sea, thrown overboard from ships, or deliberately dumped from land. Solid waste washes up on nesting beaches causing a particular hazard to young birds and chicks, and may entrap adult birds while foraging. There is also the possible threat of leaks from landfill sites situated near the coast. In some countries, wetland and marine areas are often favoured areas for dumping of building wastes. Solid waste is considered a particular problem in most countries, where beaches and near-shore reef and seagrass areas are heavily polluted by discarded plastic and other refuse materials.

Coastal industries in the Region include power and desalination plants, oil refineries, petrochemical plants, tanning factories and fertilizer and food manufacturers, as well as loading and transport facilities. These industries and their effluents (oil, organic pollutants, heavy metals, large amounts of heated brine and chlorinated cooling water) are considered important problems in every country of the Region and are often major polluters. Problems are likely to be most severe where there are particular concentrations of industries, such as along the Jordanian coastline of the Gulf of Aqaba, around the Jeddah and Yanbu areas in Saudi Arabia and in the Suez area. Regulations governing acceptable levels of industrial discharges into the coastal and marine environment are inadequately enforced in the Region and the resulting impact on the marine ecosystems of the RSGA and the region's seabirds in particular is poorly known.

Fertilizer and pesticide residues are discharged into the RSGA as a result of agricultural run-off, probably most often as concentrated bursts following rain when wadis (dry river beds) fill. The effects of these discharges on seabirds are most likely to be indirect through poisoning of prey species and disruption of the food chain. Extensive use of pesticides, insecticides and herbicides for agriculture and other purposes is known to occur along the coasts of Sudan, Yemen and Somalia. For instance, potential hazards along Sudan's Red Sea coast include effluent from the Tokar Delta Agricultural Scheme and the country's Locust Control Programme, which is probably the largest in Africa and the Middle East.

5.6 Impact of fisheries

Over-fishing

Despite the importance of fisheries to national economies, the status of fisheries in some nations of the Region is not well known because of deficiencies in stock assessments and incomplete fisheries statistics. However, over-fishing has been documented as one of the threats to the living marine resources in all countries of the Region (PERSGA/GEF 2001). Apart from fish, catches of lobster and strombids have declined, cuttlefish stocks have collapsed and there is evidence that shrimp populations (a major food source for many seabirds) are being depleted.

In Yemen, over-fishing is a particular problem. This is attributed to badly monitored foreign vessels trawling close to shore causing massive damage to coral reefs and shallow waters; shrimp fishing, particularly at khawrs and bays near Kamaran Island, the islands around Hodeidah (Al-Hudaydah) and islands close to the border with Saudi Arabia; and trawling in

shallow waters using fine nets which harvest most small fish (important food sources for seabirds). Collectively, these practices are causing massive depletion of the fish stocks. Unsustainable and environmentally damaging fishery practices impacting seabirds have also been recorded in Egypt (BAHA EL DIN et al. 2003) and Saudi Arabia (TATWANY et al. 1995). It is also believed that an increase in poverty among coastal communities in most of the RSGA countries has led to an increase in the numbers of fishermen, causing extra pressure on marine resources.

Studies in the Farasan Islands, Saudi Arabia, have shown that terns tend to feed in water close to their nesting colonies (SWEET 1994; SIMMONS 1994) and the same is true for many other seabird species (see Annex 2). Consequently, unsustainable fishing activity around islands in the RSGA is likely to adversely impact the breeding success of their seabirds.

Ultimately, indiscriminate over-fishing, destruction of spawning, nursery and feeding grounds, inappropriate resource use and inadequate fisheries regulations, coupled with poor law enforcement not only affect seabird populations through reduced food supplies but threaten the livelihoods of a wide range of people engaged in potentially sustainable activities such as artisanal fishing, aquaculture and tourism.

Incidental catch of seabirds

Long-line fishing is not considered a big problem in the RSGA Region, unlike other seas of the world where it is a major cause of mortality to albatrosses and petrels. None of the fishermen interviewed by AL-SAGHIER (2002a) in the Yemeni Red Sea reported catching seabirds using line fishing, probably, in part, because of the short lengths of line employed. Although little is known about Jouanin's Petrel it does not appear to commonly follow ships, which would put it at increased risk from long-lining.

There are reports of seabirds occasionally getting trapped in fishing nets in the Region, such as feeding flocks of Socotra Cormorant, and fishermen do sometimes kill cormorants and pelicans found in their fishing nets (GALLAGHER et al. 1984). However, numbers killed are probably low.

In general, there is a lack of data on fisheries and their impact on seabirds in the RSGA Region and research is needed at both national and regional levels.

5.7 Global warming

The now uncontested rise in global temperatures due to the accumulation of 'greenhouse gases' such as carbon dioxide and methane is predicted to have major impacts on all life on this planet. Coastal areas and low-lying islands, such as those along the RSGA, are likely to be lost to significant rises in sea level as glaciers and land-locked ice sheets in Antarctica and elsewhere melt and other physical processes intervene. Thus, important seabird nesting areas are expected to be lost leading to changes in feeding areas and possibly food sources. Exact effects are still difficult to predict, particularly at the species level, as are timescales. However, one clear example of the impact of global warming that has already occurred in the Red Sea is the bleaching and death of corals (PERSGA/GEF 2001).

5.8 Threats to individual species and key sites in the RSGA Region

The threats described above are generic in that they probably affect all the breeding seabird species of the RSGA, although their impact will differ between species and areas.

Threats to individual species

Many species, particularly the gulls and terns, are considered at high risk from a multitude of threats but some threats, notably human disturbance, introduced predators and invasive species, habitat destruction and degradation, and human exploitation are of particular concern.

Table 3 shows an attempt to quantify these threats, presenting an assessment of the degree of threat from the above activities for each of the 17 breeding seabird species in the Region. The assessments are based on analysis of the country seabird status reports, unpublished data and the opinions of experts from around the RSGA Region, but they are not based on comprehensive, detailed, quantitative research. Therefore, the predicted impacts on individual species should be treated with caution (especially for species that have been less well studied). However, it is considered that the combined assessment across all species is sufficiently reliable to give a broad indication of the likely total impact of the threats on priority species. Two points are particularly noteworthy. Firstly, these assessments are at a regional scale and the magnitude of impacts may vary considerably when assessed at smaller scales (national, local or site populations). Second, where a threat is not listed as having an impact on an individual species, this should not be interpreted as proof that there is no effect or impact, but merely that no harmful effects or impacts have been discovered so far.

Adding all values for the 17 species to obtain a total score for each threat shows that human disturbance, human exploitation, marine pollution, habitat destruction and degradation, and introduced predators and invasive species are all important threats, although marine pollution appears to be a particularly common threat. Furthermore, 'weighting' the scores according to the conservation importance of each species shows a similar ranking. Thus, the threats to important seabirds are common to other species. In turn, this indicates that focusing actions on key threats will address the conservation needs of the most important seabird species and the seabird community in general.

Threats to important sites for breeding seabirds in RSGA

Table 4 gives a similar assessment for the IBAs in the RSGA Region considered most important for breeding seabirds, identified in Section 4.4.

Table 3. Assessment of impacts of threats on individual species of breeding seabird in the RSGA Region

Key to threat scores. If threats continue as expected from current knowledge, it is predicted that RSGA population impacts will be: * = Low (occasional losses of birds and eggs but no population decline >20% over the next 20 years); ** = Serious (predicted RSGA population decline of over 20% over next 20 years); *** = Critical, (extinction as a breeding species within the RSGA Region over the next 20 years); ID = Insufficient data.

In order to assess the relative importance of the various threats a 'Threat Score' and 'Weighted Threat Score' has been derived for each threat. The former is the sum of all impact scores for a particular threat. The latter is the sum of each threat score weighted (multiplied) according to the priority status of the particular species affected. Threat scores are: Low = 1; Serious = 5; Critical = 10. Priority weightings for species (based on Table 2), are: Priority Species A = 10; B = 6; C = 3; D = 1.

Species	Priority score*	Human disturbance	Human exploitation	Habitat destruction and degradation	Pollution		Impact of fishing	Invasive/ introduced predators	Global warming	Total threat score
					Marine	Terrestrial				
Jouanin's Petrel *Bulweria fallax*	6	*	*	*	**	*	ID	*	*	**11**
Persian Shearwater *Puffinus persicus*	6	*	*	*	**	*	ID	*	*	**11**
Red-billed Tropicbird *Phaethon aethereus indicus*	3				**	*	ID		*	**11**
Brown Booby *Sula leucogaster plotus*	1	**	**	**	**	*	ID	**	*	**27**
Masked Booby *Sula dactylatra*	6	**		**	**	*	ID	**	*	**23**
Socotra Cormorant *Phalacrocorax nigrogularis*	10	**	**	**	**	*	ID	**	*	**27**
Sooty Gull *Larus hemprichii*	3	**	**	**		*	ID		*	**19**
White-eyed Gull *Larus leucophthalmus*	10	**	**	**	**	*	ID	**	*	**27**
Caspian Tern *Sterna caspia*	1	**	**	**	**	*	ID	**	*	**27**
Swift Tern *Sterna bergii velox*	6	**	**	**	**	*	ID	**	*	**27**
Lesser Crested Tern *Sterna bengalensis*	1	**	**	**	**	*	ID	**	*	**27**
White-cheeked Tern *Sterna repressa*	1	**	**	**	**	*	ID	**	*	**27**
Sooty Tern *Sterna fuscata*	1	**	**	**	**	*	ID	**	*	**27**
Bridled Tern *Sterna anaethetus*	1	**	**	**	**	*	ID	**	*	**27**
Little Tern *Sterna albifrons albifrons*	1	***	***	**	**	*	ID	***	*	**42**
Saunder's Little Tern *Sterna saundersi*	1	**	**	**	**	*	ID	**	*	**27**
Brown Noddy *Anous stolidus*	1				**		ID			**11**
Low impact		4	5	4	1	17	0	5	17	
Medium impact		12	11	13	16	0	0	11	0	
High impact		1	1	0	0	0	0	1	0	
Total threat score		**74**	**70**	**69**	**81**	**17**	**-**	**70**	**17**	
Weighted threat score		**236**	**212**	**231**	**283**	**59**	**-**	**224**	**59**	

Table 4. Preliminary assessment of impacts of threats to key seabird breeding sites in the RSGA Region

Key to threat scores. If threats continue as expected from current knowledge, it is predicted that impacts will be: * = Low (occasional losses of birds and eggs, but no site decline >20% over the next 20 years); ** = Serious (predicted population decline of over 20% over next 20 years); *** = Critical (extinction at site predicted over next 20 years); ID = insufficient data.

Site	IBA No.	Human disturbance	Human exploitation	Habitat destruction and degradation	Pollution		Impact of fishing	Introduced/ invasive species	Predicted impact of global warming
					Marine	Terrestrial			
Djibouti									
Isles des Sept Frères	DJ004	**	**	**	***	***	ID	**	
Moucha and Maskali Islands		***	***	***	***	***	***	***	*
Egypt									*
Hurghada Archipelago	EG015	***	ID	***	***	***	***	**	
Tiran Island	EG016	**	**	***	ID	ID	ID		*
Wadi Gimal (Jimal) Island	EG017	***	**		***	**	**	*	*
Qulân Islands	EG018	***	**	*	**	**	**	*	*
Zabargad Island	EG019	***		*				*	*
Siyal Islands	EG020	**	**	*	*	*	**	*	*
Rawabel Islands	EG021	**	**	*	*	*	**	*	*
Saudi Arabia				*	*	*		*	*
Al Wajh Bank	SA011	**	**	***	**	**	***	***	
Madinat Yanbu al-Sinaiyah	SA016				**	**	**	**	*
Qishran Bay	SA025	***	***	***	ID	ID			*
Umm al-Qamari	SA026	***	***	**		**	**	*	ID
Farasan Islands	SA038	**	***	**	**	**	**	**	
Somalia									*
Jasiira Ceebaad (Aibat island) and Sa'adadin Island (Jasiira Sacaada Din or Saad ad Din Island)	SO001	***	***	***	ID	ID	*	***	ID
Jasiira Maydh (Mait Island)	SO002	***	***	***	ID	ID	ID	***	ID

				Habitat destruction and degradation				species	* global warming
					Marine	Terrestrial			
Sudan									
Mukawwar Island and Dungonab Bay	SD002	***	**	***	ID	ID	ID	***	*
Suakin Archipelago	SD004	**	***	***	***	ID	***	***	*
Yemen									*
Midi - Luhayyah	YE001	**	**	***	**	***	**	**	
Islands north of Al-Hudaydah	YE004	***	***	**	**	**	**	***	*
Bahr Ibn Abbas-Ra's Isa	YE007	***	***	***	**	**	**	***	
Al-'Urj	YE010	***	**	***	**	**	**	***	*
Jaza'ir Al-Zubayr	YE012	***	**	**				***	ID
Nukhaylah-Ghulayfiqah	YE015	***	***	***	**	**	**	***	
Jaza'ir al-Hanish	YE 019	***	***	**	**	*	**	***	ID
Bab-al-Mandab-Mawza (incl. Mayun Is.)	YE022	***	***	***	***	**	**	***	*
Islands off Bir Ali	YE 030	***	***	**	*	*	**	***	ID
Jabal Ma'lih Escarpment/Badiya Qalansiya	YE036				*	*			
Ra's Momi and Fikhah	YE051							**	
Sabuniya and Ka'l Fir'awn, (Socotra)	YE 054	**	**	**			ID	**	
Abd Al-Kuri (Socotra)	YE 055	**	**	**			ID	***	ID
Al-Ikhwan	YE 056	*	*	*	*	*	ID	***	ID

6. CURRENT CONSERVATION ACTIONS FOR BREEDING SEABIRDS IN THE RED SEA AND GULF OF ADEN

6.1 International environmental initiatives covering the RSGA Region

International environmental conventions and agreements

The global conventions most relevant to the seabirds of the RSGA Region are those dealing with conservation of biodiversity, such as the Convention on Biological Diversity (CBD) and the Convention on Migratory Species (CMS or Bonn Convention) and with pollution, particularly marine and oil pollution agreements such as MARPOL 73/78. There are also several relevant regional environmental conventions, the most important of which is the Jeddah Convention (which has led to the creation of PERSGA and its current Strategic Action Programme). The ratification status of each in the RSGA Region is given in Table 5, and brief descriptions of each convention or agreement are given in Annex 5.

The various global and regional conventions and directives listed in Table 5 represent a strong basis for international co-operation among PERSGA members for the conservation of the wider environment and shared natural resources.

PERSGA programmes

As part of its Strategic Action Programme PERSGA has developed and implemented several regional and national programmes that directly benefit seabird conservation. These include:

- The development of a regional environmental monitoring programme (REMP) in co-operation with the Coordinating Unit of the Mediterranean Action Plan and the Marine Environment Laboratory of the International Atomic Energy Agency (Monaco).
- A new vessel traffic separation scheme for the southern Red Sea, initiated through PERSGA and supported by The World Bank and the United Kingdom Hydrographic Office (UKHO). This was approved by the International Maritime Organization (IMO) and came into operation in July 2003. It will make a substantial improvement to navigation safety in the Region and reduce the risk of shipping accidents and marine pollution.
- Preparation of a regional Programme of Action for the protection of the marine environment from land based activities, with the support of UNEP/GPA and the implementation of two national Programmes of Action (Egypt and Yemen), in co-operation with UNEP/GPA.
- In addition, the IMO's Marine Environment Division, in close co-operation with PERSGA, has funded the preparation of a Regional Action Plan to cover the development of National Systems and Regional and Sub-Regional mechanisms to prepare for and respond to major marine oil spills in the Red Sea and Gulf of Aden. Some initial funding through the IMO's Integrated Technical Co-operation Programme will allow this Plan to be started. The IMO will work with PERSGA to find donors who will support the full implementation of the Action Plan.

Regional legal instruments in development

Drafts of two protocols have been prepared: a Protocol on the Protection of the Marine Environment from Land-based Sources of Pollution in the Red Sea and Gulf of Aden, and a Protocol Concerning the Conservation of Biological Diversity and the Establishment of Protected Areas for the PERSGA Region.

Table 5. Ratification status of biodiversity- and marine-protection related conventions relevant to seabird conservation in the Red Sea and Gulf of Aden, as of July 2003

	Djibouti	Egypt	Jordan	Saudi Arabia	Somalia	Sudan	Yemen	Countries signed/ ratified
Global								
CBD	CP	CP	CP	CP		CP	CP	6
Ramsar	CP	CP	CP					3
WHC		CP	CP			CP	CP	4
CMS		CP	CP	CP	CP			4
AEWA	CP	CP	CP			CP		4
CITES	CP	CP	CP	CP	CP	CP	CP	7
UNESCO MAB		P				P		0
UNFCCC	CP	CP	CP	CP		CP	CP	6
UNCLOS	CP	CP	CP	CP	CP	CP	CP	7
Basel	CP	CP	CP	CP			CP	5
MARPOL 73/78	CP	CP						2
Regional								
Jeddah	CP	CP	CP	CP	CP	CP	CP	7
IGADD					P	P		0
ACCNNR	CP	CP				CP		3
Nairobi					CP			1
PPAWFEAR					CP			1
PCCCMPCEEAR					CP			1

CP = Contracting Party (has ratified or acceded to Convention), S = Signatory, P = Participating Member

Global

CBD: Convention on Biological Diversity

Ramsar: Convention on Wetlands of International Importance especially as Waterfowl Habitat

WHC: Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention)

CMS: Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)

AEWA: Agreement on the Conservation of African-Eurasian Waterbirds (Agreement under the Bonn Convention)

CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora

UNFCCC: United Nations Framework Convention on Climate Change

Basel: Convention on Control of Trans-boundary Movements of Hazardous Wastes and their Disposal

MARPOL 73/78: International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978

Regional

Jeddah: Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment, together with its Protocol concerning Regional Co-operation in Combating Pollution by Oil and Other Harmful Substances in Cases of Emergency

IGADD: Inter-governmental Authority on Drought and Development

ACCNNR: African Convention on the Conservation of Nature and Natural Resources

Nairobi: Convention for the Protection, Management and Development of the Marine and Coastal Environment of the Eastern African Region

PPAWFEAR: The Protocol concerning Protected Areas and Wild Fauna and Flora in the Eastern African Region

PCCCMPCEEAR: Protocol Concerning Co-operation in Combating Marine Pollution in Cases of Emergency in the Eastern African Region

6.2 National legislation and implementation of international agreements in PERSGA countries

Implementation of international agreements

Most countries in the region have well-established environmental legislation, although in some this legislation probably needs updating to take into account the increased pressures on the environment and threats to biodiversity of the RSGA Region in recent years. A summary list of some of the key environmental legislative instruments affecting seabirds is presented in the Regional Seabird Status Report (PERSGA/GEF 2003a) and PERSGA is currently carrying out a further detailed review of its member states' ratification and national implementation of international agreements.

Parties to the CBD are required to prepare national strategies, plans or programmes for the conservation and sustainable development of the nation's natural resources and to integrate these into other relevant sectoral and cross-sectoral plans, programmes and policies. Usually, this is achieved through National Biodiversity Strategies and Action Plans (NBSAP), or similarly titled documents. Although six of the seven PERSGA countries have ratified or acceded to the CBD, only four have so far produced NBSAPs. These are Djibouti, Egypt, Saudi Arabia and Yemen.

Site protection measures - Marine Protected Areas

Most marine protected areas (MPAs) in the region follow the IUCN multiple-use model, whereby different habitats or areas are afforded various levels of protection and use through application of a zoning plan (CHILD & GRAINGER 1990). There are only 11 established MPAs in the RSGA Region that are important for breeding seabirds, although a further 23 have been proposed, making a total of 34 MPAs. This figure is different from the number of IBAs considered important for seabirds (31) because the IBAs and MPAs do not overlap in all cases and several IBAs may be located within the boundaries of an MPA and vice versa. Many of the existing MPAs suffer from lack of resources and political interest, and have been little more than 'paper parks', although the GEF-sponsored Strategic Action Programme (SAP) has been trying to address these problems through one of its eight Components.

A list of the existing and proposed MPAs in the RSGA Region that are important for breeding seabirds is given in Table 6.

Table 6. Existing and proposed marine protected areas in the RSGA Region that are important for breeding seabirds

	Status	Size (km^2)	Breeding seabirds	Comments
Djibouti				
Moucha Island	Established		Red-billed Tropicbird, White-eyed Gull, Sooty Gull, Bridled Tern, White-cheeked Tern, Lesser Crested Tern, Swift Tern, Brown Noddy	
Maskali Island	Established		Red-billed Tropicbird, White-eyed Gull, Sooty Gull, Bridled Tern, White-cheeked Tern, Lesser Crested Tern, Swift Tern, Brown Noddy	
Isles des Sept Frères	Proposed		Red-billed Tropicbird, Brown Booby, White-eyed Gull, Sooty Gull, Swift and Lesser Crested terns.	Also has breeding Western Reef Heron, Little Green Heron, Osprey and Sooty Falcon; important for migrating raptors crossing the Bab al Mandab Straits
Egypt				
Ras Mohammed National Park	Established	480	Seabirds breed on Tiran Island and in mangroves at Ras Mohammed	Tidal flats along the Gulf of Suez coast are feeding and roosting sites for Seabirds
Nabaq Protected Area	Established			Contains most extensive mangrove in the northern Egyptian Red Sea and most northerly mangrove in the world
Gabel Elba Protected Area	Established		Seabirds said to breed on the islands and in mangrove areas but have never been adequately surveyed	Largest protected area in Egypt with largest area of mangroves in country
Wadi El Gimal-Hamata Protected Area	Established			Egypt's newest reserve, established January 2003
Red Sea Islands and Mangroves Protected Area	Established			Originally an extension of the Gabel Elba Protected Area now being managed as a separate protected area; includes the islands off the coast of Hurghada, Zabargad Island and the other islands to the south that are not part of the other protected areas and coastal mangroves from north of Hurghada south to Wadi Gimal
Saudi Arabia				
Yanbu Royal Commission Protected Area	Established	*c*. 5	Saunder's Little Tern and White-cheeked Tern	Protected by the Royal Commission through an agreement with MEPA
Umm al Qamari	Established	0.1	Swift Tern, Brown Booby and Sooty Gull	Also important breeding site for African Collared Dove, Little Green Heron, Reef Heron and Cattle Egrets
Farasan Islands	Established	3,310	Large proportion of the Red Sea's seabirds breed in the archipelago	Also important habitat for mangroves, seagrasses, coral reefs, marine mammals, marine turtles and an endemic gazelle
Straits of Tiran	Proposed			Also contains important marine turtle and dugong habitat
Ras Suwayhil	Proposed	267		Also contains suitable habitat for dugong
Sharm Zubayr	Proposed	80		Supports the northernmost mangroves in the Red Sea
Ghubbat Bal'aksh	Proposed	33		Supports coral reefs with particularly high species diversity
Al Wajh Bank (Archipelago), including Sharm Habban and Sharm Munaybirah	Proposed	2,840		The most extensive coral reef system of the entire Red Sea, diverse reef-associated fauna, seagrass beds and mangroves and a key area for dugong
Qalib Islands	Proposed			Also important for nesting marine turtles

		Size (km^2)	Breeding seabirds	Comments
Al-Hasani and Libanah Islands, including Ras Abu Madd and Sharm Hasi	Proposed			Also important for nesting marine turtles
Ras Baridi and Sharm Al-Khawr	Proposed			Most important marine turtle nesting site in Red Sea
Shi'b al-Qirin	Proposed	30		Also important for its high quality inshore reef complex
Ras Hatiba	Proposed	*c*. 450		Prime site for environmental education projects
Ash-Shu'aybah and Mastaba	Proposed	*c*. 100		
Qishran Bay	Proposed			Also important dugong habitat
Outer Farasan Bank	Proposed			Also important for nesting turtles
Khawr Itwad	Proposed	*c*. 70		
Shi'b Abu al-Liqa and Shi'b al-Kabir	Proposed	*c*. 140		Support abundant fringing corals and mangroves
Somalia				
Aibat and Sa'adadin Islands	Proposed	*c*. 300	No recent information on the avifauna in the islands, but White-eyed Gull bred in thousands on both islands during the first half of the twentieth century; Sooty Gull and White-cheeked, Swift, and Lesser Crested Terns, Brown and Masked Booby also said to occur	Contains possibly the largest coral reef area in the Gulf of Aden; Sa'adadin Island has the largest mangrove stands and coral reefs along the Gulf of Aden coast of Somalia; in addition, numerous species of Palearctic migrant waders and waterfowl, exceeding 20,000 birds, occur seasonally
Mait Island	Proposed	*c*. 1	Old records estimated 100,000 breeding seabirds, including Red-billed Tropicbird, Masked Booby, Sooty Tern and Bridled Tern; no recent information	Isolated, steep-sided granitic island
Sudan				
Mukawwar Island and Dungonab Bay	Proposed	300	Sooty Gull, White-eyed Gull, Bridled tern, White-cheeked tern	Also supports breeding colonies of Osprey, Sooty Falcon and Crab Plover; Mukawwar Island is important for breeding turtles
Suakin Archipelago	Proposed			
Yemen				
Socotra Island Group Protected Area	Established	3,626	Jouanin's Petrel, Persian Shearwater, Masked Booby and probably Socotra Cormorant	Extremely important area for marine biogeography
Belhaf and Bir Ali area	Proposed		Socotra Cormorant	
Ras Isa/Kamaran Island	Proposed		Socotra Cormorant, Bridled Tern	
Bab al-Mandab	Proposed		Common Noddy, Masked Bobby	
Sharma-Jathmon	Proposed		Sooty Gull, terns	
Hawf	Proposed		Migratory species	
Luhayyah	Proposed		Bridled tern, White-eyed Gull	

7. OVERALL CONSERVATION OBJECTIVES

The overall objective of the Regional Action Plan for the Conservation of Breeding Seabirds and their habitats in the Red Sea and Gulf of Aden Region is:

> *The conservation of the breeding seabirds of the Red Sea and Gulf of Aden Region and their habitats for the use and enjoyment of present and future human generations, and for their intrinsic biodiversity, ecological, aesthetic and other values from which human benefits accrue.*

Specific objectives

i. Prevent the global extinction of any seabird occurring in the Region

ii. Maintain existing regional and national populations within limits of acceptable change*

iii. Restore populations of threatened species to target levels*

iv. Restore degraded key habitats and sites important for breeding seabirds to target levels

* Limits of acceptable change and target levels for restoration of species populations will be set at the implementation stage of the RAP to enable consideration of available resources and priorities for action in other RAPs.

In order to meet these aims and objectives, a Framework for Action has been developed.

8. FRAMEWORK FOR ACTION

8.1 Introduction to the Framework

The Framework for Action takes an integrated multi-dimensional approach. It is based on the format developed for the Regional Action Plan for the Conservation of Coral Reefs in the Red Sea and Gulf of Aden (PERSGA/GEF 2003b), since many of the threats to the Region's coral reefs are also faced by seabirds. Consequently, there are many common objectives and actions. Furthermore, many of the actions are applicable to the conservation of other coastal species and habitats because of their shared use of the same RSGA sites and habitats. RAPs are also being produced for mangroves and marine turtles. Adopting a common approach among the RAPs reinforces the need for action, aids integration between different programmes and increases the likelihood of overall success of all plans.

The Framework for Action for breeding seabirds is constructed around seven key 'Components' that it is believed, if implemented will meet the aims and objectives set out in the previous section. These are:

1. Integrated Coastal Zone Management Planning for Seabirds
2. Education, public awareness and community participation
3. Site and habitat protection and management
4. Regulation of human exploitation
5. Research and monitoring
6. Legislation
7. Institutional capacity building and training

These key areas have been identified through consultation with seabird experts at national and regional levels and reflect recommendations set out in the Regional Seabird Status Report (PERSGA/GEF 2003a) and the national seabird status reports.

For each component, principal objectives are defined, recommended actions briefly described and priorities identified. Priorities are based on an analysis of the severity of particular threats to seabird species in the RSGA Region (Table 3), the potential impact of the action on the threat (Annex 6) and practicalities affecting implementation (such as funding constraints and opportunities, the potential for combined actions common to other RAPs, the likelihood of success and levels of public support). The priority and level of urgency for each action is indicated as:

*** = very urgent action, for example, where immediate action or intervention is required;

** = urgent action, for example, where intervention is required over the five year RAP period to ensure the continued viability of species of regional - global importance;

* = priority action, where there is an institutional set-up or there are on-going projects and opportunities for synergies with existing efforts.

Designation of a level of priority to each specific action allows a phased approach to implementation and aids budget, programme and project planning and capacity building.

8.2 General approach to implementation

Implementation

It is suggested that a RAP Steering Committee is established to promote, coordinate and integrate the implementation of this and other RAPs. The Committee should include representatives from each participating nation and the major international, regional and national organisations including PERSGA focal points, the BirdLife Middle East Office, UNEP-ROWA and UNDP. This body would oversee implementation and monitoring of the RAP and its incorporation into national policy, legislative and investment frameworks, over its initial five year period. The Steering Committee would act as the interface between government, major donor agencies and other relevant international initiatives. The Terms of Reference for the Steering Committee should be developed by PERSGA in consultation with the national focal points. In addition, a Regional Seabird Coordinator may be appointed to work within PERSGA, to direct the day-to-day implementation of the RAP.

It is not currently possible to identify national priorities, responsibilities, time-scales and budgets for implementing the proposed RAP actions as these will vary considerably between the PERSGA member countries and will need to take into account likely funding availability and the needs of other RAPs. In some cases there may be competing requirements for funding across the RAPs but in many other cases there will be opportunities for combined actions that meet multiple objectives. It is therefore proposed that national implementation priorities, time-scales and responsibilities are identified at a later stage by the RAP Steering Committee, or as part of the development of National Action Plans.

It is envisaged that regional groups and specialists will carry out the bulk of the implementation of this RAP but international exchange of knowledge and experience, including establishment of international partnerships, is considered to be important for long-term success. However, international consultants should only be involved where the required expertise is not available in the RSGA Region. Their main task will be to transfer knowledge and experience. Systems should be put in place to ensure that all data gathered by international consultants is made available to PERSGA and the participating countries. NGOs should also be heavily involved in both the design and implementation of the RAP.

In order to ensure the long-term success and sustainability of the RAP beyond its 5-year timeframe a high priority should be given to institutional strengthening and capacity building, and to the training and education of various target groups.

Funding

Financial resources are crucial for implementation of the Seabirds RAP and in the short and medium term it is likely that much of the funding will need to be sought from international donors. Although there is a high level of awareness of bird conservation needs in many potential international donor organisations, this awareness needs to be raised in many of the PERSGA member states. Thus, in the longer term the securing of funding for seabird conservation and management activities should be aided by some of the proposed awareness activities.

However, there is also an urgent need to build the capacity of many PERSGA countries to develop project proposals for efficient multi-sectoral conservation programmes. Development of practical fund raising mechanisms in PERSGA countries would allow governmental, non-governmental and community based organisations to access funding resources by identifying conservation problems, setting priorities and preparing related proposals for submission to

donors. Thus it is suggested that the following actions are taken to secure funding for this and other PERSGA RAPs

Securing funding for seabird conservation

i. Identify potential funding sources from bilateral and multilateral donor organisations, including government and inter-governmental organisations, such as ministries, endowment funds, national and international foundations, Global Environment Facility (Large, Medium and Small Grant Program), UNEP, UNDP, overseas aid agencies, non-profit organisations (WWF, IUCN, Ramsar), and private foundations. Co-funding sources should also be investigated, including the Asian Development Bank, the African Development Bank, European Union and World Bank.

ii. Develop the capacity at a national and regional level to prepare proposals which secure sole or co-funding from government and inter-governmental programmes and non-government institutions.

iii. Establish a network of environmental organisations concerned with the conservation of seabirds and biodiversity in the RSGA Region.

iv. Publish a reference guide for fundraising which lists ideas for sponsorship and provides information on successful proposals and funding sources.

v. Develop regional proposals for fundraising which address multi-sectoral and integrated conservation approaches.

vi. Establish a trust fund for long-term administration of conservation and management actions.

Indicators of success

It is suggested that internal reviews of the success of each Component in meeting its objectives, are conducted annually and an external independent assessment made after two years and again after the five year life of the RAP. It is important that all stakeholders, including NGOs and local groups, are involved in the evaluation process. To enable an objective review to be made the Steering Committee and member countries should agree a set of defined SMART (Specific, Measurable, Achievable, Realistic and Time-specific) performance indicators for each action. Data requirements to monitor implementation should also be identified and a standard format for analysis and reporting defined. General best practice principles for implementation of the RAP are given in Box 1.

Box 1. General principles for successful implementation of the RAP (after DE FONTAUBERT et al. 1996; BENITEZ et al. 2000; PERSGA/GEF 2003b)

1. Involve all stakeholders (from local communities to central government) in consultation and decision-making.
2. Ensure high levels of information-sharing and technology-transfer across all scales of implementation and among all participants.
3. Foster widespread education and awareness.
4. Strengthen institutions and implement appropriate legal instruments.
5. Develop flexible and adaptive management systems that respond quickly to changing circumstances and new information.
6. Address socio-economic issues behind resource use and environmental degradation.
7. Collect and evaluate relevant environmental and socio-economic data with a focus on obtaining answers to resource management questions.
8. Ensure adequate and sustained financing for all aspects of the RAP.
9. Ensure effective integration of all priority actions and targets within the RAP and with other relevant regional plans, such as the Coral Reefs RAP.
10. Maintain consistency of approach across all spatial scales of implementation - local and national actions should be consistent with regional and global actions and co-operation.

8.3 Component 1: Integrated Coastal Zone Management Planning for Seabirds

Concerns and needs

There is a high degree of connectedness among coastal and marine ecosystems. Effective conservation of breeding seabirds and other marine wildlife requires successful management of adjacent coastal development and use. Because most of the Region's seabirds breed and feed close to or on the coast they are particularly sensitive to changes in coastal land-use patterns and in many areas are threatened by poorly planned developments. For instance, important islands for nesting seabirds have been targeted for tourist development in the Region, especially in the northern Red Sea and more recently, in the south. Additionally, a growing number of shrimp farms are being sited in important shallow-water areas. Planning needs to take place within an ICZM programme that zones areas exclusively for specific forms of development and/or access.

Some nations in the Region, such as Saudi Arabia, Jordan and Egypt, have taken major steps towards managing their coastal zones with the implementation of ICZM plans and their integration into national development plans. With the assistance of PERSGA, other countries in the Region have also initiated the preparation of their national ICZM plans. However, even in those countries with more advanced ICZM planning, improvements can be made in co-ordination between ministries, defining jurisdictions, avoiding conflicting objectives and in execution of land-use plans.

Principal objective(s)

To implement ICZM planning for the conservation of breeding seabirds and their associated breeding, feeding, roosting and wintering habitats and sites, in all PERSGA nations. This should be supported by appropriate legislation, land-use planning, participatory approaches, socio-economic and environmental impact assessment, monitoring and enforcement.

Actions and priorities

i. Ensure that all national ICZM strategies and plans take into account seabird conservation requirements and where necessary, restrict potentially damaging activities within or in the vicinity of important breeding sites and feeding habitats (**)

ii. Develop regional and national guidelines for incorporating seabird conservation requirements into ICZM (**)

iii. Ensure potential terrestrial and marine pollution sources are adequately identified and covered in ICZM and other local plans, paying particular attention to those located near seabird nesting sites (**)

iv. Develop key demonstration sites using best practice ICZM where seabird conservation is highlighted (**)

Implementation and comments

Effective implementation of ICZM plans will reduce the incidence of inappropriate development decisions and provide an effective mechanism for sustainable long-term use of the coastal zone. The adoption of this planning and management process to support development decisions throughout the Region could significantly reduce unnecessary degradation of the coastal and marine environments and should be considered an important weapon in seabird conservation.

PERSGA is currently preparing guidelines for ICZM. It is important that these take account of the recommendations in this RAP and ensure that a precautionary approach is adopted towards any future development issues affecting seabirds and the coastal zone.

8.4 Component 2: Education, public awareness and community participation

Concerns and needs

The raising of public and government awareness of the importance of the Region's breeding seabirds and of the threats they face is crucial to their long-term conservation. PERSGA has already taken important steps in raising general environmental awareness, through regular publication of a newsletter ('*Al Sanbouk*') and other materials, and through development and enhancement of regional and national communication networks. However, there seems to have been little directed specifically at seabirds and their conservation in the RSGA.

Specific groups will need to be targeted in a seabird public awareness campaign, the most important being fishermen, local planners, tourists and tour agencies, and the military. Most fishermen are probably not aware of the laws and regulations regarding seabird collection because it has been a traditional activity and their 'rights' have never been questioned. As the level of tourism increases in the important seabird areas the level of potential threat is also likely to increase and tourists should also be made aware of the sensitivity of certain areas.

There is an important need to encourage young ornithologists in the Region who will take on the future role of research, monitoring and conservation.

Principal objective(s)

To raise government and public awareness of the Region's seabirds and their conservation through the implementation of education and awareness programmes. These should be developed for dissemination through communication networks to decision-makers, the mass media, schools, universities and local communities.

Actions and priorities

i. Produce, publish and disseminate general education and awareness materials on the importance of seabirds in the Region and the threats to them (***)

ii. Develop special awareness campaigns aimed at target groups, especially fishermen, the military and coastguards in each PERSGA country, and enlist support for the protection of nesting seabirds among fishing communities and at the highest level in the military and coastguard authorities (***)

iii. Develop strong links with key government departments for delivering important findings from research and monitoring to decision-makers (***)

iv. Develop strong links with the mass media for dissemination of major newsworthy items (***)

vii. For each country, identify and develop consultative processes with the key stake-holders with relevance to breeding seabirds (***)

viii. Develop a public awareness campaign on the effects of pollution on the terrestrial and marine environments, targeted at local decision-makers and planners, focused on areas around important seabird nesting sites (**)

ix. Increase awareness among stakeholders (fishermen, the military and developers) of the impact of introduced predators on islands with nesting seabirds, and suggest practical ways for avoiding new accidental introductions (**)

Implementation and comments

There are a multitude of approaches to education and awareness raising, ranging from talks in remote coastal communities to the distribution of materials via the internet. Several of these methods are already employed routinely within the Region (see for example FLEMING 1996), notably by NCWCD at several sites in Saudi Arabia and by Egyptian Environmental Affairs Agency (EEAA) as an integral part of the management of the Ras Mohammed National Park in Egypt. These programmes could serve as models for improving education and raising awareness in the RSGA Region. The national seabird status reports suggested that environmental education centres should be established at Moucha Island in Djibouti, the Farasan Islands Protected Area in Saudi Arabia, on the Yemeni Red Sea islands and on the island of Socotra.

Groups developing publicity materials should liaise with regional and international groups that have experience in developing avian education campaigns, such as BirdLife International, regarding the development of public awareness materials and campaigns for the Region. Active participation by local communities around important conservation areas in the early design and operation phases of education and awareness campaigns is also likely to significantly increase the chances of success.

Scientists and educators involved with the seabird conservation projects should submit articles and information to PERSGA for inclusion into the newsletter, educational materials and web pages.

Public awareness programmes should stress the linkages between healthy ecosystems and the sustainability of fisheries resources. Those directed at fishermen should focus on persuading them to fish responsibly to ensure the long-term sustainability of the seabird populations as well as the fisheries in which they operate.

8.5 Component 3: Site and habitat protection and management

Concerns and needs

As described in Section 5, many breeding sites and wider habitats important for seabirds are under particular threat in the Red Sea and Gulf of Aden. Sandy beaches and islands, rocky coasts, mangroves and seagrass beds all need protection and appropriate management. The value of protected areas for the conservation and sustainable utilisation of seabirds is well established, with economic benefits from MPAs including income generation and employment through well-managed bird tourism. Such tourism-based revenue from protected areas has proven to be a viable source of funding for seabird management and research in other parts of the world, such as some islands in the Seychelles. There is the potential for implementation of similar systems of 'users-pay' in the RSGA Region.

Over the past decade, most nations in the Region have taken important steps towards establishing MPAs, encompassing a wide variety of marine and coastal habitats and a RSGA Regional Network of Marine Protected Areas - Regional Master Plan has recently been published (PERSGA/GEF 2002).

While many of the existing MPAs in the Red Sea and Gulf of Aden do support significant populations of breeding seabirds, not all of the important sites are included, nor are all species adequately represented within these protected areas. Indeed, many IBAs important for nesting seabirds in the Region are not within officially protected areas at all (see Section 4.5). PERSGA/GEF (2003a) identify 14 sites (MPAs and IBAs) that should be considered priorities for the seabird conservation (Figure 2).

Furthermore, many if not most of the Region's MPAs are not adequately protected and do not offer sufficient safeguards to nesting seabirds. If resources are limited emphasis should be on institutional and capacity building, including resource mobilisation, to avoid designating more MPAs than can be managed.

Many seabird nesting sites can be conserved through site-specific measures such as the establishment and management of protected areas. However, seabird feeding areas are much larger and their protection is probably best addressed through habitat conservation measures. Unfortunately, there is a general lack of accurate and up-to-date information on the distribution and status of coastal habitats in the RSGA, particularly outside of protected areas and areas of key feeding habitats for seabirds have not been well identified.

Introduced predators are a particularly important threat to seabirds nesting on islands in the RSGA. However, there is little or no control over pets brought by fishermen, lighthouse keepers and military personnel to islands. There have been no recent systematic attempts to eradicate introduced predators from seabird nesting islands in the Red Sea or Gulf of Aden (the British administration formerly controlled rats and snakes on Mait Island off Somalia). Experience from other parts of the world, notably New Zealand, indicates that eradication campaigns on islands can be successful but are often costly and time consuming and need to be very thorough to succeed (VEITCH & BELL 1990; ASHMOLE et al. 1994).

The Region forms one of the major thoroughfares for international maritime traffic between Asia-Pacific and Europe, particularly for oil, most of which is transported by sea. The Region also has an abundance of reefs and narrow navigational channels and insufficient navigational markers. As described in Section 5, these factors place the Region's seabirds at high risk from potential marine pollution.

Figure 2. Priority sites for the conservation of nesting seabirds in the Red Sea and Gulf of Aden (from PERSGA/GEF 2003a)

Several important measures to minimise the impact to coastal species and ecosystems from oil spills have already been implemented, including the development of national oil spill contingency plans by Egypt, Jordan, Saudi Arabia and Sudan, the oil spill equipment stockpile in Djibouti and progress towards the establishment of the Marine Emergency Mutual Aid Centre (MEMAC) in Egypt. PERSGA has also been promoting a number of measures to reduce navigation risks and maritime pollution through Component 2 of the SAP. It is vital that further actions are taken where necessary to ensure that all measures are fully implemented and effective in the long term.

Principal objective(s)

To ensure that all the major breeding sites and wider habitats (including sandy and coralline islands, islets, rocky coasts, seagrass shallows, coastal lagoons and mangroves) used by seabirds in the Region are adequately protected and their ecological functions maintained and, where necessary, restored.

Actions and priorities

i. Review the current effectiveness of protection and management at existing MPAs important for breeding seabirds and, where necessary, enhance these to ensure adequate protection of seabird populations (***)

ii. Designate and establish all IBAs important for breeding seabirds as MPAs (Annex 4) within the context of developing integrated regional and national MPA networks (***)

iii. Ensure that Environmental Impact Assessments (EIAs) are mandatory for developments such as hotels, roads, airports, ports, shrimp farms and industrial developments, where they may impact on MPAs and IBAs, whether directly (through land-take) or indirectly (for example, by disturbance or pollution) (***)

iv. Develop a management plan for all MPAs important for breeding seabirds, and regional and national guidelines for assessment of MPA management effectiveness in conserving breeding seabirds (***)

v. Establish Site Support Groups (see below) that monitor seabird populations, habitat condition and threats in all seabird IBAs (***)

vi. Assist in developing or improving performance of existing demonstration MPA sites, identified in the SAP and Coral Reef RAP, using best management practice, paying particular attention to seabird conservation measures (**)

vii. Support the regional network of MPA managers and researchers promoting regular communication and information-sharing (**)

viii. Draft regional/national guidelines, as appropriate, for achieving sustainable sources of funding for important seabird areas (**)

ix. Produce regional and national guidelines for treating seabird conservation issues within EIAs (**)

x. Support implementation of Port State Control throughout the Region (**)

xi. Contribute to the development of the Regional Navigation Risk Assessment and Management Plan (**)

xii. Support the development and implementation of regional and sub-regional vessel traffic systems with special emphasis on avoiding areas important to breeding seabirds. Additionally, upgrade existing marine navigation aids, particularly in the vicinity of sensitive areas important for nesting, feeding and roosting seabirds (**)

xiii. Develop, upgrade and implement local, national and regional pollution contingency plans and oil spill response capacities, and ensure their adequacy for the protection of seabirds (**)

xiv. Explore alternative sources of building materials and fuel for communities living near mangrove areas (*)

xv. Control grazing access to mangrove areas and set aside selected mangrove areas for complete protection (*)

xvi. Develop 'no-fishing' zones and, where necessary, closed fishing seasons during spawning periods to protect important reproductive fish stocks, in and around MPAs and IBAs important for nesting seabirds, particularly in areas of spawning aggregations (*)

xvii. Increase the enforcement of fishery regulations to reduce and if possible eliminate illegal trawling in shallow water areas, particularly over seagrass beds (*)

Implementation and comments

There is a high degree of overlap between the recommended actions listed above and those relating to protected area and wider habitat management given in the PERSGA Regional Master Plan for MPAs (PERSGA/GEF 2002) and the other RAPs. Full implementation of these plans would also promote conservation of the Region's seabirds.

The establishment of Site Support Groups, as developed by BirdLife International for IBAs in Africa, can be an efficient and practical tool for involving local communities and stakeholders in the conservation of important sites. They may also produce effective linkages and synergies with each other, with the local administration and with external agencies. Key activities of Site Support Groups are:

- To raise awareness in local communities of the importance of the wise use of natural resources and of IBAs for the conservation of biodiversity
- To monitor the status of key species and habitats in their sites and the human activities occurring and to report illegal or destructive activities to the relevant authorities
- To start environmentally-friendly projects, clearly linked to conservation, that will help communities generate some income (for example, eco-tourism)
- To work with environmental NGOs and government agencies to rehabilitate degraded habitats, for example, by litter removal
- To provide a link to the local communities for negotiations and interventions at site level.

It is also important that a mechanism for assessing the effectiveness of MPA management, giving special regard to managing breeding seabirds, be developed for the Region.

The IUCN World Commission on Protected Areas (WCPA) has established a 'Management Effectiveness Steering Committee' to develop a system for verifying or assessing management effectiveness. This will include ongoing management of existing MPAs and the siting and design of new MPAs. As part of their work a document entitled "*Evaluating Effectiveness: A Framework for Assessing the Management of Protected Areas*" has been produced (HOCKINGS et al. 2000). A brief list of the general principles for assessment of MPA effectiveness is given in Appendix 8 of the RAP for Coral Reefs (PERSGA/GEF 2003b) and guidelines on developing management plans for MPAs in the Red Sea and Gulf of Aden are given in the Regional Master Plan for MPAs (PERSGA/GEF 2002). The BirdLife International Partnership has produced 'Guidelines for IBA Site Action Planning' as part of the development of the IBA programme for Africa (BIRDLIFE INTERNATIONAL 2001).

Restoration of degraded key habitats and sites should initially focus on IBAs and on areas required by the highest priority species. Regular clean up efforts should be made along key stretches of coast and at key seabird breeding sites, funded by oil and tanker companies using the Red Sea/Gulf of Suez route.

8.6 Component 4: Regulation of human exploitation

Concerns and needs

Although levels of egg collecting and chick harvesting have not been quantified, they are believed to have a major impact on the RSGA seabird populations. Studies in other parts of the world have shown that uncontrolled harvesting of seabird eggs can quickly lead to local extinctions and threaten the survival of a species (BURGER & GOCHFIELD 1994). Consequently,

protection of nesting seabird sites from human activities needs to be increased and made effective.

However, given the long established tradition of collecting seabird eggs (and to a lesser extent, chicks) by the Region's artisanal fishermen, it is necessary to take broader social, cultural and economic considerations into account when designing conservation measures. Moreover, the SAP for the Red Sea and Gulf of Aden states that, "Wherever possible, it [*the Action Plan for a key group such as seabirds*] should build on traditional beliefs and conservation practices". Successful models for the sustainable harvesting of seabird eggs that take account of the economic and cultural importance of harvesting to local fishing communities have been developed in other parts of the world (BLANCHARD 1994) and may be appropriate for some species and at some sites in the Region.

Principal objective(s)

To reduce to sustainable levels the collection of seabird eggs and harvesting of chicks, while preserving the traditional rights and cultures of key stakeholders.

Actions and priorities

i. Establish the feasibility of introducing sustainable harvesting of seabird eggs for common and non-declining species (*)

ii. If appropriate, according to the results of Action (i), develop guidelines for sustainable harvesting in consultation with key stakeholders and introduce a pilot scheme at a suitable site in collaboration with local fishing communities and other stakeholders (*)

Implementation and comments

The development and execution of a sustainable model for seabird egg collection in the Region would require more extensive seabird population assessment and monitoring than currently takes place. It would also require an improved understanding of the population biology and ecology of the target species.

Radical new initiatives and solutions to the current poor enforcement at seabird nesting sites may be needed and could include the hiring and training of former 'poachers' as law enforcement officers.

The success of the actions recommended above would be enhanced by a public awareness and rural development programme to improve local food supply and diet, reducing the need for seabird eggs as a supplementary food.

8.7 Component 5: Research and monitoring

Concerns and needs

Effective seabird conservation needs accurate information on the status, distribution and biology of each species gathered at regular intervals, in order to develop species protection measures for ICZM plans, MPAs and other planning exercises, and for assessment of the effectiveness of conservation management itself. Seabirds are important bio-indicators of the health of the marine environment, as they are predators at the top of the food chain. Sampling of eggs, feathers or tissues can allow monitoring of the levels of organochlorines, heavy metals and pollutants in the marine environment. Seabird monitoring could include examination of the levels of oil and plastic pollution at nest sites and give an indication of general environmental pollution. In addition, monitoring seabird populations, diets and breeding success can indicate the state and health of the fisheries in the Region.

Currently there is insufficient accurate data available on the seabirds of the RSGA and much of the information that does exist was collected outside of the breeding season or more than 10 years ago (PERSGA/GEF 2003a).

Most countries in the Region have yet to initiate seabird research. There are no systematic seabird monitoring projects and very few species-specific studies in the Region. There are major differences in logistic capacities between nations in relation to levels of finance, human capacity and expertise, equipment, and so on. This has meant that some parts of the Region have been reasonably well surveyed for breeding seabirds, for example, Egypt and Saudi Arabia, while others, notably Somalia and Sudan, have not.

Effective lobbying for conservation at government and inter-governmental levels benefits from the capacity to make realistic comparisons of the various financial costs and benefits that are attached to different courses of action. Analyses of the various economic values of seabirds, such as ecotourism, and costs of conservation, such as establishing protected areas, have yet to be properly attempted in the Region but are badly needed, especially since most governments rely on economic valuations in prioritising development options.

Since seabirds are not viewed as a priority by institutions in the Region, funding for seabird surveys generally comes from international and regional organisations. No effort has been made to attract financial sponsorship from wealthy organisations, such as oil companies. At present PERSGA is carrying out baseline habitat assessment studies in the Region, but further funding is needed to establish long-term research, monitoring and conservation activities.

Information on the extent and intensity of commercial trawling, illegal fishing, involvement of foreign vessels, and artisanal fishing in the RSGA is poor and the effect of fishing on the Region's seabirds is not well understood.

Principal objective(s)

To identify the status, distribution and ecological requirements of the Region's seabirds, to quantify threats to these and to establish national and regional monitoring schemes in relation to set habitat and species population targets.

Actions and priorities

i. Initiate research into the key aspects of seabird biology and ecology of the high-priority and poorly-known species (including Jouanin's Petrel, Persian Shearwater, Socotra Cormorant and White-eyed Gull) concentrating on areas of highest importance for management and conservation (***)

ii. Define habitat condition, species population, breeding success and survival rate targets for each seabird species (***)

iii. Conduct additional surveys in the Region to ensure that all key nesting, feeding and roosting sites for seabirds are identified, concentrating on those species, countries and areas where data are particularly lacking (**)

iv. Develop a regional system of monitoring environmental threats to seabirds, which should include routine sampling of toxin levels in eggs, discarded feathers and dead birds (**)

v. Establish a regionally coordinated, comprehensive, long-term monitoring programme at key seabird sites in the Region (IBAs) and establish national and regional reporting guidelines, to assess attainment of conservation targets and to identify sites where threats to seabirds are operating (**)

vi. Assess the status, distribution and condition of the major coastal habitats in the Red Sea and Gulf of Aden at both national and regional levels and identify degraded areas of former importance for the highest priority seabirds, that may be potentially restored. Assess the feasibility and costs of doing so (**)

vii. Determine and monitor the extent, intensity and impact of egg and chick collecting by fishermen and military personnel throughout the Red Sea and Gulf of Aden (**)

viii. Undertake research into, followed by development of, methods to reduce and ideally eliminate mammalian predators from islands with significant breeding seabird colonies, targeted at mongoose, dogs, feral cats and rats (**)

ix. Investigate the impact of fisheries practices (introduction of new technology, fisheries conservation methods, use of nets and lines) on seabird populations in the Region (*)

x. Investigate the feasibility of Indian House Crow control methods in the countries and areas where this species is established and determine the likelihood of success of intensive trapping on islands with breeding seabirds where the species occurs (*)

Implementation and comments

Consistent application of standard methods will provide scientifically robust information on seabird status for local and national management agencies and will facilitate regional and global comparisons.

Standardised methods should be made as simple and inexpensive as practicable, to be equally applicable in all nations and tailored to the conditions of the Region. PERSGA has already developed Standardised Survey Methods for the census of breeding seabirds (see Section 3.1), which could form the basis for monitoring programme methods.

It is important that the results of research, surveys and monitoring of seabirds are made readily available to key decision-makers and to the general public.

In the longer term, a region-wide, seabird ringing programme should also be established, although it is recognised that this will require extensive training programmes, since there is a shortage of qualified bird ringers in member countries.

Oil, tourism and fisheries industry bodies should be approached to establish a fund for seabird monitoring and research in the Red Sea and Gulf of Aden.

A regional survey of shrimp and cuttlefish stocks and research into the impacts of trawl fishing on the environment are currently underway.

8.8 Component 6: Strengthening legislation

Concerns and needs

Although most of the PERSGA countries have national legislation protecting the marine environment and many are signatories to international conventions concerning the conservation of seabirds, the legislation is not adequately regulated or effectively enforced. This is probably because seabirds are not viewed as a priority for management (PERSGA/GEF 2003a).

Principal objective(s)

To increase the legal protection afforded to seabirds, their breeding sites and their wider habitats in the RSGA Region.

Actions and priorities

i. Where identified as a requirement by PERSGA (see below), further develop policy and legislation frameworks to ensure effective protection of MPAs against damaging activities (***)

ii. Encourage all countries in the Region to join the CBD, CMS and other relevant global and regional biodiversity conservation and marine pollution conventions (**)

iii. Where required, further develop relevant national legislation defining safe shipping routes and passages, and if necessary, require compulsory pilotage of vessels carrying high risk cargo through critical seabird areas (**)

iv. Examine the feasibility of establishing 'Particularly Sensitive Sea Areas' around the key seabird nesting sites considered to be most at risk from ship groundings and oil spills, with the assistance of the International Maritime Organization (**)

v. Ensure ratification of relevant marine pollution conventions, such as the Basel Convention and MARPOL, by all of the Region's nations, including Eritrea (**)

vi. Review and update the conservation status of the Region's seabirds in each country's Red List/Red Data Book (**)

vii. Incorporate international 'best use' guidelines on environmental management, public participation in EIAs, conservation management, monitoring and research into national policy and legislation (**)

viii. Strengthen national and local legislation and enforcement relating to pollution from terrestrial sources (*)

ix. Introduce a ban, where appropriate, on the introduction or keeping of pets on offshore islands in the Red Sea, particularly through the military and lighthouse operating authorities (*)

Implementation and comments

PERSGA have appointed a team to review environmental legislation in each country and to provide a national report for each member state summarising its responsibilities under, and implementation of, international environmental agreements. This will be used to identify requirements for further legislation to address gaps in implementation of international agreements. The actions listed above should therefore focus on addressing such gaps.

8.9 Component 7: Institutional capacity building and training

Concerns and needs

Most nations in the Region have recently started to activate marine environmental protection as an economic security measure. However, responsibility for the marine environment is usually shared between different departments, which often creates a conflict of interests.

Most of the work carried out on seabirds in the Region (largely research) has been undertaken by international bodies or researchers. Non-governmental groups (NGOs) have not played a major role in seabird conservation and they need to be encouraged to participate.

There are a limited number of conservation experts in the Region and many of these are expatriates. The shortfall of qualified, experienced people is particularly acute at the senior management level. There is a clear need to increase manpower and strengthen skills to improve assessment, planning and management of coastal and marine environments.

Principal objective(s)

To increase the capacity of national organisations, both governmental and non-governmental, to protect breeding seabirds by the enforcement of legislation, monitoring work and research.

Actions and priorities

i. Develop capacities for day-to-day management, monitoring, surveillance and enforcement at MPAs, through training courses (***)

ii. Develop coordinated national inter-departmental policy and responses to seabird and marine conservation issues (**)

iii. Build national capacities for seabird population monitoring, research and management, in collaboration with international and national NGOs, universities and other research organisations, through training, exchange visits and other model projects (**)

iv. Encourage closer coordination among existing seabird projects and programmes in the Region to share experiences, methodology and manpower (**)

v. Assist in building national capacities for surveillance and enforcement of shipping regulations, ensuring legislation has appropriate punitive clauses for legislative breaches affecting seabirds and particularly nesting sites (**)

Implementation and comments

Significant strengthening of existing institutional arrangements is required for successful implementation of the priority actions identified in this RAP. Given the trans-boundary character of many environmental threats, co-operation and coordination among the various sectors will need to be substantially strengthened at both the regional and national levels.

Consideration should be given to establishing a ‘pool’ of regional specialists who could be sourced to undertake work in the different PERSGA countries. The ‘twinning’ of MPAs and IBAs in countries with fewer resources, such as Somalia, with wealthier ones, such as Saudi Arabia should also be considered.

Where possible, training courses should be designed and operated by groups within the Region with assistance from international experts if required. Training courses should include seabird sanctuary management, surveying and monitoring, ranger enforcement duties, and conflict resolution.

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Appendix 11

The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden

(PERSGA)

Regional Action Plan for the Conservation of Mangroves in the Red Sea and Gulf of Aden

DRAFT 27-04-2004

April 2004

EXECUTIVE SUMMARY

This Plan provides a set of priority actions for the conservation and sustainable development of mangroves and associated coastal habitats in the Red Sea and Gulf of Aden (RSGA). The Region[1] supports significant mangrove areas and associated coastal habitats of often-high ecological integrity, supporting globally significant levels of biodiversity, and providing a wide range of renewable services to human populations.

The Plan was developed in recognition of the great economic, ecological, aesthetic and biodiversity values that these ecosystems provide, and in response to the extremely high levels of threat posed by increasing human and natural impacts. These threats range from local to global and include uncontrolled coastal development, various forms of coastal and marine pollution, destructive methods of utilization, impacts from shipping and disturbances associated with predicted future climate change. Many of the Region's mangroves are growing near the climatic extremes of mangrove development, and are particularly threatened by any increase in disturbance. Over the next several decades, predicted increases in these disturbances may cause major disruptions of mangrove function and the loss of associated services provided to human populations.

In recognizing the severe level of threat, the RAP defines a set of priority actions pertaining to six major objectives aimed at ameliorating the predicted impacts to mangroves and associated coastal habitats through:

Implementation of Integrated Coastal Zone Management planning for mangroves

Education and Awareness

Marine Protected Areas

Ecologically Sustainable Mangrove Utilization

Impacts of Shipping and Marine Pollution

Research, Monitoring and Economic Valuation

Integrated Coastal Zone Management (ICZM): Many of the Region's mangroves are particularly sensitive to changes in coastal land-use patterns, including development, land-filling, raw sewage, other forms of pollution (particularly solid wastes and hydrocarbons), and alterations to wadi or mersa drainage patterns. Most nations have taken important steps towards effective ICZM, developing national strategies, plans, policies and legislation.

The Priority Objective is: Implementation by all participating nations of integrated coastal zone management planning for conservation of mangroves and associated coastal habitats, supported by appropriate legislation, land-use planning, participatory approaches, socio-economic and environmental impact assessment, monitoring and enforcement.

Education and Awareness: To be most effective, the priority actions require dedicated and continued support across all governmental and inter-governmental levels and from the public at large.

[1] The Region (capital 'R') denotes the geographical coverage of the Red Sea and Gulf of Aden region as described and delimited in Article II of the Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment, 1982.

The Priority Objective is: Raised government and public awareness through implementation of education and awareness programmes developed for dissemination through communication networks (electronic mail) to decision-makers, the mass media, schools and universities, and local communities.

Marine Protected Areas (MPAs): Establishment of a biologically interconnected network of MPAs is crucial to the long-term maintenance of mangroves and associated coastal habitats and viability of populations of endemic, rare, threatened or endangered and harvested species. Most nations in the Region have taken important steps towards developing MPAs, although considerable national differences in management capacity exist, and capacity-building in all aspects of MPAs is a priority.

The Priority Objective is: Development of 'flag-ship' demonstration MPA sites containing mangroves in each of the major sub-regional seas, as examples of effective mangrove management practices in the Region:

- Straits of Tiran (if the mangroves of the Nabq Managed Resource Protected Area are included) (Northern Red Sea, Saudi Arabia and Egypt)
- Ras Mohammed National Park (Northern Red Sea, Egypt)
- Giftun Islands and Straits of Gubal (Northern Red Sea, Egypt)
- Wajh Bank - Sharm Habban and Sharm Munaybirah (Northern Red Sea, Saudi Arabia)
- Dungonab Bay and Mukawwar Island (Central Red Sea, Sudan)
- Farasan Islands Marine Park (Southern Central Red Sea, Saudi Arabia)
- Belhaf - Bir Ali (Gulf of Aden, Yemen)
- Isles des Sept Frères and Ras Siyyan (Gulf of Aden, Djibouti)
- Socotra Islands (Arabian Sea, Yemen)
- Aibat and Sa'adadin ([Saad ad-Din], Gulf of Aden, Somalia)

With increasing MPA management capacity built during the RAP, other MPAs will join these initial sites.

Ecologically Sustainable Mangrove Utilization: The mangroves of the RSGA Region constitute essential, and traditional, sources of fodder and firewood to coastal inhabitants throughout the Region. Utilization of mangroves for fodder and firewood exceeds levels of sustainability in most areas, which places the environmental services provided by mangroves (e.g. fish nursery areas, coastal protection, bird roosting areas) at considerable risk. Ecologically sustainable mangrove utilization must be implemented to allow traditional utilization to continue without reducing the other benefits derived from mangrove areas.

The Priority Objective is: Implementation by participating nations of accurate stock assessment and monitoring, effective regulation of mangrove utilization through licensing and other methods, protected areas with "no take zones", establishing "planting for harvest" areas, and surveillance and enforcement.

Impacts of Shipping and Marine Pollution: The Region forms one of the major global thoroughfares for international maritime traffic and is also the world's largest producer and exporter of oil, most of which is transported by sea. These factors place the Region's mangroves

and other coastal and marine ecosystems at high risk of major ecological disruption through ship groundings or collisions, and other forms of marine pollution.

The Priority Objective is: Implementation by participating nations of obligations under regional and international conventions, adoption of Port State Control, improved navigation systems and oil spill response capacities above all in sensitive mangrove areas, surveillance and enforcement.

Research, Monitoring and Economic Valuation: Effective ICZM and MPA management, and sustainable mangrove utilization require the provision of accurate information on the status and trends in the components of interest, derived through management-related research and monitoring. A second crucial element of monitoring is the assessment of the effectiveness of management itself. Further, effective lobbying for conservation and development of mangroves at government and inter-government levels benefits from the capacity to make realistic comparisons of the costs and benefits that can accrue from different courses of action.

The Priority Objective is: Implementation by participating nations of standardised methods of biophysical and socio-economic survey and monitoring, data-storage, analysis and reporting, using regional (PERSGA, ROPME) and international protocols, where available.

Finally, integration and financing of the RAP is discussed, and suggested implementation and financing mechanisms are outlined.

Scope of the Plan

For each of the six priority actions, regional and national priority actions are identified, expected results, desired outcomes and time-frames are defined, performance indicators and methods of quality assurance are outlined. Each component will be coordinated at the regional level through PERSGA, in liaison with other national and international agencies. In individual countries, implementation will occur through integrated networks of national and local working groups, government departments, agencies and personnel, non-governmental organisations and other stakeholders. Designation of a level of urgency to each specific priority action in the major objectives allows a phased approach to implementation, subject to budget and available national capacity. The levels of urgency do not necessarily indicate the sequence of priority.

To assist effective implementation, a Steering Committee will be formed to coordinate the RAP over its initial period of implementation. The committee, composed of representatives from each participating nation and the major regional and national organizations, will act as the interface between government, major donor agencies and international mangrove initiatives.

Overall Objective: The conservation and ecologically sustainable development of mangroves and associated coastal habitats of the Red Sea and Gulf of Aden for the use and enjoyment of present and future human generations and for their intrinsic biodiversity, ecological, aesthetic and other values from which human benefits accrue.

INTRODUCTION

Human and natural impacts on mangroves and associated habitats and biota have continued to escalate, both globally and within the RSGA Region. Foreseeable future levels of impact by an increasing array of habitat destruction, over-exploitation, pollution, and climate change threaten the continued functioning of the mangrove ecosystem. To address this threat, this RAP represents a regional commitment, which to be effective, requires dedicated support across all governmental and inter-governmental levels and from the public at large. The process will be facilitated through coordination and integration with other programmes and conventions (see Appendix 1).

Mangroves of the RSGA Region face increasing levels of threat at national, regional and global scales. Because many mangroves are growing in environments near the extremes of mangrove development, they are particularly threatened by future increases in disturbance. Localised threats include various forms of pollution from shipping, urban, industrial and tourism developments, raw sewage, dredging and land-filling. Uncontrolled coastal developments adjacent to, or in the mangroves, have already damaged or destroyed these habitats in many parts of the Region.

At the regional level, threats to mangroves include major pollution events, such as those associated with massive oil spills, which also have serious trans-boundary implications, intensive camel grazing and firewood extraction, diversion of freshwater input and other hydrological modifications, and the developing aquaculture industry in the coastal zone.

Predicted climatic changes over the next several decades are expected to cause major changes in mangrove distribution and productivity, and lower the capacity of mangroves to recover from stress or disturbance. This loss of resilience is linked to projected increases in sea level, and in combination with impacting activities, threatens the continued existence of mangrove ecosystems in the Region.

Fortunately, through a unique combination of natural and human factors, some of the Region's mangroves remain in good to excellent condition. The Region thus provides an excellent opportunity for the implementation of a well-planned RAP, which represents a coordinated approach to conservation and sustainable development of mangroves and associated coastal habitats.

Capacities to implement the priority actions vary greatly among countries within the Region and there is a pressing need to build capacity in aspects of ICZM, MPA management, mangrove management and restoration, navigation, research and monitoring. Thus capacity-building and training programmes to improve the national human resource bases, from which the RAP will be implemented, are crucial to its overall success. It has been designed as a dynamic approach towards mangrove conservation, which requires regular evaluation and updating as conditions in regional mangroves change. If fully implemented the actions identified here will help to ensure that mangroves and associated coastal habitats continue to provide valuable ecological, social and economic services to future generations.

Background

Since its initiation in 1998, the Strategic Action Programme (SAP) has undertaken concerted actions, mainly through HBC, ICZM and MPA components, towards conservation of mangroves in the Region (Box 1). This has led in turn to the establishment of widely credited activities,

ranging from collecting and compiling an ample data set on mangrove resources and status, to capacity building and establishing demonstration projects in the different RSGA countries.

However, the SAP work also identified a knowledge gap, the need for continuously updating accurate information and, most importantly, charting of a clearer path towards a better managed mangrove ecosystem in the Region. Therefore, a decision was made to develop a dynamic long-term Regional Action Plan (RAP) for mangroves, which would not only upgrade and integrate the current efforts, but also safeguard proper mangrove management in the future.

BOX 1: SAP activities targeting mangroves

1. Mangrove areas in the Region were covered by pilot surveys, with a short inventory provided in the SAP Country Reports (PERSGA/GEF 2001).
2. The HBC component of the SAP developed Standard Survey Methods (SSM) for mangrove and inter-tidal habitats in 2001 (PERSGA/GEF 2002b).
3. The HBC component held a training course in Djibouti for regional specialists who were involved in conducting surveys using the SSM (March-April 2001).
4. The HBC component conducted a Mangrove Survey Programme using the SSM in the different RSGA countries (2001).
5. Development of a regional and five national mangrove status reports (2001-2002), based on the HBC Mangrove Survey Programme.
6. The MPA component established a regional network of MPAs in the different RSGA countries; several include mangroves. The component has recently developed a Regional Master Plan for the network (PERSGA/GEF 2002a) and individual site-specific management plans.
7. The ICZM component supports the preparation and implementation of model ICZM plans at selected sites with mangrove areas in Djibouti, Sudan, northern coast of Somalia and Yemen.
8. Several of PERSGA 's public awareness activities have concentrated on mangrove conservation (see PERSGA-SAP Annual Reports 2001 and 2002).

Framework for Action

To be most effective, actions must be prioritized and integrated into a logical framework, where strong interconnections and positive feedbacks between the key components enhance the likelihood of overall success.

This *Framework for Action* is constructed of six key components:

1. Integrated Coastal Zone Management planning for the conservation of mangroves
2. Education and Awareness
3. Marine Protected Areas
4. Ecologically Sustainable Mangrove Utilization
5. Impact of Shipping and Marine Pollution
6. Research, Monitoring and Economic Valuation

The objectives, identified through extensive consultation at the national and regional level, are consistent with initiatives already underway in the Region. For each component, priority actions are identified, expected results, desired outcomes and time-frames are defined, performance indicators and methods of quality assurance outlined. Several of the priority actions are already well advanced in parts of the Region. Designation of a level of urgency to each specific priority action in the major objectives allows a phased approach to implementation, as budget and capacity allow. Effectiveness of implementation of the priority actions can be optimized through adherence to 12 general principles (see Appendix 2). Although focusing on mangroves, this Plan relies on, and conforms with, the "Regional Action Plan for the Conservation of Coral Reefs in the Red Sea and Gulf of Aden" (PERSGA/GEF 2003a), and is applicable to associated coastal and marine ecosystems, particularly coral reefs, seagrass beds and salt marshes, in light of the strong degree of biological and ecological interconnectedness among them.

Objective independent assessment of the success of implementation of the RAP is crucial for adaptive management. This can be achieved through a coordinated approach based on use of performance indicators of results, outcomes and 'impact' of the RAP. Indicators are listed in Appendix 3.

USING THIS ACTION PLAN

The RAP addresses complex problems with complex solutions. The Executive Summary, Introduction and Background provide a general overview of the background and long-term approach, and link the plan with previous and current SAP activities targeting mangroves. Operational principles and conservation are outlined under the component headings (Integrated Coastal Zone Management Planning for Mangroves; Education and Awareness; Marine Protected Areas; Ecologically Sustainable Mangrove Utilization; Impacts of Shipping and Marine Pollution; Research, Monitoring and Economic Valuation). For each component of the RAP a priority objective, expected results, outcomes and time frames, and performance indicators have been identified. The level of urgency for each action is indicated as:

*** - very urgent action where immediate action or intervention is required, as for example to protect habitats and ecosystems under severe threat,

** - urgent action where intervention is required to ensure the continued viability of species, communities, ecosystems of regional - global importance,

* - priority action where there is an institutional set-up or there are on-going projects and opportunities for synergies with existing efforts.

It is obvious that the urgency of certain priority actions may vary among the different RSGA countries, and even between mangrove areas within the same country. For example, camel grazing is a major threat to mangroves in Djibouti, Sudan and Yemen, while in Egypt the impacts from modifying local hydrological regimes through damming of wadis, excessive groundwater pumping, and the expansion of tourist projects are more important. Thus, flexibility is needed in prioritizing the actions to be undertaken in the different countries. Categorization of priority actions suggested in this document was based on regional status. Although regional discrepancies were specifically considered, it may be necessary in some cases, to adopt other prioritization strategies to fit specific country needs or to cope with emerging issues that may appear in the future.

Time-frames under "expected results and outcomes" indicate the number of months required to achieve the respective result or outcome, provided that sufficient funds are available for full implementation. Additional details can be found in the appendices.

COMPONENT 1: INTEGRATED COASTAL ZONE MANAGEMENT PLANNING FOR MANGROVE CONSERVATION

The high degree of connectedness between coastal and marine ecosystems is well understood (e.g. KENCHINGTON 1990; KELLEHER et al. 1995). Land-based sources - industrial, agricultural and municipal wastes and run-off - account for around 70% of coastal and marine pollution, and are particularly problematic in estuaries and other partially-enclosed waters (GESAMP 1990).

Most nations in the Red Sea and Gulf of Aden (RSGA) Region have recognized that effective management for conservation of coastal and marine ecosystems, and mangroves in particular, requires successful management of adjacent coastal processes and impacts. Some national laws and regulations have been developed pertaining to protection of marine and coastal environments in the Region, including mangroves (Box 2). The RSGA countries are also signatories to several international conventions addressing the subject.

Because of their occurrence at the land-sea interface, mangroves are particularly sensitive to changes in coastal land-use patterns (SAENGER 2002). Their conservation requires appropriate integrated management, based on sound legislative frameworks, land-use planning, participatory approaches, *a priori* socio-economic and environmental impact assessments (EIA) and, where necessary, remedial actions.

Some nations in the RSGA Region have taken major steps towards managing their coastal zones, with implementation of ICZM plans and their integration into national development plans. The Kingdom of Saudi Arabia, for example, has prepared an ICZM plan for its coastal areas and a National Biodiversity Strategy and Action Plan. Egypt has developed a Coastal Zone Management Plan for the Red Sea coast defining areas of urban development, tourism development and other major infrastructure, and EIA is obligatory for any development project. ICZM plans for Sudan and Djibouti are under preparation through the Strategic Action Programme (SAP) and ICZM plans have been completed for Aden (Yemen). At the regional level, PERSGA and ROPME have organized several ICZM workshops.

> ***Priority Objective**: Implementation by all participating nations of Integrated Coastal Management Planning for conservation of mangroves and associated coastal habitats and species, supported by appropriate legislation, land-use planning, participatory approaches, socio-economic and environmental impact assessment, monitoring and enforcement.*

Actions:

i. For each country, identify the relative importance of different types of coastal and catchment development and their impact on mangroves (***)

ii. Where not already completed, develop national ICZM plans incorporating requirements for mangrove conservation in land-use planning, socio-economic and environmental impact assessments (***)

iii. Where not already completed, develop policy and legislation relevant to mangroves (***)

iv. For each country, identify and develop consultative processes with the key stakeholders with relevance to mangroves (**)

BOX 2: National laws and regulations pertaining to coastal and marine environments in RSGA countries (source: PERSGA/GEF 2001, 2003a)[2]

Djibouti: There are 31 national laws, regulations, orders and decrees addressing protection of coastal and marine environments in Djibouti, including provisions on marine pollution, protection of endangered species, designation of protected areas (Moucha and Maskali Islands; Isles des Sept Frères, Ras Siyyan), and ratification of regional and international conventions and agreements. It has been reported however, that lack of understanding and recognition at the local level greatly inhibits the implementation of the existing environmental legislation in the country.

Egypt: There are 14 national laws, regulations, orders and decrees pertaining to coastal and marine environments in Egypt. These concentrate on prevention of pollution, cleaning ports/territorial waters, fishery regulation, maritime transport, trade, navigation safety, protected areas and coastal zone management. Another set of institutional decrees ratify the country as signatory of some 22 regional and international conventions addressing the subject. Although several authorities are involved in implementing marine and coastal environmental legislation, the Egyptian Environmental Affairs Agency (EEAA), and the National Committee for Integrated Coastal Zone Management (NCICZM) are the principal players. The main objectives of the NCICZM (established in 1994) are to evaluate major projects, approve rehabilitation programmes, ensure presence of contingency arrangements, coordinate coastal activities and specify the mandates of the different authorities involved, and ensure balance between development projects and the carrying capacity of the ecosystems in the coastal zone. Among 21 sites designated as protected areas, those located on the Red Sea include Ras Mohammed, Tiran/Senafir Islets, Zaraeig-Sabkhat Al-Bardawil, Nabq, the coastal area between Al-Arish and Rafah, Abu Galoum and Jebel Elba. These include most of the Egyptian Red Sea coast and almost all mangrove areas. However, in spite of the presence of ample legislation addressing environmental protection, implementation is inadequate mainly due to lack of awareness, sufficient capacities, earnestness and coordination between different authorities.

Saudi Arabia: Twelve royal and ministerial decrees related to marine and coastal area environments have been developed. They include regulations regarding seaports and lighthouses, fisheries and living aquatic resources, pollution prevention, sewage treatment, environmental management, coastal construction and landfills, the regulatory authority of the Presidency for Meteorology and Environment (PME) and the foundation and authority of the National Commission for Wildlife Conservation and Development (NCWCD). Although several authorities are involved in guarding and implementing marine and coastal environmental legislation, PME and NCWCD are the most concerned. Twenty of the reserves suggested by NCWCD include mangroves in their territories. Of these, two are already established: the Yanbu Royal Commission and the Farasan Island MPAs. By ratifying and establishing the other proposed protected areas, a considerable number of mangrove sites along the mainland and island coasts will gain legal protection. Saudi Arabia is also a signatory to 4 bilateral or regional, and 12 international agreements and conventions.

Somalia: Somalia had, before the collapse of the central government in 1990, around 10 national decrees and laws regulating ports administration, fisheries, shipping and maritime transport. The country was also a signatory to 8 regional and international agreements and conventions. As the central government (implementing authority) has been absent since 1990 and the new entities are not recognized by the international community, this legislation is not now in effect.

Sudan: There are 27 federal and state laws and regulations related to protection of coastal and marine environments in Sudan. The country has also signed 43 regional and international agreements and conventions on the subject. According to the Federal Constitution, environmental policy and protection is a shared responsibility between the Federal Council for Environment and Natural Resources and the relevant councils in the different states. The main shortcomings in environmental legislation have been identified as a lack of updating and amending according to emerging issues, a lack of coordination between the involved authorities, soft penalties and lack of awareness and incentives.

[2] Extracted from SAP Country Reports (PERSGA/GEF 2001) and a document on national legislation (PERSGA/GEF 2003b). Refer to the original documents for further details. (Jordan is not included here as there are no mangroves on the Jordanian coastline.)

Yemen: There are 14 principal laws and decrees related to coastal and marine environments. These address environmental protection from pollution and regulate fisheries, urban planning, land tenure, construction activities, urban planning, marine affairs, shipping, ports and harbours, tourism, free zones, mining, protected areas and involved local authorities. Yemen is signatory to 11 international agreements and conventions on the subject. According to Environmental Protection Law, the Environment Protection Council (EPC) is the official government agency responsible for developing the general national policy for the environment and coordination with concerned bodies, which should adhere to, and are obliged to implement decisions, resolutions and recommendations of the EPC. Major shortcomings identified include not having any designated areas under legal protection (as protected areas) along the entire Yemeni Red Sea coast. In addition there is a lack of awareness about the importance of impact assessment and environmental protection and their link to economic development.

v. Develop regional and national guidelines for ICZM assessment with regard to environmental impacts on mangroves (**)

vi. Train national teams in conducting EIA on mangroves (*)

vii. Use ICZM best practices at key mangrove sites within the Region and develop as demonstration sites (*)

Expected Results - outcomes and time-frame:

i. National meetings to identify the relative importance of different types of coastal and catchment development and their impact on mangroves, and the key stakeholders (after 12 months)

ii. Consultative meetings among the key stakeholders to develop national ICZM plans covering mangrove ecosystems (where not already completed) and to build capacity and coordination (after 18 months)

iii. Review of ICZM plans and recommendations on amendments (where necessary) to national ICZM policy and legislation regarding mangroves (after 18 months)

iv. Publication of regional guidelines for socio-economic and environmental impact assessment (after 12 months)

v. Publication of national socio-economic and EIA guidelines (after 12 months)

vi. Training courses for national teams in conducting EIA in mangrove areas (after 18 months)

Performance Indicators and Quality Assurance:

i. Publication of regional and national guidelines for ICZM, socio-economic and environmental impact assessments

ii. Development of policy and enactment of legislative amendments

iii. Implementation of ICZM and EIA in decision making

iv. Independent assessment of the effectiveness of ICZM

COMPONENT 2: EDUCATION AND AWARENESS

The raising of public and government awareness of the importance of mangroves and of the very real dangers mangroves are facing, is crucial to their long-term conservation. PERSGA has already taken important steps in raising awareness, through regular publication of its newsletter '*Al Sanbouk*' and other material, and through development and enhancement of regional and national communication networks.

Box 3: How the mangrove *Avicennia marina* got its name

The evergreen vegetation fringing the desert landscapes of the Red Sea and the Arabian Gulf has long aroused curiosity. Already by the fourth century BC, Theophrastus (pupil of Plato and Aristotle) had described the mangroves of the Red Sea in his *Peri phyton historia* (Enquiry into Plants). At around the same time, Admiral Nearchus, the commander of the fleet of Alexander the Great, described the mangroves of Tylos, present day Bahrain, while conducting a military reconnaissance between the Indus delta and the Euphrates. Later in the eighteenth century, the Danish botanist Pehr Forsskål, one of Linnaeus' students, commenced his extended exploratory travels to the Middle East in 1761. In his *Flora Aegyptiaco-arabica* (published in 1775 twelve years after his death of malaria near Sana'a, Yemen), he first described *Avicennia marina*, the most widely distributed of all mangrove species from the Red Sea as *Sceura marina* to Latinize, but perpetuate, the Arabic name of this species - *schura*, characterizing it as '*... frequens in Insulis ad littoribus Maris Rubri ... Folia pabulum praebent Camelis, asinis, ovibus narrarunt'*. Unbeknown to Forsskål, his mentor had described a plant from India in his 1753 *Species Plantarum* as *Avicennia officinalis* - after the famous Persian philosopher-scientist of Islam, Avicenna or Ibn Sina, author of a *Book of Healing*, which was the medical authority in Europe for several centuries. Ultimately, *Sceura marina* became *Avicennia marina*, thus combining the generic name of Linnaeus, the master, with the specific name of Forsskål, the loyal student! Additionally, but quite fortuitously, the Middle Eastern connection was also maintained in the new name.

There are a multitude of approaches to education and awareness raising (see Appendix 4), ranging from talks in remote coastal communities to the WorldWideWeb. Several of these methods are already employed routinely within the Region notably by NCWCD in Saudi Arabia (see e.g. FLEMING 1996), and by EEAA (Egypt) as an integral part of management of the Ras Mohammed National Park in Egypt.

***Priority Objective**: Raised government and public awareness through implementation of education and awareness programmes developed for dissemination through communication networks to decision-makers, the mass media, schools and universities, local communities and the public at large.*

Actions:

i. Produce, publish and disseminate education and awareness materials, using electronic media, information sheets, brochures, booklets, videos, CDs and other media, and incorporate such materials into rural extension programmes in coastal areas (***)

ii. Make results of research, surveys, monitoring and economic valuations available, in suitable format, to decision makers and the general public (***)

iii. Liaise with the International Society for Mangrove Ecosystems (ISME) regarding the development of public awareness materials and campaigns for the Region (*)

iv. Develop strong linkages with key government departments for provision of findings of importance to decision-makers (***)

v. Develop strong linkages with the mass media for dissemination of major newsworthy items (**)

Expected Results - outcomes and time-frame:

i. Production of a wide range of education and awareness materials within the next 10 years

ii. Development of teaching materials for schools and universities (after 12 months)

iii. Improved links with government agencies and mass media (after 18 months)

iv. Improved media skills developed through training courses in media presentation (after 6 months)

Performance Indicators and Quality Assurance:

i. Production of education and awareness materials

ii. Demonstrable increase in government and public awareness and in mass media coverage of mangrove issues

COMPONENT 3: MARINE PROTECTED AREAS (MPAs)

The value of MPAs in conservation and sustainable development of mangroves and associated habitats is well established, both from the perspectives of conserving biodiversity and of sustaining the interconnectedness of associated coastal habitats (FORTES 1988; YAÑEZ-ARANCIBIA et al. 1993; HEMMINGA et al. 1994). These interactions may be biotic or abiotic (SAENGER 2002). Numerous case-studies have conclusively demonstrated the 'flow-on' and 'spill-over' benefits to nearshore fisheries of even small 'no-take' reserves, *provided* such reserves are not themselves exploited through ineffective policing (e.g. RUSS 1985; GALAL et al. 2002). In other instances, the sediment- and nutrient-retention functions of mangroves provide waters suitable for coral reef or seagrass development (WOLANSKI et al. 1997, 1998).

Other economic benefits obtained from MPAs include generation of employment and sustainable finances through well-managed eco-tourism. Following the successful integration of environmental protection and sustainable development along the Gulf of Aqaba, Egypt is now considering that a balance between protected areas and development along the coast of the Red Sea is the only opportunity for long-term sustainability of tourism. Entrance fees for protected areas and guided mangrove tours (e.g. in the mangroves of the Nabq Managed Resource Protected Area) are some of the measures implemented to date. Additional means of generating revenue include the establishment of non-profit conservation funds and private-sector grants.

Conservation of biodiversity is more complex, requiring the long-term maintenance of overall ecological integrity, community structure and viable populations of the species of interest (SOULÉ 1987). This may prove particularly challenging in the RSGA Region, where mangroves largely occur in small discrete areas, and where complex biogeographic patterns and the presence of partial barriers to gene flow (SHEPPARD et al. 1992; MAGUIRE et al. 2000) pose significant and unique challenges to the development of an effective regional MPA network.

Over the past decade, most nations in the Region have taken important initial steps towards establishing MPAs encompassing a wide variety of marine and coastal habitats, including mangroves (GLADSTONE 1994; KELLEHER et al. 1995). PERSGA, through the SAP has taken major steps towards the establishment of a regional network of MPAs (PERSGA/GEF 1998, 2003). Most MPAs in the Region follow the IUCN multiple-use model, where different marine and coastal habitats are afforded various levels of protection and use through application of a zoning plan (CHILD & GRAINGER 1990).

***Priority Objective**: Development of marine protected areas containing mangroves that are representative of the major sub-regional sea areas, into 'flag-ship' demonstration MPA sites, as examples of effective MPA management practices in the Region.*

Actions:

i. Identify key MPA sites, in the context of developing integrated regional and national MPA networks, with adequate representation of mangroves (***)

ii. Identify activities to facilitate the ratification of several proposed and suggested MPAs containing mangroves (***)

iii. Develop specific *management* and (where applicable) *zoning* plans for all MPAs (***)

iv. Develop capacities for day-to-day management, monitoring, surveillance and enforcement through training courses (***)

v. Assist in developing or improving performance of demonstration MPA sites, using best management practices (***)

vi. Support the regional network of MPA managers and researchers with regular communications and information-sharing (***)

vii. Foster development of policy and legislation (where required) to enshrine MPA sites containing mangroves in sound legislative frameworks (**)

viii. Draft regional and national guidelines for achieving sustainable sources of funding for MPAs with important mangrove areas (**)

ix. Develop regional and national guidelines for the assessment of MPA management effectiveness in the conservation of mangroves and their associated coastal habitats (**)

Proposed 'Flag-ship' Demonstration MPA Sites

Based on appropriate selection criteria, the '*Regional Action Plan for the Conservation of Coral Reefs in the Red Sea and Gulf of Aden*' (Appendix 8, PERSGA/GEF 2003a) identified a set of eleven key MPA demonstration sites for the Region, from all major sub-regional seas. However PERSGA/GEF (2002a) identified twelve MPA sites (Figure 1), the difference being the inclusion of the Wajh Bank (northern Red Sea, Saudi Arabia). Because of its significant mangroves, including the most northern stands of *Rhizophora mucronata*, this latter site should be included in the 'flag-ship' MPA list. Of these sites, ten contain locally to regionally significant mangrove areas, namely (from north to south):

- Straits of Tiran (if the mangroves of the Nabq Managed Resource Protected Area are included) (northern Red Sea, Saudi Arabia/Egypt) - these reef-associated mangroves comprise the most northern mangroves of the Indian Ocean realm.
- Ras Mohammed National Park (northern Red Sea, Egypt) - limited mangroves, occupying a narrow fault line, infilled with sand, a unique geomorphological setting in the Region.
- Giftun Islands and Straits of Gubal (northern Red Sea, Egypt) - these limited reef-associated mangroves comprise the northernmost stand in the Red Sea proper.
- Wajh Bank - Sharm Habban and Sharm Munaybirah (northern Red Sea, Saudi Arabia) - contains the most northerly stands of *Rhizophora mucronata* in the Indian Ocean realm.
- Dungonab Bay and Mukawwar Island (central Red Sea, Sudan) - extensive monospecific stands of *Avicennia marina* both near Mohammed Gol on the mainland and on Mukawwar Island, where camel grazing and wood harvesting need urgent management.
- Farasan Islands Marine Park (south-central Red Sea, Saudi Arabia) - extensive mangroves, containing dense groves of *Rhizophora mucronata*.
- Belhaf - Bir Ali (Gulf of Aden, Yemen) - contains the only mangroves on the Gulf of Aden coast of Yemen, including the unique *Avicennia marina* stands of the crater lake at Khor Shuran (Kharif Sha'ran)
- Isles des Sept Frères (Gulf of Aden, Djibouti) - extensive mangroves occur around Ras Siyyan, although over-exploitation and burial by drifting sand need urgent management.
- Socotra Islands (Arabian Sea, Yemen) - several extensive stands occur on the south-western coastline, sheltered by fossil coral reefs and berms.
- Aibat and Sa'adadin (Gulf of Aden, north coast of Somalia) - contain some of the most extensive stands of *Avicennia marina* and *Rhizophora mucronata* in the Gulf of Aden.

Figure 1: Map of proposed network of MPAs in the Red Sea and Gulf of Aden

The proposed demonstration MPAs are in different stages of planning and implementation, and will require different levels of support in building capacities for effective implementation of management and zoning plans, establishment of day-to-day management capacities including monitoring, surveillance and enforcement and sustained financing mechanisms. Each country is encouraged to nominate additional MPAs, principally for mangroves, as demonstration sites as these become functional. Possible examples could include the mangroves of Kamaran Island (southern Red Sea, Yemen), and Marsa Sha'ab (central Red Sea, Egypt).

Expected Results - outcomes and time-frame:

i. Development of a protocol for sustained funding for MPAs (to be published after 18 months)

ii. Development of a protocol for assessment of MPA management effectiveness (after 18 months)

iii. Identification of key MPA sites and their boundaries within the Region, with recommendations for additional sites based on biodiversity, mangrove condition, habitat distribution or other considerations, published as a regional report (after 12 months)

iv. Demonstrated assistance towards refinement and/or development of sound legislative frameworks for MPAs (after 12 months, including published legislative amendments)

v. Demonstrated enhancement of capacity in the various aspects of mangrove MPA management, developed through training courses (after 12 months)

vi. Demonstrated enhancement of communication networks and information sharing among mangrove managers and scientists in the Region, achieved through fostering both formal information exchange (workshops or conferences) and via electronic mailing lists (after 18 months)

vii. Demonstrated assistance toward improving management effectiveness and performance of the 'flag-ship' demonstration MPA sites, including appropriate policy and practice (after 30 months)

viii. Demonstrated assistance in the development of at least one additional mangrove demonstration MPA site in each signatory country using best management practice (after five years)

ix. Demonstrated assistance in the development of the integrated network of coastal MPAs at the regional level, supported by best management practices (after 10 years)

Performance Indicators and Quality Assurance:

i. Demonstrable advances in management of the initial 'flag-ship' demonstration MPA sites

ii. Independent evaluation of the management effectiveness of the demonstration MPAs (see Appendix 5)

iii. Publications on advancements in research and management of the demonstration sites in the regional MPA network, legislative frameworks and sustainable funding protocols

iv. Demonstrable improvements in information-sharing among MPA managers, scientists and other stakeholders through the conduct of workshops and publication of proceedings

COMPONENT 4: ECOLOGICALLY SUSTAINABLE MANGROVE UTILIZATION

Mangroves constitute essential, and traditional, sources of fodder and firewood for coastal inhabitants throughout the Region. Foliage of the mangrove *Avicennia marina* is most commonly used for camels, although it provides survival fodder only (FAYE 1993), being inadequate in relation to calcium, phosphorus, copper, zinc and manganese. Nevertheless, utilization of mangroves for fodder and firewood exceeds levels of sustainability in most areas (PERSGA 2003c). This places other environmental services provided by mangroves, such as fish nursery areas, coastal protection and bird roosting areas, at considerable risk. Ecologically sustainable mangrove utilization must be implemented to allow traditional utilization to continue without reducing the other benefits derived from mangrove areas.

Achieving ecologically sustainable utilization of mangroves for fodder and firewood requires regulation of these activities (e.g. through licensing, "no take" zones, surveillance and enforcement) and enrichment planting (e.g. restoring degraded mangroves and establishing "planting for harvest" areas, and monitoring). These activities will require different levels of support in building management capacities for initial stock assessment and exploitation rates, and for mangrove planting and restoration projects.

There is strong potential for well-planned mariculture of some ornamental and food species, with urgent need for development of appropriate legislation and guidelines. Aquaculture has enormous potential for production of food, alleviation of poverty, and generation of wealth for impoverished people living in coastal areas. However, there are significant problems associated with it, including the destruction of productive mangrove areas and associated coastal habitats, poor production levels, susceptibility to poor water quality and aquatic pollution, poor disease and stock control, and the inequitable distribution of the benefits derived from the industry (DE GRAAF & XUAN 1998; GESAMP 2001; SAENGER 2002).

BOX 4: Uses and functions of mangrove ecosystems

The uses to which mangrove plants are put are surprisingly diverse. Where mangrove forests are extensive the trees are often of considerable economic importance. The wood is widely used as fuel, and that of some species makes good quality lumber used in houses and boat construction, as fence posts and railroad ties. It is also harvested for manufacture of rayon. The bark is a source of commercial tannin used in tanning leather and preservation of fish nets. It is also a source of various dyes and stains. The leaves have been used as livestock feed and as "green manure" in southeast Asian brackish fish ponds. They have also been used for various medicinal purposes for humans and livestock. The fruits of some species are edible and some are sources of fish poisons (SAENGER et al. 1983).

The ecological functions of the mangrove ecosystem are far more important than the uses of the plants and forest products. Mangroves provide a buffer between land and shallow sea communities, such as corals and seagrass beds. They have excellent capacity to trap terrigenous sediments. The removal of mangroves from an area may thus bring about degradation of adjacent habitats. Mangrove roots are effective sediment binders which protect shores from waves and storms and they are often planted for erosion control (WOLANSKI et al. 1997, 1998).

The most important functions of the mangroves are those of providing food and shelter for a large group of marine fish and shellfish. Worldwide, MATTES & KAPETSKY (1988) list well over 1000 species of commercial importance from mangrove areas. Extensive mangrove forests also support a variety of terrestrial wildlife such as small mammals, reptiles and avian fauna. In the Red Sea mangroves are regarded as important nesting sites for several birds such as the Goliath heron, *Ardea goliath*, and the reef heron *Egretta gularis* (ORMOND 1980).

Traditional artisanal inshore fisheries are of great importance in many parts of the Region, and deserve high priority for sustainability, over-riding any competing commercial exploitation. This has added benefits in building co-operation among local stakeholders and managers, particularly important where the artisanal fisheries are developed in multiple-use MPAs.

Priority Objective: *Maintenance of sustainable mangrove utilization through implementation by participating nations of accurate stock assessment and monitoring of mangroves, effective regulation of mangrove utilization through licensing and other methods, protected areas with "no take" zones, establishing "planting for harvest" areas, and surveillance and enforcement.*

Actions:

i. Conduct assessments of mangrove standing stock and the rate of utilization through firewood harvesting and camel grazing (***)

ii. Develop, in marine protected areas, 'no-take' zones for protection of important mangrove areas (***)

iii. Introduce exclusion zones for camel grazing to ensure adequate mangrove growth and regeneration (***)

iv. Develop regional guidelines for site selection for mangrove restoration sites (***)

v. Establish mangrove restoration sites as demonstration projects (***)

vi. Assist in building national capacities for mangrove stock and utilization assessment and for monitoring, through training courses (***)

vii. Assist in building national capacities for surveillance and enforcement of mangrove protection regulations, particularly in relation to MPA zoning (***)

viii. Develop regional and national guidelines for responsible and ecologically sustainable mangrove utilization (**)

ix. Through liaison with other programmes and agencies, develop relevant national policy and legislation (where necessary), based on FAO and GESAMP recommendations for sustainable aquaculture development in coastal areas (**)

Expected Results - outcomes and time-frame:

i. Continued implementation of MPA zoning and other regulations incorporating 'no-take' mangrove areas (after four years)

ii. Training courses completed in mangrove management, including stock-assessment and monitoring, surveillance and enforcement, particularly in relation to MPA zoning (after 18 months)

iii. Demonstrated improvement in assessment capacity for mangrove standing stock, mangrove utilization rates, monitoring, surveillance and enforcement (after 18 months)

iv. Publication of regional guidelines for site selection for mangrove restoration sites (after 18 months)

v. Publication of regional and national guidelines for ecologically sustainable mangrove utilization (after 18 months)

vi. Publication of regional and national guidelines for ecologically sustainable aquaculture development in coastal areas (after 18 months)

vii. Establishment of a network of mangrove restoration sites as demonstration projects (after five years)

Performance Indicators and Quality Assurance:

i. Incorporation of 'no-take' mangrove areas in MPA zoning or other regulations, included in each specific MPA management plan

ii. Relevant regulations based on FAO and GESAMP recommendations for sustainable aquaculture development incorporated in national and local policy and legislation

iii. Demonstrable improvement in local and national capacities for mangrove assessment, monitoring, surveillance and enforcement

iv. Independent review of the status of mangrove utilization and restoration sites, through stock assessment and monitoring

COMPONENT 5: IMPACT FROM SHIPPING AND MARINE POLLUTION

The RSGA Region forms one of the major thoroughfares for international maritime traffic between Asia-Pacific and Europe. It is also the world's largest producer and exporter of oil, most of which is transported by sea. These factors place the Region's mangroves at high risk. PERSGA/GEF (1998) identified five major regional threats associated with shipping, navigation, petroleum transport and production:

1. Extensive risk of ship collision and grounding in major traffic lanes
2. Discharge of sewage from vessels
3. Ship discharge of solid waste
4. Oil spills from exploration, production and transport
5. Illegal disposal of toxic wastes

The sometimes-complex mazes of reefs, narrow navigation channels, insufficient navigational markers and human error have all contributed to the numerous ship groundings that have already caused damage to reefs, mangroves and associated coastal habitats in the Region.

Mangroves are particularly vulnerable to oil, both through direct toxicity from the lighter hydrocarbon fractions, and by interfering with the root ventilation systems whereby oxygen is delivered to their roots (DICKS 1986; BÖER 1993; YOUSSEF et al. 2000; SAENGER 2002).

Several important measures to minimize the impact to mangroves and other coastal ecosystems from oil spills have already been implemented, including development of local and national oil spill contingency plans. At the national level, several countries including Egypt, Jordan and Saudi Arabia have developed national oil spill response plans, and a national oil spill contingency plan for Sudan is awaiting government approval. In Egypt three oil spill response units are operational. A regional contingency plan is under preparation and a regional Marine Emergency Mutal Aid Centre is being established in Hurghada (Egypt).

***Priority Objective**: Implementation by participating nations of obligations under regional and international conventions, adoption of Port State Control, improved navigation systems and oil spill response capacities, surveillance and enforcement.*

Actions:

i. Support implementation of Port State Control throughout the Region (***)

ii. Contribute to the development of the Regional Navigation Risk Assessment and Management Plan (***)

iii. Support the development and implementation of regional and sub-regional vessel traffic systems with special emphasis on mangrove protection (***)

iv. Upgrade existing marine navigation aids, particularly in the vicinity of significant mangrove areas (***)

v. Develop, upgrade and implement local, national and regional contingency plans and assure their adequacy for mangrove protection (***)

vi. Foster development of relevant national legislation defining safe shipping routes and passages, and if necessary compulsory pilotage of vessels carrying high risk cargo through critical reef and significant mangrove areas (**)

vii. Assist in building national capacities for surveillance and enforcement of regulations, ensuring legislation has appropriate punitive clauses for legislative breaches near mangroves (**)

viii. Ensure ratification of relevant conventions, such as UNCLOS, MARPOL, Civil Liability Convention, Convention on Hazardous and Noxious Substances and Limitation of Liability, and Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (**)

Expected Results - outcomes and time-frame:

i. Implementation of Port State Control procedures throughout the Region (after three years)

ii. Contribution to the development of the Regional Navigation Risk Assessment and Management Plan (after six months)

iii. Upgrading of existing marine navigation aids in the Region, particularly in narrow reef passages and significant mangrove areas (after 18 months)

iv. Preparation (where necessary) of national oil spill contingency plans (after 18 months)

v. Development of relevant national legislation defining safe shipping routes and passages, and if necessary compulsory pilotage of vessels carrying potentially high risk cargo through critical reef and significant mangrove areas (after 18 months)

vi. Development of emergency and contingency plans incorporating trans-boundary cooperation in the event of ship grounding, collision or pollution spill into mangrove areas (after three years)

vii. Ratification of all relevant conventions (after three years)

Performance Indicators and Quality Assurance:

i. Demonstrable improvements in response capacity to shipping accidents and emergencies on reefs or near mangroves

ii. Demonstrated improvements in national capacities for surveillance and enforcement of shipping regulations with relevance to reefs and significant mangrove areas

iii. Notable reduction in the number of ship groundings, pollution spills or collisions through demonstrable compliance with relevant regulations

COMPONENT 6: RESEARCH, MONITORING AND ECONOMIC VALUATION

One corner-stone of effective mangrove management is the provision of accurate information on the present condition of the ecosystems. This data is necessary for ICZM and MPA planning, for assessment and monitoring of mangroves status, and for assessment of the effectiveness of management itself. To be most effective, research and monitoring are integrated into a logical overall framework of action providing scientifically robust management-oriented information, including data for:

1. Planning and development of MPAs, such as distribution of habitats, biodiversity and socio-economics
2. Monitoring ecosystem properties and the status of biological, ecological, oceanographic and socio-economic parameters for ICZM and MPA management
3. Environmental and socio-economic impact assessment, both before and after development takes place, and economic valuations of different courses of action
4. Assessing 'health status' of the ecosystems, such as mangroves, in terms of natural and human disturbances
5. Mangrove standing stock assessment and monitoring to assess the effects of mangrove utilization

Most nations in the Region have initiated mangrove research and monitoring programmes, although major differences exist in national logistic capacities in relation to different levels of finance, human capacity and expertise. Until recently, there had been only limited success in pooling national data to provide regional insights. This is being addressed through regional initiatives to develop standard protocols linked with extensive training programmes (see Box 5). These methods are as simple and inexpensive as practicable (ARONSON et al. 1994) in order to be equally applicable in all nations of the Region. Consistent application of standard methods will provide scientifically robust information on mangrove status to local and national management agencies, and facilitate regional and global comparisons.

With regard to disturbances affecting mangroves of the Region, monitoring data will prove valuable in alerting governments. Effective lobbying for mangrove conservation and development at government and inter-government levels benefits from the capacity to make realistic comparisons of the various financial costs and benefits that can accrue from different courses of action. Such analyses of the various economic values of mangroves and associated coastal habitats are at an early developmental stage (DIXON 1993; RUITENBEEK 1994; GILBERT & JANSSEN 1998; NICKERSON 1999). Most governments rely on economic valuations in prioritizing development options.

Priority Objective: *Implementation by participating countries of standardized methods of biophysical and socio-economic survey and monitoring, data-storage, analysis and reporting using regional and international protocols, where available and appropriate.*

Actions:

i. Conduct biodiversity, socio-economic, oceanographic and genetic assessments of key sites containing mangroves, in the network of MPAs (***)

ii. Develop regional survey and monitoring capacities, through the conduct of training courses (***)

iii. Establish and maintain a network of long-term mangrove monitoring sites (***)

iv. Develop capacity within the region to analyse monitoring data and establish reporting guidelines for the analyzed data (**)

v. Establish sustainable sources of funding to maintain the monitoring network (**)

vi. Develop the capacity to undertake economic valuations (*)

vii. Develop capacities to conduct basic and problem-oriented research on mangrove ecosystems in the Region (*)

BOX 5: Standardized research and monitoring protocols

Application of standard protocols has already facilitated national and regional comparisons, both within the Region and elsewhere, informing management agencies and raising awareness at government and inter-government levels.

In the RSGA Region, PERSGA is standardizing biological and ecological survey and monitoring methods (PERSGA/GEF 2002b). The core survey methods for mangroves and associated intertidal habitats are based on Rapid Site Assessment (RSA), permanent monitoring, and quantitative surveys. PERSGA's standard survey methods follow those developed from such international programmes as the ASEAN-Australia Marine Science Project (ENGLISH et al. 1997), and the GEF Large Marine Ecosystem Project for the Gulf of Guinea (SAENGER et al. 1996). Mangrove surveys were carried out in Djibouti, Sudan and Yemen in 2002 and the results are due to be published in a regional status report in 2004.

Data generated from the protocols (e.g. see PERSGA/GEF 2003c for regional summaries of mangrove data) will be stored and analysed in regional centres of excellence. These nodes will bear responsibility for data quality assurance, archival and reporting.

Expected Results - outcomes and time-frame:

i. Survey and monitoring training courses (after 18 months)

ii. Demonstrable increase in national capacities in research, survey, monitoring, and data analysis (after 18 months)

iii. Completion of site assessments for MPAs (after 18 months)

iv. Establishment of regional monitoring network (after 18 months)

v. Regional guidelines for reporting the analyzed monitoring data (after 24 months)

vi. Establishment of sustained funding for monitoring network (after three years)

Performance Indicators and Quality Assurance:

i. Demonstrable improvements in national and regional capacity to assess through surveying and monitoring MPAs containing mangroves

ii. Established network of long-term mangrove monitoring sites

iii. Demonstrable improvements in national and regional capacity to analyze and report monitoring data

INTEGRATION AND FINANCING OF THE RAP

This Regional Action Plan has both 'top-down' and 'bottom-up' aspects to its structure and operation. It represents a regional approach co-ordinated and supported by the regional organisations, but mostly conducted at national levels by all countries within the RSGA Region.

The Plan also aims to fulfil the regional goals of larger global initiatives for the conservation and sustainable use of mangroves, including those of the various United Nations organisations and major non-government organisations, such as IUCN and ISME.

To assist effective implementation a steering committee will be formed. It will be composed of representatives from each participating nation and the major international, regional and national organisations. The steering committee will co-ordinate the mangrove RAP over its initial three-year period of implementation. The committee will also act as the interface between government, major donor agencies and international mangrove initiatives.

Effective communication among these various bodies in relation to recent advances in methods and findings, and in presentation of a coordinated consistent 'picture' of mangrove status to the global community will assist in achieving the overall objective of the 'Regional Action Plan for the Conservation of Mangroves in the Red Sea and Gulf of Aden'.

It should be recognized that adequate sustainable financing is the single most important factor in the success or otherwise of this RAP. Although mangrove forests in the Region are mostly small, it is anticipated that, at least in some areas, if mangrove resources were efficiently managed, costs and revenues should correspond to those for other rich forests, - that is, mangrove areas would generate sufficient income for their own management. However, before being able to rely on this as a source of finance, it will be necessary to develop capacities through rehabilitation and restoration. Although costs of salaries for staff implementing the RAP in the different RSGA countries will be borne by relevant governments, a system of incentives is perhaps necessary to motivate management and ranger staff alike.

For effective RAP implementation, the mechanisms, means, criteria, and guidelines for access to mobilization of funds and utilization of financial resources must be determined. PERSGA, with support from the governments of the PERSGA member countries and international donor agencies, may possibly establish a Public Fund for Mangrove Conservation and Sustainable Use (PFMCSU). Sustainable and non-routine sources of funds may include:

- Central government budgets of RSGA countries
- International donor agencies and NGOs, e.g. GEF, UNEP, UNDP, IUCN, UNESCO etc.
- Sales of mangrove products
- Entrance fees from MPAs, and possibly entrance fees for limited camel grazing
- Licences for permission to establish stalls, take photographs, fish, conduct research
- Sales of TV documentaries, books, images, CDs etc.
- Donations and grants
- Fines from illegal activities and compensation for oil spills, mangrove destruction (e.g. for construction, e.g. private fish or shrimp farms)

BUDGET

1. Integrated Coastal Zone Management Planning for Mangrove Conservation

Budget code	Budget item
ICZM-1	Publication of regional and national guidelines for ICZM and EIA
ICZM-2	Conduct national meetings among key stakeholders
ICZM-3	Review of existing laws and regulations; development of recommendations on policy and legislative amendments
ICZM-4	Assistance in development of key demonstration ICZM sites
ICZM-5	Independent assessment of the effectiveness of ICZM

2. Education and Awareness

Budget code	Budget item
EAW-1	Production, publication and dissemination of education and awareness materials
EAW-2	Mangrove awareness campaigns
EAW-3	Conduct mass-media training courses

3. Marine Protected Areas

Budget code	Budget item
MPA-1	Establishment and upgrading of regional demonstration 'flag-ship' MPA sites containing mangroves
MPA-2	Establishment/upgrading of national demonstration MPA sites containing mangroves
MPA-3	Support for integrated network of MPAs
MPA-4	Production of publications relevant to key MPA sites containing mangroves
MPA-5	Review and refinement of policy and legislative frameworks for MPAs
MPA-6	Information exchange and meetings

4. Ecologically-sustainable mangrove utilization

Budget code	Budget item
ESMU-1	Review and upgrading of relevant laws and regulations
ESMU-2	Training in mangrove stock assessment, monitoring, surveillance and enforcement
ESMU-3	Mangrove stock assessment and monitoring in MPAs
ESMU-4	Production of guidelines for ecologically sustainable mangrove utilization
ESMU-5	Production of guidelines for mangrove restoration demonstration site selection criteria

ESMU-6	Production of guidelines, policies and legislation for sustainable aquaculture development in coastal areas
ESMU-7	Establish a network of mangrove restoration demonstration sites
ESMU-8	Independent review of MPA effectiveness in relation to mangrove utilization and restoration

5. Impact of Shipping and Marine Pollution

Budget code	Budget item
SMP-1	Support for implementation of Port State Control
SMP-2	Development of regional navigation risk assessment and management plan for reefs and mangroves
SMP-3	Establishment of regional and sub-regional vessel traffic systems with emphasis on mangrove protection
SMP-4	Upgrading of navigational aids near significant mangrove areas
SMP-5	Preparation / upgrading of oil spill contingency plans
SMP-6	Review and upgrading of relevant legislation
SMP-7	Building national capacities for surveillance and enforcement of shipping regulations around significant mangrove areas

6. Research, Monitoring and Economic Valuation

Budget code	Budget item
RME-1	Surveys and site assessments, above all in MPA areas containing mangroves
RME-2	Establishment of a monitoring network of mangrove sites
RME-3	Establishment of regional nodes for monitoring, GIS and remote sensing
RME-4	Training in economic valuation techniques
RME-5	Training in survey and monitoring of mangroves, and data analysis

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Appendix 12

The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden

(PERSGA)

Regional Action Plan for the Conservation of Marine Turtles and their Habitats in the Red Sea and Gulf of Aden

DRAFT 12-06-2004

June 2004

EXECUTIVE SUMMARY

This plan provides a set of priority actions for the conservation of marine turtles and their habitats in the Red Sea and Gulf of Aden (RSGA). All species of marine turtle have been classified as endangered and are listed by CITES in Appendix I. This region supports globally important feeding and nesting grounds for populations of green, hawksbill and loggerhead turtles in particular. Turtles are migratory; they may swim considerable distances from their feeding grounds to their nesting beaches. Recent nesting surveys carried out in Djibouti by PERSGA have discovered a migratory route from as far away as Sri Lanka. Turtle conservation requires international cooperation to be successful, both between countries and between regions.

The main threats to the maintenance of stable turtle populations are now well understood. They range from local threats at nesting beaches caused by litter or marine debris, opportunistic capture or egg removal, to global threats such fishing mortality particularly associated with trawling operations, and threats from pollution incidents.

Following a brief introduction to the marine turtles of the region and activities that have been carried out in the past to promote conservation, this Regional Action Plan addresses the primary causes of turtle mortality with a series of proposed actions. These actions include:

- identifying the populations most at risk
- reducing threats to turtle populations from commercial fisheries, land development operations, and human interference
- implementing programmes that provide alternatives to communities dependent on turtle populations for their survival or livelihood
- regulating direct capture and trade in turtles
- developing nesting beach programmes to maximise hatchling recruitment
- and promoting turtle rescue and rehabilitation along with public awareness activities.

It is recognised however that reducing the threats to marine turtle populations alone will be insufficient to guarantee their survival. Hence a further set of recommendations considers the importance of protecting and conserving marine turtle nesting and feeding habitat, research and monitoring, community education and participation in conservation activities, the capacity of national agencies to carry out the necessary management activities and to enforce legislation, and securing funding for turtle conservation measures.

An extensive reference list is supplemented with suggested additional titles and a set of useful appendices.

For each of the regional and national priority actions identified, expected results and performance indicators are defined. Designation of a level of urgency to each specific priority action allows a phased approach to implementation, subject to budget and available national capacity. The levels of urgency do not necessarily indicate the sequence of priority.

To assist effective implementation, a steering committee will be formed to coordinate the RAP over its initial period of implementation. The committee, composed of representatives from PERSGA and the major regional and national organisations, will act as the interface between governments, major donor agencies and international turtle conservation initiatives. In individual

countries, implementation will occur through integrated networks of national and local working groups, government departments, agencies and personnel, non-governmental organisations and other stakeholders.

SCOPE OF THE PLAN

This plan acknowledges that there exist a number of gaps in the knowledge of the status of marine turtles and their habitats in the Red Sea and Gulf of Aden. It draws on discussions held during the PERSGA-sponsored Sea Turtle Training Workshop held in Yemen in December 2000, the recently-completed preliminary country surveys, and previous scientific literature as the basis for determining the conservation needs and actions that will result in the sustainable management of marine turtles in the region.

The Action Plan takes its structure and recommended courses of action from both the *Conservation and Management Plan* (which was developed as part of the *Memorandum of Understanding on the Conservation and Management of Marine Turtles and their Habitats of the Indian Ocean and South-East Asia*[1]), and the *Global Strategy for the Conservation of Marine Turtles* published by the Marine Turtle Specialist Group of the IUCN Species Survival Commission.

The structure of the Plan reflects a combination of the two documents, and where possible attempts to maintain similar language for consistency. The Action Plan is designed to be implemented by the appropriate agencies in each nation with the mandate to conserve marine turtles, although it is acknowledged that in several cases marine turtles are not addressed directly in the mandates of any particular institution, and responsibilities for conservation actions outlined in the Plan may be shared among the relevant bodies.

The actions contained herein concern specific regional needs and conservation actions, but are not intended to restrict any given nation from expanding on these actions depending on individual needs and concerns. PERSGA member states may wish to develop a Memorandum of Understanding (MoU) for the conservation of marine turtles in the region along the same lines as other regional turtle conservation initiatives. (Some suitable activities may be drawn from the Indian Ocean-Southeast Asian MoU and other documents, which are included in Appendices VI-VIII for convenience and reference purposes only.)

USING THIS ACTION PLAN

The conservation of marine turtles and their habitats can be rationalized through prioritisation of activities, projects and programmes grouped into eight major categories, each of which is individually examined below. The actions listed under each of the eight main components are not exclusive, and often overlap. The main components are:

1. Reducing direct and indirect causes of marine turtle mortality
2. Protecting, conserving and rehabilitating marine turtle habitats
3. Research and monitoring
4. Public awareness, information and education

[1] The *Memorandum* is an agreement reached under the auspices of the Convention on Migratory Species which covers the Indian Ocean and its associated bodies of water.

5. Community participation in conservation
6. Building capacity for conservation, research and management
7. Integrated management for marine turtles, and
8. Funding for marine turtle conservation

In keeping with existing PERSGA documentation, this plan adheres to the format of the Regional Action Plan (RAP) for Coral Reefs in the Red Sea and Gulf of Aden, whereby key issues and actions are outlined under each component of the RAP. Time frames under "expected results and outcomes" indicate the number of months required to achieve the result or outcome, starting from the launching of the Regional Action Plan for Marine Turtles and their Habitats. The level of urgency for each action is indicated as:

*** - **very urgent**, where immediate action or intervention is required, as for example to protect habitats and ecosystems under severe threat;

** - **urgent**, where intervention is required to ensure the continued viability of species, communities or ecosystems of regional or global importance;

* - **priority**, where there is an institutional set-up or there are on-going projects and opportunities for co-operation with existing efforts.

The priority designation for each of the expected results and outcomes was devised using a number of criteria, which included the available knowledge on the effectiveness and response times for various past conservation actions, the potential immediate impacts of prescribed actions on marine turtle populations, the status of marine turtle nesting and foraging populations in the RSGA region, and the expected levels of technical input and investment of resources for the conservation of marine turtles and their habitats by the various government, research and conservation agencies.

1. INTRODUCTION

1.1 Geographical Setting

This Plan addresses the conservation of marine turtles and their habitats in the Red Sea and Gulf of Aden (Figure 1) in line with the objectives and mission of the Habitats and Biodiversity Component (HBC) of the Strategic Action Programme (SAP) for the Red Sea and Gulf of Aden. The region encompasses various distinctly different marine and coastal habitats, containing complex and unique tropical marine ecosystems with high biological diversity and many endemic species. The coastal habitats are surrounded by some of the driest land in the world, such that continental influences are limited, but the waters are major shipping lanes due to regional petroleum reserves, with high-risk bottlenecks at the narrow Bab Al-Mandab, and the Gulf of Suez. While parts of the region are still in a pristine state, environmental threats (notably from habitat destruction, over-exploitation and pollution) are increasing rapidly, requiring immediate action to protect the region's coastal and marine environment.

Figure 1. The Red Sea and Gulf of Aden region

The Red Sea is a semi-enclosed water body and a reservoir of marine biodiversity of global importance, home to the best developed coral reefs in the western Indian Ocean. It is approximately 2000 km long, and 300 km wide at its widest part, with depths that exceed 2,000 m. The Red Sea coast and islands support a variety of coastal and marine habitats. These are related largely to the oceanographic regime, degree of exposure, and topographic features, particularly the distribution of suitable antecedent topography for development of coral reefs, mangrove stands and seagrass beds. With its relative isolation, an extraordinary range of ecosystems, biological diversity and endemism has developed.

The Gulf of Aden extends between the southern reaches of the Arabian Peninsula and the African coast from Djibouti to the easternmost tip of Somalia. It is influenced by seasonal upwellings that limit coral reef development and promote planktonic and macroalgal growth. Despite this, there are many areas of biological importance, including seagrass meadows and mangrove stands. Some of the sandy beaches are major nesting sites for sea turtles, and the Socotra Island Group has been nominated as a UNESCO Man and Biosphere Reserve.

1.2 Marine Turtles in the RSGA

Marine turtles are some of the oldest surviving reptiles on the planet, and have inhabited the tropical seas and oceans for millions of years. Recently, mankind's actions, in particular in the 19th and 20th centuries, have brought many populations to the brink of extinction. Turtles appeared in the late Triassic circa 200 million years ago (PRITCHARD 1997), and have survived relatively unchanged since that time through their adaptation to marine environments. There are several key anatomical and physiological features that are common to all sea turtle species and which set them apart from other Testudines such as non-retractile limbs, extensively roofed skulls, limbs converted to paddle-like flippers, and salt glands to excrete excess salt. As is the case with other reptiles, the sex of hatchlings is dependent on temperature during incubation, particularly during the third and fourth weeks (MILLER 1985; MILLER & LIMPUS 1981).

Sea turtles and their products have been used by mankind for thousands of years as a basis for food and a host of other applications. Today, turtles also provide a range of non-consumptive benefits through tourism, education, research, and employment. Turtles are also irreplaceable ecological resources, in that they function as key individuals in a number of habitats, and can play the role of indicator species for the relative health of their surroundings. These habitats have a tangible value to society, in that they also support commercial fish and invertebrates (seagrass beds, open oceans and coral reefs among others), which are valued by mankind. Turtles can act as flagship species for conservation programmes and, because the conservation of turtles and their habitats addresses vast and diverse marine areas, they indirectly protect the complex and interconnected world on which humans depend.

Today, there are seven species of sea turtles in existence: the leatherback *Dermochelys coriacea* (Family Dermochelydae), the loggerhead *Caretta caretta*, the hawksbill *Eretmochelys imbricata*, the olive ridley *Lepidochelys olivacea*, the Kemp's ridley *Lepidochelys kempi*, the green *Chelonia mydas* and the flatback *Natator depressus* (all in the Family Cheloniidae). An eighth species, the black turtle *Chelonia agassizii* is currently the subject of debate among biologists, having first been described by BOCOURT (1868) but later disputed by BOWEN et al. (1993). Of these, the green, loggerhead and hawksbill are the most common in the Red Sea and Gulf or Aden (RSGA), with the leatherback and olive ridley infrequently seen, and with no recorded nesting. All marine turtles share a similar lifestyle (see Appendix I), which has made them relatively similarly threatened by anthropogenic activities. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) lists all marine turtles on its Appendix I (prohibited from international trade). The World Conservation Union (IUCN) lists *Caretta caretta* as Vulnerable and the remainder are listed as Endangered or Critically Endangered. Marine turtles migrate and disperse over vast distances. This makes their survival dependent on their conservation over a wide area and in a wide range of marine and coastal habitats.

Of the major nesting populations found in the RSGA, the green, hawksbill and loggerhead are the most common. The green is an herbivorous marine turtle that forages on shallow seagrass beds and usually undertakes long sea migrations to nest on isolated sandy beaches (HIRTH 1997). Excluding recent efforts by PERSGA, green turtle populations were surveyed in detail in Saudi Arabia for the first time in 1986 and 1987 (MILLER 1989). This work was followed up by the National Commission for Wildlife Conservation and Development from 1989 until 1997 (AL-MERGHANI et al. 2000; PILCHER 1999a; PILCHER & AL-MERGHANI 2000). A synopsis of all the work carried out in Saudi Arabia is presented in AL-MERGHANI et al. (2000). Green turtles were also studied in Yemen over 20 years ago (HIRTH & CARR 1970; HIRTH et al. 1973), and more

recently through a UNEP study (UNEP/IUCN 1996); in the Egyptian Red Sea fifteen years back (FRAZIER & SALAS 1984), and briefly in Somalia (IUCN 1997; SCHLEYER & BALDWIN 1999).

Hawksbills are circumtropically distributed and often inhabit coral reefs where they feed on a number of invertebrates, sponges in particular (CARR & STANCYK 1975; MEYLAN 1988). Hawksbills have been studied in Sudan (ABDEL LATIF 1980; HIRTH & ABDEL LATIF 1980), Yemen - including the islands of Socotra (FAO 1973; GREEN 1996; UNEP 1985), the Egyptian Red Sea (FRAZIER & SALAS 1984) and Saudi Arabia (MILLER 1989; PILCHER 1999b), where they are found in both the Red Sea and the Arabian Gulf, but are only known to nest in significant aggregations on one of the Gulf's small islands. These studies do not include the recent efforts by PERSGA to address the lack of data at a regional level (PERSGA 2003a-e).

Loggerheads feed predominantly on crustaceans and molluscs, and inhabit shallow water reef assemblages. They have only been studied extensively in Socotra, Yemen (PILCHER & SAAD 2000), with only minor references in other works. No other reports are available.

1.3 Critical Life-History Adaptations and their Relationship with Conservation

The physiological design and biological adaptations of sea turtles have remained unchanged for millions of years. Certain aspects of their natural history set them apart from most marine inhabitants and, when combined with modern technology and population pressures, may prove detrimental to their long-term survival.

Habitat Requirements and Threats

Sea turtles need a number of different habitats to complete their natural life cycle (NRC 1990). From eggs deposited on clean sandy beaches, to hatchlings migrating through unpolluted waters, in shallow foraging sites such as seagrass beds, worm reefs and coral reefs, and in deep oceans teeming with life, turtles depend on habitats that circumscribe the tropics and even extend to far northern and southern latitudes. On some beaches there is a small risk of density dependent nesting mortality as the population size grows exponentially (BALAZS 1980) and nests face higher risks of being disinterred by other nesting adults. Lighting on beaches is hazardous to emerging hatchlings as lights attract hatchlings away from the shoreline (WITHERINGTON & BJORNDAL 1990), and in many developed coastal areas may be responsible for a large percentage of hatchling loss. In Florida, there is legislation that controls light-use close to turtle beaches (LUTCAVAGE et al. 1997). Nesting habitats are threatened by the disappearance of beaches through sea level rise and erosion processes (ACKERMAN 1997), beach nourishment, armouring and sand mining, and through residential development (LUTCAVAGE et al. 1997). In the open sea turtles face the risk of fishery mortality (POINER & HARRIS 1994), and oil pollution (HUTCHINSON & SIMMONDS 1992). At foraging sites turtles are threatened by marine debris (BALAZS 1985), destructive fishing practices such as blast and cyanide fishing (BJORNDAL 1996; PILCHER & OAKLEY 1997), anchors and propellers, siltation and the use of bottom trawls in seagrass ecosystems (BJORNDAL 1996).

Migrations

One of the characteristics that has intrigued biologists through time is the periodic migrations marine turtles make to and from nesting and foraging sites, sometimes over vast distances. Adult females do not necessarily nest at the closest rookery to the feeding area, as noted with green and hawksbill populations along the Great Barrier Reef (LIMPUS et al. 1983). Turtles make "very deliberate journeys to specific geographical targets" with green turtle females showing high site fidelity after remigrations, generally of 2-4 years (LIMPUS et al. 1992).

These migrations entail the use of open oceans and seas, across international boundaries (see Figure 2), and over vast distances. Exploitation of fishery stocks on the high seas threaten the migrating turtles (the long-line fishing industries of the Pacific and Indian Ocean which continually land loggerhead and leatherback turtles are prime examples). Aggregations of turtles close to nesting beaches make them susceptible to capture in trawl-fisheries, and the added complexities brought about by international boundaries and definition of High Seas rights mean that turtles at sea are turtles at risk.

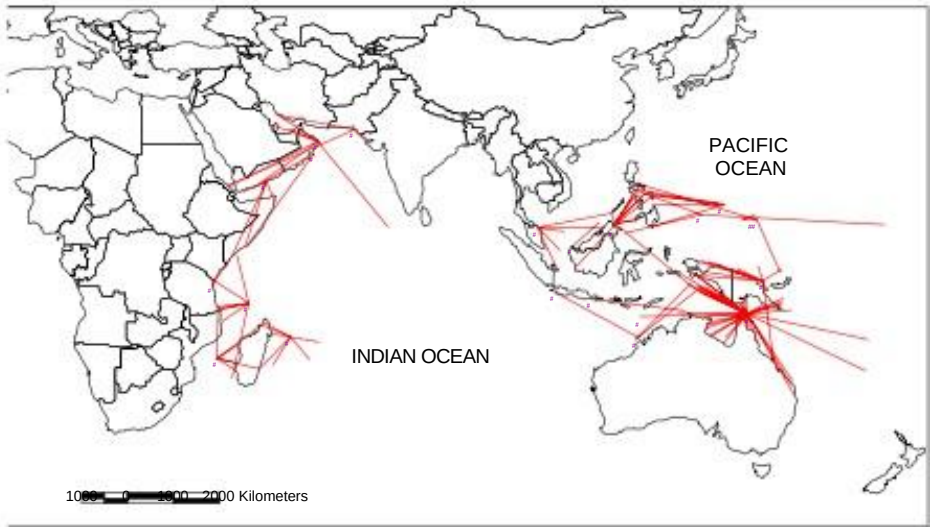

Figure 2. Known migrations of green turtles in the Indian Ocean region, as an example of the distances travelled and international borders crossed by migrating turtles (courtesy of C. LIMPUS).

Age at Maturity

Marine turtles are believed to live long lives, perhaps up to 100 years. They are known to reach sexual maturity only after 15-40 years (MILLER 1997), depending on species, presenting unique management requirements. Turtle hatchlings emerging today might only return to nest after 20-30 years, by which time few, if any, of our present scientists and managers will be following their progress. Additionally, their long absence from known feeding or foraging sites masks any changes to population sizes. For this reason, effects on long-term survival such as egg collection or adult harvesting might not be noted for a number of years, if at all (Figure 3). More importantly, their long maturation period means they face an ever-increasing number of mortality pressures over a long period of time, which hinders population restocking.

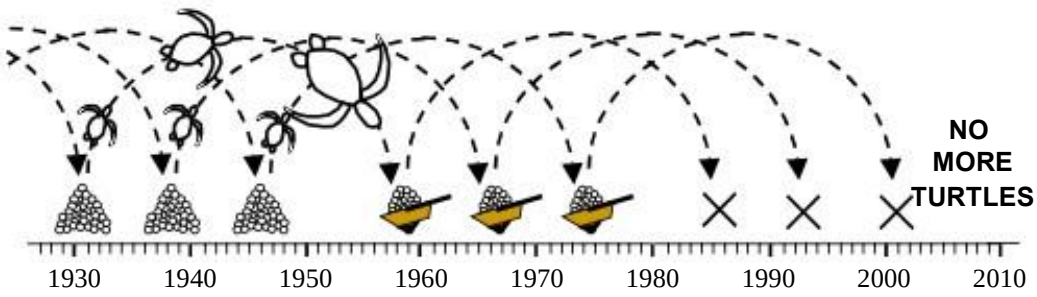

Figure 3. In a simple hypothetical case, while eggs are laid and allowed to hatch, turtles are produced; but if 100% of eggs were harvested or if 100% of turtles were harvested each year before laying eggs, there would reach a point at which no further breeding females would be available. However, this would not become apparent for another 25 years (modified after MORTIMER 1995, with permission).

1.4 Integration of Marine Turtle Conservation with PERSGA Policy Related to the Regional Protocol on Biological Diversity

The draft *Protocol Concerning the Conservation of Biological Diversity and the Establishment of Protected Areas* provides for the conservation, protection and restoration of the health and integrity of the ecosystems and biological diversity in the PERSGA region; and to safeguard threatened species, critical habitats, sites of particular importance, and representative types of coastal and marine ecosystems, their biodiversity and their sustainable use and management, to ensure long-term viability and diversity.

Within this context the *Regional Action Plan for the Conservation of Marine Turtles and their Habitats* addresses a number of the key objectives and obligations shouldered by each country. These obligations include protecting, conserving and managing natural biological diversity with particular emphasis on threatened species, among which marine turtles are included. In addition the draft includes requirements to protect, preserve and manage in an environmentally sound and sustainable manner, areas that are unique, highly sensitive or regionally representative, notably by the establishment of protected areas many of which include key marine turtle habitat.

The Protocol also call for the adoption of strategies, plans and programmes for the conservation of biodiversity and the sustainable use and management of marine and coastal biological resources. It addresses a number of key issues relevant to marine turtle conservation including support for appropriate planning, management and supervision including legislation and monitoring measures for protected areas, and contingency plans for environmental emergencies. These issues are included within this Regional Action Plan.

1.5 PERSGA Activities in Marine Turtle Conservation

Until recently, most research on marine turtles in the region dated back more than 15-20 years and was relatively limited in scope (summarized by ROSS & BARWANI 1982). However, during 2000 PERSGA developed a standardised set of survey methods and, based on these standard survey methods, conducted a training course for trainers and country representatives in Yemen (December 2000) for 18 national specialists from all the PERSGA member states. In 2003 PERSGA implemented baseline surveys along many portions of previously-unstudied coastlines in five of the seven PERSGA member states. The surveys were led by regional specialists who provided training to national representatives and determined the present marine turtle populations and habitat status (PERSGA 2003a-e).

At present there is still a shortage of data on the distribution of habitats for marine turtles in the region, particularly their foraging sites. Many of the key population statistics such as population size and nesting season are not known. A summary of the major nesting and foraging sites known in the region, morphometric data and population statistics, is presented in Table 1. The location of some of these key sites is given in Figure 4.

Table 1. Key nesting and foraging sites and population statistics for the RSGA region

	Species	Key Nesting Sites	Nesting Season	Size of Nesting Population	CCL (cm)	CCW (cm)	Key Foraging Sites
Djibouti	Green	Iles Moucha & Maskali, Ras Siyyan, Iles des Sept Frères	Jan.-Apr.	~100	66.67	63.3	Gabel
	Hawksbill	Ras Siyyan, Sept Frères	Mar.-Jun.	ND	59.5	65.5	All fringing reefs
	Loggerhead	ND	ND	ND	ND	ND	Haramous Loyada
Egypt	Green	Wadi Al-Gimal, Ras Banas, Sarenka, Siyal, Zabargad & Rowabil Islands	Jun.-Aug.	~200	_ _	___	ND
	Hawksbill	Shedwan, Giftun Kabir & Giftun Sagheir Islds.	May-Jul.	~200	_ _	_ _	All fringing reefs
Jordan	Green	None	n/a	n/a	_ _	_ _	All fringing reefs
	Hawksbill	None	n/a	n/a	_ _	_ _	All fringing reefs
Saudi Arabia	Green	Ras Baridi	Aug.-Nov	~100	105.69	96.5	Al Wajh Bank, Farasan Islands
	Hawksbill	Farasan Islands	Feb.-May	~50	ND	ND	All fringing reefs
Somalia	Green	Raas Xatiib to Raas Cuuda, Berbera	Jan.-Apr.	<50	ND	ND	ND
	Hawksbill	Sa'adadin, Aibat Islands, Raas Xatiib to Raas Cuuda	Mar.-Jun.	<50	ND	ND	All fringing reefs
Sudan	Green	Seil Ada Kebir Island, Suakin Mukawwar Is.	All year	<50	ND	ND	Unknown
	Hawksbill	Mukawwar Is. Seil Ada Kebir Suakin	Mar.-Jul. ND	ND ND	71.93 66.0	64.63 ND	All fringing and barrier reefs
Yemen	Green	Ras Sharma	July	~6000	106.0	96.0	Khor Umeira
	Hawksbill	Jabal Aziz	ND	~500	ND	ND	All fringing reefs
	Loggerhead	Socotra	Jul.-Aug.	~50-100	94.3	85.8	Unknown

Sources: Djibouti: PERSGA 2003b; Egypt: FRAZIER & SALAS 1984, PERSGA 2003a; Saudi Arabia: PERSGA 2003c, MILLER 1989, PILCHER & AL-MERGHANI 2000; Somalia: SCHLEYER & BALDWIN 1999, IUCN 1997; Sudan: DIAMOND 1976; PERSGA 2003e; Yemen: PERSGA 2003d, PILCHER & SAAD 2000, UNEP/IUCN 1996. ND = No Data.

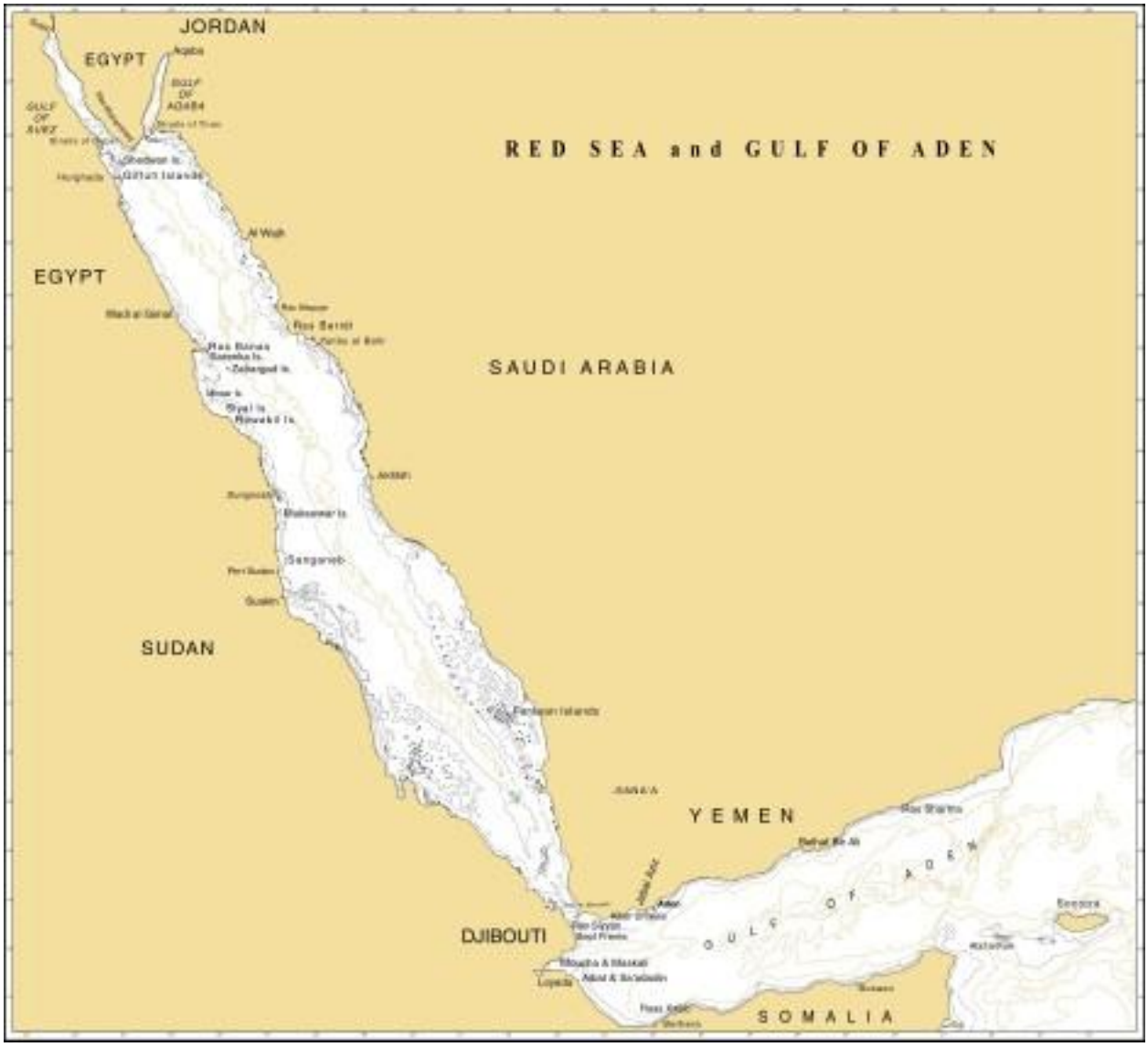

Figure 4. Location of key sites for marine turtles in the Red Sea and Gulf of Aden

1.6 The PERSGA Marine Protected Areas Programme and Marine Turtle Conservation

A regional network of Marine Protected Areas (MPAs) in the Red Sea and Gulf of Aden has been established through the PERSGA Strategic Action Programme (SAP) to facilitate the achievement of regional objectives for sustainable resource use, conservation of biodiversity and for economic development. Concurrent with the development of the network, a Regional Master Plan (PERSGA/GEF 2002) was developed which is comprehensive in its coverage of objectives while being attentive to the differences between the PERSGA member states.

Marine turtle habitats in many cases overlap with the established network of MPAs, and the linkages provided through the strategic Master Plan allow for the management of these highly migratory species. For instance, marine turtles that were tagged while nesting on Socotra have been recaptured in the vicinity of the Sept Frères islands in Djibouti, providing concrete evidence of biological connectivity. The twelve MPAs in the network and key marine turtle habitats in the region are outlined in Table 2.

Table 2. Overlap (shaded regions) between regional network of MPAs and key marine turtle habitats

Country	Key Marine Turtle Habitats	PERSGA Network of Established and Proposed MPAs
Djibouti	Iles des Sept Frères / Ras Siyyan Moucha & Maskali Islands	Iles des Sept Frères / Ras Siyyan Moucha & Maskali Islands
Egypt	Giftun Islands	Giftun Islands and Straits of Gubal
	Shedwan Wadi Al-Gimal	Straits of Tiran Ras Mohammed National Park
	Ras Banas Sarenka Siyal Islands Zabargad Rowabil Islands	
Jordan		Aqaba Marine Park
Saudi Arabia	Farasan Islands	Farasan Islands Protected Area
	Wajh Bank	Wajh Bank
	Ras Baridi	Straits of Tiran
Somalia	Aibat and Sa'adadin, Islands	Aibat and Sa'adadin Islands
	Raas Xatiib to Raas Cuuda	
Sudan	Mukawwar Island and Dungonab Bay	Mukawwar Island and Dungonab Bay
		Sanganeb Marine National Park
Yemen	Jabal Aziz	Belhaf Bir Ali Area
	Socotra	Socotra Islands Group

2. REDUCING DIRECT AND INDIRECT CAUSES OF MARINE TURTLE MORTALITY

Turtles have been used by coastal people for many generations, particularly in the southern states of the PERGSA region. They have formed an important nutritional addition to villagers' diets in remote locations, such as on the Socotra archipelago. Turtle carapaces have been used as cooking vats, dwelling hut apexes, and for storage.

Female turtles are slaughtered as they emerge on the beaches to nest, and adults and juveniles are harvested with nets and harpoons in shallow water environments. Turtles are also frequently killed accidentally in shrimp trawlers, which operate in the southern Red Sea. A number of cultural practices also entail killing the turtles through decapitation when they become fouled in nets, to prevent reoccurrence of the problem. Hatchlings and eggs are threatened through beach use for tourism and development.

Marine turtles have a low intrinsic rate of population growth resulting from a combination of long maturation period and low survivorship from egg to adult. For this reason marine turtle populations that have been depleted take several hundred years to restore their original population size. Due to the long period between egg-deposition and adult nesting, many people are unaware of the changes in population structure as little change is detected during their working lifetimes. For example, the continued and near-complete removal of eggs from nesting beaches would not change the number of females emerging to nest for several decades, leading many to believe the population was in a healthy state. However, after a long period, few animals would be recruiting to juvenile and adult sub-classes, and the viability of the population would be in danger.

The Regional Action Plan for Marine Turtles and their Habitats in the RSGA identifies important sources of mortality, both direct and indirect (such as incidental mortality through commercial fishing operations), in all life stages. The mitigating solutions must then be designed and implemented.

Action 1: Identify and Document the Threats to Marine Turtle Populations

a) Document and collate existing data on the nature and magnitude of threats to marine turtle populations;

b) Determine those populations affected by traditional and direct harvest, incidental capture in fisheries, and other sources of mortality.

Action 2: Minimise Threats to Marine Turtle Populations

a) Enact and enforce legislation requiring the use of gear, devices and techniques to minimise incidental capture of marine turtles on commercial trawlers in the southern Red Sea, in particular promoting the use of Turtle Exclusion Devices (TEDs);

b) Develop procedures and training programmes to promote implementation of these measures, such as vessel monitoring systems and inspections at sea, in port and at landing sites, and national on-board observer programmes;

c) Regulate landfilling and dredging of key foraging sites;

d) Reduce, and where possible eliminate, pollution from light at key nesting sites;

e) Regulate vehicular traffic access to key nesting sites, particularly during peak nesting and hatchling emergence periods;

f) Regulate, and where possible eliminate, development and modification of key nesting sites;

g) Reduce, and where possible eliminate, direct harvests of adult turtles through the development of alternative livelihoods and public awareness programmes;

h) Reduce, and where possible eliminate, predation on marine turtles by feral animals at nesting sites;

i) Adopt the best conservation and management practices for marine turtle populations, reflecting the latest scientific and technical knowledge, particularly with regard to nesting populations and hatchery operations.

Action 3: Implement Programmes which Provide Alternatives to Communities Dependant on Marine Turtle Populations

a) Conduct socio-economic studies within communities that interact with marine turtles and their habitats;

b) Identify economic incentives in order to reduce threats and mortality, and develop programmes to implement them;

c) Identify resources and sources of funding for the programmes.

Action 4: Regulate the Direct Capture or Killing of, and Domestic Trade in, Marine Turtles, their Eggs, Parts or Products

a) Enact legislation to prohibit direct harvest and domestic trade, allowing exceptions only for traditional take;

b) Regulate, and where appropriate eliminate, fishery practices and gear types at key foraging sites, and at nesting sites during reproduction seasons;

c) Establish management programmes that may include limits on levels of intentional harvest;

d) Determine the cultural and traditional values and economic uses of marine turtles (both consumptive and non-consumptive);

e) Develop a management agreement on the sustainable level of traditional harvest to ensure that such harvest does not undermine conservation efforts at a regional level.

Action 5: Develop Nesting Beach Management Programmes to Maximise Hatchling Recruitment

a) Evaluate the effectiveness of nest and beach management programmes;

b) Reduce the mortality of eggs and hatchlings to maximise hatchling recruitment and survival, preferably using conservation techniques that emphasise natural processes wherever possible;

c) Minimise the mortality of eggs, hatchlings and nesting female turtles caused by feral and domestic animals.

Action 6: Promote Marine Turtle Rescue and Rehabilitation Activities

a) Where appropriate, incorporate turtle rehabilitation activities with existing wildlife management and educational / research facilities;

b) Promote collaboration and information exchange among regional agencies during emergency or disaster situations;

c) Provide specialised training in sea turtle rescue and rehabilitation procedures;

d) Develop public awareness programmes to inform the general public of the existence and role of rehabilitation centres.

Expected Results - Outcomes and Time Frame

a) A workshop dedicated exclusively at determining methods to minimize or eliminate regional threats to marine turtles and their habitats (***)(3 months);

b) The promotion and development of legal instruments which regulate the levels of indirect mortality in commercial fisheries though the adoption of gears, TEDs and technology (***)(12 months);

c) Fishing operators initiate by-catch monitoring and reduction efforts (***)(12 months);

d) Training workshops for commercial fishing operators and law enforcement personnel in the use of turtle friendly fishing gears and relevant laws (**)(6 months);

e) Development of alternatives to direct harvest which are in keeping with local community and traditional or customary needs (**)(24 months);

f) Regulatory measures for the control of development and activities at key nesting and foraging habitats (***)(12 months);

g) Implementation of best practice conservation methods as outlined by the IUCN-SSC Marine Turtle Specialist Group (***)(12 months and onward).

Performance Indicators and Quality Assurance

a) Clear guidelines exist as to the threats to marine turtles and methods to eliminate and reduce these to levels where marine turtles are not negatively impacted;

b) Legal leverage exists through which threats to marine turtles and their habitats can be addressed;

c) Government agencies work in partnerships with local communities to moderate and where possible eliminate direct take;

d) Commercial and artisanal fishing operations no longer cause the mortality of marine turtles, evidenced through lower reports of incidental capture and infrequent strandings of dead turtles on coastlines.

3. PROTECTING AND CONSERVING MARINE TURTLE HABITATS

An assessment of the distribution and status of critical habitat in the RSGA (i.e. habitat critical to the survival of sea turtle populations), and the protection of such habitat from threats is fundamental to the conservation of marine turtles. Major threats to nesting beaches include shoreline development (e.g. refinery facilities), artificial lighting, coastal sand mining, and beachfront stabilisation structures. Major threats to foraging grounds and migratory corridors include industrial and agricultural discharges (point and non-point sources), destructive fishing practices, petroleum industry activities (e.g. refining and transport), seabed destruction (e.g. dredging and anchoring), and other forms of marine pollution, including persistent marine debris.

The RSGA region is, for the most part, in good condition but threats from unregulated development, pinpoint pollution sources and shipping accidents have already, or threaten to, reduce the quality of nesting beaches and foraging sites. Coupled with this are natural factors such as global warming which impact coral reefs through bleaching, further reducing the quality and nutritional content of coral reefs.

Given that turtles choose nest sites based on a complex of beach characteristics and nearby anthropogenic activities (see MORTIMER 1980; MORTIMER 1982), the females are less likely to emerge on cluttered or developed beaches, or close to bright lights, particularly if these are moving. Nesting beaches need relatively clean sand, and a suitable depth at the dune area that is not flooded by high tides. An accumulation of debris such as logs, discarded nets, solid waste and plastics can deter nesting females. Nesting beaches are also threatened by erosion that can expose egg clutches, and sea level rise that can flood nesting habitat.

Long-term conservation of sea turtles will depend on the availability and condition of nesting beaches. It is necessary to identify suitable nesting habitat and gather evidence of historic and/or current nesting. Nesting beaches should be inventoried by area, habitat type, ownership, and conservation status, and records should be maintained regarding the loss or degradation of nesting beaches due to natural or anthropogenic causes.

Action 1: Establish Necessary Measures to Protect and Conserve Marine Turtle Habitats

a) Identify and establish the condition of all areas of critical habitat such as migratory corridors, nesting beaches, inter-nesting zones and feeding areas;

b) Designate, declare and manage protected/conservation areas, sanctuaries or temporary exclusion zones for key nesting sites and any critical foraging habitats;

c) Develop incentives for adequate protection of areas of critical habitat outside protected areas;

d) Manage and regulate within each jurisdiction the use of beaches, for example: location and design of buildings, use of artificial lighting, and transit of vehicles in nesting areas;

e) Monitor and promote the protection of water quality from maritime pollution, including marine debris and petroleum industry derivatives;

f) Implement best practice waste disposal programmes to reduce impact of debris at key turtle habitats;

g) Incorporate marine turtle conservation issues in integrated coastal zone management plans.

Action 2: Rehabilitate Degraded Marine Turtle Habitats

a) Remove debris that impedes turtle nesting and hatchling production;

b) Enhance recovery of degraded coral reefs;

c) Enhance recovery of degraded mangrove and seagrass habitats.

Expected Results - Outcomes and Time Frame

a) Critical habitats needed by marine turtles of all life stages (e.g. nesting, developmental, foraging) are protected through legal and practical means (***)(18 months);

b) Regional marine pollution reduction programmes are developed with a resulting reduction in fouling, spillages and collisions which impact turtles and their habitats (**) (24 months);

c) General marine conservation programmes are developed and implemented which indirectly benefit marine turtles (*)(12 months and onward);

d) A prioritisation exercise is performed through which immediate action to rehabilitate degraded habitats takes place, taking into account concerns about funding and implementation logistics (**)(3 months).

Performance Indicators and Quality Assurance

a) Legal and public support drive programmes to protect key nesting and foraging habitats;

b) Nesting and hatchling emergence rates improve over the long-term through beach protection and rehabilitation;

c) Marine habitats support stable or growing turtle populations, reflected through increases in numbers of nesting females, sightings during underwater visual census, and monitoring of foraging populations.

4. RESEARCH AND MONITORING

Although a number of turtle surveys have recently been conducted in the region the complete picture regarding their status is still inadequately understood. In addition, given the life history characteristics of marine turtles, long-term monitoring is needed to detect changes in population structure and size. Information on the habitats where juvenile turtles grow and develop within the RSGA region is virtually non-existent. While some progress has been made with regard to determining the effects of human actions on regional turtle populations, there is a wide gap between present knowledge and information needs.

PERSGA has made significant progress in the standardization of research methods, with a training course for trainers held in Yemen in December 2000, and the development of standardised survey methods (SSMs) for marine turtles in nesting and foraging habitats of the region (PERSGA/GEF in press). However, surveys since that time have been limited by funding and the practical experience of the survey teams, and more complete nation-wide surveys are still needed to determine the extent and distribution of key habitats.

Key issues which need resolving are the lack of data on size, distribution, and condition of nesting and feeding habitats, incomplete data on size and ecological integrity of breeding populations, survivorship of turtles at each key life stage, and inadequate information on threats, use and trade which might affect turtle populations.

Action 1: Conduct Studies on Marine Turtles and their Habitats

For each country, conduct extensive and thorough baseline studies, or update previous baseline studies, on key turtle populations and habitats using PERSGA's Standard Survey Methods for Marine Turtles:

a) Prioritise key nesting and foraging sites and determine their research and management needs;

b) Identify key regional sites, and initiate and/or continue long-term monitoring to assess conservation status;

c) Identify key populations through the use of genetic analysis;

d) Carry out studies on marine turtle population dynamics and survival rates, using tagging as a key study tool;

e) Conduct research on the frequency and pathology of diseases of marine turtles;

f) Assess survivorship of eggs and hatchlings, particularly in instances in which there is human intervention;

g) Assess the condition of nesting and foraging habitats;

h) Determine the impact of changes to nesting and foraging habitats on turtle survival;

i) Determine migration routes and patterns of movement at different life stages, possibly through the use of satellite tracking;

j) Develop a GIS system to accommodate nesting, tagging, and migration data;

k) Assess predation by feral and domestic animals;

l) Determine levels of intentional (direct) and accidental (indirect) mortality, particularly that caused by shrimp trawlers, and evaluate domestic and international harvests and trade;

m) Develop guidelines on sustainable use of turtles and their products;

n) Explore alternatives to turtle utilisation.

Action 2: Strengthen Collaborative Research and Monitoring

a) Strengthen collaborative studies and monitoring on genetic identity, conservation status, migrations, and other biological and ecological aspects of marine turtles among PERSGA member states, other nations, scientific institutions, non-governmental and international organisations.

Action 3: Exchange Information

a) Compile, on a regular basis, data on marine turtle populations of regional interest;

b) Exchange, on an annual basis, information between the PERSGA Secretariat and the PERSGA member countries;

c) Exchange, at regular intervals, scientific and technical information and expertise among nations, scientific institutions, non-governmental and international organisations.

Tagging as a Learning Tool

Often researchers labour under the false impression that tagging sea turtles in some way miraculously protects them from harm, and often governments lay claim to efficient conservation efforts based on tagging projects. However, tagging is a merely a research tool, albeit a powerful one, which can provide information on turtle movements and international linkages, and can foster a sense of commitment and ownership among those involved in the process. For a tagging programme to be effective there must be a commitment to continuing the work over a long period, so that tag returns and recaptures in future surveys provide a better understanding of the population dynamics. If the objective is simply to count turtles, this can be done without tagging, and several non-invasive options exist.

The basic premise behind tagging requires consistent and correct use of the tags, which should be applied to the proximal trailing edge of each front flipper to reduce the chances of abrasion, entanglement and tag dislocation. If the tags are not applied correctly, or if the tag material deteriorates rapidly in salt water, tags might not provide the feedback that was originally expected.

Some basic points to keep in mind for tagging programmes are: numbers should be consecutive and prefixed by the country's international ISO code; tags should not be ordered as double sets (i.e. bearing the same number) as this is unnecessary and increases the risk of two turtles accidentally being tagged with the same number; tag numbers should bear a message indicating the return address and not be duplicated within a project or among projects; workers should apply two tags to each turtle, one on each front flipper; workers should check turtles for presence of previous tags or signs of tag loss prior to placing new tags, to maintain a long-term history of the turtle, and replace old tags only if they appear heavily corroded and might be lost easily. Workers should also tag turtles only once they have completed covering the nest cavity with the rear flippers to minimise the possibility of disturbing the turtle and causing her to abandon the nesting effort. Tags should be made of titanium, as it has been determined to be the longest-lasting material when in water.

Tagging has resulted in the understanding of migration patterns for turtles in the southern Red Sea and the Gulf of Aden, through which it is now known that turtles migrate to and from Socotra and the southern coast of Yemen to Oman, and from Sri Lanka, Oman and Socotra to Djibouti. The more extensive the tagging programmes in the region, the better understanding scientists and managers will have of turtles' migration routes, with which to design and implement more efficient conservation measures.

Expected Results - Outcomes and Time Frame

a) Country reports highlighting updated, comprehensive survey data for the coastlines of each country detailing geographic location and extent of nesting and foraging habitats and the species composition within each habitat (**)(6 months);

b) A threats-analysis document leading to a prioritisation exercise and subsequent identification of key habitats and populations (*)(3 months);

c) The implementation of long-term studies on key populations to provide continuous feedback to management institutions (**)(6 months and onwards);

d) A regional summary on key threats to habitats and populations, mortality rates, diseases and levels / forms of turtle utilisation (*)(3 months);

e) A computer database to accommodate research and monitoring information in keeping with standard international protocols (*)(3 months);

f) Frequent and periodic international workshops to share project results, information and ideas related to the conservation of marine turtles and their habitats (*)(18 months).

Performance Indicators and Quality Assurance

a) Reports indicate the extent of habitats and clearly demonstrate a thorough coverage of the coastal areas;

b) Key habitats and populations are identified and monitoring programmes are implemented at each key site (funding permitting);

c) Updated information on key populations, tagging programmes and migrations are readily available through the PERSGA Secretariat;

d) The threats-analysis leads to the reduction of impacts on marine turtle populations evidenced through population growth over the long-term and the restoration/rejuvenation of degraded habitats;

e) Nesting populations remain stable and/or increase over time (at least ten years monitoring required).

5. COMMUNITY PARTICIPATION, PUBLIC AWARENESS, INFORMATION AND EDUCATION

For hundreds, if not thousands of years marine turtles have played a minor role in the livelihoods of coastal populations in the region. While subsistence take occurred in the past in a number of RSGA countries, in general it was at low levels limited by equipment and storage considerations. In modern times, with the advent of mechanised boats, refrigeration systems and a network of distribution opportunities, the demand by coastal communities has begun to exceed the sustainable harvest levels of days past, and threatens many regional populations.

Many coastal communities however, remain unaware of the dire condition of many turtle populations, with little knowledge of nesting patterns and virtually no knowledge of maturation periods, natural survival, and the impacts of man's actions. As depicted in Figure 3 (Introduction, above) the sheer time between egg deposition and the return of adult females to nesting beaches (where they are most often captured) is the length of a typical working lifetime for many coastal dwellers, and changes to population structure therefore often go unnoticed. Turtle conservation issues are generally not widely publicised, nor made available in an understandable manner to remote coastal communities, tourist markets, commercial enterprises and government policy makers, further compounding the problem.

Government agencies and funding institutions often fail to make marine turtle conservation a priority issue. Some funding institutions are opposed to species-specific conservation approaches, and fail to recognise the wider conservation benefits that marine turtle conservation can impart on coastal communities and the environment in general. Given that the protection of marine turtles entails the protection of a wide range of marine habitats, from coral reefs to seagrass beds and mangroves, turtles have the potential to act as exemplary ambassadors in a diverse marine conservation strategy.

The participation of local communities in conservation actions and decision-making is critical to the success of management interventions particularly when these affect livelihoods or traditional cultures. Anyone who benefits from sea turtles (either through consumptive or non-consumptive practices), or from their marine and coastal habitats, is a stakeholder, for they depend in one way or another on the condition of the turtle populations. Ultimately, stakeholders need to become the stewards of those resources as it is to their advantage that these resources survive through time, and along with the rights of use, they have the responsibility of collaborating in conservation activities.

Over the years there has generally been inadequate involvement of local communities in conservation measures, these being designed by scientific and other institutions, and implemented by government agencies. Local communities have not benefited greatly from conservation measures, which they have come to regard as over-conservative and infringing on their culture and traditional activities. However, at the same time, local communities have not been given a clear understanding of the conservation needs of marine turtles and the potential long-term benefits from conservation.

Action 1: Develop and Implement Public Education, Awareness and Information Programmes

a) Collect, develop and disseminate educational materials which demonstrate the ecological and economic value of sea turtles;

b) Establish community learning/information centres;

c) Develop and implement accurate mass media information programmes;

d) Develop and conduct focused education and awareness programmes for target groups (e.g. teachers, schools, fishing communities, media);

e) Encourage the incorporation of marine turtle biology and conservation issues into school curricula;

f) Promote the development of eco-tourism alternatives that integrate marine turtle conservation issues into commercial ventures, concurrently providing alternative livelihood opportunities to communities who depend on marine turtle resources;

g) Organise special events related to marine turtle conservation and biology (e.g. Year of the Turtle, symposia, etc.);

h) Disseminate information on marine turtles at local, national and regional levels.

Action 2: Promote General Public Participation

a) Involve stakeholders and local communities in planning and implementation of conservation and management measures;

b) Encourage the participation of government institutions, non-governmental organisations, the private sector and the general community (e.g. students, volunteers, fishing communities, SCUBA diving associations, local communities) in research and conservation efforts;

c) Encourage the adoption of sea turtle education, research and conservation issues within interest groups and NGOs;

d) Implement, where appropriate, incentive schemes to encourage public participation;

e) Enable and promote community participation in turtle surveys, monitoring programmes, and management;

f) Promote the transfer and integration of community skills in conservation activities;

g) Determine the extent, and incorporate into management strategies the traditional knowledge of local communities;

h) Promote ecotourism activities related to marine turtles and their habitats, and ensure equitable sharing of benefits with local communities.

Action 3: Develop Government Involvement and Raise Awareness of Shared Responsibilities

a) Promote adoption and implementation of relevant international instruments which relate to turtle conservation;

b) Raise awareness among relevant authorities of the obligations resulting from accession to international conventions;

c) Promote marine turtle conservation as a priority among policy-makers;

d) Provide training and learning opportunities to government officers in issues relating to turtle conservation.

Action 4: Integrate Community Development with Environmental Education

a) Facilitate liaisons with existing rural development organisations;

b) Include community infrastructure components in conservation agendas;

c) Incorporate community development into wildlife and environmental training programmes;

d) Develop programmes in collaboration with the appropriate regional and international organizations.

Action 5: Evaluate Community Practices as they Impact Marine Turtles and their Habitats

a) Evaluate impacts of local communities on nesting and foraging turtle populations;

b) Identify impacts of fishing techniques, and promote best practice fishing techniques to minimise impacts to marine turtle populations;

c) Evaluate impacts of local communities on turtle habitats, including beaches, coral reefs and seagrass beds;

d) Promote the immediate release of accidentally-caught turtles among fishermen, and encourage sharing of any tag return information;

e) In conjunction with local communities, develop alternative livelihood practices that are environmentally conscious and ecologically sustainable.

Expected Results - Outcomes and Time Frame

a) Public awareness materials are designed, developed and disseminated to a wide range of societal levels, governments, and non-government agencies (**)(18 months);

b) Governments are provided with clear and succinct materials and data upon which to base sound decisions relating to marine turtle conservation (**)(12 months);

c) All relevant stakeholders receive adequate information to meet their respective needs (**) (24 months and onward);

d) Stakeholder groups are involved, to a certain extent, in research and conservation activities (such as schoolchildren helping with data collection on nesting beaches) (*) (12 months and onward);

e) Training and capacity-building opportunities are provided for relevant policy-makers (*) (12 months and onward);

f) Local communities are trained in research and monitoring methods, and contribute significantly to conservation agendas (**)(18 months);

g) Local communities grow and develop through integrated conservation approaches which take into account the socio-economic needs of the communities and balance these with environmental conservation (*)(24 months and onward);

h) Local knowledge is incorporated into scientific-based and government-led conservation programmes (*)(12 months);

i) The extent of traditional impacts on marine turtles and their habitats is examined, and suitable alternatives are identified, developed and implemented (**)(6 months).

Performance Indicators and Quality Assurance

a) Schoolchildren, fishermen, the general public and policy-makers have a rudimentary knowledge of turtle conservation issues;

b) Mass-media agencies (television, radio, newspapers) play an integral role in disseminating information;

c) Implementation of international legal instruments is enhanced;

d) Governments play a key role in driving conservation activities through implementation of legislation, policy, and guidelines;

e) Marine conservation issues, beyond those concerning marine turtles, are regularly considered and acted upon;

f) Local communities assume conservation initiatives independent of government-led programmes aimed at reducing and/or eliminating impacts on turtles and their habitats;

g) Bi-directional information exchange (from communities to policy-makers and conservationists, and *vice versa*) is enhanced and productive;

h) Marine turtle populations and their habitats notably improve in status following community integration and participation in conservation measures.

The Story of the Socotra Islands and Marine Turtle Conservation

Socotra lies due south of the Arabian peninsula and eastward off the Horn of Africa, at approximately 13ºN, 54ºE. Politically it is part of the Republic of Yemen and is home to approximately 80,000 people. The main island measures approximately 120 km by 40 km and covers a total area of 3,625 sq km. Its outlying islands are Abd Al-Kuri, Darsa, Samha (also known as the Two Brothers), and the Kal Faraon and Sabouniyah rocks. Until recently, little or no scientific studies had been undertaken on Socotra since a British expedition in 1967, and none had investigated the sea turtle populations.

Sea turtle nesting takes place primarily on the main island of Socotra, with only scattered nesting on Abd Al-Kuri and Samha. No nesting has been found on Darsa, Kal Faraon or Sabouniyah. A stretch from the town of Gubba to Ras Gaddama is the main nesting beach during the pre-monsoon period on Socotra, with most nesting (~ 90 %) occurring two and a half kilometres on either side of Ras Abalhan, halfway along the beach. Nesting averages approximately two turtles per night over five kilometres of beach, translating to a nesting population of about 50-100 females per season and an unknown number of accompanying males. Although green *Chelonia mydas* and hawksbill *Eretmochelys imbricata* remains were identified on the beaches, only the loggerhead *Caretta caretta* was found nesting at any of the beaches.

The use of turtle meat and eggs by the northern and southern Socotri people is pronounced, with turtles brought to the market in Hadibo daily, having been captured from as far distant as Gubba. Options for conservation will require the participation of the Socotri people, and may include: protecting the area between Gubba and Ras Gaddama extending 1-2 nautical miles offshore, education programmes to discourage turtle meat consumption, and a 'Turtle Safe' certification programme to curb harvests and demand.

6. BUILDING CAPACITY FOR CONSERVATION, RESEARCH AND MANAGEMENT

Acknowledging that there is a shortage of skilled personnel, equipment and resources to carry out research and monitoring, to liaise with coastal communities, and to enforce regulations, important first steps have been taken by PERSGA and national governments to increase the number of researchers in the region and provide training for them.

This deficiency in manpower and lack of basic knowledge on turtle biology and conservation needs has resulted in inappropriate management of nests, eggs and hatchlings, inadequate surveillance and enforcement on nesting beaches and foraging grounds, and a shortage of guidelines and understanding related to turtle management and use.

Action 1: Training and Capacity-Building

a) Build capacity at regional and national levels to strengthen conservation measures;

b) Identify needs for capacity-building in terms of human resources, knowledge and facilities;

c) Provide training (e.g. through workshops) in marine turtle conservation and management techniques to relevant agencies, individuals and local communities;

d) Coordinate training programmes and workshops at a regional level;

e) Develop partnerships with universities, research institutions, training bodies and other organisations that can provide twinning and educational opportunities to PERSGA member states, relevant to marine turtle conservation issues.

Action 2: Provision of Resources to Support Training, Research and Monitoring

a) Conduct a 'needs assessment' of essential equipment;

b) Develop country and regional proposals incorporating requests for equipment;

c) Maintain the regional tagging and tag distribution scheme.

Expected Results - Outcomes and Time Frame

a) A significant complement of policy-makers, enforcement officers and research and monitoring personnel trained and knowledgeable in the biology and conservation needs of marine turtles (**)(12 months);

b) Adequate equipment, human and financial resources for the long-term implementation of enforcement, research and monitoring efforts (**)(18 months).

Performance Indicators and Quality Assurance

a) Trainers exist at a regional level who can implement adequate educational activities which result in the protection of marine turtles and their habitats;

b) Adequate resources exist which allow for the enforcement of regulations and the study of marine turtles.

7. INTEGRATED MANAGEMENT FOR MARINE TURTLES

Conflicts of interest arise because of competing demands for the same resources. The habitats on which marine turtles depend are also used for a number of community activities including tourism, shipping, housing and defence. Often the interconnectivity of marine ecosystems and their inhabitants with sectors upon which human cultures depend are poorly understood. For instance, nesting and foraging habitats need to be considered in coastal planning but often commerce and tourism predominate in decision-making.

Within the PERSGA member states there often exists a level of overlap, or gaps in the legal mandates of environmentally-associated agencies and legislation is often lacking or insufficiently focused on marine turtles and their conservation needs.

Marine turtle conservation will ultimately depend on the effective integration of management actions based on sound legislative frameworks, land-use planning, stakeholder participation, and regional cooperation.

Action 1: Cooperation and Promotion of Information Exchange

a) Use PERSGA networks to strengthen existing mechanisms for cooperation and information exchange at the national, regional and global levels;

b) Establish relationships with national fisheries bodies with a view to obtaining data on incidental capture and encourage them to adopt marine turtle conservation measures;

c) Use PERSGA networks for cooperative management of shared populations within the region and, where appropriate, formalise cooperative management arrangements at national and regional levels;

d) Promote the integration of marine turtle issues in the design, development and implementation of marine protected areas;

e) Develop, where appropriate, transboundary marine protected areas using ecological rather than political boundaries.

Action 2: Enforcement and Legislation

a) Strengthen and improve enforcement of conservation legislation;

b) Review national policies and laws where appropriate to address gaps or impediments to marine turtle conservation;

c) Clarify mandates, and promote collaboration among, responsible agencies for the conservation of marine turtle and their habitats;

d) Identify provincial authorities and encourage and facilitate implementation of their commitments under national legislation and international agreements;

e) Cooperate regionally in law enforcement to ensure compatible application of laws across and between PERSGA member states;

f) Collaborate with appropriate enforcement agencies to protect nesting beaches from degradation due to coastal development, including sand-mining, beachfront construction, destruction and alteration of coastal habitats and agricultural/pastoral habits.

Action 3: Use of data in Management

a) Use data to mitigate threats and assess/improve conservation policies;

b) Prioritise populations for conservation actions and identify responsible agencies;

c) Identify population trends;

d) Use research results to improve management, mitigate threats and assess the usefulness of conservation activities (e.g. hatchery management practices, habitat loss, etc.);

e) Continue the establishment of protected areas that incorporate habitats for marine turtles and appropriate management regimes based on research and monitoring data.

Action 4: Adoption and / or Implementation of International Legal Instruments

a) Encourage PERSGA member states that have not already done so to become Parties to relevant international agreements relating to turtle conservation.

b) Review and facilitate at a national level compliance with obligations under relevant international agreements acceded to by each nation relating to trade in marine turtles, their eggs, parts or products (CITES);

c) Identify and eliminate routes of international illegal trade through monitoring;

d) Identify, prevent, deter and, where possible, eliminate domestic illegal trade through monitoring, implementation of legislation, identification of gaps in enforcement capabilities in each country, and training of enforcement officers;

e) Exchange and discuss information on compliance and trade issues at regular intervals, such as through annual reporting and at regional meetings.

Action 5: National and Regional Action Plan Implementation

a) Assist PERSGA member states, upon request, to develop and implement national action plans for the conservation and management of marine turtles and their habitats;

b) Identify and implement specific local management issues required for successful conservation and management;

c) Identify overlaps between marine turtle conservation needs and other regional initiatives, such as the PERSGA Marine Protected Area (MPA) network, and integrate conservation activities to maximise efficiency of resources;

d) Identify specific local management issues where cooperation among PERSGA member nations is required;

e) Review action plans at regular intervals to take into account recent advances in skills and knowledge regarding marine turtle conservation and management, as well as changes in conservation status of marine turtle populations.

Expected Results - Outcomes and Time Frame

a) Cooperation mechanisms are established among national government agencies, non-governmental organisations, commercial operations and other relevant institutions to address marine turtle conservation issues (**)(12 months);

b) Marine protected areas are established which incorporate marine turtle habitats and migratory routes (**)(18 months);

c) Legislation and legal mandates of government agencies and legal authorities are clarified and acted upon, with minimal overlap (*)(18 months);

d) PERSGA member states accede to international conventions which directly address marine turtle conservation (*)(18 months);

e) Illegal trade is eliminated through enactment and enforcement of adequate legislation (*) (18 months);

f) National plans and the Regional Action Plan are implemented and enforced, and cooperation among member states is enhanced to accommodate the migratory nature of marine turtles (***)(12 months and onward).

Performance Indicators and Quality Assurance

a) Clarity and understanding exists of the roles and responsibilities of all relevant agencies;

b) Illegal trade in marine turtles and their products is eliminated;

c) National plans exist which address action requirements outlined in the Regional Action Plan for Marine Turtles in the RSGA;

d) Marine turtle populations are stable or increasing and their habitats notably improve in status following establishment of marine protected areas, and the inclusion of marine turtle conservation issues in cross-sectoral planning.

Lack of Funding for Conservation Activities

Widespread is the lack of funding for conservation activities, mostly as a result of the developing status of most of the countries in the region, whose resources are limited, and invested in industrial, agricultural and human development rather than conservation. In the RSGA region and in similar developing areas, the concept of conservation is often thought to be counterproductive to development plans. Many of these countries rely on natural resources to build a strong enough economy to diversify into new markets. Coupled with growing human population densities, especially in coastal areas, the fate of marine resources is in a delicate state. It is imperative that funding for conservation measures be sought to bring about a positive change and restore some of these turtle populations to some semblance of stability. It is also imperative that these conservation measures be developed with the input of local stakeholders, so that livelihoods that potentially might be affected are rewarded in some manner. Little of this is news. On the contrary, people have been talking about protecting marine ecosystems for years, but on the whole, implementation of conservation plans rarely meets with the agreement of all stakeholders, or interested parties, often because funding infrastructure is lacking.

8. FUNDING FOR MARINE TURTLE CONSERVATION

Funding for marine turtle conservation and management activities has generally taken a backseat to wider-coverage conservation action plans and proposals, due largely to a lack of understanding and appreciation of the multi-sectoral impact of efficient turtle conservation programmes, and also due to a lack of capacity to develop and submit suitable funding proposals to donor agencies.

There is a clear lack of funding for species-specific programmes at a global level. However this Regional Action Plan, its preceding training courses and country surveys, were carried out through the Strategic Action Programme executed by the PERSGA Secretariat and the member states. For marine turtles to be addressed in a significant manner, conservation programmes need to integrate a host of marine conservation issues, and specifically to address the socio-economic well-being of communities impacted by conservation activities.

Action 1: Securing Funding for Marine Turtle Conservation

a) Identify available funding sources at a number of levels, including government and inter-governmental (e.g. Ministerial, Global Environment Facility, UNEP, UNDP, Overseas Aid packages), non-profit organisations (e.g. WWF, IUCN, Ramsar), and private foundations;

b) Develop the capacity at a national and regional level to prepare proposals which secure funding from government and inter-governmental programmes and non-government institutions;

c) Publish a reference guide for fundraising which lists ideas for sponsorship and provides information on successful proposals and funding sources;

d) Develop regional proposals for fundraising which address multi-sectoral and integrated conservation approaches;

e) Establish a Trust Fund for long-term administration of conservation and management.

Expected Results - Outcomes and Time Frame

a) Funding sources are identified and suitable proposals are submitted which address multi-sectoral and integrated approaches to marine turtle conservation over the long-term (**)(12 months);

b) Research and management actions are carried out and maintained through funding sources which are less dependant on government support (*)(12 months and onward);

c) Enforcement activities are frequent and regular, reduce direct and indirect mortality of marine turtles, and reduce negative impacts to their habitats (**)(6 months).

Performance Indicators and Quality Assurance

a) The capacity exists at a national level to identify funding sources and prepare proposals for funding marine turtle conservation activities;

b) Funding is secured to expand on current research, monitoring, enforcement and conservation measures.

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APP. 13 EFFICIENT MANAGEMENT OF SANGANEB AND DUNGONAB BAY – NATIONAL PARKS

INTEGRATED MANAGEMENT APPROACH:

Management Plan will be

- **Clear and accessible**: easy to read, jargon free and well presented.,
- **Concise and comprehensive**: no longer than is absolutely necessary, but with enough information to fulfil its functions.,
- **Accurate and objective**: without major errors or statements likely to date and with the criteria for all judgements clearly explained.,
- **Systematic and logical**: With management policies derived from an assessment of the site and with a clear rationale given for all proposals..
- **Acceptable and motivating** to all those with interests in and emotional attachment to the site..
- **Precise and practical**: with clear objectives, realistic methods for achieving them, resulting in desired outcomes which can be monitored..
- **Focused and effective**: fulfilling its purpose as a tool for site management, meeting the needs of its users and satisfying any legal or other obligations.

Integrated management is a socially defined concept that is interpreted and understood in a variety of ways.

It is however **widely accepted** as recognizing "nonlinear processes and connectivity between problems" in a

managerial context

It is **holistic and cross-disciplinary** in its approach to balancing potential gains and losses

It implies ensuring coherence among the various business functions as well as **harmony between the organization,**

society, and the natural environment

The **needs and expectations of all stakeholders are equitably satisfied by the best use of all resources**

Improve integration between academia, policymakers, industry, and community leaders to better reflect the belief that **management skills are applicable across all organizational sectors:**

1- **'participatory'**, involving the people affected by management of the protected area. Participation should take place as early in the process as possible and continue throughout. Two audiences are involved: an **external one (local people, visitors and other stakeholders),** and an **internal one (the staff who will be charged with the plan's implementation).** In both cases, the plan is much more likely to be implemented if the affected audiences are involved in its development and have a sense of '**shared ownership'**.
It is increasingly the practice to involve local communities and other stakeholders in protected area planning and management. In addition, **park staff must be empowered to make sufficient and important con -attributions to the preparation of a Management Plan,** if they are to feel ownership of it and be motivated to implement it. **for improving 'sense of ownership' of a plan among protected area staff**

(WCGA, Red Sea State-WCGA rangers, Directorate of Environment and Tourism, Red Sea University, Fisheries Research Center, Faculty of Marine Science, Wildlife Administration, Coastal Fisheries Administration, Marine Environment Protection Administration, Tourism Depart., Tourism Private Sector, Maritime Security, representative of Mohamed Goal Locality, , representative of Dungonab local Community, and representative of Mohamed Goal Local Community, Red Sea State NGOs)

2- **Regional integration** becomes particularly important when others are responsible for administering the area beyond the protected area boundary.
This is a common feature in countries where the national government has re sponsibility for national parks, and provincial, regional or local administrations have responsibility for the area outside the parks
Management Plans should be integrated with or at least link to local development processes and the activities of other agencies and organizations working in the area including:

- *The Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment (Jeddah Convention), 1982,*
- *The Protocol concerning Regional Co-operation in Combating Pollution by Oil and other Harmful Substance in Cases of Emergency, 1982.*
- Sudan became a Party to the Protocol, 5 June 1984 *Protocol Concerning the Conservation of Biological Diversity and the Establishment of network of Protected Areas in the Red Sea and Gulf of Aden, 2007.*
- *Protocol concerning the Protection of the Marine Environment from Land-Based Activities in the Red Sea and Gulf of Aden, 2007.*
- *Protocol concerning Technical Cooperation in Transboundary Transfer of Equipment, Experts and Technicians in cases of Emergencies, 2009.*
- *Convention for Biological Diversity (CBD), 1992:* Sudan became a Party to the Convention on 30 October 1995.
- *Convention of International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973:* Sudan became a Party to the Convention on 26 October 1982.
- *United Nations Convention for the Law of the Seas (UNCLOS), 1982:* Sudan became a Party to the Convention UNCLOS, 23 January 1985.
- *African Convention on the Conservation of Nature and Natural Resources, 1968:* Sudan became a Party to the Convention on 21 October 1973.
- PERSGA Regional Action Plans (RAPs) for conservation of those key habitats and species.
- *Ramsar convention- Sudan joined at 2005*

3- **Link to National Systems Plans, other planning and legislation**
Management Plans should desirably be prepared within the context of a national systems plan for protected areas (see Davey, 1998). This will help ensure co-ordination with other national planning systems/agencies and with other protected areas. It will also provide strategic guidance for individual Management Plans. If no system plan has been developed, Management Plans should be linked to other relevant plans (e.g. local government plans, development plans) and legislation.

- Integrated Coastal Management Plan which will take legal status by the National Environmental law (2000),
- Environmental Protection Act (2006) and Fisheries legislation (Marine Fisheries Ordinance 1937; Regulations amendment 1975)
- Sudanese Fishery Ordinances and Regulations: Dates back to 1937 and was amended in 1975 and 1978. Prohibits overfishing, dumping of refuse, including oil, into the sea and the collection of corals, shells and aquarium fish.
- Environmental Health Act: Established in of 1975. Prohibits the dumping into the sea of any item that is harmful to humans or animals.
- Marine Fisheries Ordinance: gives police, customs officers, and local authorities the right to board and search a vessel, and detain any craft accused of violating the above regulations.
- Maritime Law: Drafted by the Maritime Administration and approved in 2011.
- Comprehensive National Strategy: Through this, Sudan has committed to the pursuit of sustainable development and environmentally sound resource management.
- The Red Sea State Environment Protection Act (2006)
- Sudan has also prepared the following national action plans:

- National Oil Spill Contingency Plan for Sudan.
- National Integrated Coastal Zone Management
- National Plan of Action for the Protection of the Marine Environment from Land based Activities.

4- A clear framework of approved policy

It is important that management planning be carried out within a framework of approved policies within the protected area agency. This framework should be sufficiently specific both to guide and set limits on different aspects of protected area management

- Both SMNP (1990) and DMNP (2004) are declared as MPAs by Presidential Decrees

5- Identification of resources required

A clear process for integrating park planning with budgets and budgeting must be in place.

6- Capacity for planning

The management planning process will run much more smoothly if an effort has been made to train and educate staff (especially **protected area managers**) on the planning process and to provide them with the skills required to participate in this task. Therefore building such capacity is a priority for management.

- Management Plans can be prepared, by **internal expertise** with assistance and advice of **external consultants (IUCN)**.

Protected area management planning steps

1. Pre-planning – decision to prepare a Management Plan, appointment of planning team, scoping of the task, defining the process to be used
2. Data gathering – issues identification, consultation
3. Evaluation of data and resource information
4. Identification of constraints, opportunities and threats
5. Developing management vision and objectives

To Merge the following objectives:

SMNP Mang. Plan Objectives are as follows:

- To manage SMNP sustainably,
- To maintain species diversity, conserve habitats and the human built environment within SMNP,
- To promote sustainable tourism in SNP,
- To educate and inspire,
- To contribute significantly to the development of a national capacity to plan and manage MPAs,
- To involve local communities and stakeholders as partners in SMNP management,
- To provide for the sustainable use of living marine resources.

Dungonab Bay–Mukkawar Island Master Plan Objective:

- The protection of wildlife and the conservation of the Federal Parks and the game areas.
- The optimum utilization and development of the wildlife resources.
- The implementation of the international Convention on International Trade in Endangered Species of wild fauna and flora (1973).
- The provision of information on wildlife resources, their distribution inside and outside Sudan, and the encouragement of scientific research on wildlife and their reservations.
- Preserving the natural beauty of some of these areas, or those with special importance; as far as their natural components are concerned.

Aiming to implement the sustainable development goals:

1- **Alleviate poverty** in all its forms in the coastal areas of the Red Sea, by Implementing nationally appropriate social protection systems and measures to have equal rights to economic resources, as well as access to basic services, natural resources, appropriate new technology and financial services, including microfinance, reduce the local community exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks
2- **Ensure healthy lives** and promote well-being for all at all ages, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all
3- **Ensure equal access to all levels of education and quality technical, vocational and tertiary education**, including university for the villages bordering the property
4- Taking into account the **social and cultural tradition of the local communities** when adopting and strengthen sound policies and enforceable legislation for the promotion of gender equality and the empowerment of all women and girls at all levels.
5- **Improve water quality** by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and material by strengthen the participation of local communities in improving water and sanitation management
6- Promote development-oriented policies that **support productive activities**, decent job creation, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services
7- **Develop quality, reliable, sustainable and resilient infrastructure**, including regional and transborder infrastructure, to support economic development and human well-being
8- **Strengthen efforts to protect and safeguard the cultural and natural heritage** of the property
9- Developing and implementing framework of programmes on **sustainable consumption and production.** Taking into account the development and capabilities of the Red Sea State for strengthen the scientific and technological capacity to move towards more sustainable patterns of consumption and production.
10- **Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in the coast**
11- Prevent and significantly **reduce marine pollution** of all kinds, in particular from land-based activities, including marine debris and nutrient pollution
12- **Sustainably manage and protect marine and coastal ecosystems** to avoid significant adverse impacts
13- **Effectively regulate harvesting and end overfishing**, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics
14- **Ensure the conservation of Sea and coastal ecosystems**, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development
15- Seek **effective public, public-private and civil society partnerships**, and assistance for sustainable development.
16- Ask for **international support for implementing effective and targeted capacity-building** to support national and state plans to implement all the sustainable development goals.

REPULIC OF SUDAN
Ministry of Interior
Police Head Quarter
Wildlife Conservation General Administration

Date:12/1/2016 *No:50/1/1/*

Efficient management of Saniganeb and Dungonab Bay – National parks

The Wildlife Conservation General Administration (WCGA) implemented different activities during the last year which can be summarized as follows :—

—The nomination of the two parks as one world heritage site in collaboration with MAB committee and facilitated the visit of the IUCNexpert to the site .

—The WCGA in last year signed relevant regional initiativelike memorandum of understanding on the conservation and management of Dugongs and their habitats throughout their range , under umbrella of CMS convention and the ISOEA Marine Turtule memorandum of understanding Indian Ocean - South - East AsianMarine Turtle memorandum of understanding Green Turtles, the nominated site is a major important place for the two species.

—The WCGA also engaged with Cousteau organization in a programme concerning,the monitoring of Sharks and Manta rays in Dungonab which is a very important area of the aggregation of the species in region.

—TheWCGA alsocollaborated with a local NGO in a training of local communities and the parks staff.

—WCGA also reached agreement with local government authorities of the Red Sea state to solve some conflicts concerning many issues like Eco-Tourism and protection of the site.

— In the management efficiency (WCGA) and in collaboration withHigher Counil ofEnvironment and Natural Resources is preparing a 2.1 millions US dollars project under biodiversity convention for better management of Sudan protected areas(PAs) which includes the two parks and establishment of marine and terrestrial PAs specially the establishment of Shwab Romi which will cover the buffer zone of the nominated site .

– WCGA submitted a 30,000USdollars project to be funded by the annual budget (2016) to protect the Coral Reffes from damage of anchoring by boats visiting the site by using artificial anchors .

—WCGA recruited anew13 rangers,this recruitmentincreased the numbersof rangers from 10to23.

—The H.Q of marine PAs unitwas moved from Port Sudan city to Dungonab Bay national park, so as to give more protection and patrolling and a staff is designated to Saniganeb National park in collaboration with Sea Port corporation.

—The monthly operational budget is also increased .

—In the last two years, capacity building and training of the parks staff was given incollaborationwith PERSEGA Cousteau,Sea Ports corporation and local NGOS

,these training was in diving, integrated management, fish classification and monitoring of sharks and manta rays and of course in police and military training .

– One boat is maintained and a plan is going on to purchase another more effective boat .

–Lastly WCGA is planning more steps in management efficiencyspecially if the site is declared asan international heritage site and the priority will be a new management plan for the site as an international heritage siteand different funds will be available from local and international.

Sand Suleiman Ibn Suleiman
Director
Wildlife Conservation General Administration

Sanganeb Marine National Park (SMNP) and Dungonab Bay-Mukkawar Island Marine National Park (DMNP)

ID	Longitude (E)	Latitude (N)
1	37.018833°	21.425100°
2	36.938689°	21.375588°
3	37.000004°	21.250003°
4	37.041664°	21.250006°
5	37.041666°	20.916669°
6	37.113333°	20.916667°
7	37.147500°	20.650000°
8	37.200833°	20.650000°
9	37.250000°	20.650000°
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12	37.082100°	21.464000°
13	37.237694°	20.462877°
14	37.188198°	20.455277°
15	37.182170°	20.028866°
16	37.268211°	19.838236°
17	37.389139°	19.779753°
18	37.444679°	19.671791°
19	37.504124°	19.744564°
20	37.446824°	19.829631°
21	37.445772°	19.750711°
22	37.367789°	20.567895°
23	37.219344°	21.057000°

Legend

- Center Coordinate
- Boundary Coordinates
- Buffer
- Settlements
- Paved Road
- Dongonab Core Zone
- Sanganaib Core Zone
- Portsudan Town
- Small Islands
- Red Sea

Warning: Not all contents of this product have been field verified. Caution should be exercised when making measurements. Boundaries and areas shown in this map do not represent the authorized data of any country.

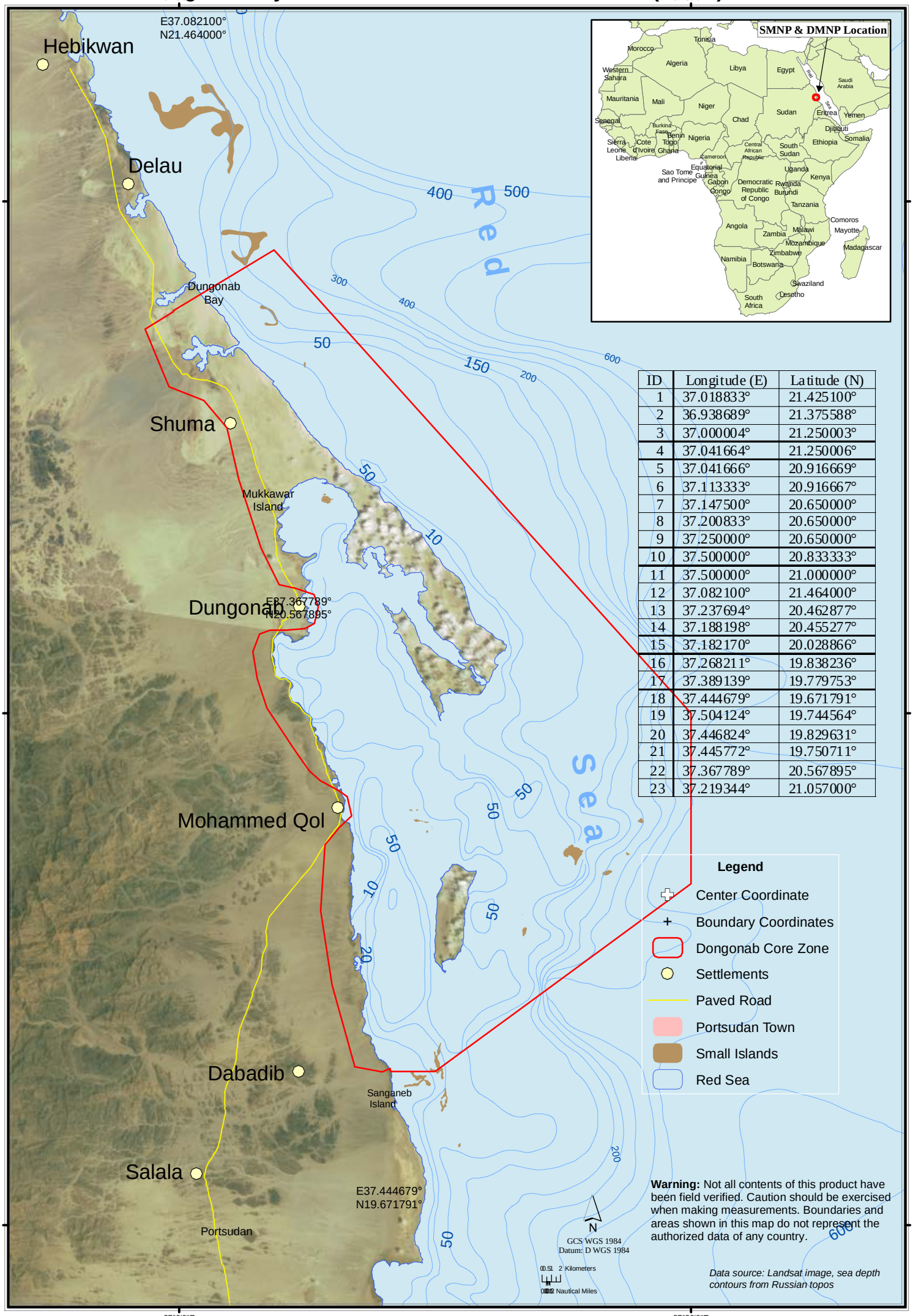
Data source: Landsat image, sea depth contours from Russian topos

GCS WGS 1984
Datum: D WGS 1984

0 1 2 4 Kilometers
0 1 2 Nautical Miles

37°0'0"E 37°30'0"E 38°0'0"E
21°30'0"N 21°0'0"N 20°30'0"N 20°0'0"N

Sanganeb Marine National Park (SMNP) and Dungonab Bay-Mukkawar Island Marine National Park (DMNP)



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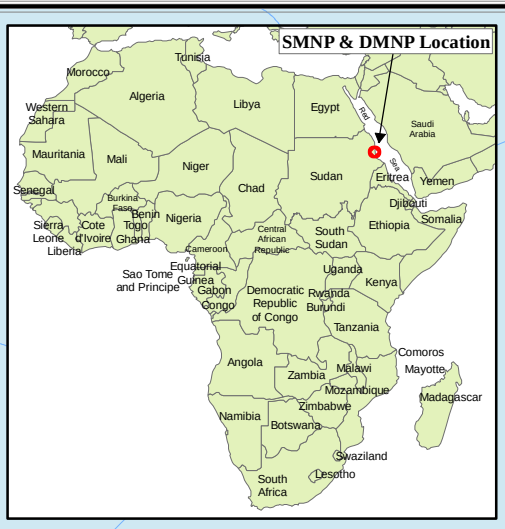
Sanganeb Marine National Park (SMNP) and Dungonab Bay-Mukkawar Island Marine National Park (DMNP)



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Dungonab Bay

Mukkawar Island

Sanganeb Island

Eit

Musayab

Tameideilai

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Legend

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