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

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PERSGA is an intergovernmental organisation dedicated to the conservation of the coastal and marine environments in the region and the wise 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.

PERSGA, P.O. Box 53662, Jeddah 21583, Kingdom of Saudi Arabia

Tel.: +966-2-657-3224. Fax: +966-2-652-1901. Email: persga@persga.org

Website: http://www.persga.org

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List of Abbreviations and Acronyms

CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
EEAA	Egyptian Environmental Affairs Agency
EIA	Environmental Impact Assessment
FAO	Food and Agriculture Organization of the United Nations
GEF	Global Environment Facility
GESAMP	Group of Experts on the Scientific Aspects of Marine Environmental Pollution
HBC	Habitat and Biodiversity Conservation
ICZM	Integrated Coastal Zone Management
IOC	Intergovernmental Oceanographic Commission
ISME	International Society for Mangrove Ecosystems
IUCN	The World Conservation Union
MARPOL	International Convention for the Prevention of Pollution from Ships
MPA	Marine Protected Area
NCWCD	National Commission for Wildlife Conservation and Development
PERSGA	Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden
PME	Presidency for Meteorology and Environment
Ramsar	International Wetlands Convention
ROPME	Regional Organization for the Protection of the Marine Environment
ROWA	Regional Office for Western Asia (UNEP)
RSGA	Red Sea and Gulf of Aden
UNCLOS	United Nations Convention on the Law of the Sea
UNDP	United Nations Development Programme
UNEP	The United Nations Environment Programme
UNESCO	The United Nations Educational, Scientific and Cultural Organization
WHC	World Heritage Convention
WWF	World-Wide Fund for Nature

PREFACE

Mangroves, which grow along many tropical shorelines, have attracted man's curiosity from the earliest times. However, it was not until the 1970's that man began to understand and appreciate the role of this unique vegetation. We now see mangroves being protected or managed in many areas of the world, for the fisheries they support, the forest products they yield and the stability they contribute to the coastal zone. Yet at the same time, mangroves are being destroyed for reasons that are frequently illogical. In our region the majority of mangroves are under stress from a variety of activities including grazing by camels, cutting for timber, pollution by solid wastes and sewage, in addition to physical modification of the coastal habitat.

PERSGA has taken the initiative to conserve this important resource, taking several steps towards their protection. The first step was developing a set of Standard Survey Methods (SSM) for Inter-tidal and Mangrove Habitats in the Red Sea and Gulf of Aden. The second step involved training regional specialists in these methods. Surveys were then conducted to determine the status of mangroves within the region. The fourth step was the development of this Regional Action Plan (RAP) for the Conservation of Mangroves in the Red Sea and Gulf of Aden.

Immediate adoption and implementation of the Mangrove RAP will lead to a reduction in the degradation of mangrove areas. In addition to reducing the economic losses of timber resources it will directly benefit marine life and sustain the ecological role played by the mangroves, including protection of the coast from erosion and protection of adjacent coral reefs from excessive sedimentation.

Furthermore, PERSGA has already implemented a number of actions that serve its primary objective, namely the conservation of the marine and coastal environments of the Red Sea and Gulf of Aden. Some of the actions mentioned in this RAP are complementary to the major outputs of the Strategic Action Programme (SAP) components:

1. Development of a "Regional Outline for ICZM"
2. Establishment of a "Regional Network of MPAs"
3. Development of a "Regional Master Plan for MPAs"
4. Development of "Site-specific Management Plans" for four regional MPAs
5. Enhancement of the capacity of regional specialists through a series of training courses, and
6. Development of a "Regional Management Plan for the Sustainable Use of Living Marine Resources".

We are positive that the integration of the actions recommended by this RAP with the results from the SAP components will be both harmonious and synergistic.

Prof. Dr. Abdelelah A. Banajah

Secretary General of PERSGA

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This Regional Action Plan for the Conservation of Mangroves in the Red Sea and Gulf of Aden was initiated following national surveys of the status of mangroves arranged by PERSGA. The Plan builds on the substantial base of previous and continuing work by regional and national organizations, and covers the mangroves of all the member states of PERSGA. The first and revised drafts of this document were prepared by Professor Peter Saenger (Southern Cross University, Australia) and Dr. Ahmed S.M. Khalil (University of Khartoum, Sudan) under contract to PERSGA. Comments and input were provided by the authors of individual country reports, and the participants at the PERSGA Workshop for the Regional Action Plan for Mangroves held in Jeddah from 8-9 September, 2003. The document was reviewed by Dr. Lewis Le Vay (University College North Wales, Bangor).

We acknowledge the commitment and dedication of the late Secretary General of PERSGA, Dr. Nizar I. Tawfiq for his leadership and inspiration, and the SAP Lead Specialist for the Habitat and Biodiversity Conservation (HBC) component, Mr. Abdullah Al-Suhaibany, for his coordination and management of the work. Financial support for the preparation of this document was made available through the Strategic Action Programme for the Red Sea and Gulf of Aden (SAP) executed by PERSGA and implemented by the GEF partners, UNDP, UNEP and the World Bank, with supplementary funding from the Islamic Development Bank and the countries of the Region. Valued assistance in the preparation of the Plan was provided by the World Conservation Union (IUCN) and representatives of all the participating countries.

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 1

Integration of RAP with other programmes and conventions

The RAP is in accord with major international and regional conventions including:

- Regional Convention for Co-operation on the Protection of the Marine Environment from Pollution (Kuwait Convention)
- Regional Convention for the Conservation of the Red Sea and Gulf of Aden Environment (Jeddah Convention)
- Convention on Biological Diversity (CBD)
- World Heritage Convention (WHC)
- Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)
- United Nations Convention on the Law of the Sea (UNCLOS)
- International Convention for the Prevention of Pollution from Ships (MARPOL)
- International Wetlands Convention (Ramsar)

The RAP is also in accord with inter-governmental and non-governmental initiatives including those of:

- The United Nations Environment Programme (UNEP - Regional Seas)
- The United Nations Development Programme (UNDP)
- The United Nations Educational, Scientific and Cultural Organization - Intergovernmental Oceanographic Commission (UNESCO-IOC)
- The World Conservation Union (IUCN)
- The World-wide Fund for Nature (WWF)
- The International Society for Mangrove Ecosystems (ISME) Mangrove Action Plan 2004-2008.

Appendix 2

Principles of implementation of the RAP

Successful implementation will benefit from the application of 12 general principles (after PERSGA/GEF 2003a):

1. Involve all stakeholders (from local communities to central government) in consultation and decision-making
2. Harmonize resource use among stakeholders
3. Strengthen institutions and implement appropriate legal instruments
4. Alleviate poverty to reduce environmental degradation
5. Collect and evaluate appropriate data on environmental and socio-economic status
6. Develop flexible and adaptive management systems that respond quickly to new information
7. Maintain consistency of approach across all spatial scales of implementation - local and national actions should be consistent with regional and global actions and cooperation
8. Ensure high levels of information-sharing and technology-transfer across all scales of implementation, and among all participants
9. Foster widespread education and awareness
10. Ensure adequate and sustained financing
11. Ensure effective integration of all Priority Action components and specific actions, making full use of positive feed-backs among components
12. Adopt a precautionary approach to any future development issues affecting mangroves and associated coastal habitats

Appendix 3

Indicators of success of the RAP

The following set of indicators is based on those proposed in PERSGA/GEF (2003a), with the addition of several others with high applicability specifically to mangroves and associated coastal habitats:

I. Outcome Indicators

1. Demonstrable expansion in human resources capacity – increased numbers of managers and project staff - across all areas of the RAP
2. Policy and legislative changes relevant to ICZM, MPAs, mangrove utilization, shipping and marine pollution
3. Demonstrable improvements in management efficiency in ICZM, MPAs, mangrove utilization, shipping and marine pollution
4. Expanded infrastructure and capital equipment
5. Implementation of ICZM and EIA in planning
6. Effective management of MPAs, concentrating initially on the ‘flag-ship’ demonstration sites
7. Demonstrable sustainability of mangrove utilization
8. Demonstrable minimization of threats from shipping and marine pollution, including improved navigation aids and pilotage, surveillance and enforcement capacities
9. Demonstrable increase in research and monitoring capacity, through the conduct of surveys, establishment of long-term monitoring sites and of regional "nodes" for data storage, analysis and dissemination
10. Publications – manuals, atlases, multi-media kits, education and awareness materials etc.
11. Demonstrable increase in education, government and public awareness

II. Impact indicators

1. Demonstrable improvement in stakeholder involvement in decision-making
2. Stakeholder and user conflict resolution
3. Demonstrable improvement in standard of living of coastal communities and other socio-economic benefits within the sphere of influence of the RAP
4. No further degradation of mangrove condition, and improvement of degraded mangrove areas through planting and restoration
5. Achievement of sustained financing from government and other sources

Appendix 4

Techniques for raising awareness of mangroves and associated coastal habitats

1. Development and provision of teaching materials to schools, targeting different age groups
2. Talks at schools and other interest groups
3. Addition of subjects in school and college curricula covering mangroves and associated coastal habitats
4. In conjunction with rural extension programmes in coastal areas, include materials concerned with sustainable utilization and conservation of mangroves
5. Production of newsletters and information sheets – booklets
6. Production of postage stamps featuring mangroves and associated coastal habitats (with co-operation of postal authorities)
7. Production of specific information materials for individual MPAs, provided to all visitors as part of the fee structure for MPA entry
8. Development of public awareness campaigns (potential for collaboration with ISME)
9. Widespread use of the mass media – newspapers, radio, television and the WWW, with development of strong linkages to various mass media
10. Production and distribution of videos and CDs, (several excellent videos and CDs are already in wide circulation)
11. Production of target materials for resort hotels near mangroves
12. Organization of seminars, workshops and conferences with invitations to the mass media, key government representatives and the general public
13. Talks at coastal villages and towns with provision of free lectures – meetings – question-answer sessions
14. Development of strong linkages and information networks with key government departments and agencies, with regular supply of updated materials
15. Employment of public relations ‘extension’ officers – particularly useful where local communities are major stakeholders in MPAs (e.g. local fishing communities)

Appendix 5

Assessing management effectiveness in MPAs

The IUCN World Commission on Protected Areas has established a 'Management Effectiveness Task Force' to develop a system for verifying or assessing management effectiveness – including on-going management of existing MPAs and the location and design of new MPAs. The Task Force recommends use of generic 'outcome' indicators (e.g. measuring biodiversity conservation and socio-economic effectiveness). Principles for assessment of MPA effectiveness include the following (after WELLS 1999):

1. Assessment systems should be participatory at all stages, involving all relevant organizations and stakeholders
2. Assessment should be 'transparent' and comprehensible to all participants, and be based on appropriate environmental and social science
3. Management objectives must be clearly defined and understood by both managers and assessors
4. Assessment should focus on the most important issues, threats and opportunities affecting achievement of management objectives
5. MPA design, results and outcomes should all be considered
6. MPA Effectiveness Indicators should identify critical aspects of ecological-environmental, socio-economic and other management issues, including the relationship of the MPA with its surroundings
7. The assessment system must be able to demonstrate trends in management effectiveness over time, through repeated assessments
8. Strengths and weaknesses should be identified and issues clearly separated into those within and outside the control of management
9. Recommendations for improved management, including prioritization of conservation effort, and limitations of the evaluation should be clearly identified

Another approach is the assessment of overall MPA performance by scoring success in each of five broad categories:

1. Maintenance of living and non-living resources
2. Market value of the MPA and its resources
3. Social expectations
4. Maintenance of ecosystem functions
5. Management

The use of standard MPA evaluation data-sheets and statistical software provides a standard means of comparison of management effectiveness among MPAs.