4. STATUS OF CORAL REEFS IN THE RED SEA AND GULF OF ADEN REGION

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ABSTRACT

- Coral reefs are generally healthy throughout the Red Sea and Gulf of Aden with 30% to 50% live coral cover at most locations and more than 50% total on average;
- Coral reefs have been damaged near urban and industrial centres from land-filling and dredging; port activities (damage by anchors, oil and wastewater discharges); sewage and other pollution (causing localised coral disease, poor recruitment, and excessive algae); and tourism (damage from anchors and recreational scuba divers);
- Most of the coral reefs in the region severely damaged by coral bleaching in 1998 (approximately 30%) are recovering, especially in the central to northern Red Sea of Saudi Arabia (especially near Rabigh) and in Yemen (Belhaf, Hadhramaut, Socotra Archipelago);
- Outbreaks of crown-of-thorns starfish (COTS) have been reported from the Iles des Sept Freres, Ras Siyyan Marine Protected Area (Djibouti), and on Yemeni Red Sea Reefs;
- Invertebrate populations are generally healthy except for localised declines of giant clams (Egypt) and other molluscs (Sudan), lobsters (all Red Sea and Gulf of Aden reefs) and sea cucumbers (Egypt, Yemen, Sudan);
- Target fish species, especially grouper, are relatively common compared to elsewhere, although there is heavy exploitation in Sudan and Yemen;
- Fishing pressure is increasing at spawning and nursery sites, and sharks are heavily exploited; ornamental fishes are collected in Egypt (recently banned), Saudi Arabia, and Yemen but not yet assessed. The fish community structure adjacent to industry in Aqaba and Yemen has been significantly altered;
- There is some evidence of recent climate change damage on coral reefs;
- Two natural disturbance events affected reefs in 2007: extreme low tides in March caused coral bleaching and mortality on reef flats in Egypt, Sudan, and Jordan; and bleaching killed corals to 20 m depth on ‘Rocky Island’ in the southern Egyptian Red Sea;
A volcano on 30 September 2007 damaged some reefs around Jabal Al-Tair island off Yemen;

PERSGA has issued Regional Action Plans for conservation of coral reefs, marine turtles, mangrove, and seabirds in the Red Sea and Gulf of Aden Region; and

PERSGA has added climate change impacts to the regional monitoring programmes.

INTRODUCTION

The Red Sea and Gulf of Aden is a globally significant marine ecosystem, renowned for unique and beautiful marine and coastal environments and high species richness, including many endemic species. The global conservation values of the Region include the diversity of coral reef habitats in the central Red Sea of Saudi Arabia and Sudan; distinct zoogeography and many endemic species; unique coral reefs around the Sinai (Egypt); atoll-like formation of Sanganeb Atoll (Sudan); extensive stands of mangroves and populations of dugong and turtles in the southern Red Sea; unique biodiversity of the Socotra Archipelago (Yemen); and extensive stocks of commercial fishes in the Gulf of Aden.

The living marine resources of the Red Sea and Gulf of Aden have played a major role in the history, development, and cultural heritage of the countries. These waters are a transit route for much of the world’s petroleum, dry bulk and other cargoes; thereby providing major challenges to their sustainable use. Traditional uses by the original inhabitants were predominantly ecologically and socially sustainable, however, increasing coastal populations, rapid development and human exploitation threaten the sustainability and special conservation values. In several countries, petroleum industries dominate the economies thereby requiring extensive sea transport and port facilities. International dive tourism growth has damaged some coral reefs at heavily visited reefs, especially in Egypt. Population growth in the coastal zone has led to localised habitat destruction and modification, and pollution, and there is now over-fishing of invertebrates, fishes, and sharks.

Considerable advances have been made in coral reef management and understanding of the marine environment of the Red Sea and Gulf of Aden. PERSGA produced ‘The State of the Marine Environment Report’, which assesses natural resource status, current issues, needs for additional actions, and constraints to continued progress in environmental management and understanding. There is also significant progress in: the establishment of marine protected areas (MPAs); capacity building and management experience; scientific understanding of some species and ecosystems; improved safety measures for maritime transport; and integrated coastal management. In 2006 PERSGA activated the ‘On-ground Projects Programme’ which aims to implement a project each year in the member countries on specific needs, for example, in Jordan, ‘Education for sustainable development – coastal and marine ecosystem’; in Sudan, ‘Capacity building in ICZM’; in Saudi Arabia, ‘Mooring buoys for reef conservation’; in Egypt, ‘Eco-tourism in managing the mangrove areas’. The regional monitoring programme is to be implemented every two years, with the next survey planned for 2010. Furthermore, PERSGA has integrated the IYOR-2008 in all its planned activities to raise the public awareness about the importance of the marine resources and their conservation, and updating databases including those on biodiversity and MPAs (e.g. MPA global database).
Status of Coral Reefs in the Red Sea and Gulf of Aden Region

Legend:
- Coral Reefs

Map showing the location of coral reefs in the Red Sea and Gulf of Aden region, with major cities and locations such as Hurghada, Port Sudan, and Jeddah indicated.

Scale:
- 0 75 150 300 Kilometers

Countries and regions highlighted include Egypt, Saudi Arabia, Sudan, Eritrea, Yemen, Ethiopia, and Djibouti.

Key locations:
- Gulf of Suez
- Gulf of Aqaba
- Red Sea
- Gulf of Aden

Cities and points of interest:
- Hurghada
- Jeddah
- Port Sudan
- Suakin
- Massawa
- Dahlak Archipelago
- Sept Freres
- Eilat
- Aqaba
- Al Wadj Bank
- Rocky Island
- Dungonab Bay
- Sanganeb Atoll
- Kamaran Island
- Farasan Island
- Ras Mohammed
- Ras Mohammed National Park

The map provides a detailed overview of the geographical distribution of coral reefs in the region, highlighting areas of conservation interest.
STATUS OF CORAL REEFS: 2008

The following information has been summarised from the ‘Country Reports’ gathered by PERSGA from its regional experts network (REN), and updated from various sources, including survey and monitoring data from 2004-2008, and the chapters presented on the attached CD.

Egypt

The diverse coral reefs of the Egyptian Red Sea have evolved from the area’s unique geological and bio-geographic features. In the north, the Red Sea rift system splits into the Gulfs of Suez and Aqaba which both have markedly different morphologies. Inside and south of the Gulfs of Suez and Aqaba are extensive fringing reefs which extend from Gubal in the north to Ras Hedarba at the border of Sudan. These fringing reefs are not continuous because periodic flooding from wadies creates gaps, resulting in soft bottom sharms or lagoons. Mohammed Kotb and colleagues recognized 6 basic types of reef and bottom profiles along the Egyptian Red Sea based on the type of bottom, reef width, water depth and topography, influence of floods and gradient of the different reef zones. There are 209 hard coral and 16 soft coral species in the Egyptian Red Sea; while there are about 300 hard coral species in the entire Red Sea. Live coral cover on the Egyptian reefs averages 48% (34% hard coral, 13% soft coral) at the surveyed sites. The Reef Check target fish species estimates are that butterflyfish are the most abundant with 7.2/500 m³, with fewer grouper (0.8/500 m³) and parrotfish (2.2/500 m³).

The coral reefs of Egypt are under increasing pressure from the rapidly expanding tourism industry, which is also an extremely important economic activity. Damage occurs from direct impact of divers and snorkelers, and indirect impacts caused by developing tourism facilities including landfill, dredging for artificial beaches, boat anchors and grounding, and sedimentation. The strategy of assigning carrying capacity to a reef may not be sufficient to limit the impact of divers. Therefore, a more comprehensive framework of approaches is required to limit diver and snorkeller damage. The number of hotels in the Gulf of Aqaba has increased from 5 in 1989 to 141 hotels in 2006: the number of hotel rooms increased from 565 to more than 48 000. Similarly, around Hurghada, the number of hotel rooms increased from a few hundred in 1989 to 35 000 in 2004 and is predicted to reach 75 000 by 2009. Unconstrained development along the Red Sea and Gulfs of Suez and Aqaba will intensify tourism damage to all reefs, especially the fringing reefs.

The number of tourism boats has increased sharply over the last 20 years leading to increased damage from anchoring and boat groundings. In Sharm El Sheik dive boat numbers rose from 23 in 1989 to 350 in 2006 and in Hurghada the increase was from less than 50 to more than 1200 boats. The Red Sea Protectorates Authority reports an average of 15 boat groundings per year. Some anchoring damage has been eliminated since moorings were established from Hurghada to the Fury Shoals. Beaches are prime attractants for resort developers, but there are few natural beaches, so some coastal resorts on rocky shores have created artificial beaches. This not only covers reef habitats, but also the sand is transported down current causing sedimentation and increasing water turbidity.

The Government of Egypt has enacted laws prohibiting discharge of sewage and other contaminants into the Red Sea. Freshwater is scarce in these areas thus most resorts have their own sewage treatment facilities and use the wastewater for irrigation. However, there is
still pollution from: seepage of untreated sewage from septic tanks as the cities lack central sewage treatment; seepage from irrigation waters; and discharge of untreated sewage from day and safari boats.

Two series of COTS outbreaks occurred in the Ras Mohammed National Park in 1994 and 1998. The first outbreak was relatively minor, whereas the 1998 outbreak was extensive and probably continued through 1999 and 2001 although major control programs were implemented.

Until 2 events in 2007 there had been little evidence of climate change impacts on Egyptian coral reefs. Extreme low tides in March exposed reef flats from the Gulf of Aqaba to the Fury shoals, 430 km south of the Sinai Peninsula, resulting in extensive coral bleaching and mortality. The other was a thermal water bleaching event in October, with major coral bleaching to 20 m depth at ‘Rocky Island’, 450 km south of the Sinai Peninsula. Rocky Island is surrounded by deep water and bleaching followed the September predictions from NOAA of a ‘hot spot’ in the central Red Sea based on Degree Heating Week (DHW) analyses. The extent of coral mortality was not quantified on this remote area.

**Over-fishing** poses a threat to Egyptian coral reefs through an increase in commercial fishing and heavy trawling in the Gulf of Aqaba, along with poaching in no-take zones. Fisheries in the Red Sea are predominantly seasonal and correspond with the spawning seasons of the most valuable commercial fishes, such that commercial fish populations are under serious threat of depletion.

**Destructive fishing** results from local fishermen, migratory fishermen from other provinces, and visiting fishers from the Nile Delta who use purse-seine nets during the fishing season and then return to their home villages. The traditional local fishers are increasingly abandoning fishing for more lucrative opportunities in the dive industry or in hotels. Newcomers who replace them have less knowledge about the local ecology and often use unsustainable fishing practices, resulting in an increase in habitat destruction from net damage. Also, traditional local fishing knowledge is being irreversibly lost.

**Shark fishing and sea cucumber collection** are more recent threats to Egyptian reefs. The insatiable market for shark fins has induced sharp increases in shark fishing which introduces a conflict with tourism. Sharks in the Egyptian Red Sea constitute a very high commercial resource for tourism: for example, the annual commercial value of an individual shark at the valuable diving site of Brother Island exceeds $300,000 because these sharks represent the main attraction for divers. The Egyptian government issued a decree banning shark fishing on the Egyptian Red Sea coast in 2004.

After sea cucumbers were depleted in many other parts of the world a small-scale fishery began in Egypt in the late 1990s. By 2000 the sea cucumber fishery had increased greatly because of high prices. In April 2000 the Red Sea Governorate banned sea cucumber fishing in coastal areas under its jurisdiction, however, the sea cucumber fishery was re-opened in 2002 despite the efforts of Egyptian Environment Agency and the Governorate to retain the ban. Between 2002 and 2004 extensive fishing of sea cucumber resulted in serious depletion of the natural stocks and 5 commercial species have disappeared completely from many reefs. All Egyptian authorities agreed to completely ban sea cucumber fishing in 2004. The decline in Egypt’s sea cucumber fishery has followed similar patterns elsewhere—a boom followed by a collapse of most stocks.
**Djibouti**

There is discontinuous fringing reef growth on the 370 km coastline of Djibouti with the coral reef area being only 12 km², and mostly growing on the fossil reef plateau of the islands of Musha and Maskali. The best reef areas are around the Sept Frères archipelago in the north near the narrow Strait of Bab-al-Mandab and along the Gulf of Tadjoura. Corals grow between 1 m and 45 m depth but the relatively high turbidity limits most coral growth to the upper 15–25 m. A survey in 2007–2008 estimated average coral cover at 56% (33% hard corals and 23% soft corals). Butterflyfish were the most abundant of the Reef Check target species with 6.1/500 m³, while grouper were 0.5/500 m³, and the parrotfish 1.2/500 m³.

Reef Check surveys in 2004 at 19 sites in the Gulf of Tadjourah and Sept Frères region reported coral cover from 5% in the Moucha channel to 65% off Sable Blanc with an overall average of 27.3% in the Gulf of Tadjourah. Earlier surveys in 2002 showed minimum coral cover to be 12%, the maximum more than 60%, and the average 36%. This may indicate that the status of corals is deteriorating. The highest cover reported was 71.9% on north-east Sept Frères, with half of this being soft corals. In the Gulf of Tadjourah the cover was predominantly hard corals, with the highest on the northern coast of Gulf of Tadjourah (66.3% at Sable Blanc and 51.9% at Ras Duan). Whereas there was moderate cover on the southern coast of Gulf of Tadjourah (23.1% at Trois Plage) and Banc d’Ambouli at 42.5%. The lowest cover was on Moucha and Maskali Islands (5% to 35.6%); lower than the minimum cover on Sept Frères of 38.8%.

Djibouti’s reefs are under threat from domestic tourism, sewage discharges, shipping and associated spills and pollution, with pressures particularly high around the capital city. Shipping is an important commercial sector as Djibouti is the major harbour for Ethiopia. Anchor, boating and tourism damage is increasing, with little increase in environmental awareness. International tourism is just developing and damage so far is limited. There is low level subsistence fishing and limited exploitation of fish for live export but aquarium fish collecting is increasing.

**Saudi Arabia**

The Red Sea coast of Saudi Arabia is 1840 km long with extensive coastal fringing, patch/platform, pillar and barrier reefs. The reefs are highly developed in the northern and central Red Sea, but decrease towards the south due to higher sedimentary input. Most reefs in Saudi Arabia are in good condition with the exception of those flanking the major cities of Jeddah, Yanbu and Jizan. The highest coral cover was in the Gulf of Aqaba (51% at 5 m depth, average 46.3%) and on the reefs off Jeddah in the centre with a minimum of 27% (average 30% at 5 m). There were high fish counts in the Gulf of Aqaba (e.g. maximum counts of butterflyfish 8.9/100 m², parrotfish 4.75/100 m² and grouper 30.1/100 m²), whereas in Jeddah the respective counts were 2/100 m², 2.3/100 m² and 0/100 m². Thus fishing is very low in the Gulf of Aqaba but much higher near Jeddah with higher local and tourist populations. Coastal areas along the Jeddah Corniche were in-filled with 700 000 m³ last year and dredged extensively. The disturbed sediments, petroleum products, industrial pollution and poorly treated sewage are damaging the nearby reefs. Jeddah produces more than 800 000m³ of wastewater per day which is discharged into the sea near the centre and south of the city. Fishing and anchoring on coral reefs is a cause for concern. More than 8 accidents occurred in the port during 2006–2007 damaging more than 600 m² of coral reefs and spilling 450 tons of oil. Desalination plants pump 2.27 million cubic metres a day of salty, hot water into the sea. All these factors are resulting in extreme environmental stress along the Jeddah coast.
Considerable efforts have been directed to minimize these human impacts on the coral reefs. For example, Saudi government agencies and the private sector have carried out 8 clean up activities on the seabed involving more than 100 divers collecting 2 to 40 tons of waste per month. Land filling along the Jeddah Corniche was suspended by the head of Meteorology and Environment Protection because the contractor was using illegal methods. The Environment Committee of the Mecca Emirate and PERSGA developed an action plan to preserve the Mecca coastal zone in June 2007 with the first step being the installation of mooring buoys off Jeddah city to eliminate anchor damage.

**Sudan**

The 750 km coast of Sudan is characterized by variable biodiversity environments which are attracting many coral reef divers. The status of coral reefs in Sudan is currently good, with no significant changes since the 2004 report. Recent surveys by the High Council of Environment and Natural Resources, Red Sea State in late 2007 reported thick aggregations of COTS damaging the reefs of Talatla Saghir. Risks to the coral reefs are increasing due to the expansion of coastal activities, such as 4 new extensions to the port at Port Sudan using explosives, resulting in very turbid water and sediments which smother corals. Oil exploration is being planned for Suakin and the area of Talatla Saghir and Talatla Kabir.

The most recent surveys estimate an average coral cover of 40% consisting of 25% hard corals and 15% soft corals at the surveyed sites. Butterflyfish were the most abundant of the Reef Check target group with 7.5/500 m³ while the grouper count was 1.0/500 m³, and parrotfish 1.4/500 m³.

The immediate coral reef conservation focus in Sudan is coastal and marine monitoring of the Sudanese Red Sea; implementing the existing monitoring programme; training scientists to dive and monitor the Sudanese reefs; and conducting regular monitoring. PERSGA is planning to implement a mooring buoy system at the most popular diving and fishing sites to protect these reefs as tourism development is increasing.

**Yemen**

Southern Yemen is in the Gulf of Aden and Arabian Sea Region and reefs extend from the narrow strait of Bab Al Mandab at the southern entrance to the Red Sea to the Omani border in the east. The Gulf of Aden region contains about 70% of the 1400 km long coastline of Yemen and is characterized by rich marine diversity, due to its geographical location, stable meteorology and variable hydrodynamic factors; all of which favour many different marine fauna and flora such as coral reefs, seagrasses and algae. A seasonal upwelling in the Gulf of Aden promotes the growth of macro-algae on most hard substrates, especially to the east and increases primary productivity that supports high biodiversity. This is a major shipping area, thus the international MARPOL convention has designated the Red Sea and the Gulf of Aden as ‘special areas’. Oil is exported through Yemen and both exploration and port developments are increasing.

Corals are widespread and generally healthy in this area. The Yemen Liquefied Natural Gas (YLNG) project surveyed several sites in 2005 including the Balhaf area; however, Yemen lacks the capacity to design, implement, and support monitoring and management programs in the area. There are extensive and high-cover coral communities in the Gulf of Aden region,
especially in sheltered and moderately sheltered areas where coral cover is often well over 50% and up to 100% at the best sites, which may spread for hundreds of metres. In Khor Omera, Aden, Shuqra, Balhaf, Bir Ali and Burum the reefs are dominated by branching, foliose, encrusting and massive coral forms, as well as soft corals. The volcanic headlands and small rocky islands near Aden are covered with highly diverse coral communities, including branching, encrusting, foliose and massive formations which often cover 100% of the rocky surfaces. Balhaf and Bir Ali are the most important coral areas in the eastern Gulf of Aden with extensive fringing coral reefs and important fishing areas.

Recent estimates show that average coral cover is 45% (25% hard coral, 20% soft coral) at the survey sites. The target fish populations are dominated by butterflyfish (5.5/500 m$^3$), while grouper (0.5/500 m$^3$), and parrotfish (0.6/500 m$^3$) are less common.

There are several important conservation areas, for example the Five Islands, less than 8 km off Bir Ali, have high coral species diversity (73 hard coral species and 8 genera of other reef cnidarians) at Balhaf. The status of corals in the region is generally good, however, localized damage is being caused around major cities such as Aden and Al Mukalla, including over-exploitation, damage from fishing vessels, artisanal fishermen and small boat use, anchoring, damaging fishing methods, sewage discharges, and shipping and associated spills. Local tourists are over-collecting corals and invertebrates, and trampling over the reefs, especially in the Shuqra area. A major natural stress occurred in September 2007 with a volcanic eruption and earthquakes at Jabal At Tair Island. There were previous eruptions in the 18th and 19th centuries, however the 2007 eruption was strong, with lava shooting 300 m into the air and lava and magma flowing into the sea.

Fish populations have been depleted due to increased fishing effort and the use of non-sustainable gear, such as traps. There is no collection for the aquarium trade. Yemen is developing plans to conserve the marine environment at the national, regional and international levels by applying integrated coastal management under the umbrella of PERSGA. This aims to improve local capacity to plan and monitor coastal development to improve environmental conditions and prevent further degradation (Decree of Prime Minister No.99-2005). This includes protecting the corals and corals communities in the Aden Governorate; but the plan has not been implemented. Some important coastal areas have been proposed as protected areas; Bir Ali is a de facto protected area, and could be declared officially in the near future. The area from Balhaf to Burum qualified as an area of regional importance and it is proposed as a Yemeni MPA and included in an ICM Zoning Plan. Yemen recently revised legal and regulatory frameworks, and implemented other measures to conserve the marine environment and their living resources.

**Somalia**

The 3300 km coastline of Somalia is naturally divided into north and south sectors. The north coast is generally shallow with exposed, high energy sandy beaches and occasional outcrops and cliffs. There are a few coral reefs near Raas Khansir, Raas Cuuda Siyara, and off El Girdi and west of Berbera: these mostly grow on shallow fossilised rocks, 1–10 m deep. The coral communities vary considerably in condition and all have been affected by recent coral bleaching. The shallow reefs east of Berbera have suffered extensive mortality, whereas the deeper reefs (2–5 m) are in better condition. At the Saardin islands 69 species of scleractinian coral, 11 species of alcyonacean coral and 2 fire corals were recorded in 2002, and fish populations
contained many large fish. The last survey 6 years ago showed an average of 50% living coral cover (30% hard coral, 20% soft coral) at the survey sites. Butterflyfish were most abundant with \(4.1/500 \text{ m}^3\), plus grouper \((0.6/500 \text{ m}^3)\), and parrotfish \((0.9/500 \text{ m}^3)\). The area is both productive and relatively pristine, apart from the effects of coral bleaching and some COTS predation. Somali fishermen target a limited number of demersal stocks and a small range of coral reef fish. Fishing is limited and nearly entirely artisanal, however, foreign commercial fishing occurs on the north coast.

Three areas have been proposed for protection on the north coast but only the Aibat, Saad ad-Din and Saba Wanak area includes coral reefs. There is minimal human disruption to the environment; the only exceptions are relatively heavy, opportunistic exploitation of turtles and sharks. Fisheries and transport are small components of the national economy and pose no significant threats to coral reefs. Somalia is politically unstable thus the ability to effectively implement international or regional agreements is limited and national conservation legislation is virtually non-existent. Increased funding and training of local personnel are required to improve coral reef conservation but this has a lower priority than the rebuilding of the nation and eradicating poverty. The major needs are a system of marine protected areas; the introduction of oil spill response measures; broad-scale environmental education; and monitoring to detect reef deterioration.

**Jordan**

The Gulf of Aqaba coastline is only 27 km long, with 30% of this for ports and 30% an MPA. Fringing reefs border 50% of the coast with a high diversity of coral and associated fauna (about 180 coral and 512 fish species). Jordanian coral reefs are in good condition, with up to 90% coral cover in some areas. No major catastrophes have been recorded recently although some localized damage has occurred in areas visited by tourists or close to industrial facilities. There is approximately 45% living coral cover consisting of 30% hard corals and 15% soft corals. The target fish species with the highest abundance are butterflyfish \((6.2/500 \text{ m}^3)\), while grouper are \(0.9/500 \text{ m}^3\), and parrotfish \(1.2/500 \text{ m}^3\).

The main threats are oil spills and industrial discharges, municipal and ship-based sewage, and solid waste. Unplanned tourism development may also further threaten the reefs. There is one 7 km long MPA in Jordan (The Marine Peace Park). Jordan has recently revised its legal and regulatory framework for environmental protection at national and international levels, and Jordan is party to 8 regional and international conventions or treaties pertinent to coral reef conservation. There is a need to strengthen institutional capabilities of Jordanian government agencies through hiring and training of staff, implementation of environmental protection laws and regulations, and improving regional cooperation to co-ordinate and enhance the efforts of individual Gulf-bordering nations. Also needed are the development of an integrated coastal management strategy and capacity building at legislative, management and operational levels.

**Socioeconomic Status**

The socioeconomic significance of artisanal and industrial fisheries is important in the national economies and rural communities in all PERSGA member countries, except for Jordan which has minimal fisheries; however, these have not been studied. There are threats to some fish
stocks, especially vulnerable species such as sharks, cuttlefish, shrimp, and rock lobster. The main reason is a lack of reliable information on fisheries and environmental interactions.

**STATUS OF MANGROVES, SEAGRASSES AND FISHERIES**

Mangroves occur as distinct but isolated stands on all coastlines except for Jordan. Those on the Egyptian and Saudi Arabian coasts of the Gulf of Aqaba are the northernmost distribution in the Indian Ocean. Extensive stands occur in the southern Red Sea of Saudi Arabia and Yemen where the continental shelf is wide with stable sediment layers suitable for mangrove growth. There are no mangroves on the Gulf of Aden coast of Yemen apart from a unique, isolated stand in the crater lake at Kharif Sha’ran. There are extensive mangrove areas (*Avicenia marina*) in lagoons separated from the sea by sand dunes around the Socotra Archipelago. Dense, healthy stands of both *A. marina* and *R. mucronata* occur in Somalia. Human uses for mangroves include using wood for fuel, house construction, fence posts, and the collection of leaves for livestock fodder. The latest survey of 79 stands in the region report that 74% are damaged and shrinking rapidly, with the remainder in good condition. The major efforts to conserve the mangrove areas are contained in national and regional action plans, however, the implementation of these plans is proceeding at very variable rates. For instance, all mangrove areas in Egypt are protected and protection is being enforced.

There are 11 species of seagrass in the Red Sea and Gulf of Aden region, ranging from mid-water to 70 m deep. The most commonly recorded species are *Halodule stipulacea*, *H. uninervis*, *Thalassodendron ciliatum*, *Syringodium isoetifolium*, and *Halophila ovalis*. Seagrass beds generally occur in protected lagoons and bays with 3 major assemblages along the eastern Red Sea separated by latitude. This suggests distinct biographic groupings. Similarly, three types of seagrass assemblage have been differentiated in the Gulf of Aqaba.

Management of living marine resources (LMR) has not been fully addressed by the countries at both local and regional levels. Sustainable use and management efforts encouraged by PERSG–SAP during 1999–2003 stimulated some actions and initiatives, particularly the management of commercial fisheries resources. However, there are weak statistical data collection systems and countries seek to regulate traditional fishing effort based on inadequate stock assessment studies to reduce effort; inadequate institutional and technical capacity to conduct research and stock assessments; poor legal frameworks for fisheries management and development in many states; no incorporation of internationally accepted modules for management; insufficient monitoring, control, and surveillance systems; poor awareness of the need for and benefits of effective fisheries management by stakeholders in the fisheries sector; and limited fisheries management plans in the member states. PERSGA has built capacity for sustainable management of LMR; developed management strategies for LMR stocks; assessed the environmental effects of fishing techniques; and assessed stocks of fishes and other invertebrates.

**CONSERVATION EFFORTS:**

PERSGA has issued Regional Action Plans (RAPs) for conservation of coral reefs, marine turtles, mangroves, and seabirds in the Red Sea and Gulf of Aden Region. These RAPs contain priority actions with these major objectives:

1. Integrated Coastal Zone Management
2. Education and awareness
3. Marine Protected Areas (MPAs)
4. Ecological Sustainable Reef Fisheries
5. Impact of Shipping and Marine Pollution
6. Research, Monitoring and Economic Valuation

Each RAP addressed specific actions, expected results and performance indicators and quality assurance. National Action Plans (NAPs) were developed for each member country in parallel with the RAPs. The implementation of NAPs and RAPs will be variable depending on national capacities, constraints and priorities. Therefore, international agencies and donors are requested to assist in overcoming these constraints. PERSGA has integrated the implementation of RAPs and NAPs into the 2004–2014 strategic plan and established an On-Ground Project Programme (OGPP) to directly support the implementation of NAPs according to resource availability. Furthermore, in 2005 PERSGA member states formulated a regional agreement for biodiversity conservation and establishment of a regional MPA network. In addition, potential climate change impacts on the marine and coastal environment have been included in regional monitoring programmes. Related topics such as sea level rise, coral bleaching, coastal environment degradation will be emphasised in national scientific research plans.

RECOMMENDATIONS

- Cooperation with international and donor agencies is needed to overcome the constraints of implementing the NAPs and RAPs: urgent assistance is required.

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SUPPORTING DOCUMENTS

The Status of Coral Reefs reports for each of the countries are included in the CD attached to this printed report. In addition, the PERSGA website: www.persga.org has the following documents:
Eritrea has had a troubled recent history, such that little information has come out on the status of their coral reefs. However, there have been recent exciting findings from a major initiative, the Eritrea Coastal Marine Island Biodiversity Project (ECMIB, funded by GEF, administered by UNDP and implemented by the Ministry of Fisheries). Since 2004 this has focused on building capacity, assessing the coastal resources and building the platform for conservation. The project found that Eritrean reef resources are indeed rich in the 3 distinct zones where coral reefs grow along the 1350 km long Eritrean coastline and more than 350 offshore islands in the central Red Sea. Each region contains globally important and unique assemblages of species with some of the most spectacular coral reefs in the world. Most of the coastline is sparsely populated, with Massawa and Assab the two main population centers, and only 7 of the offshore islands are inhabited: hence there are few human stresses, except for some land reclamation, sedimentation, and resort developments at Massawa and nearby islands. There has also been some anchor and diver damage but fishing and curio collection is minimal. The ECMIB project trained 53 Eritrean nationals overseas to assess biodiversity, especially on coral reefs, mangroves and seagrasses, as well as marine turtles, dugong, algae, birds and perform socioeconomic surveys. Another 40 nationals were trained locally with a focus on field work. They have surveyed 96 coral reef stations (68 using Reef Check protocols; 16 using video and photo transects, photo quadrats using AIMS methods adapted for the Red Sea; and 12 for coral taxonomy). Prior to 2007 only 154 coral species were known from Eritrea; however, visits to the northern Dahlak islands, the southern Dahlak islands and Assab islands found that coral cover can reach 100% in deeper waters, and the number of coral species has jumped to 220 in 38 genera. Included were 5 new species and perhaps a new genus. There was limited bleaching damage: the possibly exists that Eritrean corals may be resistant to wide temperature variations because local water temperature can reach 37.5°C in summer at 10 m depth. These warm waters of Eritrea now contain flourishing coral reefs that cope easily with warmer water; this may provide the reservoir to re-seed reefs damaged by climate change bleaching with corals that can grow at higher temperatures. It also may mean that Eritrea can develop a lucrative tourist industry based on divers who want to enjoy some of the world’s few remaining flourishing coral reefs. In addition, there is spectacular beauty on land and famous archaeological sites. Thus the government now has the responsibility of advancing conservation to protect these resources. Already they are planning to develop Sheikh Seid and Dissei-Madote islands as Eritrea’s two first MPAs and a new GEF project may expand this to larger areas around the Buri peninsula (from Virginie Tilot, ‘Charlie’ Veron and Alain Jeudy de Grissac).