

Information Sheet on Ramsar Wetlands (RIS)

- 2006-2008 version -

1. Name and address of the compiler of this form:

A. S. M. Khalil, E. A. Elhag and A. D. Elhag
C/O: Higher Council for Environment and
Natural Resources (HCENR).
Tel. +249 83 784 279
P.O. Box 10488 Khartoum
Tel:++249 183 784279
Fax: ++ 249 183 787617
e-mail: hcenr@sudan mail.net,
hcenr2005@yahoo.com

FOR OFFICE USE ONLY.

DD MM YY

--	--	--

Designation date

--	--	--	--	--	--

Site Reference Number

2. Date this sheet was completed/updated: 15th January 2009

3. Country: Sudan

4. Name of the Ramsar site: Dongonab Bay-Marsa Waiyai

5. Designation of new Ramsar site or update of existing site:

This RIS is for (tick one box only):

- a) Designation of a new Ramsar site ; or
b) Updated information on an existing Ramsar site

6. For RIS updates only, changes to the site since its designation or earlier update: Not applicable

7. Map of site

a) A map of the site, with clearly delineated boundaries, is included as:

- i) a hard copy: ;
ii) an electronic format ;
iii) a GIS file providing geo-referenced site boundary vectors and attribute tables .

b) Describe briefly the type of boundary delineation applied:

The boundary follows the Dongonab Bay, and covers the main stretch of coast where the relevant biodiversity is found. The area also includes two small proposed marine protected areas around Mukkwar Island and the Shuaab Rumi coral reefs.

8. Geographical coordinates:

The latitude goes from 21° 24' N to 19° 42' N, while the longitude goes from 37° 00' E to 37° 26' E

9. General location:

Eastern Sudan – Red Sea State (Estimated population as of 2008 is 684,271)
The proposed Ramsar Site extends between Marsa Waiyai (19° 45' N, 37° 15' E), just north of

Port-Sudan in the south to Khor Shannab (21° 24' N) in the north, and from the higher reaches of Khor Shanaab (37° 00' E) in the west to Brajah Island (37° 25' E) in the east. At the southern part of the site the marine part extends more southeast to include Shuaab Rumi coral reefs and Sanaganeeb Atoll (19° 42'N, 37° 26'E). Most of the site (northern part) is located in Halaib Directorate, while only a small southern portion of the site belongs to Red Sea Directorate.

Estimated populations of:

Dongonab 1000

Mohammed Gol 1000

Source: *Socio economic survey (WRC,2007)*

Distance from the nearest significant town or city centre:

Dongonab to Port Sudan (the State capital) is 165 Km

10. Elevation: Sea level to about 10 m.

11. Area:

The coastal stretch extends for about 140 km (without inundations). Given an average width of 20 km, the total area of the proposed site represents approximately 280,000 hectares.

12. General overview of the site:

The site is an extensive coastal stretch including various biotopes of coral reefs, mangroves, off-shore islands, soft-bottom mud flats sand beaches and hard bottom rocky shores, in addition to salt-marsh, sabkha and khor basins. The northern part of the site represents the proposed Dongonab Bay-Mukkwar Island Marine Protected Area. Beside Mukkwar Island the site also includes a large number of islands of smaller size, particularly important for breeding birds. The coastal stretch to the south, up to Marsa Waiai (southern limit of the site) includes various soft-bottom habitats important for shorebirds. Several marsas occur at deltas of wadis, which harbor mangroves and salt-tolerant vegetation. Off-shore at the southeastern corner of the site Shuab Rumi reefs and the unique Senganeb Atoll are located. The former is proposed MPA. The latter has been identified as a potential World Heritage Site and declared as Marine National Park since 1990. Senganeb National Park (SNP) is protected and managed by the Wildlife Conservation Administration, which has recently developed a master plan for SNP management (WCA 2003).

13. Ramsar Criteria:

1 • 2 • 3 • 4 • 5 • 6 • 7 8 • 9

14. Justification for the application of each Criterion listed in 13 above:

Criterion 1: The site includes well-developed coastal *Avicennia marina* mangrove stands adjacent to Mohamed Gol village, at Marsa Arakiayi and Marsa Halut, as well as on inshore and offshore islands e.g. Mukkawar Island (Khalil 2003). These are by far the biggest and oldest *Avicennia* trees recorded from mangrove areas in the country. Coral reef exhibits unique diversity at the site. This refers to the variation of oceanographic conditions between water within and outside Dongonab Bay. Whereas coral communities inside the bay are more similar to coral growths of the southern parts of the Red Sea, e.g. coasts of Eritrea and Yemen, those outside the bay are more similar to coral growths at the central and northern parts of the Red Sea. The site includes a large number of coastal and off-shore islands such as Mukkwar, Umm Al-Gorosh, Umm Al-Sheikh and Saad-Allah Archipelago, which provide nesting sites for seabirds and turtles (See criterion 5 below).

Criterion 2: It has been reported that the population of dugong (*Dugong dugon*) within the proposed Dongonab Bay-Mukkwaw Island MPA may exceed the numbers reported from the East African coast of Mozambique, Kenya and Tanzania. The dugong is considered vulnerable in the IUCN Red List. At least two species of marine turtles, the hawksbill turtle (*Eretmochelys imbricata*, CR) and green turtle (*Chelonia mydas*, EN) have been reported in the site (WCA 2003, Abdellatif, 1980). The green and hawksbill turtles are considered endangered and critically endangered, respectively, by the IUCN Red List. They are also both included in CITES Appendix I. Additionally, the Barbary sheep (*Ammotragus lervia*) and the Dorcas gazelle (*Gazella dorcas littoralis*) are considered vulnerable; while the Nubian ibex (*Capra ibex nubiana*) is classified as endangered by the IUCN Red List. Finally, the ostrich (*Struthio camelus*) is included in CITES Appendix I.

Criterion 3: The site includes mangrove forests and extensive coral reefs, coastal and off-shore islands which support biodiversity characterized by typical Red Sea and Indo-pacific communities, many of which are still in a pristine state (see justification for criterion 1 above). The hard and soft coral fauna at Sanganeb Atoll is among the richest in the Red Sea. A total of 124 cnidarian species (Mergner & Schumacher 1985) and 250 coral fish species have been recorded.

According to Fishpool and Evans (2001), this site coincides with an Important Bird Area (IBA) and is known to hold, on a regular basis, greater than 1 % of the biogeographic population of the White-eyed Gull (*Larus Leucophthalmus*) with about 100 breeding pairs, and the Lesser Crested Tern (*Sterna bengalensis*) with about 1700 breeding pairs. The site is also known to hold a significant component of the group of species whose distributions are largely confined to the Sahara-Sindian Biome. Seven of the 17 species of this biome that occur in Sudan have been recorded in this site. These include the Sooty Falcon (*Falco concolor*), the Spotted Sandgrouse (*Pterocles senegallus*), Bar-tailed Lark (*Ammomanes cincturus*), Desert Lark (*A. deserti*), Hoopoe Lark (*Alaemon alaudipes*), White-crowned Wheatear (*Oenanthe leucopyga*), Mourning Wheatear (*O. lugens*) and Fulvous Chatterer (*Turdoides fulvus*).

Criterion 4: Islands at the site provide nesting sites for a significant diversity of breeding waterbirds including true seabirds (e.g. gulls and terns), and marine turtles (*Eretmochelys imbricata*, *Chelonia mydas*). Mangroves and marsas are breeding and feeding grounds for several fish species and shrimps. Some of the breeding birds present include the little green heron (*Butorides striatus*), pink-backed pelican (*Pelecanus rufescens*), goliath heron (*Ardea goliath*), osprey (*Pandion haliaetus*), sooty falcon (*Falco concolor*), crab plover (*Dromas ardeola*), sooty gull (*Larus hemprichii*), swift tern (*Sterna bergii*), lesser crested tern (*Sterna bengalensis*) and white-cheeked tern (*Sterna repressa*).

Criteria 6: The site includes an elongated, largely undisturbed stretch of coastline for passage and wintering of shorebirds, gulls and terns. In addition to Mukkwaw Island the site includes a large number of islets of different size and substrate types that support breeding marine birds. According to a recent PERSGA survey (Shobrak 2002), which only collected information for one year, the site supports 548 individuals of the white-eyed gull (*Larus leucophthalmus*).

According to Fishpool and Evans, 2001, this site is known to hold on a regular basis, greater than 1% of the biogeographic population of the Lesser Crested Tern (*Sterna bengalensis*). About 1700 breeding pairs of *Sterna bengalensis* are reported at this site, representing 2 % of the population of this species (the 1% threshold = 1700 individuals as by Wetlands International, 2006).

Criteria 8:

Mangroves and marsas are breeding grounds and nurseries for several fish species and shrimps. Khalil & Krupp (1994) described the relations of fish species to mangroves in the Sudanese Red Sea and identified three main categories:

- True residents, which spend their entire life cycle in the mangroves and include *Aphanius dispar*, *Gerres oyena* and some gobiids.
- Closely associated species, which are found in the mangroves as juveniles or juveniles and sub-adults. These species apparently utilize the mangroves as nursery and feeding grounds and include *Acanthopagrus berda*, *Chanos chanos*, *Crenidens crenidens*, *Hypoatherina temminckii*, *Leiognathus equulus*, *Terapon jarbua*, *Pomadasy commersonni* and some Mugilidae spp.
- Loosely associated species, which occur in the mangroves as occasional visitors entering there searching for food or protection e.g. *Sillago sihama*, *Thryssa baelama* and several others.

The marsas and associated mangrove stands are important habitats for commercial shrimp species in the area; these species include *Penaeus semisulcatus*, *P. latisulcatus*, *P. japonicus*, *P. monodon*, *P. indicus*, *Metapenaeus monoceros* and *M. stebbingi* (Elhag 1978, Brandford 1980).

15. Biogeography

b) biogeographic region:

Western Indo-Pacific, Tropical African

This site also falls under the North African Bioregion. It is part of the Red sea coastal ecoregion and contains xeric systems (these generally receive less than 250 mm of rainfall per year) as the major habitat type (Michelle L.T. *et al.*, 2005)

b) biogeographic regionalisation scheme:

Coastal complexes of mangroves, seagrass beds and coral reefs, Red Sea (Krupp *et al* 1994).

The classification scheme used for Fresh water eco-regions of Africa and Madagascar (Michelle L.T. *et al.*, 2005).

16. Physical features of the site:

In geological terms the region belongs to the Nubian segment of the Arabian-Nubian shield, and is underlined by volcano-sedimentary sequences into which granitoid batholiths have been intruded. The tectonic setting is described by Körner *et al.* (1987). The basement complex, comprising the Red Sea hills, is characteristically a series of volcanic structures separated by basement rock formations. This north-south trending east facing escarpment represents an abrupt transition from the coastal lowlands to the uplands which have elevations of 1000 m and more. The western-facing slope towards the Nubian Desert is a gentle one, and is marked by the presence of a wind-blown sand cover.

A coastal plain of generally gentle topography lie between the Red Sea and the scarp that bounds the Red Sea hills. A typical profile shows that the coastal plain is made of inter-digitating marine and continental deposits of Pleistocene and recent ages, that overlay un-conformably tertiary deposits of the Red Sea littoral. The continental fraction includes extensive stream deposits forming fan deltas, wadi-fillings and terraces. These deposits are composed of boulder conglomerate, gravel, sand and clays, which lie over tertiary marine, lagoonal and clastic deposits, as well as basalts. Sediments in the central Red Sea systems are superficial and up to 1 km thick. Much of the coastal shelf in the northern and central parts is covered by sediments as a result of alluvial deposits.

A major feature of the coastline is the presence of emerged reef complex deposits, which may rise up to 16 meters above the high water mark (e.g. in Mukkwar Island), and may extend few kilometers inland. The main primary deposits in the shallow coastal zone are coral reef deposits, formed and eroded under a variety of physical processes. The form of most contemporary reefs and many reef-flats, sharms, mersas and wadis outwashes reflect fossil reef-rock structure.

Mollusca, algal foramineferan and diatomaceous deposits also occur but are less important in the coastal zone, although they provide heterogeneity to soft-bottom substrates, which for instance can enhance growth of various sea-grasses. Living biological associations generate and maintain the structure of the coastal zone and stabilize its substrate, and they integrate to enhance productivity. Four biotopes have particular importance in these respects: coral reefs, mangroves sea grasses and salt marshes.

The Red Sea Hills are well dissected by a network of steep dry valleys (*khors*), which drain surface water resulting from infrequent but intense rainstorms that occur in the region towards the coastal plain. El Tom (1991) notes that precipitation in the region is produced by two wind patterns, a northeasterly wind which picks up moisture over the Red Sea and produces rainfall over the coastal plain, and a southwesterly moist air-stream which affects the Red Sea Hills towards the end of the summer. The eastern slopes thus receive their highest rainfall during winter, while for western slopes the rainfall peaks occur in summer. Higher regions are generally subject to both regimes. The mean annual rainfall is generally low. Average ranges between 36 mm at Halaib in the north and 93.4 at Port Sudan at the southern limit of the site. A general drop in the annual rainfall occurred in the past three decades with extreme drops during the eighties. Since the beginnings of the 1990s a relative recovery in the rainfall to the normal rates has occurred (Sudan Meteorological Department cited in Khalil 2001), however, recovery of indigenous vegetation is rather difficult due to severe impacts of the prolonged drought on plant cover and soil.

Tidal movements along the Red Sea coast are very small. In the central part there are virtually no daily tides. However, seasonal variations in the water level occur. In the summer the mean water level in the central region is nearly a meter lower than winter (Pazert 1974, cited in Khalil 2001). Such seasonal changes together with surface currents are influenced primarily by monsoonal winds and secondarily by temporal variations in density and evaporation. Water salinity is relatively high (38-41 ppt), and it could be much higher in shallow lagoons and coastal depressions (Wilkei 1995). Generally the surface waters of the Red Sea are nutrient-poor, with nitrate being depleted more than phosphate. However, in the central Red Sea, where the Sudanese coast is located, relatively higher nutrients concentration have been recorded.

17. Physical features of the catchment area:

Hydrological studies were carried out in the region during the 1980s as part of a Sudanese German project, to evaluate the water potential of the main wadis and the coastal strip by means of borehole investigation of wadi fills and deltas (Budesanstalt für Geowissenschaften und Rohstoffe 1980, Rein-Ruhr Ingenieur Gessellschaft Mbh 1989). There are no records of boreholes that penetrate the crystalline basement and so the groundwater potential of the basement remains largely unknown. Submarine springs occur in the Red Sea; these springs discharge freshwater, possibly originating in the highlands and flowing seaward via an interconnected fracture system. There is lack of rivers permanently flowing into the Red Sea. Freshwater in the area is mainly obtained by harvesting seasonal rainwater in the major khor basins and groundwater pumping.

A relationship is demonstrated between surface drainage, fracture characteristics and lithology on the one hand, and groundwater flow patterns in the region on the other. In hard rock aquifers groundwater flow is generally restricted to fractures such as faults, joints, and bedding planes, which serve as major conduits. Recharge is via surface water which is concentrated in drainage channels (wadis or khors), as described earlier. Major khors in the coastal area occupied by the site are those reaching the sea (from north to south) near Dongonab (khor Shanaab), at Marsa Arakiay (20° 18'N), Marsa Darur (19° 50' N), Marsa Halut (19° 48' N) and Marsa Waiai (19° 45' N). The last three marsas represent the alluvial fan at the lower reaches of Khor Arbaat, one of the largest khor basins in the area, with permanently flowing upper reaches. Lower and middle reaches of these khors may often catch

temporary freshwater pools during the rainy season.

The same is true for the general geology and geomorphology features and soil types as in section 16.

18. Hydrological values:

Natural vegetation of the saltmarsh and coastal plains provides pasture for camels and goats. Animal breeding is the major economic activity for coastal population. The shoreline is rich in inundations (marsas) that represent fish landing sites. These often support mangroves which stabilize shoreline and provide breeding grounds and nurseries for several commercial fish species as mentioned earlier. The mangroves also provide fodder for camels, especially during the dry season, when the land pasture shrinks. Its wood is also used for building fishermen huts and as firewood. Coral reefs protect the coastal area from waves and erosion. Major fisheries depend on these habitats. Oyster culture is traditionally practiced in sheltered bays e.g. Dongonab bay and represent an important economic activity in the area. Living biological associations generate and maintain the structure of the coastal zone, stabilize its substrate, and they integrate to enhance productivity.

19. Wetland Types

a) presence:

Marine/coastal: A • B • C • D • E • F • G • H • I • J • K •
Zk(a)

Inland: L • M • N • O • P • Q • R • Sp • Ss • Tp • Ts • U •
Va •
Vt • W • Xf • Xp • Y • Zg • Zk(b)

Human-made: 1 • 2 • 3 • 4 • 5 • 6 • 7 • 8 • 9 • Zk(c)

b) dominance:

A > C > B > G > H > D > E > I > J > K

20. General ecological features:

The area comprises about 140 km of Red Sea coastal stretch with a variety of habitats including intertidal flats, inlets, bays, salt marsh, mangroves, seagrass beds, rocky shores and coral reefs.

The northern part is occupied by Dongonab Bay, which is considered as one of the largest bays of the Red Sea. The bay has a wide entrance at its southern part, which is almost blocked with coral reefs, with a few navigable passages for small vessels only. South of the bay to the southern coastal limit of the site, the area comprises a flat stretch of Red Sea coast extending up to marsa Waiai north of Port Sudan. This includes sandy beaches e.g. Arus area, large areas of sabkha, patches of intertidal mud flats in the more sheltered marsas including near Mohamed Gol, Arakiyai, Halut, Darur and Waiai, rocky shore and seagrass beds e.g. near Mohamed Gol. *Avicennia marina* mangrove stands grow on several of these marsas comprising south of Mohamed Gol (at 20° 47'N, 37° 10'E) Marsa Arakiyai (20° 18'N), Marsa Arus (20° 00' N), Marsa Darur (19° 50' N), Marsa Halut (19° 48' N) and Marsa Waiai (19° 45' N). The last three marsas probably represent the extensive alluvial fan at the lower reaches of Khor Arbaat, one of the largest khor basins in the area, with permanently flowing upper reaches.

The coastline is fringed by coral reefs, which give way to a deep channel, followed by the

outer barrier reefs at a distance of 2-6 miles from the shore. Most of the coast is thus sheltered by these reefs and not seriously affected by waves and currents. Beside fringing reefs, two other conspicuous reef formations are found at the southern parts of the suggested site, Shuab Rumi and Senganeeb Atoll (19° 42'N, 37° 26'E).

Terrestrial vegetation comprises mainly halophyte bushes such as *Suaeda* sp. and *Zygophyllum* sp., which grow in sandy areas and sabkhas above the high water mark. Towards the plains, the vegetation is dominated by *Acacia tortilis* desert scrub. Kassas and Zahran (1967) distinguished 13 different communities of plants within the littoral saltmarsh of the Red Sea. However, within any locality only a few of these zones are represented. Furthermore, considerable degradation of the saltmarsh vegetation has occurred during the past few decades, mainly due to increased human disturbance and drought. For example, Kassas (1957) reported six recognizable zones at Marsa Atta (south of Port Sudan), but Ali and Mohamed (1991) found only three of these remaining.

The khor basins in the area support more woody vegetation than the surrounding desert coastal plains. At the southern part of the site, particularly north of port-Sudan and the lower reaches of khor Arbaat, the main indigenous woody vegetation (*Acacia* and *Suaeda* shrubs) has been extensively replaced by a dense cover of the introduced *Prosopis* sp.

21. Noteworthy flora:

Terrestrial vegetation includes mainly xerophytes and halophytes. Small to moderate stands of *Avicennia marina* mangroves are found at several intertidal locations and islets of the site.

Mangrove vegetation:

Mohamed Gol mangrove area is located at 20° 47' N, 37° 10' E: a few kilometers south of the coastal Mohamed Gol village. The mangrove area comprises a thin belt of *Avicennia marina* growing on a sandy mud and sandy substratum. On the landward outer zone of the belt the substratum is sandy mud with a compact top layer, which becomes rather loose towards the lower eu littoral. In the inner and deeper parts of the forest the substratum is dark consisting of loose sandy mud and muddy sediments. The small lagoons among the mangroves have a deep colloidal muddy substratum. The mangroves are distributed in three separate stands; each is about 200-250 m at greatest width. The southern stand extends for about 900 m in a U shaped forest connecting in the north and enclosing a shallow lagoon. The second stand is some 500 m north and extends about 180 m along the shore. The third is located some 1000 m to the north. It is rather denser as it extends along a 200 m elevated islet separated from the main shore by a mud flat covered with shallow water.

The mangrove stand at marsa Arkaiyai extends along the shore for about 0.9km. Although the stand is very thin consisting of only 1-2 rows of trees at most of its length, the *Avicennia* trees grow to relatively massive size attaining up to 7-11 m height and 100-240 cm GBH. These are by far the biggest and oldest *Avicennia* trees recorded from mangrove areas in the country.

The mangrove stand at Halut grows on a tidal inlet of relatively wide depressed shore area, where a part of Khor Arbaat reaches the sea. Substratum is loose muddy sand and mud. Landward, the inlet is enclosed with a raised rock of fossil corals. The elevated rocky plate, which is sharply cut at the inner edge facing the stand, is grooved at the southern site by runoff and flood waters of Khor Arbaat. Salinity is apparently relatively low as some terrestrial halophytes (*Aeloropus* sp. and *Zygophyllum* sp.) overlap with *Avicennia* shrubs on the landward parts of the stand. This may suggest the presence of considerable discharge of freshwater seepage. Further west the land vegetation consists mainly of a thick belt of the introduced *Prosopis* sp. The mangroves comprise two adjacent stands, each is about 250-300 m at greatest width, and 500-700 m long. The outer zone of the stands consists of extremely stunted *Avicennia* bushes 0.4-0.85 m tall.

Other terrestrial vegetation:

In the supratidal and splash zone halophytes such as *Arthrocnemum glaucum*, *A. macrostachyum* and *Halopeplis perfoliata* dominate. This is followed by a zone dominated by *Suaeda* spp., the most common of which is *Suaeda vermiculata*, and *Zygophyllum* spp. (*Z. album*, *Z. simplex*, *Z. coccineum*). Some halophyte herbs also coexist, such as *Aeluropus lagopoides* and *Panicum turgidum*, although their distribution has been extremely reduced under the pressure of overgrazing. Towards the coastal plains scattered populations of *Cassia sana*, *Aerva javanica*, *Limonium axillare*, *Cucumis melo* and *Heliotropium* sp. occur. The khor basins support more dense and woody vegetation, the most conspicuous of which is *Acacia tortilis*. Other important species include *Acacia ehrenbergiana*, *Balanites aegyptica*, *Ziziphus* sp. and *Capparis* sp. The introduced anti-desertification species, *Prosopis fuliflora*, is now widespread all over the coastal area.

Seagrass and algae:

Eight seagrass species have been reported to occur on shallow Sudanese coastal water. The most common are *Thalassia hemprichi* and *Halodule uninervis*. *Halophila ovalis* and *H. stipulacea* occur frequently at several localities. Around 24 marine algal species were reported as common in the Sudanese coastal water. The calcareous algae *Halemida* sp., *Corallina* sp. and *Padina* sp. occur widely in reefs and rocky substrates. At soft-bottom sheltered areas the red algae *Gracilaria* sp., *Hypnea* sp. and *Laurencia* sp. are very common. Around 60 marine algal species were listed from Sanganeb.

22. Noteworthy fauna:

Two species of marine turtles, hawksbill turtle (*Eretmochelys imbricata*) and green turtle (*Chelonia mydas*) were reported to nest on Mukkwar Island. The threatened dugong (*Dugong dugon*) was also reported to occur in the area. The bottlenose Dolphin *Tursiops truncatus* is often observed in open waters and around lagoons (e.g. near Sanganeb). The hammerhead sharks tend to form schools at some localities of the site. Around six other sharks species and 20 commercial bony fish species are considered as important. Among the most conspicuous are *Caranx* spp., *Lethrinus fletus*, *Lutjanus bohar*, *Lutjanus gibbus*, *Epinephelus areolatus*, *Plectropomus maculatus*, *Aprion virescens*, *Chelinus undulatus*, *Mugil* spp., *Naso unicornis*, *Agryps spinifer*, *Siganus lineatus*, *Variola louti* and some others (see Reed 1964). Coral reefs in particular support a high fish diversity. Biological surveys at Sanganeb Atoll found 91 polychaete species, 124 coral species and 250 fish species (Krupp *et al* 1994). These results indicate the huge diversity at the Atoll. The gastropod *Trochus* sp. is an important commercial species collected for shell and meat. *Strombus* sp. and *Lambis* sp. are collected for their operculum, from which a high-priced traditional perfume is extracted. The mother-of-pearl oyster *Pinctada margaritifera* is commercially cultured since the beginning of the past century, mainly in Dongonab Bay.

Important terrestrial wildlife in the area includes the mammalian species *Gazella dorcas littoralis*, *Oreotragus oreotragus* reported from seasonal valleys across the coastal plains. *Capra ibex nubiana* and *Ammotragus lervia* were also reported from remote areas in the region. Among resident birds *Pterocles senegalensis*, *Clamidotis undulata* and *Struthio camelus* were also reported. The introduced Indian crow is widespread near urban and rural settlements, and considered now as a serious pest.

Breeding birds reported by a recent PERSGA survey (Shobrak 2002), on eleven of these islands include little green heron (*Butorides striatus*): 1 pair on Salak-Assuqrah, 2 pairs on Hi-Suid; pink-backed pelican (*Pelecanus rufescens*): 1 pair on Salak-Assuqrah; goliath heron (*Ardea goliath*): 1 pair on Hi-Suid; osprey (*Pandion haliaetus*): 2 pairs on Sara, 4 pairs on Mukkwar, 2 pairs on el-Eikah, 4 pairs on Hi-Suid; sooty falcon (*Falco concolor*): 5 pairs on Mukkwar, 2 pairs on Hi-Suid; crab plover (*Dromas ardeola*): 7 pairs on Salak-Assuqrah, 55 pairs on Masharif (plus 60 crab plover nests); sooty gull (*Larus hemprichii*): 1 pair on FejaI, 2 pairs on Sara, 2 pairs on Abu-Qush, 2 pairs on Masharif, 2 pairs on Gate-Masharif, 2 pairs on

Mukkwar, 2 pairs on el-Eikah, 1 pair on Um-Taradah; white-eyed gull (*Larus leucophthalmus*): 274 pairs on Mukkwar; swift tern (*Sterna bergii*): 6 pairs on Salak-Assuqrah (plus 5 swift tern nests), 1 pair on Abu-Qush; lesser crested tern (*Sterna bengalensis*): 21 pairs on Abu-Qush, 50 pairs on Gate-Masharif (plus 1280 lesser crested tern nests on Salak-Assuqrah; white-cheeked tern (*Sterna repressa*): 600 pairs on FejaI, 211 pairs on Feja/Arus, 1390 pairs on Salak-Assuqrah, 21 pairs on Abu-Qush, 297 pairs on Masharif, 10 pairs on Um-Taradah; and bridled tern (*Sterna anaethetus*): 3 pairs on FejaI, 10 pairs on Feja/Arus, 380 pairs on Sara, 137 pairs on Abu Qush, 1413 pairs on Masharif.

23. Social and cultural values:

a) Describe if the site has any general social and/or cultural values e.g., fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values:

Socio-economic values

Currently the majority of tourist activities is confined to SCUBA diving at Sanganeb National Park (SNP). However despite the high quality of diving available at Sanganeb Atoll, only a limited number of divers are attracted to visit SNB.

Marine fishery and aquaculture are of great economic and cultural value in the area. Fishery development will largely contribute to development and raising of living standards of people. The site includes a variety of biotopes of great basic and problem-oriented research potential. Little is known about biology of most of the economically important species, as well as status of their fishery and resource exploitation. Due to land aridity agriculture is not practiced. Nomadism is the main kind of living, camels being the main animals kept, which are of great social and economic value.

b) Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning?

If Yes, tick the box and describe this importance under one or more of the following categories:

- i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:
- ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:
- iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:
- iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

24. Land tenure/ownership:

a) within the Ramsar site:

According to land legislation in the country, the government is the principal owner of the land. Based on the federal system, land rights are at relevant state level. The Land Directorate which affiliates the Red Sea State Ministry for Urban and Planning General has the authority

of planning for land use, issuing and registration of land ownership. According to the law all non registered lands are owned by the government. However, most of the local inhabitants in the area are nomadic tribes who consider that they have the land rights, so some conflicts are often reported.

b) In the surrounding area: In the surrounding area the same is true.

25. Current land (including water) use:

a) within the Ramsar site:

The main land use at the site is livestock grazing. The Red Sea State in general supports around 693,186 livestock heads, mainly camels, goats and sheeps. People are primarily *nomadic* and pastoral. Unpublished surveys classified 55% of the land in the Red Sea State as pastoral lands, 42% as saline sabkhas and desert and only 3% as agricultural lands (Saeed et al. 2002). Population at the site is extremely scarce. Small fishing settlements are found at Mohamed Gol and Dugonab villages of the site. The rest are nomads with regular movements among the coastal plain and nearby inland pastoral lands.

Oyster culture (mother-of-pearl oyster *Pinctada margaritifera*) is also practiced in the area (mainly in Dongonab and Mohamed Gol) since it was introduced at the beginning of the past century. In 1971 a peak production of 118 metric tons was reached, but the average annual landing of wild oyster declined to 25 metric tons in the subsequent years. Oyster farming flourished in Dongonab, where up to 65 family farms, with 130 local beneficiaries were established. Following mass mortalities in 1969, large scale farming stopped although export continued, mainly based on wild populations. Between 1966 and 1989, the average annual export was 37 metric tons.

According to fisheries statistics, the total number of fishermen in Mohamed Gol fishery administration area (includes the whole site and north up to Oseif village) amounts to 290 operating 88 boats of different size, the majority of which are small (3-5m). Recent surveys indicated that many of these and most of the few launches are currently not operational.

Other activities include petty trading, wood cutting or seasonal migration for labor in adjacent urban areas, mainly Port Sudan. The small market at Mohamed Gol village is often busy with visitor merchants, bringing Egyptian goods from Shalatain and Halaib at the borders. They stop there for a short rest or overnight before continuing their trips along to Port-Sudan in the south or Shalatain in the north.

b) in the surroundings/catchment: In the surrounding area the same is true.

26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

a) within the Ramsar site:

Serious threats exist due to anticipated major changes in land use. The southern stretch of the coastline at the site (north of Port Sudan) is planned to host part of a huge shrimp and fish farming industry project. The project covers around 3150 hectares and includes 10 farms distributed at the site and at Ashat area (south of Suakin). In addition to the farms the project includes several factories for Tuna and shrimps processing, livestock fodder production and ice plants. The planned shrimp farms are anticipated to create environmental problems in the future. Shrimp farms may result in irreversible conversion of coastal habitats. The mass discharge of effluent and nutrients will have serious impacts on mangroves and fringing reefs. The construction of channels to divert seasonal freshwater run-off from the mountains to protect the ponds will change the hydrological regimes in the area and adversely impact the coastal habitats

A general decline in rainfall during the last few decades has led to marked terrestrial and mangrove degradation in the region. The effects of this factor were however combined and accelerated by human stress on the resource. Natural degradation in land pasture has led to overgrazing, which in turn doubled the impact on plant cover. This has also forced the nomads and camel herders to shift to mangrove as alternative fuel-wood and fodder for their camels. The status of the mangroves has recently been assessed through extensive surveys carried out by PERSGA (PERSGA 2002). The mangrove stands at Mohamed Gol are severely affected by camel grazing, especially at their southern accessible landward parts. Where outermost and uppermost branches are severely grazed mangrove trees are stunted to only 0.7-2.0 m bushes and top dying of trees is common. Some felling and limb cutting was reported. The vast majority of the fully grown trees are multi-stemmed indicating that they had been subjected to severe cutting in the past. The shoreline north of the present mangrove stands, towards M. Gol village, is characterized by sparse *Avicennia* shrubs and remains of felled tree barks. This suggests that the mangroves were extending further north for at least three-times the present occupied area, which had been greatly diminished through cutting. Several huts at M. Gol market are built with *Avicennia* wood.

At Arkaiyai camel grazing has also heavily affected the whole mangrove stand growing there. The affected parts include outermost and uppermost branches of the young growing trees and the lower branches of the well-grown tall trees. Significant destruction of aerial roots and seedlings by camels' feet was noticed, however a good number of healthy seedlings were recorded, indicating that natural regeneration may occur if suitable protection measures are undertaken. The stand had apparently been subjected to extensive cutting and the original area occupied by mangrove was greatly reduced. Recovery of the lost cover by planting will significantly extend the present area occupied by the stand. Mature trees with dropped major limbs and felled trees are common among the stand. The area is easily accessible from land, and is apparently used as recreation site for weekend visitors. Remains of burnt charcoal and cooking fire of the visitors were observed at several sites. This represents a serious threat to the mangrove stand. At Halut dryness of uppermost and outermost branches of mangroves, heavily browsed by camels was also reported. Mortality of mangrove trees is frequent, where dead standing trees may reach up to 20% at some parts. This may be of concern regarding the presence of many other trees with dead top and outer branches.

The introduced tree species *Prosopis fulifora* is recently considered as problematic because of its high capacity to compete and exclude indigenous vegetation, as well as its serious invasion of farms and agricultural areas. However, some suggest that *Prosopis fulifora* has successfully contributed to soil stabilization in the area, which is often subject to prolonged drought periods.

b) in the surrounding area: In the surrounding area the same is true.

27. Conservation measures taken:

The suggested site includes at its southeastern part the Senganeb National Park (SNP), which was declared as National Park since 1991. Since its establishment, conservation activities have been hindered due to lack of sufficient finance, equipment and skilled park staff. However, the Wildlife Conservation Administration has recently developed a master plan for the park management, which takes into consideration such shortcoming.

a) List national and/or international Ramsar category and legal status of protected areas, including boundary relationships with the Ramsar site:

Dongonab Bay-Marsa Waiai is a protected area- National Marine Park- managed according to Wildlife Law which regulate certain uses with official permits released by Wildlife Conservation office in Red Sea State.

b) If appropriate, list the IUCN (1994) protected areas category/ies which apply to the site (tick the box or boxes as appropriate):

Ia ; Ib ; II ; III ; IV ; V ; VI

c) Does an officially approved management plan exist; and is it being implemented?:

A master plan has recently been developed for the management of the Senganeb Atoll Marine National Park, by the Wildlife Conservation Administration.

Describe any other current management practices:

Forestry and fishing regulations are also enforced in the area by Wildlife Conservation General Administration; as well as restrictions to development, management practices beneficial to wildlife, closures of hunting, monitoring schemes, survey methods and involvement of local communities in the participatory management of the site through the work of the African Park Organization which carried out various activities with the local communities in Dongonab.

Regulations relevant to the conservation of this site are:

The Law of Environment No.11 (2005): This Law is the most recent piece of legislation dealing with the environment in Red Sea State. It outlines State policies on environmental protection and use, and provides an umbrella for other environmental laws governing environmental management and use in the State. It further establishes the responsibilities for the various State Ministries and agencies

dealing with the environment. The former relevant legislation and management approaches in the state focused on natural resource utilization, with little regard for conservation and management. The recent laws have, relatively, shifted the focus to sustainable management

It includes the mandate of different authorities to set the public policy for the protection of the environment; to prepare, the plans, programs, and projects necessary for the realization of sustainable development; to prepare the specification and the standard criteria; monitor and measure the environment elements and components; coordinate all national efforts aimed at preserving the environment; to approve the establishment and management of the natural reserves and national parks; and, to prepare environmental emergency plans.

Wildlife Conservation and National Park Act, (2003): This 2003 version of the Act was developed for the 'New Sudan'. The provisions of the Act were created for application to activities relating to the conservation management and protection of wildlife, forests and environmental resources, and the establishment of National Parks, Game Reserves, Forest Reserves and other protected areas in Sudan

(*ref.Sudan Interim National Constitution (2005)*)

28. Conservation measures proposed but not yet implemented:

The proposed Dongonab Bay-Mukkawar Island MPA occupies the northern third of the suggested site. The proposed MPA extends between Sheikh-Akkado area (20° 26' N) in the south to Khor Shannab (21° 24' N) in the north, and from the higher reaches of Khor Shanaab (37° 00' E) in the east to Brajah Island (37° 75') in the west. Ratification is underway.

A master plan has recently been developed for the management of the Senganeb Atoll Marine National Park, by the Wildlife Conservation Administration. A management plan will probably be developed in the future.

29. Current scientific research and facilities:

Most of the few published research works and unpublished reports on the site have concentrated on Senganeb Atoll coral reef and associated biota (Mergner & Schumacher

1985, Krupp et al. 1994) and to a lesser extent on other parts such as Shuab Rumi reef coral reef community (Vine & Vine 1980), Shuab Brajah plankton and benthic fauna (Karbe 1980, Betz et al. 1980) and Dongonab Bay plankton (Nasr 1980). Several studies and survey reports have investigated fishery and oyster culture status in the area including the site. These are compiled by MEPI identification study (1993). Mangroves at the site have also been targeted by tentative surveys for conservation and postgraduate studies (Wilkei 1995, PERSGA 2002).

National institutions involved in marine and coastal area research include the University of Khartoum, which has established a marine station at Suakin since early 1970s, Marine Fisheries Research Center, Wildlife Research Center (both affiliate to the Federal Ministry for Science and Technology), and the Red Sea University in Port Sudan (founded in 1993). None of these institutions, however, currently run any sound research program. The main obstacles being the lack of sufficient funding, facilities and manpower as well as emigration of trained staff.

30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:

None, except for PERSGA demonstration projects (www.persga.org), conducted recently within the framework of its Strategic Action Program (SAP).

31. Current recreation and tourism:

The tourist village at Arus, which had been planned for 3000-4000 persons per year, is not operational at present. SCUBA diving at Sanganeb is rather limited, though there is a great potential. In 2000 about 800 divers (rising from 450 in 1987) visited SNP (WCA 2003). The Red Sea State in general has a great potential for tourism. However, the number of tourists visiting the state is very low, averaging around 879 annually over the past 7 years. The main reason for this being the lack of infrastructure for tourism that are below the standard expected by international tourists. Some coastal sites e.g. Arakiay are frequently asked by few weekend visitors for outdoor recreation.

32. Jurisdiction:

The following institutions are directly involved in the use and management of coastal and marine areas including the suggested Ramsar site:

- The Higher Council for Environment and Natural Resources (HCENR) is the technical government environmental agency in charge of coordination, environment and conservation policy making and international cooperation.
- The General Administration for Wildlife Conservation is charged with the protection and management of wildlife, including protected areas.
- The Marine Fisheries Administration manages fisheries resource and controls the observation of fisheries regulations.
- The State Ministry for Physical Constructions.
- The Sea Ports Corporation are in charge of all aspects of maritime transport and ports administration. The corporation is a major business government body and is responsible for implementation of plans regarding marine transport. It is very influential in developing master plans for urban areas as it has jurisdiction for huge coastal lands.
- Sudan Line is a commercial shipping company that plays an important role in observing maritime traffic at high sea.
- The Ministry of Defense is in charge of the Navy Forces in the Red Sea area. The Navy is responsible for security in the coastal and marine areas.
- The Ministry of Interior is in charge of the Police Force. The Wildlife Force is under administrative supervision of this Ministry.
- Sudan Meteorology Corporation provides weather forecasts for the area.

- The National Forests Corporation is responsible for forest resource management including mangrove areas.
- Ministry of Mining coordinates coastal and marine mining activities, oil and gas explorations.

33. Management authority:

Director of Wildlife Conservation Port Sudan Office. Mr Nasr Eldeen Mohamed,
Co. Wildlife Conservation General Administration/ Ministry of Tourism and Wildlife.
Tel. +249 183 261134
Fax. +249 183 261139
E.mail :wildlife-sudan@yahoo.com

34. Bibliographical references:

- Abdellatif E. M. (1980) Observations on nesting behavior of the Hawksbill Turtle from Suakin Archipelago. Pp: 181-192, in: Proceedings of Symposium on the Coastal and Marine Environment of the Red Sea, Gulf of Aden and Tropical Indian Ocean, Khartoum 9-14 January 1980.
- Abdellatif E. M. (1993) Factors Threatening the Marine and Coastal Environment of the Red Sea in Sudan: A call for attention. Sudanese Environment Conservation Society (SECS), Khartoum.
- Abu Bakr, O. A. (1995). The effect of waste oil disposal into the Red Sea. M.Sc. thesis. Institute of environmental Studies, University of Khartoum
- Ali, A. K. S. & Mohamed, B. F. (1991). The Ecology of the Red Sea coast in the Sudan: Environment and vegetation. RESAP Technical Papers, No. 4, U. of K. and U. of Bergen. Khartoum
- Andrews, F. W. (1950). The flowering plants of Anglo-Egyptian Sudan. Sudan Government.
- Babier, E., & Cox, M. (2002). Economic and demographic factors affecting mangrove loss in the coastal provinces of Thailand, 1979-1996. *Ambio* 31(4): 351-357
- Branford, J. R. (1980). Paeneid shrimps in Tokar Delta Region of the Red Sea .pp: 246-274 in: Proceedings of Symposium on the Coastal and Marine Environment of the Red Sea, Gulf of Aden and Tropical Indian Ocean, Khartoum 9-14 January 1980.
- Betz, K. H., & Otte, G. (1980). Species distribution and faunal biomass of soft bottom faunal macrobenthos in a coral reef (Brajah, Central Red Sea). In: Proc of the Symp. On the Coastal and Marine Environment of the Red Sea, Gulf of Aden and Western Indian Ocean, 9-14 Jan 1980, Khartoum, ALESCO/UNESCO/ The Saudi-Sudanese Red Sea Commission, Vol. 1, pp. 135-162
- Budesanstalt für Geowissenschaften und Rohstoffe (BGR). 1980. Sudanese-German exploration project: reconnaissance of groundwater and surface water resources in the coastal area of Sudan (Eastern Red Sea Province). Unpublished technical report, BGR, Hannover, Germany
- Crowfoot G.M. (1928) Flowering Plants of the Northern and Central Sudan. Orphans Printing Press Ltd., Leominster.
- El Hag, A. E. (1978). Some ecological aspects of the estuarine prawns of the Sudanese Red Sea coast. M.Sc. thesis, University of Khartoum.
- El Tom, M. A. (1991) The Climate of the Red Sea Region of the Sudan: An Outline. Red Sea Area Programme (RESAP) Technical Papers No. 1, University of Khartoum.
- Fishpool, L. D. C. and Evans, M. I., eds. (2001). Important Bird Areas in Africa and associated islands: Priority sites for conservation. Newbury and Cambridge, UK: Pisces Publications and BirdLife International (BirdLife Conservation Series No. 11).
- Jones, D. A. (No date). Standard Survey Methods for inter-tidal biotopes. PERSGA, Jeddah.
- Karbe, L. (1980). Plankton investigations on an exposed reef of central Red Sea (Shuab Brajah, Sudan). Pp: 519-540. In: Proc of the Symp. On the Coastal and Marine Environment of the Red Sea, Gulf of Aden and Western Indian Ocean, 9-14 Jan 1980, Khartoum, ALESCO/UNESCO/ The Saudi-Sudanese Red Sea Commission, Vol. 2.

- Kassas, M. (1957). On the ecology of the Red Sea coastal land. *J. of Ecology* 45: 187-203.
- Kassas, M. & Zharan, M. A. (1967). On the ecology of the Red Sea salt marshes, *Egypt. Ecol. Monographs* 37(4): 297-315.
- Khalil, A.S.M. (1994) An Ecological study on fishes of the mangrove ecosystems of the Sudanese Red Sea. M. Sc. Thesis, Dept. Of Zoology, University of Khartoum, Sudan.
- Khalil, A. S. M. 2001. Response of meiofauna to mangrove deforestation in arid coastal habitats of the Red Sea (Sudan) with emphasis on free-living marine nematodes. ZMT Contribution 13. Center for Tropical Marine Ecology, Bremen. 82pp.
- Khalil, A.S.M., (2002). Monitoring program for mangrove and intertidal biotopes in the Red Sea and Gulf of Aden. PERSGA, Jeddah.
- Khalil. 2003b. *Status of Mangroves in the Red Sea and Gulf of Aden: Regional Report*. PERSGA, Jeddah.
- Khalil, A.S.M., Krupp F. (1994) Fishes of the mangrove ecosystem. In: Comparative Ecological Analysis of Biota and Habitats in Littoral and Shallow Sublittoral Waters of the Sudanese Red Sea. Report for the period of April 1991 to December 1993. Faculty of Marine Science and Fisheries, Port Sudan & Forschungsinstitut Senckenberg, Frankfurt.
- Kitheka J.U., Ongwenyi G.S. & Mavuti, K.M. (2002). Dynamics of suspended sediment exchange and transport in a degraded mangroves in Kenya. *Ambio* 31(7-8): 580-587
- Krupp, F., Turkay, M., Elhag, A.G.D. and Nasr, D. (eds) (1994). Comparative Ecological analysis of biota and habitats in littoral and shallow sublittoral waters of the Sudanese Red Sea. Forschungsinstitut Senckenberg, Frankfurt and Faculty of Marine Science and Fisheries, Port Sudan 89 pp.
- Körner, A, Greiling, R. O., Reischmann, T., Hussein, I. M., Stern, R. J., Dürr, S., Krüger, J., and Zimmer, M. 1987. Pan-African crustal evolution in the Nubian segment of NE Africa. In *Proterozoic Lithospheric Evolution*, edited by A. Körner, Geodynamic Series, vol. 17 (Washington, DC: American Geophysical Union), pp: 235-257.
- MacNae, W. (1968). A general account of the fauna and flora of the mangrove swamps and forests in the Indo-West-Pacific Region. *Adv. Mar. Biol.* 6: 73-270.
- MEPI (1993) Identification study for Sudan Red Sea Fisheries. Ministry of Economic Planning and Investment. Khartoum
- Mergner & Schumacher (1985). Quantitative analysis of coral communities on Sanganeb Atoll (central Red Sea) comparison with Aqaba (Northern Red Sea). Proceedings of the fifth International Coral Reefs Congress, Tahiti, Vol. 6 pp: 243-248.
- Michele L. Thieme, Robin Abell, Melanie L.J. Stiassny, Paul Skelton, Bernhard Lehner, Guy G. Teugels, Eric Dinerstein, Andre Kamdem Toham, Neils Burgess and David Olson, 2005. Freshwater Ecoregions of Africa and Madagascar: A Conservation Assessment. World Wide Fund-United States.
- Mohamed, B. F. 1984. Ecological observations on the mangroves of the Red Sea shores of the Sudan. *Hydrobiologia* 110: 109-111.
- Musa S.B. (1991) Surface run-off in the Red Sea Province. Red Sea Area Programme (RESAP) Technical Papers No. 5, University of Khartoum, Sudan.
- Nasr, D. H. (1980). Coastal plankton fauna of Sudanese Red Sea. Pp: 561-582. In: Proc of the Symp. On the Coastal and Marine Environment of the Red Sea, Gulf of Aden and Western Indian Ocean, 9-14 Jan 1980, Khartoum, ALESCO/UNESCO/ The Saudi-Sudanese Red Sea Commission, Vol. 2,
- Ormond, R.F.G. 1980. Management and Conservation of Red Sea habitats. In: Proc of the Symp. On the Coastal and Marine Environment of the Red Sea, Gulf of Aden and Western Indian Ocean, 9-14 Jan 1980, Khartoum, ALESCO/UNESCO/ The Saudi-Sudanese Red Sea Commission, Vol. 2, pp. 135-162
- Patzert W.C. (1974) Seasonal reversal in Red Sea circulation. *Proc IAPSO Symp.*, Paris 9-10 Oct. 1972, p 55-85.

- PERSGA 1998. *Strategic Action Programme for the Red Sea and Gulf of Aden*. World Bank, 98 p.
- PERSGA. 2002. *Standard Survey Methods for Intertidal and Mangrove Biotopes*. Prepared by A. S. M KHALIL. PERSGA Training Workshop Report, No. 1 46 pp.
- PERSGA. 2003a. Compiling and analysis of legislation on protection of coastal and marine environment in the Red Sea and Gulf of Aden countries. Part I: Technical Reports. Prepared by A. I. Al-Ebiari. PERSGA, Jeddah (*in Arabic*)
- PERSGA/GEF 2002. *The Red Sea and Gulf of Aden Regional Network of Marine Protected Areas. Regional Master Plan*. PERSGA Technical Report No. 1, PERSGA, Jeddah
- PERSGA/GEF 2003. *Regional Action Plan for the Conservation of Coral Reefs in the Red Sea and Gulf of Aden*. PERSGA Technical Report No. 3, PERSGA, Jeddah.
- PRICE, A.R.G., MEDLEY, P.A.H., MCDOWALL, R.J., DAWSON-SHLEPHARD, A.R., HOGARTH, P.J., ORMOND, R.F.G. (1987) Aspects of mangal ecology along the Red sea coast of Saudi Arabia. *J. Nat. Hist.* 21: 449-464.
- Rein-Ruhr Ingenieur Gessellschaft (RRI) GmbH .1989. Preparatory works for groundwater resources development – water supply of Port Sudan. Investigation Reports, RRI, Dortmund, Germany.
- Saeed, O. M., Elhag, K.O.M, Magid, A.E.A, Osman, N.A., Mudathir, H.E., Gaiballah, A.K. & ElSaudi, G.M. (2002): Integrated Coastal Zone Management Program for Sudan: Sudan coastal profile (Draft). PERSGA, Jeddah.
- SAP (2001). Country Reports. PERSGA, Jeddah.
- Shobrak, M. (2002): The Status of Seabirds in Sudan. PERSGA, Jeddah.
- Vine, P.J. and M.P. Vine (1980). Ecology of Sudanese reef fishes with particular reference to reef morphology and distribution of fishes. In: Proc of the Symp. On the Coastal and Marine Environment of the Red Sea, Gulf of Aden and Western Indian Ocean, 9-14 Jan 1980, Khartoum, ALESCO/UNESCO/ The Saudi-Sudanese Red Sea Commission, Vol. 1, pp. 80-140.
- WCA (2003). Sanganeb National Park, Sudan: Master Plan. Wildlife Conservation Administration, Sudan.
- Wetlands International, 2006. Waterbird Population Estimates-Fourth Edition. Wetlands International, Wageningen, The Netherlands.
- WILKEI, M. L. (1995) Mangrove conservation and management in the Sudan. FAO Report. Ministry of Environment and Tourism. Khartoum & FAO.

Please return to: **Ramsar Convention Secretariat, Rue Mauverney 28, CH-1196 Gland, Switzerland**
Telephone: +41 22 999 0170 • Fax: +41 22 999 0169 • e-mail: ramsar@ramsar.org
