# Suakin Archipelago Marine Park


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## Introduction:

MPAs are created to protect endangered species and ecosystems, conserve biodiversity, reduce risks, establish ecosystem integrity and manage uses to avoid user conflicts as well as to enhance productivity of fisheries and marine invertebrates. The Suakin Archipelago is a group of reefs and small islands in the Sudanese Red Sea proposed by the International Union for Conservation of Nature under Category II (Marine Park) with an area of about 1500 square kilometers. The archipelago constitutes an important marine protection area for many of the marine flora and fauna of the Red Sea.

**Literature studies:** by Tarik CHEKCHAK *et al* 2015 Integrated Coastal Zone Management Project in Sudan.

**Physical Characteristics of Sudanese Red Sea coast**

The Sudanese Red Sea coast lies in the central – northern Red Sea, and extends for 750km from 18□00'N to 22□55'N. The Red Sea is 2,100km long from Suez to the Bab el Mandeb, with an average width of 280km (CHIFFINGS, 1995).

In geological terms, this sea is an ocean, sea floor created as a result of the gradually increasing separation of the African and Arabian tectonic plates; a process which began approximately 70 million years ago (SHEPPARD ET AL. 1992).

The Red Sea is very deep and steep-sided throughout its northern and central area (where the shelf extends less than 20km from the shore, and in many places is almost non-existent), but south of about 20 N the continental shelf becomes very wide giving rise to very different conditions, and so to very different ecological communities. In Sudan the continental shelf extends over 50km offshore in the area of the Suakin Archipelago

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***Climate.***

The climate of the Red Sea region is hot and arid. During the winter, air temperatures may fall as low as 15ºC, but summer temperatures can reach 40ºC or higher (FARAH, 1982; SHEPPARD *et al*., 1992). Sea water temperatures range from 26ºC to 31ºC, but in semi-enclosed and shallow waters may range from a low of 19ºC in winter to a high of 35ºC in summer (FARAH, 1982).

Annual precipitation is very low (111 mm yr-1) and this low rainfall, combined with a lack of perennial freshwater inputs from land and high rates of evaporation (2,000 mm yr-1), mean that the entire Red Sea is effectively an evaporating basin, only maintained by net inflow of water from the Gulf of Aden via the Bab al Mandab.

Red Sea circulation patterns are determined by the seasonal, monsoon weather patterns. During the summer months, a strong SW monsoon wind blows over Arabia, while in winter, the system reverses and the NE monsoon prevails. This gives rise to a seasonal reversal of prevailing wind directions in the southern Red Sea. South of 19°N (a position approximating to the south-central part of the Sudanese Red Sea coast), NW-winds prevail in summer, while in winter, winds blow from SE over the southern Red Sea. North of 19°N there is a fairly constant NW wind throughout the year (CURRIE *et al*., 1973).

***Oceanography.***

The Red Sea is partially isolated from the rest of the global ocean, connected to the Indian Ocean at its southern end by the Bab el Mandeb, a strait 29 km wide and a maximum of 130 m deep. At its northern end it is connected to the Mediterranean Sea by the Suez Canal.
The waters of the Red Sea are warm, and it is the most saline of any oceanic body of water. Sea surface water temperatures range from 21oC – 28oC in the north to 26oC – 32oC in the south (EDWARDS, 1987; GLADSTONE, 2000). The high net evaporation in the Red Sea basin and limited water exchange through the Bab al Mandab give rise to high salinity, ranging from 37‰ near to the Bab al Mandab in the south to 42‰ in the north. Prevailing surface currents in the Red Sea vary seasonally, generally flowing from north to south in summer and reversing during the winter, driven by the monsoon winds and by changes in water density caused by temperature and salinity differences. At more local scales, inshore currents tend to follow the prevailing local wind pattern. Tidal range is small in the Red Sea, with the greatest ranges occurring in the northern (0.6m) and southern Red Sea (0.9m) (EDWARDS, 1987). A lack of terrestrial fresh water runoff, combined with relatively low productivity, gives rise to low levels of turbidity in the central and northern Red Sea, including most Sudanese coastal waters. Sea water clarity is particularly high in deeper water areas and around offshore reefs, where visibility typically ranges between 20 and 30m, but may reach 70m (PERSGA, 2001). This is in marked contrast to the situation in the biogeographically and ecologically very different southern Red Sea, south of approximately 20oN. Pelagic primary productivity is relatively low in the clear waters of the northern and central Red Sea, and highest in the southern Red Sea, where waters with elevated nutrient content penetrate through the Bab el Mandeb from the Gulf of Aden (SHEPPARD ET AL., 1992).

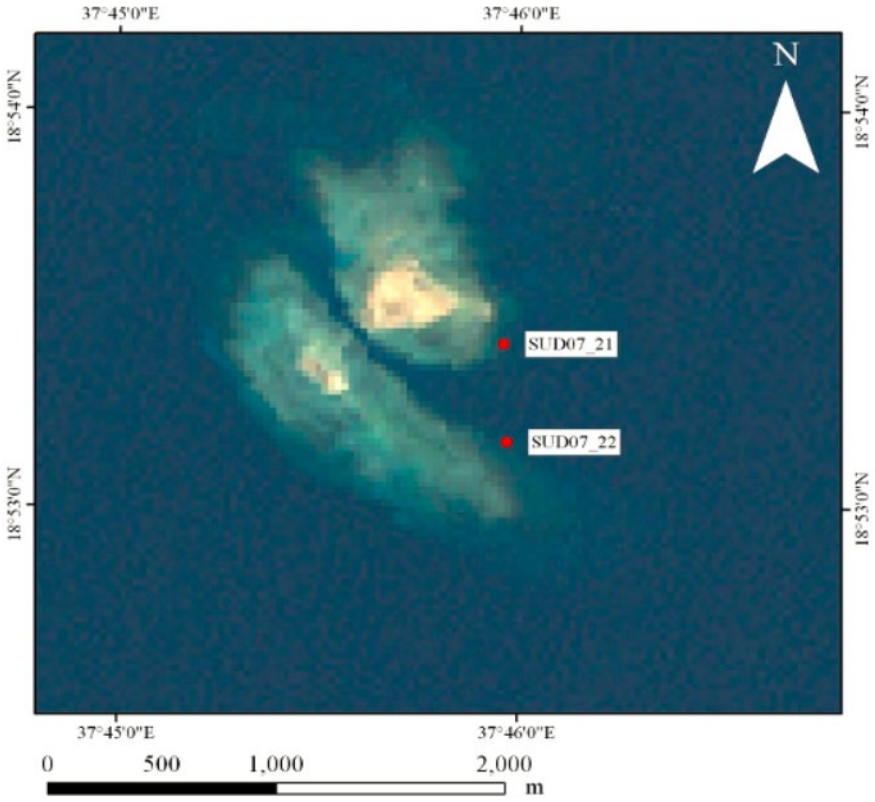
**Biological Characteristics:**

The seas of the Arabian region contain some of the world's most diverse tropical marine habitats and communities. They have complex biogeography, high levels of biodiversity, and high levels of endemism. They also include some of the most northerly coral reef and mangrove communities in the world, subject to unusually extreme, seasonal variations in temperature. These characteristics make the region globally important for marine biodiversity conservation (SHEPPARD & WELLS, 1988; SHEPPARD *et al*., 1992; CHIFFINGS, 1995, SPALDING ET AL 2001, PERSGA 2001).
The Red Sea itself is probably one of the most biologically diverse tropical seas in the world outside the Indo-Pacific region (SPALDING ET AL 2001). There are more than 200 species of corals recorded from the Red Sea, of which about 6% are endemic, and 170 species of echinoderms, of which 5.3% are endemic (SHEPPARD ET AL., 1992). About 500 species of benthic algae have been recorded (CHIFFINGS, 1995) and over 1,000 species of fish (SHEPPARD ET AL 1992, GOREN & DOR 1994). The level of endemism amongst Red Sea fish is about 17%; however, this is an average value that varies greatly between families. For example, amongst small territorial families, such as dotty backs (*Pseudochromidae*), about 90% of species are endemic, whilst amongst pelagic (open water) families there are few or no endemic species. As with most of the tropical Indo-west Pacific, scleractinian corals are a dominant feature of hard substrates in the shallow sublittoral of the Red Sea. The deep oligotrophic waters of the northern and central Red Sea, including the Sudanese coast, are fringed by almost continuous well-developed biogenic coral reefs. In many areas a well-developed offshore barrier reef complex exists, between 1km and 20km from shore, with a steep drop-off to several hundred metres being found on the seaward side of this reef. Water depths between the mainland and the barrier reefs are typically between 100m and 400m. Within the Red Sea, complex patterns of species distribution occur. This means that areas of the Red Sea separated by relatively short distances of one or two hundred kilometres can be home to markedly different species assemblages, and is well illustrated by the fish communities found there (ROBERTS *et al*., 1992; SHEPPARD ET AL 1992, KEMP, 1998). Distinct species assemblages occur in the Gulf of Suez; the Gulf of Aqaba, the central and northern Red Sea; and the southern Red Sea. There is a major discontinuity at approximately 20oN (coinciding with the widening of the continental shelf), separating the group of species assemblages characteristic of the north-central Red Sea from those of the southern Red Sea (WINTERBOTTOM, 1985; BLUM, 1989; ROBERTS *et al*., 1992).

**Some Island Fringing Reefs**

The Suakin Archipelago is situated in the south. It contains a scattering of islands with independent fringing reefs, intermixed with other submerged reef structures. The fringing reefs is different to those found margin the mainland.

**Harorayeat** consists of a pair of small, low lying, vegetated islets, both of which are surrounded by fringing reefs and separated by a reef lined channel. The reef flat to the south-east of the island was wide (~100m). By comparison, the reef lining the inner edge of channel between the islets shelves gently eastward at an angle of about 20° onto a level sandy floor at about 8-10m, with occasional large coral patches and scattered rubble.



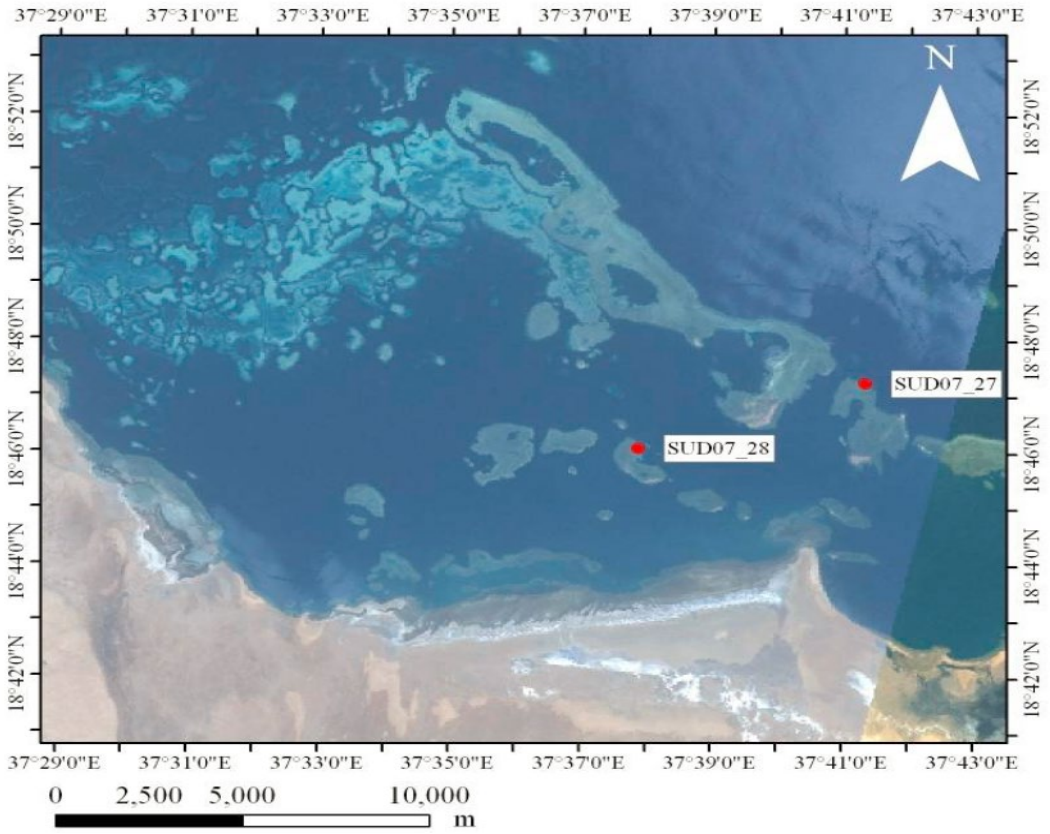

Inshore Barrier Reef

In the Shubuk region is a nearshore barrier reef system. This unusual structure is composed of three main components: (i) a barrier reef orientated northwest to southeast, which forms the main barrier structure (ii) reticulated low level patch reefs, orientated northeast to southwest, forming the north western edge of the structure, and (iii) an inner barrier reef composed of shallow patch reefs, platform and small fringing reefs around islets, which form an arc between the outer barrier reef and the shore. The outer barrier reef structure is composed of a chain of large platform reefs, situated 15km from the shore, separated by reef lined channels. The largest individual section of the reef is >13km long and 3.6km wide, at the widest point. The reef flats support some small corals and brown macro algal communities. Deep, steep sided pools occur on the dissected reef flat. Both the inner and outer reef slopes are colonised by corals. The inner reef slope is short and shelves relatively steeply onto a sandy floor. The outer reef slopes at approximately ~45° and ends on a sand bottom

at 10-12m, where there are large tabular corals. On the north-western border of the Shubuk barrier reef is an interlocking maze of low level, patch reefs. The edges of these reefs are constructed from massive hard corals, typically *Porites* spp. And *Goniastrea* spp. The tops of these colonies are dead and heavily eroded where they reached the surface. Growing in between these colonies are large brown algae (*Sargassum* spp. And *Turbinaria* spp) and other coral communities, composed of *Montipora* spp. and *Pavona* spp.

Within the barrier reef complex are more patch reefs that form an arc closer to the shore. The reef surveyed on the eastern side of one of the islands, shelved steeply at 70° from 0.5m to approximately 8m depth, where the seabed levelled out and was composed of a fine silt and sand.

Although these reefs exist in a highly sheltered environment, with naturally low levels of light due to the turbidity of the water, they still support high levels of coral cover.



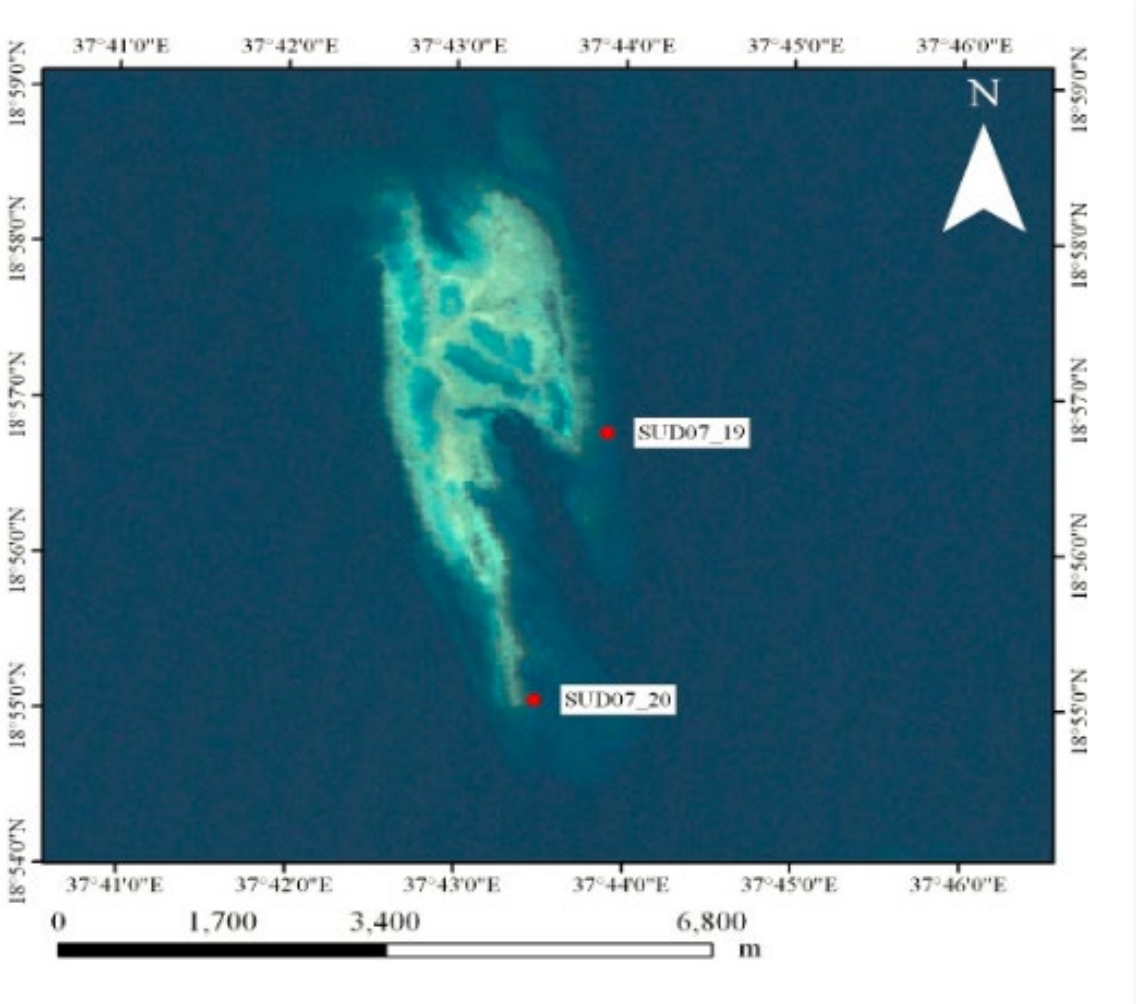

Map showing the barrier reef complex at Shubuk

**Other Reefs Types**

There are a range of other independent reefs that are typically widely spaced and set within deep water, particularly within the southern waters of Sudan. Each of these reefs has its own unusual structure. As examples of these reefs the structure of Dhanab Qirsh reef is described below:

***Dhanab Qirsh*** is orientated north-south with a deep lagoon inset into the northern end and two well developed promontories that extend southwards, with an outer reef slope on both the east and west side. The northern end of the reef shelves onto broad deep platform. This platform and the outer reef slopes are colonised by mixed *Acropora* communities that are remarkably healthy. Two

sites were surveyed, one towards the southern end of the eastern 'promontory' and the other on the inner reef slope of the western promontory. On the east, is an extensive plateau at 7-10m, with a shallow fringing reef dominated by large tabulate and branching *Acropora* and large *Porites*. The reef slopes at 20° - 45°, with a steeper section and terraces formed by large table *Acropora* ending on sand at ~ 9m with mounds of hard substrate. At the southern tip of the western promontory, the inner reef slopes gently eastwards at an angle of approximately 10°. The reef is composed mainly of large *Porites lobata* colonies, and dense beds of *Acropora*, consisting of staghorn, tabular growth forms.




**PERSGA/GEF. 2004. Status of Mangroves in the Red Sea and Gulf of Aden. PERSGA Technical Series No. 11. PERSGA, Jeddah**

**Distribution and extent of the mangrove stands in Sudan**

*Avicennia marina* was the only mangrove species found in the country. Older reports have recorded that other species were present in the past. ANDREWS (1950) reported both *Rhizophora mucronata* and *Bruguiera gymnorrhiza* as occurring south of Suakin.

The *Avicennia marina* stands are typically thin, mostly ranging between 15 to 300m in width. They grow along the shore-line, on near-shore islets and fringing tidal inlets or creeks, which extend landwards along depressed areas of various sizes, locally known as mersas. The majority of the stands are typically small, rarely exceeding 1-2km in length. The density and size of the

stands increases towards the southern coast, which supports muddier substrates and receives more freshwater influx from surface run-off.
The coastal area between Suakin to the Eritrean borders in the South. This area is characterized by relatively wide coastal plains intersected by massive valleys. The shoreline is rather undulating with numerous tidal inlets that support dense mangroves. The stands are adjacent to each other on most of the shoreline forming a thin, semi-continuous belt of *Avicennia marina* interrupted only by a few gaps of bare shore areas.

**Table: Location and extent of mangrove stands surveyed, Red Sea coast of Sudan, July 2002**

| Name | Position | Length (km) |
|---|---|---|
| Haydob | 18° 57'N, 37° 23'E | 1.6 |
| Sheikh Ibrahim | 18° 56'N, 37° 24'E | 0.4 |
| Sheikh Saad | 18° 50'N, 37° 26'E | 1.4 |
| Shabarango-Gofud | 18° 46'N, 37° 29'E | 3.5 |
| Ashat | 18° 45'N, 37° 30'E | 7.0 |

**MANGROVE AREAS SOUTH OF SUAKIN**
The area south of Suakin to the Eritrean border consists of more than 200km of coastal flats, with numerous tidal inlets and flooded depressions, rich in alluvium. The alluvium, originating from the Red Sea hills is transported by floods across the relatively wide coastal plains to be deposited at the seaward end of extensive basins (khors) that support *Avicennia* mangroves at their mouths. The wide deltas of the two major basins, Quawb and Ashat, support the most extensive and dense mangrove stands in the country.
The distribution of the mangroves in the area is probably greatly influenced by the amount of surface run-off and alluvium reaching the sea. Most of the water coming via Khor Ashat fractures from the upland will flow down as surface run-off. In Khor Quwab the lithology is mostly granite, making this basin more favourable for groundwater flow. This explains the occurrence of more extensive mangroves towards Mersa Ashat.
*Lagagengeeb-Fagum*
This consists of adjacent stands of well-developed *Avicennia* extending along approximately 4km of shoreline. The outer mangrove belt fringing the shore bends at the northern end to enclose a relatively wide lagoon, bordered seaward by another dense stand growing on a small semi-islet. This is only connected to the mainland through a narrow entrance at the southern end of the stand. The inner stand runs parallel to the outer belt and becomes fully inundated by shallow water at high tide. Landward most of the forest is backed by dense growth of terrestrial halophytes. The tree cover at the more accessible southern end of the stand has been significantly reduced by camel browsing and felling.
*Haydob*
The mangrove area at Haydob represents a good example of formerly healthy mangroves that have been severely damaged by cutting and grazing. From the remains of the destroyed vegetation, the original stand extended at least 7-8km. It fringes the shore of an elongated inlet, which intrudes from the southern side of the mersa and runs parallel to the shoreline. The inlet is permanently inundated by deep water. The mangroves growing on the inner bank are accessible through a narrow shallow channel at the northern end of the inlet. At high tide, this area becomes

fully inundated by shallow water and mangroves on the inner bank of the inlet are isolated on a small islet surrounded by shallow water.
The part of the forest that covered the outer (landward) bank of the inlet has been almost completely removed. The few remaining trees left standing indicate that the belt used to consist of well-grown *Avicennia* trees up to 5-7m in height. The stand on the inner bank suffers from severe cutting and grazing that threatens its overall existence.

*Sheikh Ibrahim*

The mangrove stand at Mersa Sheikh Ibrahim consists of a narrow belt of *Avicennia marina* along 300-400m of the shoreline. Outer fringes of the stand consist of stunted *Avicennia* bushes badly affected by camel browsing. These grade into low-growing trees of 3-5m in height. The inner zones consist of well-grown trees reaching up to 6-8m in height and. The stand is also severely affected by limb cutting and felling.

*Sheikh Saad*

The mangrove stands at Mersa Sheikh Saad are relatively small. Each consists of a narrow belt of *Avicennia marina* extending along 300-400m of the shoreline. Outer fringes of the stands consist of stunted *Avicennia* bushes badly affected by camel browsing. These grade into low growing trees of 3-5m in height. The inner zones consist of well-grown trees up to 6-8m in height. The stands are severely affected by felling, especially at Sheikh Saad. The area is important for fishing, sea cucumber and shell collection.

*Shabarango-Gafud*

The mangroves at this site form a dense belt approximately 3.5km long, fringing the shore of a round, submerged inlet. The northern stand bends around the northern edge to enclose the inlet from the north and extends forming an inner belt parallel to the outer one. The southern stand bends around the southern end of the inlet forming (with the northern stand) a semi-circular belt surrounding the inlet. The southern stand is however much smaller and supports only a sparse growth of *Avicennia*. The stands consist of low-growing trees 2-5m in height, with a few taller trees. Felling is severe in all parts of the stand. The remaining living trees suffer greatly from camel browsing, 'top dying' and limb cutting. Good seedling growth occurs on some fringes and denuded patches, indicating a good potential for natural regeneration provided that suitable protective measures are put in place.

*Ashat*

The mangrove stands at Ashat are evidently the most extensive and dense in the country. This may be attributed to the relatively high drainage of Khor Ashat as mentioned before. However, this mangrove area has suffered from extensive mass mortality during the last decade, resulting in a significant loss in the mangrove cover. The area has three stands. The northern and southern stands bend round the northern edge to enclose a large inlet. A third stand is located seaward on an elongated islet, forming the inner bank of the inlet. The northern stand is narrow and about 2.5km long. The southern stand is relatively broad and long, extending along 4km of the inlet bank. The inner stand is the smallest, forming a 500m belt. Compared to other mangrove areas in the country, the forests cover a wider area, well above 500m width in parts. The vegetation is of dense low-growing trees, which rarely exceed 5-6m in height. The southern stand is dominated by dead, standing trees. The mass mortality covered a wide area of the stand (1.5km long by 500m wide). Collection of the dry limbs and tree trunks for fuel and timber has cleared a considerable area affected by the mass mortality. Recent felling of living trees was also reported, in spite of the presence of ample amounts of dry wood. The quality of the wood from the dead trees is low because heavy infestation by wood boring insects. 'Top dying' of uppermost and outermost branches and curling leaves is common among other stands in the area. This indicates that the stand is still under stress. The cause of the mortality is uncertain. However, it could be attributed to localized changes in tidal flow regimes. This might have been caused by excessive sediment loads in the entrance and channels of the inlet. Natural regeneration is taking place. Many seedlings were observed growing in the inner fringes and some denuded patches. However, owing to the large size of the area affected by mass mortality and excessive damage by

destructive cutting and grazing, regeneration should be enhanced by planting and controlling access of camels and wood cutters.

**Fisheries sector according to Marine Fisheries Administration:**

Marine fisheries in the Red Sea are of economic and social importance for the inhabitants of coastal areas since ancient times, as these resources are exploited by traditional fishermen who target coral reef fish, pelagic fish, mollusks and crustaceans.

About sixty-five species of bony fishes are currently considered to be high economic importance, in addition to sharks, rays, shrimps, lobsters, crabs, molluscs and sea cucumber. According to the Marine Fisheries Administration, the estimated Maximum Sustainable Yield of artisanal fisheries is 10000 metric tons, while the present annual production 2021 declared is 1155 metric tons (320 tons from Suakin south area) With constantly increasing production costs (for example, for equipment, fuel, boat maintenance and spare parts, ice). There are an estimated 700 small fishing registered boats and about 200 slightly larger boats of 9-10m (4 to 5 people crew). A there are about 3000 artisan fishermen in Red Sea Sudan, 80% of whom simply with hook and line. Access to credit has been very limited. Due to limited reach of the artisanal fisheries sectors, nearshore fisheries have become locally overexploited, with catches of key species decreasing by about 50 percent, as reported by the Marine Fisheries Administration. Besides finfish, there is a significant kokian fishery (or *Trochus dentatus*). Annual export rates of kokian during the 1991-95 period, varied between 306 and 535 metric tons. Sudan is therefore by far the largest producer of *Trochus* outside the Pacific Ocean and the third largest producer globally. However, the total catch landed has fallen recent years, 89.5 tons and there are strong signs of over-collection.

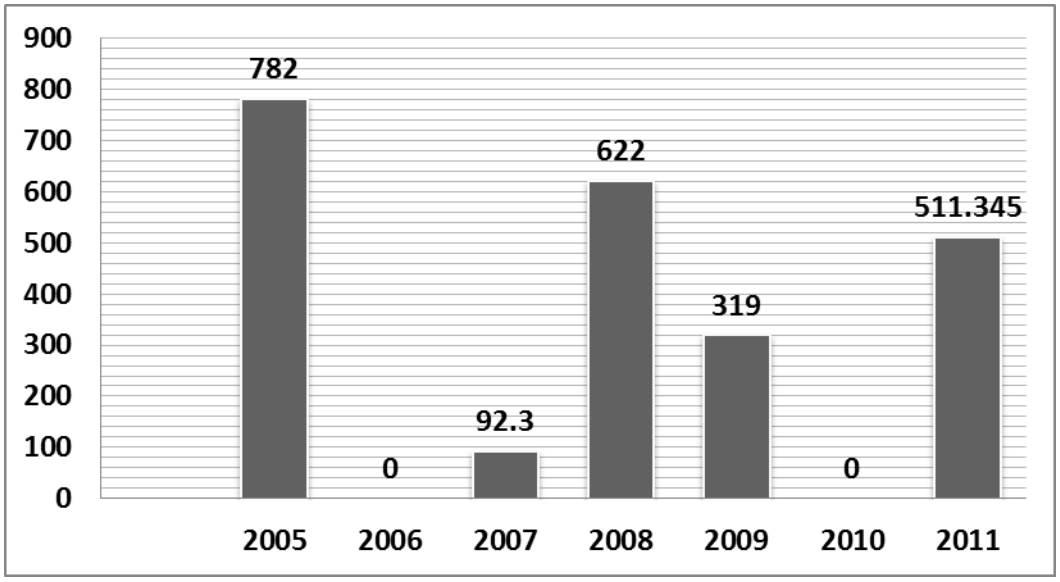
Exploitation of sea cucumber (bêche-de-mer) along the Sudanese coast was initiated in the late 1970s and since then production has been based on (Holothuria sp. and Actinopyga sp.). In 1981, 15 t of dried sea cucumber was exported. Thereafter, production declined to 1.5 t because of difficulties in collecting. However, in the present situation of declining fish and kokian landings, sea cucumber exploitation has resumed and bêche-de-mer is now over-exploited.

Pearl oyster (*Pinctada margaritifera*) and ornamental seashells (mainly Strombus and Lambia species) are also collected in Sudan, particularly from the fringing reefs inshore.

Commercial fishing sector: This sector includes bottom trawling. The products of this sector mainly support exports of marine products, and the activity in commercial fishing is seasonal, and sometimes seasons are closed to give the resources of this sector an opportunity to recover.

**A - bottom trawling fishing**: It represents the southern region of the Sudanese coast around the islands of Tala Tala, which represents the ideal environment for the species targeted by bottom trawl boats, such as shrimp, lizard fishes and goat fishes. Production fluctuates according to the number of boats approved in the season and often does not exceed 25 vessels per the season, the season extends from November to May and fishing is closed during the spawning season. The maximum sustainable yield of demersal fish in the Sudanese coast is estimated at about 3000 tons per year.

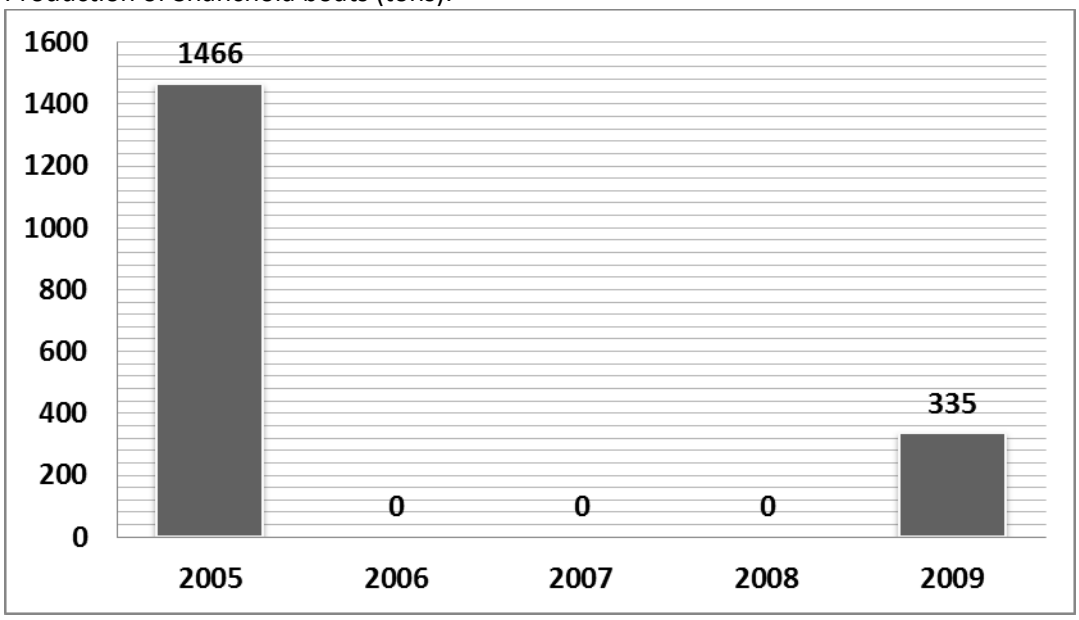
Bottom trawl production (tons):




• It was not approved for bottom trawling in the years 2006-2010-2013. Till now.

**B - Fishing with surround nets (Chanchula):** The chnchola boats use the light to attract fish and then surround them with nets, chinchola fishing areas to the south of the Sudanese coast. The chinchola targets pelagic fish such as sardines, spanish mackerels and striped tuna. A chinchola season opens in November and extends through May. The maximum sustainable yield of pelagic fish is estimated at 4 000 tons per year.

Production of Shanchola boats (tons):




• It was not approved for chanchula boats in the years 2006 - 2007 - 2008 and from 2010 until now.

# Survey Methodology:

Two methodologies were used for the broad scale survey. The objective of this survey is to provide data on corals reef and benthic communities, fishes, key mobile invertebrates, and habitat of sea grass and sea weeds and mangroves and overall status and health.

**Quick Survey:**

The ground-truthing surveys aim to collect broad scale information on the spatial distribution and variability of subtidal benthic biotope types for use in creating maps. The ground-truthing surveys

employed the 'Quick Site' survey method, which provides an initial comparative dataset on the physical structure and composition of the biological community. The Quick Site method was previously adapted from the Rapid Ecological Assessments developed by DeVantier et al., (1998) and has successfully been used for mapping other parts Sudan (PERSGA 2004), the Red Sea, and wider Indian Ocean region (Klaus, 1999, Klaus et al., 2008). As the method is quick it allows a survey team to cover a large number of sites over a broad area in a relatively short period of time and thereby provides a more geographically comprehensive overview of an area than would be achievable using more detailed survey methods alone. This facilitates the identification of: (i) Broad groups of biotopes for mapping, (ii) Suitable survey sites for more Detailed Surveys (iii) New or previously undescribed biotopes, which may also require more detailed surveys.

At the start of the 'Quick Site' the centre of the area is marked using a **GPS** and the depth. Team members then randomly snorkel over an area of roughly 100 x 100m for 10-15 minutes and record information on the **composition of the substratum** and percent **biological cover** of the site. Team members also record the **presence / absence** of key invertebrate macro fauna (urchins, sea cucumbers, starfish, clams and anemones), and species of algae, corals, fishes and other larger benthic invertebrates found in the area.

At the end of the survey, team members rapidly compile their **observations** for each site. The percentages recorded for the structure and the biological cover, total 100 percent independently. The **species lists** provide basic information on the most common and characteristic species found in each habitat. Finally, a **brief description** of the site that includes any particularly distinguishing features or ecological characteristics is recorded before progressing onto the next site.

Table for quick survey:

| **General** | **Habitat structure** | **Biological cover %** | **Presence** | **Common species** |
|---|---|---|---|---|
| GPS | Rocks small | Hard coral | Urchins | Algae |
| Site name | Rocks large | Soft coral | Sea cucumber | |
| Date | Hard substrate | Dead coral | Star fish | Corals |
| Depth | Rubble | Turf algae | Clams | |
| | Sand | Macro algae | Anemones | Fishes |
| | Silt | Coralline algae | | Invertebrates |
| | | Sea grass | | |
| | | Sponge | | |
| | | Bare | | |

**Rapid Ecological Assessments:**

Rapid Ecological Assessment (REA) sites comprise a quadrat 500m x 500m in extent, extending 250m up the shore and 250m into the subtidal zone. The intertidal/land component of the quadrat (500m x 250m) is determined from observations while walking. The subtidal component (500m x 250m) is

examined while snorkelling. Within each quadrat, the abundance of biotopes and species groups and human uses and impacts are estimated.

Rapid ecological assessment forma:

| | | | | | | |
|---|---|---|---|---|---|---|
| **Country:** | | **Location:** | | **Date:** | **Time:** | |
| **Surveyors:** | | | **Weather** | **Wind S** | **Wind D.** | |
| **Site description** | | | | | | |
| **1** | **Mangroves** | | | | | **FLORA** |
| **2** | **Seagrass** | | | | | |
| **3** | **Halophytes** | | | | | |
| **4** | **Algae (sea weeds)** | | | | | |
| **5** | **Freshwater vegetation** | | | | | |
| **6** | **Other** | | | | | |
| **7** | **Coral Reefs** | | | | | **FAUNA** |
| **8** | **Birds** | | | | | |
| **9** | **Turtles** | | | | | |
| **10** | **Mammals** | | | | | |
| **11** | **Fishes** | | | | | |
| **12** | **Invertebrates** | | | | | |
| **13** | **Other** | | | | | |
| **14** | **Construction** | | | | | **IMPACTS** |
| **15** | **Fishing / Collecting** | | | | | |
| **16** | **Metal** | | | | | |
| **17** | **Plastics** | | | | | |
| **18** | **Wood** | | | | | |
| **19** | | | | | | **OTHER** |
| **20** | | | | | | |
| **Photographs** | | | | | | |
| **Comments** | | | | | | |

## General Results and findings:

This section summarises the findings of the Survey carried out in March 2022. A total of 7 sites were surveyed. At each of these sites general data on fishes, invertebrates and corals reef were gathered that provide the status of the survey area.

Suakin area was surveyed, starting from Haidub port, for livestock and fish resources. The first survey station was Sha'ab Dhanab algirish, (E 18 54 561/N 37 43 216) which is a submerged reef with a length of 6 km and a width of 2.5 km. The area shows diversity of fishes. Coral reefs 40% live, (massive porites/ acropora/ stylophora), 50% dead with patch sands and marine invertebrates (sea cucumber/ tridacna/strombus), sea grass and marine algae (turbinaria/ surgasum and glacilaria sp).

To Hararawaite, (1853284/3745360) which is two adjacent islands that are similar and contain different types of diverse environments and habitats. There are three types of halophyte plants cover the island and a sandy beach with some pits as nests for sea turtles. The shallow area includes a variety of seagrass and seaweed. The coral reefs environment contains a group of invertebrates, marine fish (parrot fish and groupers) and coral reefs, which are in good condition. Colony of sea birds at the second Island.

To Sararat Island, (E 18 48 484/N 37 43 279) which is a long island surrounded by a group of small islands near. Sararat Island covered with halophyte plants and narrow sandy beach, and contains within it a group of internal lakes that are filled with water in high tide. There is a variety of seagrass (thalasia/ halodule) and marine algae in the shallow area. As for the northern side facing the wind has dense growth of diverse coral reefs dominated with massive porites, and the percentage of live cover in many areas exceeds 70%, interspersed with a group of fish and marine invertebrates. Despite the turbidity of the water. There are some sea birds like seagulls.

On the island of Umm Tarda, (E 18 47 474/N 37 37 027) which is a small island with a large percentage of halophyte plants on the sandy beach. The shallow area has diversify sea grassess, seaweeds, invertebrates, fishes and coral reefs.

To Ashad marsa (E 18 45 513/N 37 29 366) where there is a long belt of mangrove trees (avicinia marina) with dense and large trees, about 10 meters in diameter and 5 meters height, branched, with seeds and in good health, with no signs of diseases and pollution, except for some litters, such as plastic bottles scattered near the surveyed area in the northern part. The shallow area nearby has a large group of marine algae (padina/ red algae and brown algae) that grows on the rocks which is spread over a wide area north and northeast of the forest. It is considered as nursery area for some crustaceans, fishes and other marine organisms. This area was known as an important area for collecting sea cucumbers, especially the white type. The forest in the northern part is separated from the beach by a shallow lagoon 1 meter deep that protects it from grazing by camels.

Marsa sheikh saad (E 18 50 506/N 37 25 481) is landing site for local fishers. There is small village and traditional fish restaurants near the shore. The beach has scattered halophytes and some sea birds like sea gulls and crab plover. One kilometer far there is mangrove pelt in good condition.

During the survey, no harmful effects were observed on the marine environment such as bleaching, signs of diseases and pad practices, except the plastic waste on the coastal area, islands and mangroves, especially on fish landing site, which is a limited amount of litters.

## Conclusion:

Overall, the results of the survey presented in this report reveal a highly variable habitats (coral reefs/ Islands/ sandy beaches/ halophytes/seagrasses/ mangroves) and diversify endangered marine organisms (turtle/ sea birds/ sea cucumbers and dugong), with generally in good condition need to be protected and sustainable management.

And the detailed survey will complete the whole picture of the area.

## Appendixes:

## Data types needed for MPA and their suggested source for plan and management.

### Physical/ chemical environment:

| Data type | Source to obtain |
|---|---|
| Air and water Temperature | Fisheries Research/ Red Sea University |
| Dissolved oxygen | Fisheries Research/ Red Sea University |
| Salinity | Fisheries Research/ Red Sea University |
| Turbidity | Fisheries Research/ Red Sea University |
| PH | Fisheries Research/ Red Sea University |
| Phosphate /Nitrate/ Silicate | Red Sea University |
| Winds/ Waves / Rains | Organization of Metrology |
| Tide | Red Sea University |

### Biological environment:

| Data type | Source to obtain |
|---|---|
| Habitat | **Surveys** |
| Distribution | **Surveys** |
| Abundance | **Surveys** |
| density | **Surveys** |
| Biodiversity | **Surveys** |
| Spawning season | Fisheries Research |
| Aggregation | Fishers /dive operation |
| Nesting sites | **Surveys** |
| Endangered species | IUCN/ Marine fisheries administration |
| Catch per unit effort | Marine fisheries administration |

### Socio-economic environment:

| Data type | Source to obtain |
|---|---|
| Population | Swakin locality |
| Health | Swakin locality |
| Education | Swakin locality |
| House hold | **Surveys** |
| Drinking water | **Surveys** |
| Food and cooking | **Surveys** |
| Roads | **Surveys** |
| Communication | **Surveys** |
| Power sources | **Surveys** |
| Kinds of Working | **Surveys** |
| Number of Fishers | Marine fisheries administration |
| Number of boats | Marine fisheries administration |

## Threats/ impacts:

| Data type | Source to obtain |
|---|---|
| pollution | **Surveys** |
| Over exploitation of marine fishes | Marine fisheries administration |
| Degradation | **Surveys** |
| Litters | **Surveys** |
| Land based activities | **Surveys** |
| Climate change | **Surveys** |
| Grazing on mangroves | **Surveys** |
| Invasive species | **Surveys** |
| Introduced species | **Surveys** |