

Sanganeb Atoll, Sudan
A Marine National Park with Scientific Criteria for
Ecologically Significant Marine Areas

Abstract

Sanganeb Marine National Park (SMNP) is one of the most unique reef structures in the Sudanese Red Sea whose steep slopes rise from a sea floor more than 800 m deep. It is located at approximately 30km north-east of Port Sudan city at 19° 42 N, 37° 26 E. The Atoll is characterized by steep slopes on all sides. The dominated coral reef ecosystem harbors significant populations of fauna and flora in a stable equilibrium with numerous endemic and endangered species. The reefs are distinctive of their high number of species, diverse number of habitats, and high endemism. The atoll has a diverse coral fauna with a total of 86 coral species being recorded. The total number of species of algae, polychaetes, fish, and Cnidaria has been confirmed as occurring at Sanganeb Atoll. Research activities are currently being conducted; yet several legislative decisions are needed at the national level in addition to monitoring.

Introduction

(To include: feature type(s) presented, geographic description, depth range, oceanography, general information data reported, availability of models)

Sanganeb Atoll was declared a marine nation park in 1990. Sanganeb Marine National Park (SMNP) is one of the most unique reef structures in the Sudanese Red Sea whose steep slopes rise from a sea floor more than 800 m deep (Krupp, 1990). With the exception of the man-made structures built on the reef flat in the south, there is no dry land at SMNP (**Figure 1**). The Atoll is characterized by steep slopes on all sides with terraces in their upper parts and occasional spurs and pillars (Sheppard and Wells, 1988). The rim of the atoll reaches the surface on all but the western side where it is submerged (**Figure 2**).

The dominated coral reef ecosystem harbors significant populations of fauna and flora in a stable equilibrium with numerous endemic and endangered species.

The naturalness and the esthetic features gave the reefs of SMNP an increasing interest both regionally and internationally. They are distinctive of their high number of species, diverse number of habitats, and high endemism.

The reef of SMNP is widely reported to be the only atoll in the Red Sea (PERSGA/GEF, 2004). It is a small atoll by global standards: its maximum length along the north-south axis is 6.5km, and its maximum width is 1.6km, making it comparable to some of the smaller atolls in the Pacific Ocean (PERSGA/GEF, 2004). The area of reef flat and shallow fore reef is approximately 2km², and the area of enclosed lagoon is approximately 4.6km². The total area enclosed by the present boundaries of Sanganeb is approximately 22km².

Surface seawater temperatures range between 26.2 and 30.5°C, while at greater depths (150m) they range from 23.9–25.9°C. The seawater temperature regime can be categorised as having a low

annual variability and a small seasonal temperature range that is optimal for coral growth and reef development.

The average annual rainfall on the Sudanese coast is about 111mm, but it is only after torrential rains, which occur mainly in November and December, that there is some freshwater input to the Red Sea. This means that turbidity, particularly for offshore reefs is very low. The lower level of suspended sediments allows the penetration of sunlight further than in many other tropical seas (Vine, 1985). The occasionally measured underwater visibility reached more than 50m, which can be able to sustain plants and corals to such a depth.

Salinity in the central Red Sea is relatively high (39-41ppt) compared to most of the world's seas and is caused by high evaporation rates and the lack of permanent freshwater input anywhere along the Red Sea. Salinity is kept in equilibrium by the inflow of lower salinity seawater through the Straits of Bab al-Mandab, which connects the Red Sea to the Gulf of Aden and the rest of the Arabian Sea (PERSGAIGEF, 2004).

Location

Sanganeb atoll is located in the central Red Sea at approximately 30km north-east of Port Sudan city away from significant human impacts. Its geographical coordinates are 19° 42' N, 37° 26' E (**Figure 3**). The unique features of SMNP, and in the light of the fact that it is being located in the north-western Indo-pacific bio-geographic region that contains no World Heritage sites, stimulated the Sudanese Government to apply for the nomination of Sanganeb to be included in the World Heritage List.

Feature description of the proposed area

(This should include information about the characteristics of the feature to be proposed, e.g. in terms of physical description (water column feature, benthic feature, or both), biological communities, role in ecosystem function, and then refer to the data/information that is available to support the proposal and whether models are available in the absence of data. This needs to be supported where possible with maps, models, reference to analysis, or the level of research in the area)

Corals and coral communities

The atoll has a highly diverse coral fauna and is characterized by 13 different bio-physiographic reef zones, each providing typical coral reef assemblages (Sheppard and Wells, 1988). Coral communities have been described by Mergner and Schuhmacher (1985). A total of 86 coral species in 35 genera has been recorded.

The structure and zonation of Sanganeb reef is typical for the Red Sea and has been reasonably well studied (Vine & Vine, 1980; Mergner & Schumacher 1985); a habitat map derived from satellite imagery is presented in **Figure 4**. Also comparative ecological analysis of biota and habitats in littoral and shallow sub-littoral waters has been carried out in Sudanese Red Sea with emphasis on

Sanganeb Atoll (Krupp, et al. – Editors, 1994). Lists of plant and animal species confirmed to be found in Sanganeb Atoll are presented in **Annex I**.

In areas where the reef is wider than about 20m there is an area of back reef that supports a lower coral cover (less than 15% live coral cover) with patches of sand, coral rubble and exposed reef framework (PERSGALGEE, 2004). Massive growth forms of *Porites* and *Goniastrea* dominate here. Such areas are most extensive to the north of the atoll and in the area around the lighthouse.

The majority of the reef flat is in shallow water, particularly in the summer months when sea levels are about 15cm below those occurring in winter. Coral cover is moderate (10-30%) and dominated by massive and encrusting growth forms, particularly colonies of *Porites*, *Goniastrea* and *Montipora*, but there is a greater diversity of coral species compared to the back reef. The reef flat supports numerous herbivorous fish particularly surgeonfish (*Acanthurus sohal*) and parrotfish (*Scarus* sp.). Around the northern point of Sanganeb there is an area of slightly deeper reef flat, with an average depth of 2-3m, which is exposed to the higher wave energy arriving from the north.

Around most of the outer rim of Sanganeb the reef drops vertically by 5-10m to a debris slope that continues to fall away at a steep angle, often 40° or more, to another shelf at 20-30m. In some areas (e.g. on the south eastern edge) these drop-offs continue down to depths of at least 50m. The drop off from the reef flat to the reef slope is spectacular because of the diversity of fish life and the variety of coral. From a diver's perspective these drop-offs represent some of the best dive sites because of the rich marine life and the sense of exposure that comes with diving on vertical cliff walls in very clear water (**Figure 5**). This zone supports the greatest diversity of life and is without question the most important part of the reef from a conservation point of view.

The lagoons

The inner rim encloses three lagoons that are partially isolated from each other by reefs. The large one – the main lagoon – lies in the north which has an average depth of more than 20-25m and a wide opening to the west. Here there is a complex of ribbon reefs that have semi-isolated shallow pools and provide very sheltered habitats. Overall, the diversity of hydrographic conditions encountered within the lagoon area is high and this is reflected in the ecology it supports. Important amongst the ecological roles that the lagoon plays is that of a fish nursery and spawning ground, for species including sailfish. The middle lagoon with 27 m maximum depth bordered to north by a series of patch reefs; the southernmost lagoon is the most sheltered and the shallowest with 9 m maximum depth, which is completely enclosed except for a narrow channel, no more than 3m deep and 5m wide (**Figure 2**). Sediments in the lagoons are likely to be very silty because very little wave energy can disturb the seabed.

There have been no specific investigations into the sediments of SMNP but, being composed entirely of the remains of calcareous organisms, the sediments of Sanganeb Atoll are likely to be almost 100% carbonate with a very small contribution from wind-blown dust from both the Arabian and African landmasses.

A sill lying separates the deeper parts of the central lagoon from open water, rising in places to form small pinnacles and patch reefs. No information is available concerning the nature of this sill or

the benthic life that it supports. A bathymetric survey across the lagoon opening would provide useful information that might assist the safe navigation into and out of the lagoon.

The marine life in the open water surrounding SMNP is also an important component of the Park being pelagic, and includes cetaceans, marine turtles and commercially important fish species. **VINE & VINE, 1980** also report a pinnacle rising to within 20m of the sea surface immediately to the north east of the atoll that attracts large numbers of schooling pelagic fish.

FLORA

The algae of SMNP have been studied by EL HAG (1994) and a list of species is presented in **Annex I**. The findings show that the flora of Sanganeb Atoll is typical for coral reefs of the Indian Ocean and all species have a wide distribution in the tropical Indian Ocean. There is no published information regarding the occurrence of seagrass in the lagoon at SMNP (**PERSGA/GEF, 2004**).

FAUNA

Hard and Soft Corals

Abiotic conditions in the central Red Sea are optimal for coral growth and reef development. Perhaps due to these optimal conditions, the number of coral species observed in the Sudanese Red Sea is greater than that for either the northern or the southern Red Sea. To the north conditions are sub-optimal due to the low winter temperature extremes occurring there. To the south higher concentrations of nutrients imported to the Red Sea from upwellings in the Gulf of Aden probably limit reef development by increasing rates of bioerosion, concentration of phytoplankton in the water column and macroalgal biomass. The hard and soft coral fauna at Sanganeb Atoll is therefore likely to be amongst the richest in the Red Sea. To date a total of 124 cnidarian species, including scleractinians, have been recorded at SMNP (MERGNER & SCHUMACHER 1985).

Commercially-Important Invertebrates

There are populations of a number of commercially important invertebrates present within SNP and of these the most important are *Trochus* (*Trochus dentatus*, locally known as kokian) and sea cucumbers.

Giant clams (*Tridacna squamosa* and other species) are very abundant on the reef and may represent a totally unexploited population.

Fish

The coral reef fish fauna of SMNP has been surveyed by KRUPP et al. (1994) and has shown to be highly diverse with over 251 species so far identified, with an estimate of the actual number of species put at over 300. In addition to reef associated species, a large number of pelagic fish can be observed in the open waters of SMNP including wrasse (e.g. Napoleon Wrasse) species of tuna, barracuda, sailfish, manta rays and sharks including Hammerheads. So far a total of nine species of grouper have been recorded within SMNP of which the spotted coral grouper (*Plectropomus maculatus*, known locally as (najil) is the most important commercially and from a conservation perspective. *Genicanthus melanospilus* (*Pomacanthidae*) which has a patchy distribution in the Red

Sea occurs on the deep water reefs (Ormond,1980b). A checklist of coral reef fish is presented in **Appendix (1)**.

Marine turtles

VINE & VINE (1980) reported that hawksbill turtles are frequently sighted in the waters around Sanganeb Atoll, but there is no enough information available on the status of turtles in SMNP.

Cetaceans

There are very few data on the identity and distribution of cetaceans in the Sudanese Red Sea. Anecdotal observations suggest that humpback whales (*Megaptera novaeangliae*) and pilot whales or false killer whales occur around SMNP during winter months, and a pod of 8-10 bottlenose dolphins (*Tursiops truncatus*) are frequently observed around Sanganeb jetty (**Figure 6**).

Feature condition and future outlook of the proposed area

(Description of the current condition of the area – is this static, declining, improving, what are the particular vulnerabilities? Any planned research/programmes/investigations?)

State of reefs and corals

The reefs at SMNP are unusual in that they are still in a very good condition, have a high species richness with a large number of flagship species (e.g. large fish and sharks). They are not immediately threatened by human activity as there is no resident population and not being an important traditional fishing ground. They are largely unaffected by pollution or depletion by collecting. Yet there are signs of coral die-off not deeply being investigated, but generally attributed to sedimentation and water temperature (Nasr, in press).

European divers frequently visit the atoll on organized tours, particularly from October to May; their impact on corals is low with the exception of boat anchorage. The Regional Organization for the Conservation of the Environment of the Red Sea and Gulf of Aden (PERSGA) is planning to assist Sudan in deploying mooring buoys at specific sites in Sanganeb Atoll.

Research and monitoring

Research activities are currently carried out by the Institute of Marine Science (Red Sea University), sometimes in collaboration with overseas scientists with the aim of collecting baseline data on Sanganeb marine environment and ecology; however, research is needed to investigate resource use and users and to investigate opportunities to enhance ecological benefits arising from the Park.

Continuous monitoring is required with regard to the status of the natural resources, e.g. coral reef health (live coral cover etc.), the level of resource use (e.g. by , tourist vessels and individual visitors).

At the same time, there is a need for further, continued research and monitoring on coral reefs and an information dissemination programme to enhance community participation and awareness. An

integrated coastal management plan which takes into consideration shipping, coastal development, pollution and natural resources, has been prepared for Sudan through the assistance of PERSGA; if its implementation is effectively enforced, it should cater to most of the impacts on the biodiversity at ecosystem and species levels.

Park Management

A Site-Specific Management Plan for SMNP has been prepared by PERSGA; but not yet implemented. The objectives of the Plan being:

1. To manage SMNP sustainably,
2. To maintain species diversity, and conserve habitats and the human built environment within SMNP,
3. To promote sustainable tourism in SMNP,
4. To educate and inspire,
5. To involve local communities and stakeholders as partners in SMNP,
6. To provide for the sustainable use of living marine resources.

Sudan signed the Convention on Biological Diversity (CBD) on 9th June 1992 and became a party on 30th October 1995. Since then the Higher Council for Environment and Natural Resources (HCENR) has developed a National Biodiversity Strategies and Action Plan as part of its commitment to the Secretariat of the CBD. This document provides a framework for the development of policies relating to the use of biodiversity in Sudan, and where possible these have been incorporated in this management plan.

In spite of the approved legislation, several legislative decisions are needed at the national levels. These would strengthen Sudan's legal framework benefiting coral reefs and their biological diversity.

Assessment of the area against CBD EBSA Criteria

(Discuss the area in relation to each of the CBD criteria and relate the best available science. Note that a proposed area for EBSA description may qualify on the basis of one or more of the criteria, and that the polygons of the EBSA need not be defined with exact precision. And modeling may be used to estimate the presence of EBSA attributes. Please note where there are significant information gaps)

CBD EBSA Criteria (Annex I to decision IX/20)	Description (Annex I to decision IX/20)	Ranking of criterion relevance (please mark one column with an X)			
		No information	Low	Medium	High
Uniqueness or rarity	Area contains either (i) unique (“the only one of its kind”), rare (occurs only in few locations) or endemic species, populations or communities, and/or (ii) unique, rare or distinct, habitats or ecosystems; and/or (iii) unique or unusual geomorphological or oceanographic features.				X
<i>Explanation for ranking</i> The area is unique as described by several writers. It is reported as the only genuine atoll in the Red Sea with high diversity in animals including corals.					
Special importance for life-history stages of species	Areas that are required for a population to survive and thrive.				X
<i>Explanation for ranking</i> As the site is away from significant human impacts, it is regarded as a refuge, nursery and reproductive area that can replenish deteriorated marine life elsewhere.					
Importance for threatened, endangered or declining species and/or habitats	Area containing habitat for the survival and recovery of endangered, threatened, declining species or area with significant assemblages of such species.			X	

<i>Explanation for ranking</i>					
<p>With the growing demand for exports, there is considerable concern that Napoleon Wrasse (<i>Cheilinus undulates</i>) is now threatened. It was included in the 1996 IUCN Red List as vulnerable. Similarly, the spotted coral grouper (<i>Plectropomus maculatus</i>, known locally as najil) is commercially important and it is a key species for the Saudi export market. There is concerns that its number may decline.</p>					
Vulnerability, fragility, sensitivity, or slow recovery	Areas that contain a relatively high proportion of sensitive habitats, biotopes or species that are functionally fragile (highly susceptible to degradation or depletion by human activity or by natural events) or with slow recovery.			X	
<i>Explanation for ranking</i>					
<p>Although the site is relatively away from the coast (35km), the corals are fragile and sensitive to natural threats (e.g. Climate Change) and/or anthropogenic impacts (growing tourist activities).</p>					
Biological productivity	Area containing species, populations or communities with comparatively higher natural biological productivity.				X
<i>Explanation for ranking</i>					
<p>SMNP serves as an important larvae export area, acting as a source of recruits for all species of plants and animals present in and around the reef, including invertebrates and fish species. It also acts as an important spawning ground for key fishery species as well as a larvae export area.</p>					
Biological diversity	Area contains comparatively higher diversity of ecosystems, habitats, communities, or species, or has higher genetic diversity.				X
<i>Explanation for ranking</i>					
<p>Sanganeb Atoll serves as a biodiversity 'hotspot' lying at or close to the centre of marine biodiversity in the Red Sea and boasting hard and soft coral fauna that is amongst the richest in the Region.</p> <p>Thriving on this rich reef ecosystem, over 300 fish species (including pelagic) inhabit SMNP. SMNP also hosts significant populations of globally-important and endangered species. including: sharks, cetaceans, Napoleon Wrasse (a vulnerable species according to the 1996 IUCN Red List species), grouper, and marine turtles.</p>					
Naturalness	Area with a comparatively higher degree of naturalness as a result of the lack of or low level of human-induced disturbance or degradation.				X
<i>Explanation for ranking</i>					
<p>The naturalness and the athletic features gave the property an increasing interest both regionally and internationally as reflected in various publications.</p>					

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Sharing experiences and information applying other criteria (Optional)

Other Criteria	Description	Ranking of criterion relevance			
		(please mark one column with an X)			
		Don't Know	Low	Medium	High
<i>Add relevant criteria</i>					
<i>Explanation for ranking</i>					

References

(e.g. relevant documents and publications, including URL where available; relevant data sets, including where these are located; information pertaining to relevant audio/visual material, video, models, etc.)

El Hag, A.D.G. 1994. Seaweed studies at Sanganeb Atoll. In: *Comparative Ecological Analysis of Biota and Habitats in Littoral and Shallow Sublittoral Waters of the Sudanese Red Sea*. (KRUPP, F., TÜRKAY, M., EL HAG, A.G.D. & NASR, D. eds). Forschungsinstitut Senckenberg, Frankfurt and Faculty of Marine Science and Fisheries, Port Sudan: pp. 15-20.

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Krupp, F., Türkay, M., El Hag, A.G.D. & 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.

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Maps and Figures

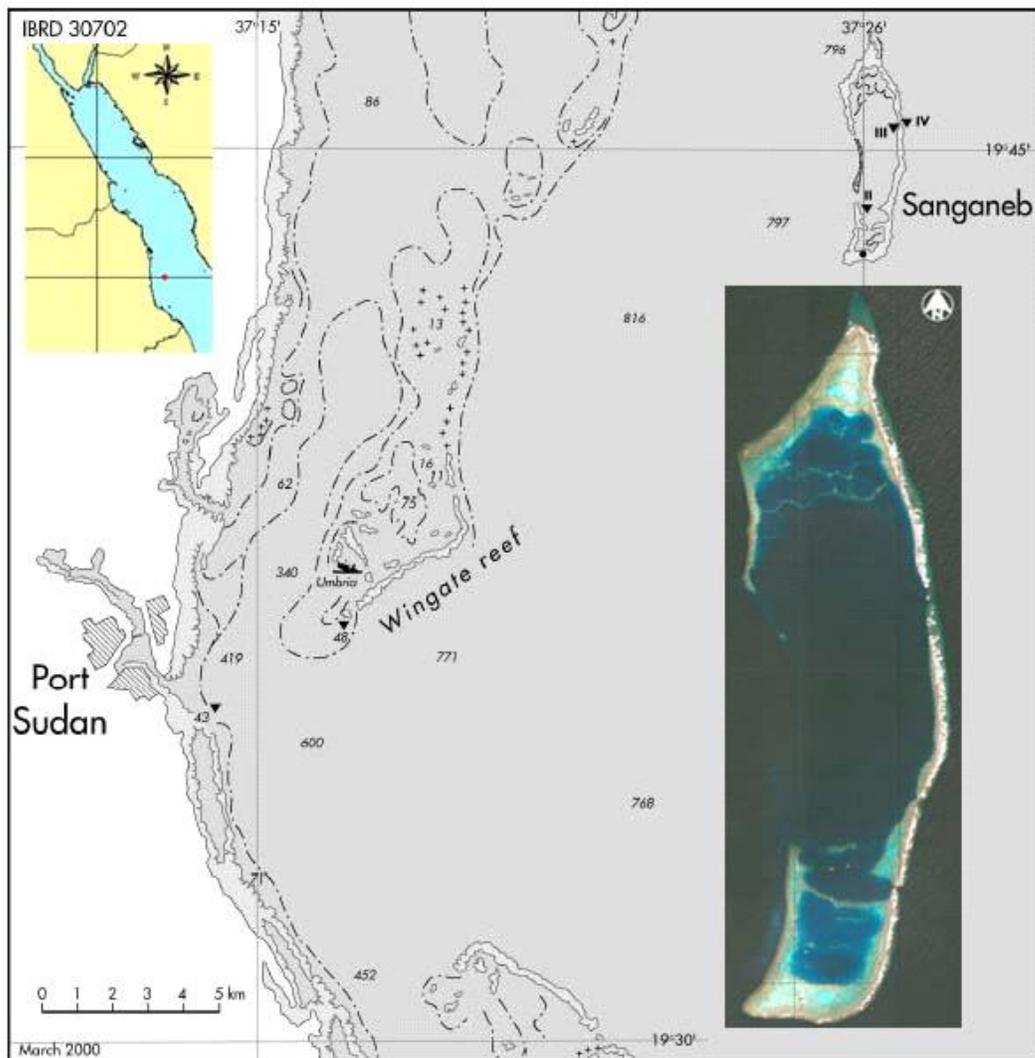
Fig. 1: The lighthouse and adjacent facilities (Photo by Hans & Nasr)



Fig. 2: The lagoons (Photo by Hans & Nasr)



Fig. 3: Sanganeb location map (Source: PERSGA/GEF. 2004)



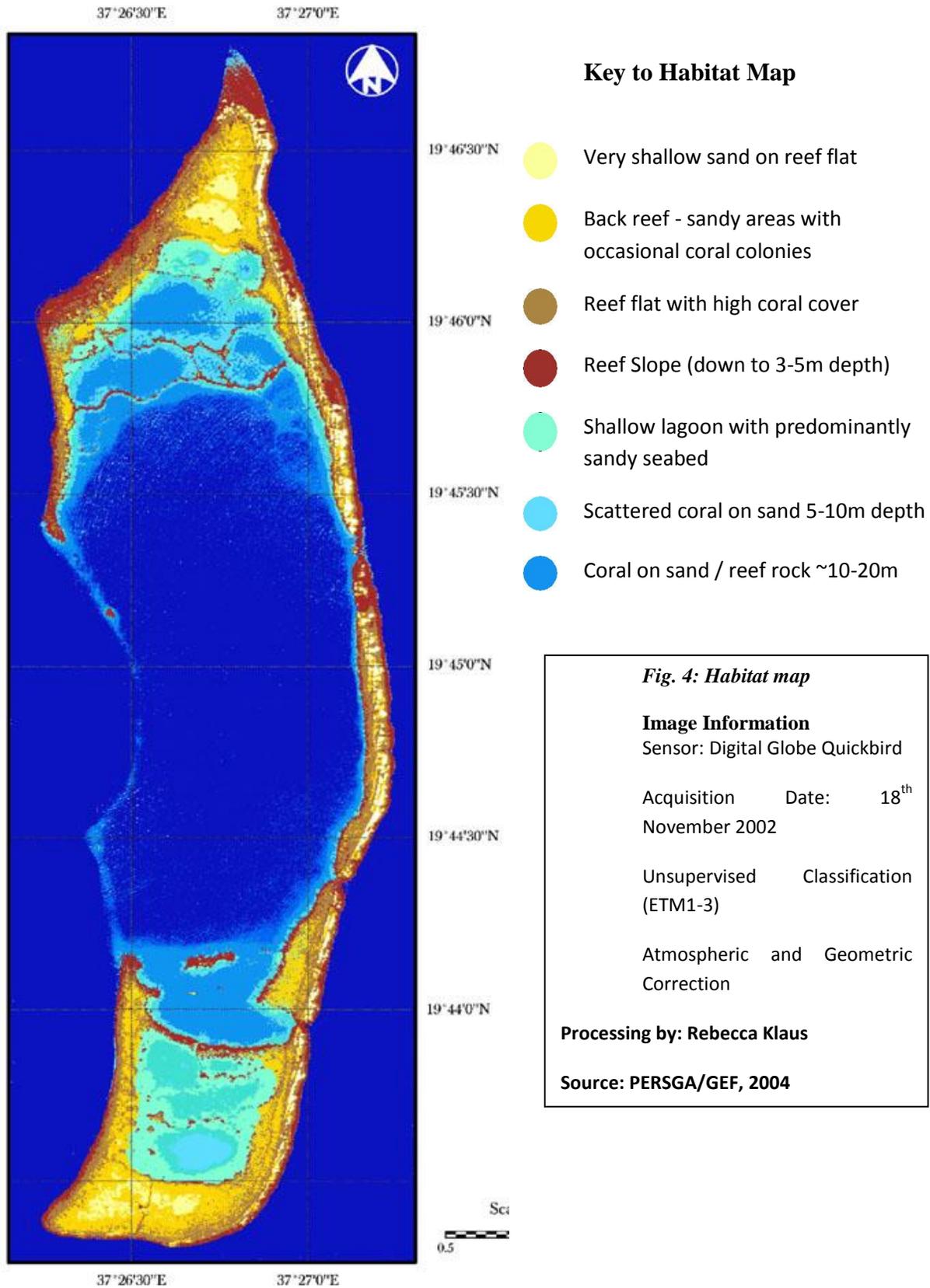


Fig. 5: Vertical cliffs (Photo by Hans & Nasr)



Fig. 6: Dolphins at Sanganeb (Photo by Hans & Nasr)



Annex 1

LISTS OF PLANT AND ANIMAL SPECIES RECORDED AT SMNP

Algae

<p>Chlorophyta <i>Chaetomorpha</i> sp <i>Cladophora prolifera</i> <i>Cladophora</i> sp. <i>Microdictyon</i> sp.1 <i>Boodlea</i> sp. 1 <i>Boodlea</i> sp. 2 <i>Cladophoropsis</i> sp.1 <i>Dictyosphaeria cavernosa</i> <i>Bryopsis</i> sp. 1 <i>Bryopsis</i> sp. 2 <i>Caulerpa serrulata</i> <i>Halimeda tuna</i> <i>Codium</i> sp. 1 <i>Codium</i> sp. 2 <i>Udotea</i> sp.1 <i>Udotea</i> sp.2</p>	<p>Phaeophyta <i>Ectocarpus</i> sp. <i>Dictyota dichotoma</i> <i>Dictyota</i> sp. 1 <i>Dictyota</i> sp. 2 <i>Dictyopteris</i> sp. 1 <i>Dictyopteris</i> sp. 2 <i>Lobophora variegata</i> <i>Padina pavonica</i> <i>Chnoospora</i> sp. <i>Turbinaria elatensis</i> <i>Turbinaria decurrens</i> <i>Sargassum</i> sp. <i>Shacelaria</i> sp.</p> <p>Cyanophyta <i>Lyngbya</i> sp. 1 <i>Lyngbya</i> sp. 2 <i>Microcoleus</i> sp. <i>Phormidium</i> sp.1 <i>Phormidium</i> sp.2 <i>Schizothrix</i> sp. 1 <i>Schizothrix</i> sp. 2</p>	<p>Rhodophyta <i>Centroceras</i> sp. <i>Digenea simplex?</i> <i>Spyridia</i> sp. 1 <i>Spyridia</i> sp. 2 <i>Martensia</i> sp. 1 <i>Dasya</i> sp. <i>Ceramium</i> sp. 1 <i>Ceramium</i> sp. 2 <i>Polysiphonia</i> sp. 1 <i>Polysiphonia</i> sp. 2 <i>Tolypocladia</i> sp. <i>Herposiphonia</i> sp.1 <i>Herposiphonia</i> sp.2 <i>Leveillea</i> sp. <i>Chondria</i> sp. <i>Corallina</i> sp.1 <i>Corallina</i> sp.2 <i>Acanthophora</i> sp. 1 <i>Laurencia</i> sp.1 <i>Laurencia</i> sp.2 <i>Laurencia</i> sp.3 <i>Jania rubens</i> <i>Jania</i> sp. <i>Lithophyllum</i> sp.</p>
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Total number of algae confirmed as occurring at Sanganeb Atoll: 91

Source: KRUPP et al. (1994).

Polychaetes

<p>Paraonidae <i>Cirrophorus</i> sp. 1 <i>Cirrophorus</i> sp. 2 <i>Cirrophorus</i> sp. 3</p> <p>Spionidae <i>Prionospio</i> cf <i>cirrifer</i> <i>Pseudopolydora kemp</i></p> <p>Chaetopteridae <i>Mesochaetopterus</i> cf <i>capensis</i> <i>Mesochaetopterus</i> cf <i>minutus</i> <i>Spiochaetopterus bonhourei</i> <i>Spiochaetopterus</i> sp. 1</p> <p>Cirratulidae <i>Caulleriella</i> sp. <i>Cirratulus africanus</i></p>	<p>Syllidae <i>Ehlersia</i> sp. 1 <i>Ehlersia</i> sp. 2 <i>Ehlersia</i> sp. 3 <i>Exogone</i> sp. <i>Haplosyllis spongicola</i> <i>Syllis</i> cf. <i>amica</i> <i>Syllis gracilis</i> <i>Trypanosyllis</i> cf <i>zebra</i> <i>Typosyllis bouvieri</i> <i>Typosyllis hyalina</i> <i>Typosyllis variegata</i> <i>Typosyllis</i> sp. 1 <i>Typosyllis</i> sp. 2 <i>Typosyllis</i> sp. 3 <i>Typosyllis</i> sp. 4 <i>Typosyllis</i> sp. 5 <i>Typosyllis</i> sp. 6</p>	<p>Arabellidae <i>Drilonereis filum</i></p> <p>Dorvilleidae <i>Dorvillea</i> sp. 1 <i>Dorvillea</i> sp. 2</p> <p>Terebellidae <i>Euploymnia</i> sp. <i>Euploymnia nebulosa</i> <i>Loimia medusa</i> <i>Lysilla</i> sp. <i>Neoamphitrite</i> cf <i>grayi</i> <i>Streblosoma cespitosa</i> <i>Streblosoma</i> sp.</p> <p>Sabellidae <i>Branchiomma</i> cf. <i>nigromaculata</i></p>
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<p><i>Cirriformia filigera</i> <i>Cirriformia</i> sp. 1 <i>Cirriformia tentaculata</i> <i>Dodecaceria</i> sp. 1 <i>Dodecaceria</i> sp. 2</p> <p>Capitellidae <i>Dasybranchus</i> sp. <i>Scyphoproctus</i> cf. <i>steinitzi</i></p> <p>Maldanidae <i>Nicomache</i> cf. <i>lumbricus</i> <i>Nicomache</i></p> <p>Phyllodoceidae <i>Eteone</i> sp. <i>Phyllodoce maderensis</i> <i>Phyllodoce</i> sp. 1 <i>Phyllodoce</i> sp. 2 <i>Phyllodoce</i> sp. 3</p> <p>Aphroditidae <i>Hermonia hystrix</i></p> <p>Polynoidae <i>Harmothoe</i> cf. <i>aequiseta</i> <i>Harmothoe</i> sp. <i>Iphione muricata</i> <i>Lepidonotus</i> sp. <i>Malmgrenia</i> sp. 1 <i>Malmgrenia</i> sp. 2</p> <p>Hesionidae <i>Gyptis</i> sp. <i>Leocrates claparedii</i></p>	<p><i>Typosyllis</i> sp. 7</p> <p>Nereididae <i>Ceratonereis mirabilis</i> <i>Leonnates jousseaumi</i> <i>Nereis</i> cf. <i>caudate</i> <i>Nereis</i> cf. <i>falsa</i> <i>Nereis falcaria</i></p> <p>Glyceridae <i>Glycera tessellata</i></p> <p>Goniadidae <i>Goniada</i> sp.</p> <p>Amphinomidae <i>Chloeia fusca</i> <i>Eurythoe complanata</i></p> <p>Euphrosinidae <i>Euphrosine foliosa</i></p> <p>Eunicidae <i>Eunice (Palola) siciliensis</i> <i>Eunice antennata</i> <i>Eunice aphroditois</i> <i>Eunice dubitata</i> <i>Eunice interrupta</i> <i>Eunice marenzelleri</i> <i>Eunice perrieri</i> <i>Eunice</i> sp. 1 <i>Eunice tubicola</i> <i>Eunice vittata</i> <i>Lysidice</i> cf. <i>collaris</i> <i>Nematonereis</i> cf. <i>Latreilli</i> <i>Lumbrineris</i> sp.</p>	<p><i>Hypsicomus phaeotenia</i> <i>Potamilla reniformis</i> <i>Sabella fusca</i> <i>Sabella</i> sp. <i>Sabellastarte</i> cf. <i>sanctijosephi</i></p>
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Total number of polychaetes confirmed as occurring at Sanganeb Atoll: 91. Source: KRUPP et al. (1994).

Fish

<p>Carcharhinidae <i>Carcharhinus albimarginatus</i> <i>Carcharhinus amblyrhynchos</i> <i>Carcharhinus melanopterus</i> <i>Triaenodon obesus</i></p> <p>Sphyrnidae <i>Sphyrna lewini</i></p> <p>Torpedidae <i>Torpedo</i> sp.</p> <p>Myliobatidae <i>Aetobatus narinari</i></p> <p>Mobulidae <i>Manta birostris</i></p> <p>Dasyatidae <i>Taeniura lymma</i></p> <p>Synodontidae <i>Saurida gracilis</i> <i>Synodus variegatus</i></p> <p>Muraenidae <i>Gymnothorax javanicus</i> <i>Siderea grisea</i></p> <p>Ophichthidae <i>Callechelys striata</i></p> <p>Clupeidae <i>Spratelloides</i> sp. <i>Herklotsichthysquadrimaculatus</i></p> <p>Belonidae <i>Tylosurus choram</i></p> <p>Hemiramphidae <i>Hyporhamphus gamberur</i></p> <p>Atherinidae <i>Atherinomorus lacunosus</i></p> <p>Syngnathidae <i>Corythoichthys flavofasciatus</i> <i>Corythoichthys nigripectus</i> <i>Corythoichthys schultzi</i></p> <p>Ophidiidae <i>Brotula multibarbata</i></p> <p>Antennariidae <i>Histrio histrio</i></p>	<p>Lutjanidae <i>Lutjanus argentimaculatus</i> <i>Lutjanus caeruleolineatus</i> <i>Lutjanus kasmira</i> <i>Lutjanus fulviflamma</i> <i>Lutjanus gibbus</i> <i>Lutjanus monostigma</i> <i>Lutjanus bohar</i> <i>Macolor niger</i></p> <p>Caesionidae <i>Caesio lunaris</i> <i>Caesio striatus</i> <i>Caesio suevicus</i> <i>Caesio varilineata</i></p> <p>Haemulidae <i>Plectorhynchus gaterinus</i></p> <p>Lethrinidae <i>Lethrinus nebulosus</i> <i>Monotaxis grandoculis</i></p> <p>Nemipteridae <i>Scolopsis ghanam</i> <i>Nemipterus</i> sp.</p> <p>Ephippidae <i>Platax orbicularis</i></p> <p>Kyphosidae <i>Kyphosus vaigiensis</i> <i>Kyphosus cinerascens</i></p> <p>Monodactylidae <i>Monodactylus argenteus</i></p> <p>Pempheridae <i>Parapriacanthus guentheri</i> <i>Pempheris vanicolensis</i></p> <p>Bothidae <i>Bothus pantherinus</i></p> <p>Soleidae <i>Pardachirus marmoratus</i></p> <p>Mullidae <i>Mulloides vanicolensis</i> <i>Mulloides flavolineatus</i> <i>Parupeneus cyclostomus</i> <i>Parupeneus forsskali</i> <i>Parupeneus macronema</i></p> <p>Malacanthidae</p>	<p>Scaridae <i>Hipposcarus harid</i> <i>Cetoscarus bicolor</i> <i>Bolbometopon muricatum</i> <i>Scarus genazonatus</i> <i>Scarus sordidus</i> <i>Scarus gibbus</i> <i>Scarus ferrugineus</i> <i>Scarus fuscopurpureus</i> <i>Scarus niger</i></p> <p>Congrogadidae <i>Haliophis guttatus</i></p> <p>Chaetodontidae <i>Chaetodon auriga</i> <i>Chaetodon austriacus</i> <i>Chaetodon fasciatus</i> <i>Chaetodon lineolatus</i> <i>Chaetodon melannotus</i> <i>Chaetodon paucifasciatus</i> <i>Chaetodon semilarvatus</i> <i>Gonochaetodon larvatus</i> <i>Megaprotodon trifascialis</i> <i>Heniochus diphreutes</i> <i>Heniochus intermedius</i></p> <p>Pomacanthidae <i>Pomacanthus imperator</i> <i>Pomacanthus maculosus</i> <i>Pomacanthus asfur</i> <i>Centropyge multispinis</i> <i>Apolemichthys xanthuris</i> <i>Pygoplites diacanthus</i> <i>Genicanthus caudovittatus</i></p> <p>Acanthuridae <i>Acanthurus gahham</i> <i>Acanthurus nigrofuscus</i> <i>Acanthurus sohal</i> <i>Ctenochaetus striatus</i> <i>Naso hexacanthus</i> <i>Naso unicornis</i> <i>Naso brevirostris</i> <i>Naso lituratus</i> <i>Zebrasoma veliferum</i> <i>Zebrasoma xanthurum</i></p> <p>Siganidae <i>Valenciennea</i> sp.</p> <p>Monacanthidae <i>Siganus luridus</i> <i>Siganus stellatus</i></p>
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<p>Holocentridae <i>Neoniphon sammara</i> <i>Myripristis murdjan</i> <i>Sargocentron caudimaculatus</i> <i>Sargocentron ruber</i> <i>Sargocentron spinifer</i></p> <p>Scorpaenidae <i>Pterois radiata</i> <i>Pterois volitans</i> <i>Pterois</i> sp. <i>Scorpaenopsis barbatus</i> <i>Synanceia verrucosa</i></p> <p>Platycephalidae <i>Onigocia oligolepis</i></p> <p>Serranidae <i>Aethaloperca rogae</i> <i>Cephalopholis argus</i> <i>Cephalopholis hemistiktos</i> <i>Cephalopholis miniata</i> <i>Epinephelus fuscoguttatus</i> <i>Epinephelus tauvina</i> <i>Plectropomus areolatus</i> <i>Plectropomus pessuliferus</i> <i>Variola louti</i> <i>Pseudanthias fasciatus</i> <i>Pseudanthias lunulatus</i> <i>Pseudanthias squamipinnis</i> <i>Pseudanthias taeniatus</i></p> <p>Grammistidae <i>Grammistes sexlineatus</i> <i>Diploprion drachi</i></p> <p>Cirrhitidae <i>Cirrhitichthys oxycephalus</i> <i>Paracirrhites forsteri</i> <i>Cirrhites pinnulatus</i> <i>Oxycirrhites typus</i></p> <p>Pseudochromidae <i>Pseudochromis flavivertex</i> <i>Pseudochromis fridmani</i> <i>Pseudochromis olivaceus</i> <i>Pseudochromis dixurus</i> <i>Pseudochromis</i> sp.</p> <p>Apogonidae <i>Apogon annularis</i> <i>Apogon aureus</i> <i>Apogon exostigma</i> <i>Apogon</i> cf. <i>fraenatus</i></p>	<p><i>Malacanthus latovittatus</i></p> <p>Mugiloididae <i>Parapercis hexophthalma</i></p> <p>Echeneidae <i>Echeneis naucratus</i></p> <p>Mugilidae <i>Crenimugil crenilabis</i> <i>Oedalechilus labiosus</i></p> <p>Sphyraenidae <i>Sphyraena barracuda</i> <i>Sphyraena jello</i> <i>Sphyraena qenie</i></p> <p>Pomacentridae <i>Amblyglyphidodon flavilatus</i> <i>Amblyglyphidodon leucogaster</i> <i>Abudefduf vaiagensis</i> <i>Abudefduf sexfasciatus</i> <i>Abudefduf sordidus</i> <i>Amphiprion bicinctus</i> <i>Chromis caerulea</i> <i>Chromis dimidiata</i> <i>Chromis ternatensis</i> <i>Chromis trialpha</i> <i>Chromis weberi</i> <i>Chromis pembae</i> <i>Chrysiptera unimaculata</i> <i>Dascyllus aruanus</i> <i>Dascyllus trimaculatus</i> <i>Neopomacentrus miryae</i> <i>Neopomacentrus xanthurus</i> <i>Paraglyphidodon melas</i> <i>Plectoglyphidodon lacrymatus</i> <i>Plectoglyphidodon leucozona</i> <i>Pomacentrus leptus</i> <i>Pomacentrus sulfureus</i> <i>Pomacentrus trichourus</i> <i>Pomacentrus trilineatus</i></p> <p>Labridae <i>Anampses twistii</i> <i>Bodianus anthioides</i> <i>Bodianus axillaris</i> <i>Bodianus diana</i> <i>Cheilinus digrammus</i> <i>Cheilinus fasciatus</i> <i>Cheilinus lunulatus</i> <i>Cheilinus mentalis</i> <i>Cheilinus undulatus</i> <i>Cheilinus</i> sp. <i>Coris aygula</i> <i>Coris africana</i></p>	<p>Blenniidae <i>Cirripectes</i> sp. <i>Exallias brevis</i> <i>Ecsenius frontalis</i> <i>Ecsenius midas</i> <i>Ecsenius nalolo</i> <i>Ecsenius</i> cf. <i>aroni</i> <i>Ecsenius gravieri</i> <i>Meiacanthus nigrolineatus</i> <i>Plagiotremus tapeinosoma</i></p> <p>Gobiidae <i>Istigobius decoratus</i> <i>Cryptocentrus lutheri</i> <i>Cryptocentrus caeruleopunctatus</i> <i>Ctenogobius maculosus</i> <i>Amblyeleotris steinitzi</i> <i>Asterropterix semipunctatus</i> <i>Ptereleotris microlepis</i> <i>Ptereleotris evides</i> <i>Nemateleotris</i> sp. <i>Amblygobius albimaculatus</i> <i>Amblygobius hectori</i> <i>Gobiodon citrinus</i> <i>Gobiodon</i> sp. <i>Eviota sebreei</i> <i>Bryaninops</i> sp. 1 <i>Bryaninops</i> sp. 2 <i>Bryaninops</i> sp. 3</p> <p>Balistidae <i>Balistapus undulatus</i> <i>Pseudobalistes fuscus</i> <i>Rhinecanthus assasi</i> <i>Sufflamen albicaudatus</i> <i>Odonus niger</i> <i>Balistoides viridescens</i> <i>Oxymonacanthus halli</i></p> <p>Ostraciidae <i>Ostracion cyanurus</i> <i>Ostracion cubicus</i></p> <p>Tetraodontidae <i>Arothron diadematus</i> <i>Arothron hispidus</i> <i>Canthigaster margaritata</i> <i>Canthigaster pygmaea</i></p> <p>Diodontidae <i>Diodon hystrix</i></p>
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<p><i>Apogon cf. coccineus</i> <i>Apogon kallopterus</i> <i>Apogon leptacanthus</i> <i>Archamia fucata</i> <i>Cheilodipterus macrodon</i> <i>Cheilodipterus bipunctatus</i> (novemstriatus) <i>Cheilodipterus lineatus</i> <i>Cheilodipterus quinquelineatus</i></p> <p>Carangidae <i>Caranx sexfasciatus</i> <i>Caranx melampygus</i> <i>Caranx cf. sexfasciatus</i> <i>Carangoides bajad</i> <i>Carangoides fulvoguttatus</i></p>	<p><i>Epibulus insidiator</i> <i>Gomphosus caeruleus</i> <i>Halichoeres hortulanus</i> <i>Halichoeres nebulosus</i> <i>Halichoeres scapularis</i> <i>Halichoeres marginatus</i> <i>Hemigymnosus fasciatus</i> <i>Hologymnosus annulatus</i> <i>Labroides dimidiatus</i> <i>Larabicus quadrilineatus</i> <i>Pseudocheilinus evanidus</i> <i>Pseudocheilinus hexataenia</i> <i>Cirrhilabrus blatteus</i> <i>Pseudodax moluccanus</i> <i>Thalassoma klunzingeri</i> <i>Thalassoma lunare</i> <i>Thalassoma purpureum</i> <i>Thalassoma sp.</i> <i>Minilabrus striatus</i></p>	
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Total number of fish confirmed as occurring at Sanganeb Atoll: 250

Source: KRUPP et al. (1994).

<p>HYDROZOA HYDROIDEA</p> <p>Milleporidae <i>Millepora dichotoma</i> <i>Millepora exaesa</i> <i>Millepora platyphylla</i></p> <p>Stylasteridae <i>Distichopora violacea</i></p> <p>ANTHOZOA, OCTOCORALLIA</p> <p>STOLONIFERA</p> <p>Tubiporidae <i>Tubipora musica</i></p> <p>ALCYONARIA Alcyoniidae <i>Lobophytum pauciflorum</i> <i>Parerythropodium fulvum</i> <i>Sarcophyton ehrenbergi</i> <i>Sarcophyton elegans</i> <i>Sinularia candidula</i> <i>Sinularia dactyloclados</i> <i>Sinularia flabellidavata</i> <i>Sinularia gardineri</i> <i>Sinularia leptocladus</i></p>	<p>Astrocoeniidae <i>Stylocoeniella armata</i></p> <p>Pocilloporidae <i>Stylophora pistillata</i> <i>Seriatopora caliendrum</i> <i>Seriatopora hystrix</i> <i>Pocillopora damicornis</i> <i>Pocillopora verrucosa</i></p> <p>Acroporidae <i>Astreopora myriophthalma</i> <i>Acropora capillaris</i> <i>Acropora corymbosa</i> <i>Acropora cf. haimeii</i> <i>Acropora hemprichi</i> <i>Acropora humilis</i> <i>Acropora hyacinthus</i> <i>Acropora pharaonis</i> <i>Acropora squarrosa</i> <i>Acropora superba</i> <i>Acropora variabilis</i> <i>Acropora sp.</i> <i>Montipora effusa</i> <i>Montipora ehrenbergi</i> <i>Montipora granulosa</i> <i>Montipora meandrina</i> <i>Montipora monasteriata</i> <i>Montipora stilosa</i> <i>Montipora tuberculosa</i></p>	<p>Faviidae <i>Favia amicornum</i> <i>Favia fava</i> <i>Favia laxa</i> <i>Favia pallida</i> <i>Favia rotumana</i> <i>Favia speciosa</i> <i>Favia stelligera</i> <i>Favites complanata</i> <i>Favites flexuosa</i> <i>Favites halicora</i> <i>Favites pentagona</i> <i>Favites rotundata</i> <i>Goniastrea edwardsi</i> <i>Goniastrea pectinata</i> <i>Goniastrea retiformis</i> <i>Platygyra daedelea</i> <i>Leptoria phrygia</i> <i>Oulophyllia crispa</i> <i>Hydnophora microconus</i> <i>Leptastrea bottae</i> <i>Leptastrea purpurea</i> <i>Leptastrea transversa</i> <i>Cyphastrea chalcidum</i> <i>Cyphastrea microphthalma</i> <i>Cyphastrea serailia</i> <i>Echinopora gemmacea</i> <i>Echinopora lamellose</i></p> <p>Oculinidae</p>
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<p><i>Sinularia minima</i> <i>Sinularia notanda</i> <i>Sinularia polydactyla</i> <i>Sinularia querciformis</i> <i>Sinularia schumacheri</i></p> <p>Nephtheidae <i>Nephthea laevis</i> <i>Dendronephthya hemprichi</i> <i>Dendronephthya savignyi</i> <i>Stereonephthya cundabiluensis</i> <i>Lithophyton arboreum</i> <i>Paralemnalia eburnea</i> <i>Paralemnalia thyrsoides</i></p> <p>Xeniidae <i>Xenia macrospiculata</i> <i>Xenia umbellata</i> <i>Heteroxenia fuscescens</i> <i>Athelia fishelsoni</i> <i>Athelia glauca</i> <i>Sympodium caeruleum</i></p> <p>GORGONARIA Gorgonidae <i>Clathraria rubrinodis</i> <i>Juncella</i> sp.</p> <p>ANTHOZOA, HEXACORALLIA SCLERACTINIA Thamnasteriidae <i>Psammocora haimeana</i> <i>Psammocora nierstraszi</i></p>	<p><i>Montipora venosa</i> <i>Montipora verrucosa</i> <i>Montipora</i> sp.</p> <p>Agariciidae <i>Pavona clavus</i> <i>Pavona divaricata</i> <i>Pavona maldivensis</i> <i>Pavona varians</i> <i>Leptoseria mycetoseroides</i> <i>Gardineroseris planulata</i></p> <p>Siderasteridae <i>Coscinarea monile</i></p> <p>Fungiidae <i>Fungia echinata</i> <i>Fungia fungites</i> <i>Fungia klunzingeri</i> <i>Fungia scutaria</i> <i>Herpolitha limax</i></p> <p>Poritidae <i>Alveopora daedalea</i> <i>Goniopora minor</i> <i>Goniopora tenuidens</i> <i>Porites echinulata</i> <i>Porites lutea</i> <i>Porites solida</i> <i>Porites (Synarea) undulata</i> <i>Porites</i> sp.</p>	<p><i>Galaxea astreata</i> <i>Galaxea fascicularis</i></p> <p>Mussidae <i>Scolymia vitiensis</i> <i>Lobophyllia corymbosa</i> <i>Lobophyllia hemprichi</i> <i>Lobophyllia pachysepta</i> <i>Acanthastrea echinata</i> <i>Symphyllia erythraea</i></p> <p>Pectiniidae <i>Mycedium elephantotus</i> <i>Echinophyllia aspera</i> <i>Oxypora lacera</i></p> <p>ZOANTHARIA Zoanthidae <i>Palythoa tuberculosa</i></p> <p>ANTIPATHARIA Anthipathidae <i>Cirripathes</i> sp.</p>
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Total number of Cnidaria confirmed as occurring at Sanganeb Atoll: 126

Source: MERGNER & SCHUMACHER (1985); VINE & VINE (1980).