

IUCN Eastern Africa Programme

**Somali Natural Resources
Management Programme**

**BIODIVERSITY ASSESSMENT OF THE NORTHERN
SOMALI COAST EAST OF BERBERA**

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BIODIVERSITY ASSESSMENT OF THE NORTHERN SOMALI COAST EAST OF BERBERA

EXECUTIVE SUMMARY

A coastal biodiversity survey was undertaken on the northern Somali coast to establish the status of the marine resources in the region, threats to the biodiversity and appropriate measures for the sustainable use and conservation of the resources. It formed part of the IUCN Somali Natural Resources Management Programme, funded by the EC, which aims to improve the socio-economic well-being of the Somali people by enhancing the ecological sustainability of their natural resource use. Fieldwork was carried out in collaboration with Cooperazione Internazionale (COOPI).

Extremely wide-ranging activities were commissioned, aimed at determining:

1. The conservation and biodiversity value of the coast between Berbera and Raas-Khansir.
2. The extent and nature of marine resource use, the user groups and their dependence on the resources.
3. The level and nature of threats to the biodiversity in the area.
4. Appropriate conservation measures needed to promote sustainable use of the area.

The survey was undertaken between 4-11 March 1999 from 15 km west of Berbera to the mangrove known as Khood Shoora approximately 150 km to the east. Data were collected on the nature and biodiversity of the shoreline, mangrove, seaweed, coral reef and pelagic environments. A record was kept on the abundance of turtles, dolphins and seabirds, as well as of the extent of turtle nesting on beaches.

The oceanographic conditions in the study area are primarily influenced by seasonal monsoons, complex seasonal currents and physical conditions. Nutrient levels are largely determined by variable current patterns and annual fluctuations in upwelling intensity. In terms of primary productivity, the study area is thought to fall in a transition zone between the richly productive water to the north-east and the East African shelf environment to the west. Daily winds generally blow parallel to the shore and generate inshore currents and a choppy sea. This disturbs the fine sediments and the inshore waters become milky and turbid. This diurnal increase in turbidity and sediment transport is probably a limiting factor on coral settlement and growth.

The marine environment off Berbera is very productive. Seaweeds flourish in many areas in the inshore region and wind-generated water movement promotes their growth as well as the transport and breakdown of algal detritus in the system. Large shoals of fish were observed in the region and these provide food for numerous dolphins, a further indication of high productivity. The seaweed beds, associated detritus and climatic energy subsidy make a contribution towards the productivity of the area. Further study would be needed to establish the importance of seaweed production relative to that derived from upwelling.

The coastline is relatively straight and consists mainly of beaches; very small rocky promontories occur only in a few localities. A raised fossilised seabed backs many of

the beaches. The dunes behind the beaches are generally low and sparsely colonised by xerophytic grasses and shrubs, as is the coastal plain. A high dune field, which is almost devoid of vegetation, occurs in one locality and arid rocky mountains are found at three sites.

At the time of the study, the beaches had a clear monsoon storm berm above the present high water mark. The latter was littered with seaweed, some coral fragments and large numbers of shells, particularly shells of gastropods occupied by scavenging hermit crabs. Remarkably little pollution was found. Ghost crabs were prolific on some beaches.

The subtidal sandy substratum appears to be relatively sterile. Seaweed detritus had accumulated in the sand ripples in certain areas and a single concentration of holothurians was found next to one reef. However, very few observations were made on the sand substratum because of time constraints and this environment may be inhabited by burrowing organisms such as bivalves. No evidence of their presence was found in beach litter.

As stated, rocky shores were sparse. The intertidal zone had a clear band of *Saccostrea cucullata*, some whelks (*Nerita* sp.) and grapsid crabs. No corals were observed in the subtidal region, which was also sparsely vegetated with few algae, probably because of surf energy.

Reefs were found between 1-10 m and appeared to originate from fossilised beach rock. They thus appear to represent a submerged coastline and were patchy. The coral communities on the reefs varied considerably in their condition. All had been affected by bleaching to some degree. The shallow reefs (1-2 m) to the west of Berbera were slightly bleached and those <1 m appeared to have died from tidal exposure. The shallow reefs to the east of Berbera were far more severely affected by bleaching and, in many instances, had suffered nearly total mortality and become both encrusted and accreted by coralline algae. *Montipora stellata* had commenced recolonisation of these areas.

Deeper reefs (2-5 m) were in better condition. Patchy reefs subject to considerable sedimentation were dominated by sediment tolerant faviids, while more established reefs were dominated by *Porites* spp. and plate *Montipora* spp. *Astreopora myriophthalma* was conspicuous on the deepest reefs (5-10 m) and manifested recovery from crown-of-thorns (COTS) predation. Three COTS were found on one reef.

A total of 69 species of scleractinian coral, 11 species of alcyonacean (soft) coral and two species of fire coral were found during the survey. Other reef organisms encountered during the field work were sparse and included only five *Panulirus versicolor*, two specimens of two species of anemones, five specimens of *Tridacna* spp. and various sponges, ascidians, holothurians, echinoids, crinoids, molluscs and zoanthids.

Seaweed were widespread in patches on hard substrata, both in the inshore area and in deeper water (<10 m) that is sedimented to a varying degree. Their prevalence on substrata which would otherwise appear more suitable for corals is probably due to a combination of physico-chemical factors. These would include

the levels of turbidity and sedimentation that were observed, as well as the nutrient enrichment emanating from these factors and regional upwelling. A range of green, brown and red algae were recorded. Sheets of *Zoanthus sansibaricus* and a number of sponges were associated with the deeper algal beds.

Reef fish were diverse and the presence of large schools of fish as well as an abundance of large fishes indicated a relatively unexploited resource and pristine environment. The diversity of reef fish was greatest in the coral reef environment and substantially lower in areas with a rocky or sandy substratum and in algal dominated assemblages. However, the abundance of fishes, including juveniles, in the latter environment was higher. The reef fish community differs considerably from that of the eastern Arabian Peninsula to the north, and the fish communities of eastern Africa to the south and the Red Sea to the west.

Large shoals of pelagic fish were conspicuous. Pelagic fishes observed at sea included schooling tuna (e.g. bonito), carcharinid sharks and whale sharks.

Small cetaceans are abundant in waters off Somaliland. A total of 35 sightings of five species of dolphins (common, spinner, spotted, bottle-nose and humpback dolphins) were recorded during the survey.

More than 20 species of sea and shore birds were recorded but, in the case of gulls and terns, these were not as numerous as anticipated, particularly as feeding aggregations over shoaling fishes.

Evidence of turtle nesting was found on beaches distant from Berbera. A total of 36 nests was the highest density encountered along a five km stretch of coast. Turtle remains and sightings at sea suggested that green turtles and hawksbill turtles are the commonest species in the area, while a single loggerhead turtle was seen at sea. The major threat to turtles arises from the opportunistic harvest of green turtles which includes incidental gill net entrapment. Natural threats to the eggs include the flooding of nests and the likelihood of egg consumption by land mammals. Humans apparently collect turtle eggs during the Southwest Monsoon season.

The extensive lagoon at Khor Shoora is bounded by a fringe of *Avicennia marina*. It is characterised by clean sediment, clear water and prolific seaweed growth; there appeared to be little freshwater input. Little evidence of timber extraction was found and very little appears to be used as firewood. The fauna in the area included a number of birds, abundant juvenile fishes and mud crabs.

Marine resources are used only on a small scale in the study area, canoes being used to set a limited number of 7, 15 and 30 cm stretch mesh size gill nets. Hand-line fishing was observed on one occasion. Sharks are especially targeted in these operations with only the valuable fins being landed; this is largely due to a lack of refrigeration.

Turtles appear to be harvested opportunistically, both by jigging and harpooning at sea and through the capture of nesting turtles. Both fishermen and nomadic herdsman are probably responsible for the latter; herders have temporary shelters and animal pens on certain beaches.

The mangrove crab, *Scylla serrata*, appears to be the only invertebrate which is harvested. These were seen in the market in Berbera but their origin was unknown.

CONCLUSIONS AND RECOMMENDATIONS

The area surveyed is both productive and relatively pristine apart from the deleterious effects of coral bleaching and, to a lesser extent, COTS predation on the coral reefs. The effects of human activity on the environment appear to be minimal, the only exceptions being the relatively heavy, opportunistic exploitation of turtles and wasteful harvest of sharks. The coast thus provides a number of opportunities for forward planning to accommodate biodiversity conservation and sustainable development. Actions taken now will safeguard the potential value of the Somaliland coast for future use. Recommendations including the following were thus made for:

1. The proclamation of small reserves or marine protected areas (MPAs).
2. Regulation of the harvesting of turtles and their eggs.
3. The continued, limited use of fishing nets and an investigation of alternative techniques for the sustainable exploitation of fisheries resources.
4. Coastal mapping and zonation in terms of sensitivity and suitability for development.
5. A review of existing legal and institutional requirements for conservation management.
6. Investigation of the establishment of small ecotourism ventures.
7. Investigation of the sustainable harvest of algae for conversion into fertiliser with the presently wasted shark harvest.
8. Extension of the biodiversity surveys to both the west and east.
9. Monitoring of the coral reefs for further deterioration or recovery from COTS outbreaks and bleaching.

INTRODUCTION

A coastal biodiversity survey was undertaken on the northern Somali coast to establish the status of the marine resources in the region, threats to the biodiversity and appropriate measures for the sustainable use and conservation of the resources. It formed part of Phase II of the IUCN (EARO) Somali Natural Resources Management Programme, funded by the EC, which aims to improve the socio-economic well-being of the Somali people by enhancing the ecological sustainability of their natural resource use.

The coastal and marine resources of Somalia are of great importance in this semi-desert country. They have been identified as having high economic value and potential for the rehabilitation and development of the country. The coastal reef and offshore fisheries are, according to many accounts, highly productive in terms of demersal and pelagic species.

Phase II of the Somali Natural Resources Management Programme has the broad aims of establishing:

- "• Priority environmental management systems implemented at local level at designated sites in the realms of wood fuel conservation, fisheries monitoring and management, marine conservation and land use planning for sustainable natural resource management.
- Institutional and human resource capacity strengthened in support of the above-mentioned priority environmental management systems through awareness raising and training.
- Knowledge base and understanding of ecological and natural resource dynamics increased within context of priority environmental management systems."

OBJECTIVES AND TERMS OF REFERENCE

Extremely wide-ranging activities were commissioned, aimed at determining:

1. The conservation and biodiversity value of the coast between Berbera and Raas-Khansir.
2. The extent and nature of marine resource use, the user groups and their dependence on the resources.
3. The level and nature of threats to the biodiversity in the area.
4. Appropriate conservation measures needed to promote sustainable use of the area.

The terms of reference of the consultancy were to undertake a preliminary ecological assessment of the area to the east of Berbera for a distance of about 150km based on field work in the area. The following specific tasks were commissioned:

- "• Detailed identification, description, classification and mapping of land and marine habitats of the area, including for example beach types (sandy/rocky), seagrass beds, mangroves, shrubs, coral reefs, etc. and definition of coordinates for these determined from a GPS;
- Detailed description of land-based ecological indicators including evidence of turtle

nesting, seabird and shorebird nesting and migration, and human-based utilisation of resources;

- Detailed description of marine-based ecological indicators including evidence of threatened marine species (e.g. turtles, tridacnid clams, etc.), human-based utilisation of marine resources (e.g. coral);
- Rapid assessment of fish populations having commercial and conservation value, including other harvestable species such as spiny lobsters that might be identified during the course of the survey;
- Rapid assessment surveys of coral reef diversity and status (e.g. coral cover, condition, etc.);
- Identification of fishing activities and their nature;
- Based on the above-mentioned findings, identify conservation issues and recommend practical measures for the development of conservation and sustainable utilisation of the land and marine-based resources of the area.
- The final Assessment Report should ... include the following:

⇒ description of the methods used for the ecological assessment;

⇒ detailed description of the results of the assessment highlighting the ecological importance and conservation value of coastal and marine habitats, and their uses and threats;

⇒ recommendations for further action to develop conservation and sustainable utilisation measures (emphasizing sensitive habitats and vulnerable species).

⇒ appendices containing maps, habitat description, species list and other data.”

METHODS

The survey was undertaken between 4-11 March 1999 from 15 km west of Berbera to the mangrove known as Koor Shoor approximately 150 km to the east (Fig. 1). Berbera was used as a base during the survey and access to the coast was gained by road and sea. Data were collected on the nature and biodiversity of the shoreline, mangrove, seaweed, coral reef and pelagic environments. A record was kept on the abundance of turtles, dolphins and seabirds, as well as of the extent of turtle nesting on beaches. While the shore surveys were conducted by foot, many of the marine observations were made while travelling to the survey sites by boat and the reef surveys were undertaken by breath-hold diving. Comprehensive species lists were kept of the biota encountered as far as possible as well as visual estimates of their density where appropriate. GPS co-ordinates of all the survey sites were recorded. Photographs were taken of interesting features above and below the water.

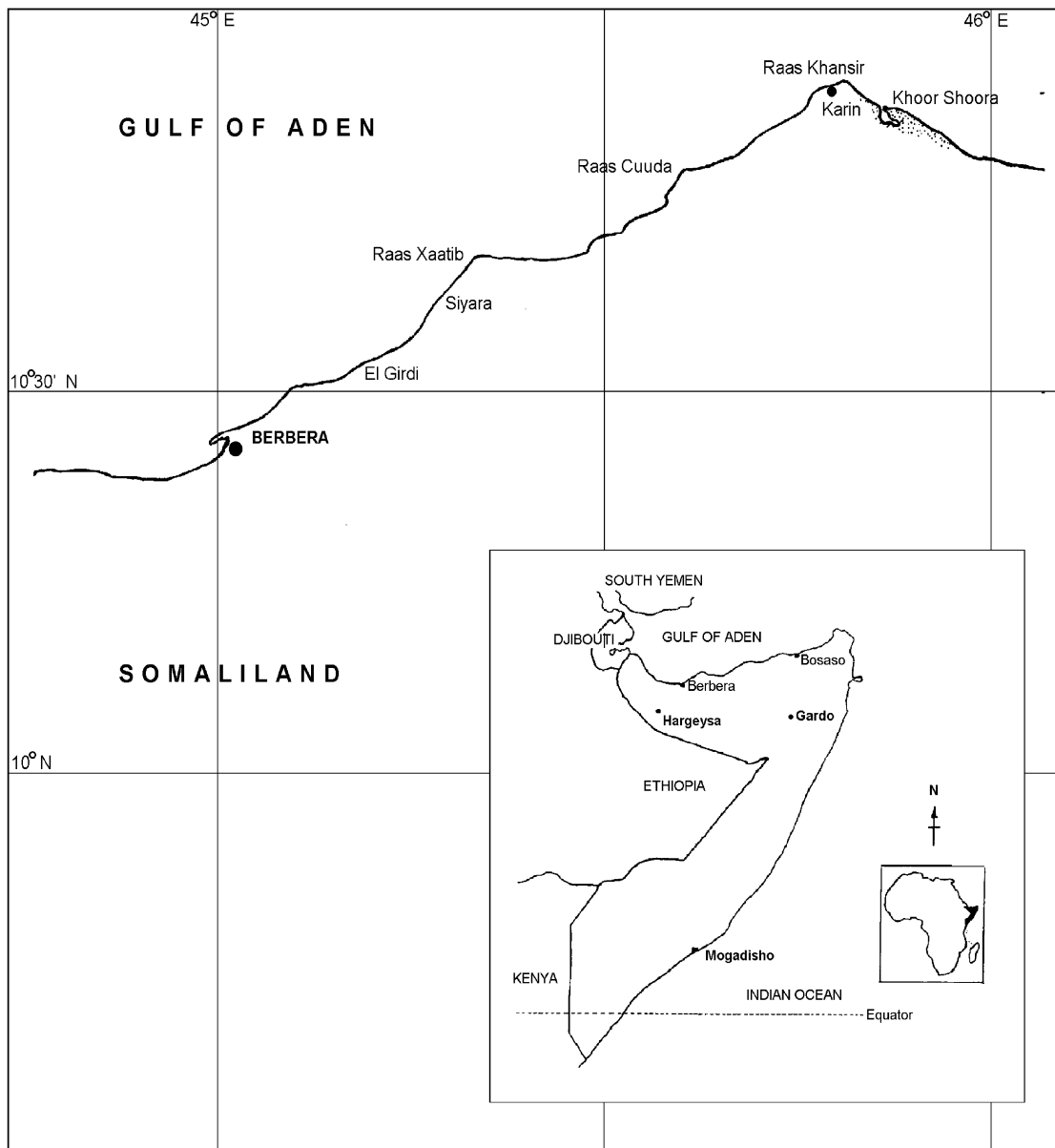


Fig. 1. Map of the study area.

RESULTS

The coastline is relatively straight and consists mainly of beaches; very small rocky promontories occur only near Raas Khansir, at Raas Cuuda and at the foot of the cliffs at Siyara (Fig. 1). A raised fossilised seabed backs many of the beaches. The dunes behind the beaches are generally low and sparsely colonised by xerophytic grasses and shrubs, as is the coastal plain. A high dune field, which is almost devoid of vegetation, occurs on a brief stretch of coast at Raas Xaatib (Fig.1). Arid rocky mountains are found close to the coast at Raas Khansir, Siyara and El Girdi (Fig. 1).

The oceanographic conditions along the coast of the Gulf of Aden between Berbera and Raas Khansir are primarily influenced by seasonal monsoons, complex seasonal currents and physical conditions. Currents generally flow eastward during the Southwest Monsoon between March and October. This monsoon drives the flow of nutrients derived from cold-water upwelling generated by the powerful Somali Gyre (June to

September) further north off the Horn. The Northeast Monsoon reverses the prevailing currents along the shore of Somaliland during the rest of the year, which then flow westward. Variable current patterns and annual fluctuations in upwelling intensity largely determine nutrient levels along the coast of the Gulf of Aden. In terms of primary productivity, the study area is thought to fall in a transition zone between the richly productive water to the north-east and the more typical East African shelf environment to the west.

A difference was noted between the beaches and coastal plain on either side of Berbera. Beaches east of Berbera consisted of fairly coarse sand that appears to be derived largely from the adjacent beach rock. Rich deposits of heavy, black mineral sand were a feature of this stretch of coast. The associated dunes and coastal plain had markedly xerophytic vegetation which was overgrazed in certain areas. Genera recognised amongst the dune vegetation were *Limonium*, *Cyperus*, *?Halopeplis* and low halophytic shrubs similar to the *Cornulaca/Sphaeracoma* community on the Arabian peninsula. Tamarisks up to 3m in height were conspicuous in wadis and low, scrubby trees such as *Acacia tortilis* were common on the coastal plain. An unidentified shrub known locally 'Mora' and used for weaving water-tight containers was also found in some localities. Gazelles were observed in the region.

The beaches west of Berbera consisted of finer, more bioclastic marine sediment and had less heavy mineral sand. The dunes were more densely covered with succulent xerophytic shrubs and the coastal plain had a sparse covering of open scrub forest consisting of 1-3 m tall specimens of *Acacia* and *?Maytenus* spp. The area is noticeably less arid and more densely vegetated. Several small, temporary shelters were encountered here with nomadic herdsman and their camels. Gazelles, dik-dik and a wild cat were observed on the plain.

Most of the subtidal substratum likewise consisted largely of sand. Reefs, where found, had developed on exposed bedrock and were colonised to a varying degree by coral or seaweed.

The winds blew parallel to the coast from the north-east during the survey period (the prevailing direction based on the evidence of dune field movement). The mornings were frequently calm but the wind generally rose before noon and generated currents and a choppy sea (up to Sea State 4 on the Beaufort Scale). This disturbed the fine sediments and the inshore waters became milky and turbid. This diurnal increase in turbidity and sediment transport is probably a limiting factor on coral settlement and growth. The sporadic outflow of silt laden water from wadis in flood would add to the turbidity and contribute nutrients to the marine environment.

The marine environment off Berbera is clearly very productive. Seaweeds flourish in many areas in the inshore region and wind-generated water movement promotes their growth as well as the transport and breakdown of algal detritus in the system. Large shoals of fish were observed in the region and these provide food for numerous dolphins, a further indication of high productivity. The seaweed beds, associated detritus and climatic energy subsidy make a contribution towards the productivity of the area. Further study would be needed to establish the importance of seaweed production relative to that derived from upwelling.

Specific findings of the survey were as follows:

FISH

Reef fishes

Reef fish were studied in conjunction with coral surveys and to a lesser extent on rocky and seaweed dominated reefs. The generally diverse fish fauna (140 species were recorded; Table 1) and the presence of large schools of fish (such as lutjanids and carangids) as well as an abundance of large fishes (such as serranids and plectorhynchids) is indicative of a relatively unexploited resource and pristine environment. The diversity of reef fish was greatest in the coral reef environment and substantially lower in areas with a rocky or sandy substratum and in algal dominated assemblages. However, the abundance of fishes, including juveniles, in the latter environment was higher. Degraded reefs that were colonised by filamentous and coralline algae had a greater proportion of herbivorous fish which, in some instances, were numerous and formed large shoals. Surgeon fishes were conspicuous in this regard.

The reef fish community differs considerably from that of the eastern Arabian Peninsula to the north, and the fish communities of eastern Africa to the south and the Red Sea to the west (even of the Saad ed Din Islands in western Somaliland). This was particularly the case in families characteristic of coral reefs, such as the Chaetodontidae, Acanthuridae and Balistidae. Nevertheless, the reef fish community shows affinities to all three regions.

Table 1. List of fish recorded during the reef surveys.

<i>Abudefduf saxatilis</i>	<i>Caranx</i> sp.	<i>Dasyatis ?sephen</i>
<i>Abudefduf sexfasciatus</i>	<i>Cephalophis argus</i>	<i>Epinephalus fasciatus</i>
<i>Abudefduf vaigiensis</i>	<i>Cephalophis miniata</i>	<i>Epinephalus lanceolatus</i>
<i>Acanthopagrus bifasciatus</i>	<i>Cephalophis</i> sp.	<i>Epinephalus malabaricus</i>
<i>Acanthurus gahhm</i>	<i>Chaetodon fasciatus</i>	<i>Epinephalus rivulatus</i>
<i>Acanthurus nigrofuscus</i>	<i>Chaetodon larvatus</i>	<i>Epinephalus soliczkae</i>
<i>Acanthurus sohal</i>	<i>Chaetodon melanotus</i>	<i>Fistularia</i> sp.
<i>Aethaloperca rogaa</i>	<i>Chaetodon melapterus</i>	<i>Flammeo sammara</i>
<i>Aetobatis narinari</i>	<i>Chaetodon semilarvatus</i>	<i>Gomphosus caeruleus</i>
<i>Aluterus scriptus</i>	<i>Chaetodon vagabundus</i>	<i>Gomphosus caeruleus</i>
<i>Anampses lineatus</i>	<i>Cheilinus abudjubbe</i>	<i>klunzingeri</i>
<i>Apolemichthys trimaculatus</i>	<i>Cheilinus lunulatus</i>	<i>Grammistes sexlineatus</i>
<i>Aprion virescens</i>	<i>Chromis ternatensis</i>	<i>Gymnothorax favigineus</i>
<i>Arothron stellatus</i>	<i>Coris aygula</i>	<i>Gymnothorax nudivomer</i>
<i>Arothron</i> sp.	<i>Coris gainard</i>	<i>Halichoeres hortulanus</i>
<i>Balistipus undulatus</i>	<i>Cryptocentron</i> sp.	<i>Halichoeres marginatus</i>
<i>Balistoides viridescens</i>	<i>Cryptocentrus</i>	<i>Hemigymnus fasciatus</i>
<i>Caesio caerulea</i>	<i>cryptocentrus</i>	<i>Hemigymnus melapterus</i>
<i>Caesio</i> cf. <i>teres</i> .	<i>Cryptocentrus lutheri</i>	<i>Hemigymnus fasciatus</i>
<i>Carangoides bajad</i>	<i>Ctenochaetus striatus</i>	<i>Heniochus acuminatus</i>
<i>Caranx ignobilis</i>	<i>Dascyllus trimaculatus</i>	<i>Heniochus intermediens</i>

<i>Holacanthus xanthotis</i>	<i>Plectorhinchus pictus</i>	<i>Scarus ferrugineus</i>
<i>Kyphosus vaigiensis</i>	<i>Plectorhinchus schotaf</i>	<i>Scarus ghobban</i>
<i>Labroides dimidiatus</i>	<i>Plectorhinchus</i> sp.	<i>Scarus niger</i>
<i>Larabicus quadrilineatus</i>	<i>Plectorhynchus gaterinus</i>	<i>Scarus rubroviolaceus</i>
<i>Lethrinus mahsena</i>	<i>Plectorhynchus pictus</i>	<i>Scarus russellii</i>
<i>Lethrinus nebulosus</i>	<i>Plectorhynchus playfari</i>	<i>Scarus scaber</i>
<i>Lethrinus</i> spp.	<i>Plectorhynchus schotaf</i>	<i>Scarus sordidus</i>
<i>Lutjanus fulviflamma</i>	<i>Plectropomus maculatus</i>	<i>Scarus. Russellii</i>
<i>Lutjanus bengalensis</i>	<i>Pomacanthus imperator</i>	<i>Scarus</i> spp. (2)
<i>Lutjanus ehrenbergi</i>	<i>Pomacanthus maculosus</i>	<i>Scolopsis ghanam</i>
<i>Lutjanus fulviflamma</i>	<i>Pomacentrus sulphureus</i>	<i>Scomberomorus commerson</i>
<i>Lutjanus kasmira</i>	<i>Pomacentrus trilineatus</i>	<i>Scomberomorus lysan</i>
<i>Lutjanus kasmiri</i>	<i>Pomacentrus</i> sp.	<i>Siganus argenteus</i>
<i>Lutjanus monostigma</i>	<i>Priacanthus hamrur</i>	<i>Siganus luridus</i>
<i>Lutjanus</i> sp.	<i>Priacanthus</i> sp.	<i>Siganus rivulatus</i>
<i>Megaprotodon trifascialis</i>	<i>Pseudobalistes</i>	<i>Siganus stellatus</i>
<i>Melichthys indicus</i>	<i>flavimarginatus</i>	<i>Sphyaena barracuda</i>
<i>Mulloides vanicolensis</i>	<i>Pseudobalistes fuscus</i>	<i>Sphyaena</i> sp.
<i>Myripristis murdjan</i>	<i>Pseudocheilinus</i>	<i>Sufflamen albicaudatus</i>
<i>Neopomacentrus xanthurus</i>	<i>hexataenia</i>	<i>Sufflamen</i> sp.
<i>Odonus niger</i>	<i>Pterois radiata</i>	<i>Taeniura lymma</i>
<i>Ostracion cubicus</i>	<i>Pterois volitans</i>	<i>Thalassoma lunare</i>
<i>Parapercis hexophthalma</i>	<i>Rhinecanthus assasi</i>	<i>Trachinotus russelli</i>
<i>Parupeneus forsskali</i>	<i>Sargocentron</i>	<i>Zanclus cornutus</i>
<i>Parupeneus indicus</i>	<i>caudimaculatum</i>	<i>Zebrasoma desjardinii</i>
<i>Parupeneus macronema</i>	<i>Sargocentron spiniferum</i>	<i>Zebrasoma xanthurum</i>
<i>Platax ?orbicularis</i>	<i>Sargocentrus</i>	
<i>Plectorhinchus gaterinus</i>	<i>caudimaculatus</i>	

Pelagic fishes

Pelagic fish were not a specific focus of the survey, but large shoals of fish were conspicuous (including clupeids and *Rastrelliger* sp.), particularly between Berbera and Raas Cuuda to the east. Other pelagic fishes that were observed at sea included schooling tuna (e.g. bonito), carcharinid sharks and whale sharks.

Pelagic fish were also frequently sighted during coral reef surveys, including large specimens of *Sphyaena barracuda*, *Scomberomorus commerson* and *Trachinotus russellii*.

CETACEANS

Small cetaceans are abundant in waters off Somaliland. A total of 35 sightings (Appendix 1) and five different species were recorded during the six day, boat-based survey, with the sighting frequency increasing with distance travelled. The majority of sightings were recorded in offshore waters.

School sizes varied between and within species, but included remarkably large schools of delphinids. One school of common dolphins (*Delphinus delphis* cf. *capensis*) numbered between 1 500 and 1 800 individuals, and both common and spinner dolphins (*Stenella longirostris*) were frequently observed in schools of between 300-1 000 individuals. Mixed schools of these two species were recorded on several

occasions, and spinner dolphins were also recorded in association with spotted dolphins (*S. attenuata*) on one occasion.

The other two species recorded, the Indo-Pacific humpback dolphin (*Sousa chinensis*) and bottlenose dolphin (*Tursiops* cf. *aduncus*), also formed mixed groups, although bottlenose dolphins were more commonly sighted alone and further offshore than the characteristically coastal humpback dolphins. School sizes of bottlenose dolphins generally varied between 2-35 animals (including an apparently resident group of 8-12 animals at the mouth of Berbera harbour) with one exceptionally large school of approximately 150 individuals. Indo-Pacific humpback dolphins were seen in typically small groups up to a maximum of 15 individuals per group.

Mating behaviour was observed among spinner dolphins and calves of several species were recorded (Appendix 1). Feeding was observed in the vicinity of large shoals of fish in the case of the delphinids and bottlenose dolphins, and close inshore in the case of Indo-Pacific humpback dolphins, often in association with terns and gulls. With the exception of the humpback dolphins, the majority of dolphins approached the survey vessel, riding the bow wave and frequently leaping close to the boat. Fishermen indicated that this is a common behaviour and that they consider dolphins to be 'man's friend'.

Large cetaceans were not observed but anecdotal reports indicated that baleen whales occur in the area (particularly further east) and apparently feed in Somaliland waters. The large numbers of small schooling fishes probably form the major prey of baleen whales as they do in the Arabian Sea to the north.

BIRDS

Sea and shore birds were recorded incidentally during boat surveys at sea and beach surveys. Crested Terns (*S. bergii*) were most commonly observed at sea, frequently feeding, and generally in pairs or small flocks. Terns and Gulls were expected to occur in larger numbers but were generally poorly represented, particularly as feeding aggregations over shoaling fishes.

Saunders's Little Terns (*Sterna saundersi*), Gull-billed Terns (*Sterna gelochelidon*) and White-eyed Gulls (*Larus leucophthalmus*) were observed in the greatest numbers (up to 140 individuals), both at sea (Appendix 1) and roosting on beaches (Appendix 2). Phalaropes (*Phalaropus lobatus*) were also observed in relatively large flocks (between 20-120 individuals per flock), either settled on the water surface or flying, generally in an easterly direction (Appendix 1). Other species common at sea, albeit mostly in very small numbers, were Sooty Gulls (*Larus hemprichii*) and Herring Gulls (*L. argentatus*), whilst a number of tern species were seen on just one or two occasions, including Sandwich Terns (*Sterna sandvicensis*) and Bridled Terns (*S. anaethetus*). An unidentified juvenile Petrel and a juvenile Masked Booby (*Sula dactylatra melanops*) were seen on one occasion (Appendix 1). Species such as the latter may occur more frequently later in the year.

Waders and shorebirds were encountered relatively infrequently and in small numbers. These included Greater Flamingo (*Phoenicopterus ruber roseus*), Redshank (*Tringa totanus*), Terek Sandpiper (*Xenus cinereus*), Reef Heron (*Egretta gularis*), Crab Plover

(*Dromas ardeola*), Sanderling (*Calidris alba*), Whimbrel (*Numerius phaeopus*) and Ringed Plover (*Charadrius hiaticula*), among others (Appendix 2).

Wheatears (*Oenanthe* spp.) and Hoopoe Larks (*Alaemon alaudipes*) were conspicuous in primary dunes behind beaches. Two Ospreys (*Pandion haliaetus*) were seen roosting, one on a rocky headland and the other on the beach. No nesting by this species, or any other species, was noted.

BEACHES AND SANDY SUBSTRATA

Beaches and subtidal sandy substrata constituted the most extensive habitat on the north Somali coast. The beaches showed a clear monsoon storm berm above the present high water mark. The latter was littered with seaweed, some coral fragments and large numbers of shells, particularly shells of gastropods occupied by scavenging hermit crabs. Remarkably little pollution was found. Ghost crabs (*Ocypode saratans*) were prolific on some beaches. The origin and other attributes of the beaches have been described above. The details of the beaches surveyed are listed in Appendix 2.

The subtidal sandy substratum appears to be relatively sterile. Seaweed detritus had accumulated in the sand ripples in certain areas and a single concentration of holothurians was found next to one reef. Relatively dense concentrations (1 m^{-2}) of the non-scleractinian coral *Heterocyathus* were found at another site, together with sparse algal growth and scattered *Clypeaster* sp., hydroids and sponges. However, very few observations were made on the sand substratum because of time constraints and this environment may be inhabited by burrowing organisms such as bivalves. No evidence of their presence was found in beach litter.

TURTLES

The most significant turtle nesting beaches in the area were found between Raas Xaatib and Raas Cuuda (10°39.80'N; 45°90'70E to 10°26.55'N; 45°58.60'E. See Appendix 2). Concentrations of up to 14 nests were found on raised beach cusps and a total of 36 nests were recorded over a five km stretch of sandy beach in this region, representing the greatest nesting density encountered. Scattered nesting also occurs in areas east of Raas Cuuda. A single visit to beaches west of Berbera revealed additional nesting there (Appendix 2).

With just one exception, nests were from a previous season's activity, and were inconspicuous, having been largely covered by wind-blown sand. All nests were above the monsoon storm berm and it is likely that monsoon weather periodically washes away the evidence of nesting. Both of these factors may have lead to an underestimation of nesting activity.

Nests could rarely be attributed to species for these reasons as well as the lack of current nesting activity. A recent green turtle nest (*Chelonia mydas*) and several other nests from a previous season indicate that this species nests on beaches between Raas Xaatib and Raas Cuuda. Anecdotal evidence also suggests that this is the main species that nests here. Tracks (without a nest) of just one other turtle were found in this area, probably a hawksbill (*Eretmochelys imbricata*) but possibly a loggerhead (*Caretta caretta*) or olive ridley turtle (*Lepidochelys olivacea*).

With the exception of cusped beaches between Raas Xaatib and Raas Cuuda, the beaches between Berbera and Raas Khansir are generally unsuitable for nesting turtles. This is largely due to natural geomorphological features, including monsoon-induced-erosion extending up to the primary dunes on most beaches. Wind and current-induced erosion outside the monsoon season result in 'stepped' beaches with extensive flooding between the beach crest and the primary dunes.

The evidence of turtle remains and sightings at sea suggest that green turtles and hawksbill turtles are the most common species in the area, while a single loggerhead turtle was seen at sea. A turtle tag from Oman was recently recovered in Somaliland and one from South Africa was recovered on the east coast of Somalia, indicating the range of these animals. The tag from Oman came from a female green turtle tagged on a nesting beach at Ra's al Hadd and was recovered after the animal drowned in a fishing net near Berbera.

Turtles were rarely observed at sea or underwater and were not observed feeding. However, algal beds and coral reefs provide suitable habitat for this purpose. Seagrass beds, a favoured feeding ground of the green turtle, were not encountered, but scattered seagrasses were found among algal and coral communities and in beach litter. These included *Halophila ovalis*, *Thalassia hemprichii* and *Thalassodendron ciliatum*. Turtles were reported to feed in waters to the west of Berbera and particularly to the east of Raas Khansir.

The major threat to turtles arises from the opportunistic harvest of green turtles. Incidental gill net entrapment also results in some mortality. Natural threats to the eggs include the flooding of nests mentioned above and the likelihood of egg consumption by land mammals such as the hyena and jackal, the spoor of which were frequently seen. Humans apparently collect turtle eggs during the Southwest Monsoon season. However, no evidence of disturbed nests was found. Hatchlings are likely to fall victim to predators on land and at sea.

Harvesting of green turtles is widespread and appears to be most intense at Khor Shooraa and near the seasonal fishing village of Karin. Evidence suggested that only green turtles are harvested. The carapace of one was offered for sale in Berbera for US\$5. A total of four hawksbill turtle remains and the remains of six unidentified turtles were also found. The number of turtle remains on beaches may have been underestimated due to scavenging by hyenas and jackals.

Nesting by turtles has apparently declined substantially during the past ten years and the ongoing harvest of turtles and their eggs is a cause for concern and management intervention.

ROCKY SHORES

As stated, these were only found near Raas Khansir, at Raas Cuuda and at the foot of the cliffs at Siyara. The intertidal zone had a clear band of *Saccostrea cucullata*, some whelks (*Nerita* sp.) and grapsid crabs. No corals were observed in the subtidal region, which was also sparsely vegetated with few algae, probably because of surf energy.

CORAL REEFS

Reefs were found between 1-10 m and appeared to originate from fossilised beach rock. They thus appear to represent a submerged coastline and were patchy. Coral reefs of limited extent were found near Raas Khansir, of fairly limited extent at Raas Cuuda and Siyara, and of considerable extent off El Girdi and west of Berbera (Fig.1, Appendix 3).

The coral communities varied considerably in their condition (Appendix 3). Bleaching had affected all of the reefs to some degree. The shallow reefs (1-2 m) to the west of Berbera were slightly bleached and those <1 m appeared to have died from tidal exposure. The shallow reefs to the east of Berbera were far more severely affected by bleaching and, in many instances, had suffered nearly total mortality and become both encrusted and accreted by coralline algae. *Montipora stellata* had commenced recolonisation of these areas.

Deeper reefs (2-5 m) were in better condition. Patchy reefs subject to considerable sedimentation were dominated by sediment tolerant faviids, while more established reefs were dominated by *Porites* spp. and plate *Montipora* spp. *Astreopora myriophthalma* was conspicuous on the deepest reefs (5-10 m) and manifested recovery from crown-of-thorns (COTS) predation. Three COTS were found on one reef.

The living coral cover varied between 0-60% on reefs affected by the bleaching and COTS phenomena, the average being between 2-5%. Reefs not so affected had a coral cover ranging between 60-80%. As these constituted a fairly narrow fringing band on the outer perimeter of the reefs, there was relatively little healthy coral.

A total of 74 species of scleractinian coral, 11 species of alcyonacean (soft) coral and two species of fire coral were found during the survey (Table 2). The identities of some of the corals, and therefore the species list, is provisional until microscopic work on their taxonomy can be completed in the laboratory. Other reef organisms encountered during the field work were sparse and included only five *Panulirus versicolor*, two specimens of two species of anemones, five specimens of *Tridacna* spp. and various sponges, ascidians, holothurians, echinoids, crinoids, molluscs and zoanthids (Table 3).

Table 2. List of corals recorded during the survey.

SCLERACTINIA		
<i>Acanthastrea echinata</i>	<i>Anomastrea irregularis</i>	<i>Favia palida</i>
<i>Acropora tenuis?</i>	<i>Astreopora myriophthalma</i>	<i>Favia rotumana</i>
<i>Acropora clathrata</i>	<i>Blastomussa merleti</i>	<i>Favia rotundata</i>
<i>Acropora digitifera</i>	<i>Coscinarea monile</i>	<i>Favia</i> sp.
<i>Acropora formosa</i>	<i>Coscinarea</i> sp.	<i>Favites abdita</i>
<i>Acropora hemprichii</i>	<i>Cycloseris cyclolites</i>	<i>Favites chinensis</i>
<i>Acropora loripes?</i>	<i>Cyphastrea microphthalma</i>	<i>Favites complanata</i>
<i>Acropora nasuta?</i>	<i>Cyphastrea serailia</i>	<i>Favites flexuosa</i>
<i>Acropora</i> sp.	<i>Echinopora gemmacea</i>	<i>Favites pentagona</i>
<i>Alveopora allingi</i>	<i>Echinopora lamellosa</i>	<i>Favites</i> sp.
	<i>Favia fava</i>	<i>Fungia</i> sp.
<i>Galaxea fascicularis</i>	<i>Montipora stellata</i>	<i>Turbinaria mesenterina</i>
<i>Gardinoseris planulata</i>	<i>Montipora tuberculosa</i>	
<i>Goniastrea retiformis</i>	<i>Pavona cactus</i>	
<i>Goniopora djiboutensis</i>	<i>Pavona decussata</i>	

MILLEPORINA

Goniopora spp. (2)
Herpolitha limax
Heterocyathus sp.
Hydnophora exesa
Hydnophora microconus
Leptastrea inaequalis
Leptastrea purpurea
Leptoria phrygia
Lobophyllia corymbosa
Montastrea magnistellata
Montastrea rotunda
Montastrea sp.
Montipora aequituberculata
Montipora informis
Montipora monosteriata
Montipora spumosa

Pavona exesa
Pavona varians
Platygyra daedalea
Platygyra lamellina
Plesiastrea versipora
Pocillopora damicornis
Pocillopora verrucosa
Porites lutea
Porites nigrescens
Porites nodifera
Porites solida
Psammocora cf. *haimeana*
Psammocora contigua
Seriatopora caliendrum
Stylophora pistillata
Symphyllia erythraea

Millepora platyphylla
Millepora squarrosa

ALCYONACEA

Litophyton cf. *liltveldi*
Sarcophyton
trocheliophorum
Sarcophyton spp. (2)
Sinularia abrupta
Sinularia brassica
Sinularia cf. *dura*
Sinularia varians
Sinularia sp.
Tubipora musica
Xenia sp.

Table 3. Fauna other than corals recorded on the reefs during the survey.

PORIFERA

Acanthella sp.
Dysidea cf. *herbacea*
Haliclona cf. *tulearensis*
Plakortis sp.
Xestospongia sp.

ANTHOZOA

Cerianthus sp.
Cryptodendron adhaesivum
Heteractis magnifica
Palythoa natalensis
Palythoa sp.

Zoanthus sansibaricus

CRUSTACEA

Panulirus versicolor

MOLLUSCA

Hytissa hyotis
Lambis lambis
Lambis truncata
Pinctada margaritifera
Sepia pharaonis
Sepia sp.
Tridacna sp.

ECHNIODERMATA

Acanthaster planci
Asterodiscides belli
Ciocalypta sp.
Clypeaster? *Humilis*
Holothuria atra
Holothuria edulis
Holothuria scabra

ASCIDIACEA

Didemnum sp.

SEAWEED

Seaweed (Table 4) were widespread in patches and beds on hard substratum, both in the inshore area and in deeper water (<10 m) that is sedimented to a varying degree. Their prevalence on substrata, which would otherwise appear more suitable for corals, is probably due to a combination of physico-chemical factors. These would include the levels of turbidity and sedimentation that were observed, as well as the nutrient enrichment emanating from these factors and regional upwelling. A range of green, brown and red algae were recorded (including alginophytes, agarophytes and carrageenophytes). Extensive stands of large brown macrophytes were often the dominant algae, including *Nizamuddinina zanardinii* (a species previously thought to be restricted to the Arabian region and the Socotra Archipelago) and *Sargassum* spp. (3). Sheets of *Zoanthus sansibaricus* and a number of sponges were associated with the deeper algal beds.

Table 4. Seaweed recorded during the survey.

Amphiroa sp.
Caulerpa sp.

Halimeda sp.
Halymenia spp.

Champia sp.
Chlorodesmis sp.
Dictyota sp.
Enteromorpha sp.
Galaxura sp.
Gelidiella sp.
Gelidium sp.
Gracilaria spp.
Gracilaria cf *crassa*

Hypnea sp.
Nizamuddinina zanardinii
Padina sp.
Sargassum spp.
Stoechosperma sp.
Turbinaria ornata
Udotea sp.
Ulva sp.

Rafts of algal detritus were seen drifting over the seabed, floating on the sea surface in the inshore region and stranded on the beach. The algal production and detritus possibly provide a key driving force in the productivity of the area and bear further study.

MANGROVE

The extensive lagoon at Khor Shoora is bounded by a fringe of *Avicennia marina*. It is characterised by clean sediment, clear water and prolific seaweed growth; there appeared to be little freshwater input. There are a few temporary fishing shelters at the lagoon near which a small number of gill nets were found. Fishermen reported the occasional capture of a "sea cow" in the lagoon but no skeletal remains of dugongs were found. However, Somaliland may lie within the range of the Red Sea population and dugong migrations were reported in early literature. A number of turtle skeletons were found in the vicinity of the shelters but the fishermen denied their consumption. Little evidence of timber extraction was found and very little appears to be used as firewood. The fauna in the area included a number of birds, abundant juvenile fishes and mud crabs.

HUMAN ACTIVITY AND FISHERIES

The most extensive use of the marine resources in the study area occurs at Berbera, Siyara and Karin, yet on a small scale. Small canoes are launched from these sites to set a limited number of 7, 15 and 30cm stretch mesh size gill nets. Handling fishing was observed on one occasion. The greatest number of canoes seen at any time at sea between Berbera and Raas Khansir was 6 and only 20 such craft were reported to operate between Zeila and Karin. Turtles appear to be harvested opportunistically, both by jigging and harpooning at sea and through the capture of nesting turtles (as described above). Both fishermen and nomadic herdsman are probably responsible for the latter; herders have temporary shelters and animal pens on certain beaches.

Apart from the COOPI operation at Berbera, the most organised fishing activity was found at the temporary fishing village at Karin. Fish drying racks, a generator and two chest freezers were observed and 30 fishermen counted during a visit to the village. The fishing also appears to be fairly organised at Siyara as gill nets are permanently set around the coral reefs at this site. Sharks are especially targeted in these operations with only the valuable fins being landed; this is largely due to a lack of refrigeration.

The mangrove crab, *Scylla serrata*, appears to be the only invertebrate, which is harvested. These were seen in the market in Berbera but their origin was unknown.

PRELIMINARY CONCLUSIONS AND KEY RECOMMENDATIONS

The area surveyed is both productive and relatively pristine apart from the deleterious effects of coral bleaching and, to a lesser extent, COTS predation on the coral reefs. The effects of human activity on the environment appear to be minimal, the only exceptions being the relatively heavy, opportunistic exploitation of turtles and wasteful harvest of sharks. The coast thus provides a number of opportunities for forward planning to accommodate biodiversity conservation and sustainable development. Actions taken now will safeguard the potential value of the Somaliland coast for future use. The following key recommendations should thus be considered with regard to:

Threats and safeguards to the Somali environment

- The proclamation of small "biosphere" reserves or marine protected areas (MPAs) between Raas Xaatib and Raas Cuuda, west of the lighthouse near Berbera Airport and around the coral reefs opposite Siyara. This will provide protection for representative seaweed beds, coral reefs and turtle nesting beaches in each area and safeguard these valuable resources for future use (see below). Biosphere reserves would attract more donor support from agencies such as UNESCO than MPAs.
- Regulation of the harvesting of turtles and their eggs to alleviate their present endangerment. This could be achieved through co-operation between Somali technical personnel and foreign fisheries agencies under the auspices of the Somaliland Aid Co-ordination Body.
- The continued, limited use of fishing nets and an investigation of alternative techniques for the sustainable exploitation of fisheries resources without endangering turtles, marine mammals and other marine life of biodiversity/conservation value. The fisheries are lightly exploited at this stage but should not be extended without undertaking the assessments needed to ensure their sustainability (see below). The fish stocks associated with the limited and depleted coral reefs should be given special attention and protection.
- A more detailed investigation of the coastal resources in participation with the user groups (nomads, fishermen etc) to develop an understanding of their seasonal exploitation and use, leading to a joint development of resource management procedures.
- Coastal mapping and zonation in terms of sensitivity and suitability for development should be commenced with the ultimate objective of coastal zone policy development and administration.

A review of the legal and institutional framework

- Review existing legal, institutional and resource requirements for conservation management. Develop these, as appropriate, and make provision for co-operation between government, non-government and private sectors.
- Review relevant international and regional conventions and the options for

participation in international and regional initiatives.

- Review, develop and implement existing Environmental Impact Assessment policies and instruments in Somaliland with regard to the marine and coastal environment. Any new fishery proposals should be subject to EIAs to alleviate deleterious effects of the fishery on the environment, target species, bycatch and endangered species such as turtles. This could again be executed under the auspices of the Somaliland Aid Co-ordination Body.
- Integrate environmental education into existing community and educational programmes and curricula.

Potential future development

- Investigate the establishment of small ecotourism ventures near Berbera and Siyara for the eventual development of tourism in the area. These resorts would make use of the proposed conservation areas and would focus on reef diving, dolphin watching, seasonal turtle nesting and water sports.
- Investigate the sustainable harvest of algae and its conversion into fertiliser with livestock manure and the presently wasted shark harvest.
- Investigate the viability of seaweed culture on the shallow sand flats in the upper reaches of Berbera Harbour.
- Consider the appointment of an environmental officer at Berbera Harbour to initiate a programme of marine environmental management and pollution control.

Biodiversity conservation

- Extend the turtle surveys to both the west and east.
- Extend the coral reef surveys both to the west and east. The degraded condition of this valuable and limited resource and its importance in the Somali marine environment render this essential.
- Monitor the coral reefs for further deterioration or recovery from COTS outbreaks and bleaching.
- Further investigate the biodiversity of the reef fishes and extend the work into a regional study of their zoogeography. This will establish the extent of endemism and the effects of reef degradation on this important resource.
- Further assess the extent and role of the seaweed beds and associated detritus in the productivity of the area, both regionally and seasonally.
- Assess the effects of overgrazing on soil erosion and its consequences on the marine environment.
- Further study the distribution, abundance and stock affinities of cetaceans in Somali waters.

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Cetacean Sightings
(Sea state in Beaufort Scale)

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
5-3-99	0715	<i>Tursiops</i> cf <i>aduncus</i>	12-15	Dorsal fin	10°26.55'N, 44°58.60'E	1	5-10
Juveniles/calves	3 juveniles, 1 calf.						
Max/min size	2.5 m max, juveniles 1.75 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Feeding along sand bank at edge of spit at mouth of Berbera harbour. Bowriding, leaping occasionally.						
Direction of travel	Heading slowly east into harbour.						
Associated species	<i>Delphinus delphis</i> less than 500 m away, just outside harbour (see separate sighting record).						
Human activity in area	13 large (>45 m) vessels in port and 10-15 smaller boats. Two to three people fishing using handlines from end of spit at mouth of harbour.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
5-3-99	0720	<i>Delphinus delphis</i>	350-400	Splash	10°26.'65'N, 44°58.63'E	1	20-35
Juveniles/calves	Juveniles and calves present.						
Max/min size	2 m max, calves less than 1 m.						
Appearance	Long snout – <i>capensis</i> type.						
Behaviour	Feeding, bowriding, leaping, travelling.						
Direction of travel	East.						
Associated species	<i>Tursiops</i> less than 500 m away, in mouth of Berbera harbour (see separate sighting record).						
Human activity in area	13 large (>45 m) vessels in port and 10-15 smaller boats. Two to three people fishing using handlines from end of spit at mouth of harbour.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
5-3-99	0800	<i>Tursiops</i> cf <i>aduncus</i>	50-60	Dorsal fin	10°32.18'N, 45°08.28'E	1-2	?
Juveniles/calves	8-10 juveniles.						
Max/min size	3 m max, juveniles 1.75 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Bowriding, milling.						
Direction of travel	Gradually east.						
Associated species	None.						
Human activity in area	Not far from Berbera harbour.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
5-3-99	0830	<i>Tursiops</i> cf <i>aduncus</i>	25-35	Splash	10°36.17'N, 45°14.12'E	1-2	?
Juveniles/calves	Few juveniles.						
Max/min size	2.75 m max, juveniles 1.50 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type						
Behaviour	Feeding, leaping.						
Direction of travel	Slowly east.						
Associated species	Two flocks of 20-40 terns/flock, mostly Saunders's Little Terns, few Crested Terns.						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
5-3-99	1035	<i>Tursiops cf aduncus</i>	6-12	Dorsal fin	10°46.23'N, 45°35.05'E (1 km west of Raas Cuuda)	1-2	?
Juveniles/calves		None.					
Max/min size		2.5-3 m.					
Appearance		Long snout and pale undersides – <i>aduncus</i> type.					
Behaviour		Feeding near fish shoals.					
Direction of travel		No definite direction.					
Associated species		3-4 Crested Terns, 1 Sooty Gull.					
Human activity in area		None.					

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
5-3-99	1115	<i>Tursiops cf aduncus</i>	6-8	Dorsal fin	10°49.'50'N, 45°42.00'E (Raas Xamra)	1-2	?
Juveniles/calves		None.					
Max/min size		2.5-3 m.					
Appearance		Long snout and pale undersides – <i>aduncus</i> type.					
Behaviour		Feeding near fish shoals.					
Direction of travel		No definite direction.					
Associated species		2 Sooty Gulls.					
Human activity in area		None.					

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
5-3-99	1200	<i>Delphinus delphis</i>	1500-1800	Splash	10°50.80'N, 45°44.76'E	2	26
Juveniles/calves		Juveniles and calves present.					
Max/min size		2 m max, calves less than 0.8 m.					
Appearance		Long snout – <i>capensis</i> type.					
Behaviour		Feeding, bowriding, leaping, travelling.					
Direction of travel		Northeast.					
Associated species		Crested Terns (8-10), Sooty Gulls (5-6), Herring Gulls (2-3).					
Human activity in area		Two fishing boats moored off the seasonal fishing village of Karin approximately 2 km to the south.					

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
5-3-99	1340	<i>Tursiops cf aduncus</i>	6	Dorsal fin	10°50.50'N, 45°43.70'E (approx. 2 km west of Karin village)	2	4-8, over <i>Porites</i> 'bommie' field
Juveniles/calves		None.					
Max/min size		2.5 m.					
Appearance		Long snout and pale undersides – <i>aduncus</i> type.					
Behaviour		Milling.					
Direction of travel		No definite direction.					
Associated species		None.					
Human activity in area		Two fishing vessels moored at seasonal fishing village of Karin, 2 km to the east.					

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
5-3-99	1615	<i>Stenella longirostris</i> and <i>Stenella attenuata</i>	70-80 (<i>S. longirostris</i>), 15-20 (<i>S. attenuata</i>)	Spinning leap	10°34.14'N, 45°11.62'E	2-3	?
Juveniles/calves	Few juveniles of <i>S. longirostris</i> .						
Max/min size	1-2 m (<i>S. longirostris</i>), 2-2.5m (<i>S. attenuata</i>).						
Appearance	<i>S. longirostris</i> showing typical tripartite colour pattern; some smaller animals pink-bellied. <i>S. attenuata</i> showing typical colour pattern, strongly falcate dorsal fins.						
Behaviour	<i>S. longirostris</i> feeding, mating, spinning, bowriding, <i>S. attenuata</i> ?feeding.						
Direction of travel	No definite direction.						
Associated species	Mixed school.						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
6-3-99	0745	<i>Tursiops cf aduncus</i>	8-10	Dorsal fin	10°26.55'N, 44°58.60'E	1	8
Juveniles/calves	One juvenile, one calf.						
Max/min size	1-2.5 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Milling.						
Direction of travel	No definite direction.						
Associated species	None.						
Human activity in area	17 large (>45 m) vessels in port and 10-15 smaller boats in Berbera harbour.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
6-3-99	0815	<i>Delphinus delphis</i>	250-300	Splash	10°30.99'N, 45°05.08'E	1	46
Juveniles/calves	Juveniles and calves present.						
Max/min size	2 m max, calves less than 0.7 m.						
Appearance	Long snout – <i>capensis</i> type.						
Behaviour	Bowriding, leaping, travelling, three groups dispersed linearly over 1-2 kms.						
Direction of travel	East.						
Associated species	Unidentified Terns (20-30).						
Human activity in area	Two small fishing crafts (hand-held paddles) approximately 2 km to the west.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
6-3-99	0840	<i>Tursiops cf aduncus</i>	120-150	Dorsal fin	10°35.75'N, 45°14.75'E	1-2	35
Juveniles/calves	Juveniles and calves present.						
Max/min size	0.75-2.5 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Feeding (3 large fish shoals in the area).						
Direction of travel	No definite direction.						
Associated species	Crested Terns (5), Herring Gulls (4), fish shoals.						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
6-3-99	0900	<i>Stenella longirostris</i>	400-500	Splash	10°37.21'N, 45°15.95'E	2	?20-40
Juveniles/calves	Juveniles and calves present.						
Max/min size	0.7-1.75 m.						
Appearance	Typical tripartite colour pattern. Some smaller animals pink-bellied.						
Behaviour	Spinning, bowriding, travelling.						
Direction of travel	East.						
Associated species	Unidentified Tern, fish shoals in the area.						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
6-3-99	0915	<i>Tursiops cf aduncus</i>	30-40	Dorsal fin	10°35.75'N, 45°17.35'E	1-2	36
Juveniles/calves	Juveniles.						
Max/min size	1.75-2.5 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Travelling.						
Direction of travel	East.						
Associated species	Fish shoals in the area.						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
6-3-99	1025	<i>Tursiops cf aduncus</i>	6-8	Dorsal fin	10°40.70'N, 45°21.29'E	2	25-35
Juveniles/calves	None.						
Max/min size	2.75 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Milling, ?feeding.						
Direction of travel	No definite direction.						
Associated species	One juvenile unidentified Petrel, fish shoals in the area						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
6-3-99	1100	<i>Tursiops cf aduncus</i> and <i>Sousa chinensis</i>	6-8 <i>Tursiops</i> , 12-15 <i>Sousa</i>	Dorsal fin	10°41.01'N, 45°28.07'E	2	4
Juveniles/calves	2-3 Juvenile <i>Sousa</i> .						
Max/min size	2.75 m.						
Appearance	<i>Tursiops</i> with long snout and pale undersides – <i>aduncus</i> type. <i>Sousa</i> slate grey with very pronounced hump, pale undersides and flanks, spreading over tailstock.						
Behaviour	Shy, slowly moving NE along coast.						
Direction of travel	Northeast.						
Associated species	Mixed school. Large fish shoals in the area.						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
6-3-99	1200	<i>Sousa chinensis</i> and <i>Tursiops truncatus</i>	4 <i>Sousa</i> , 2 <i>Tursiops</i>	Dorsal fin	10°50.50'N, 45°45.65'E	2	2-3
Juveniles/calves	None.						
Max/min size	2.5 m.						
Appearance	?						
Behaviour	?Feeding in surf.						
Direction of travel	No definite direction.						
Associated species	None.						
Human activity in area	500 m from two moored fishing vessels associated with seasonal fishing village of Karin.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
6-3-99	1330	<i>Sousa chinensis</i>	4-5	Dorsal fin	10°42.86'N, 45°32.19'E	2	2-3
Juveniles/calves	None.						
Max/min size	2.75 m.						
Appearance	Slate grey with very pronounced hump, pale undersides and flanks, spreading over tailstock.						
Behaviour	Feeding in surf.						
Direction of travel	No definite direction.						
Associated species	None.						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
7-3-99	0715	<i>Tursiops</i> cf <i>aduncus</i>	6-8	Dorsal fin	10°26.55'N, 44°58.60'E (mouth of Berbera harbour)	2	3-15
Juveniles/calves	None.						
Max/min size	2.75 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Milling, ?feeding.						
Direction of travel	No definite direction.						
Associated species	None.						
Human activity in area	17 large (>45 m) vessels in port and 10-15 smaller boats. 2-3 people fishing using handlines from end of spit at mouth of harbour.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
7-3-99	0815	<i>Delphinus delphis</i>	Approx. 800	Splash	10°33.49'N, 45°10.05'E	3	?
Juveniles/calves	Juveniles and calves present.						
Max/min size	2 m max, calves less than 1 m.						
Appearance	Long snout – <i>capensis</i> type.						
Behaviour	Travelling, leaping.						
Direction of travel	East.						
Associated species	None.						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
7-3-99	0830	<i>Tursiops cf aduncus</i>	2?	Dorsal fin	10°35.40'N, 45°13.11'E	3	?
Juveniles/calves	None.						
Max/min size	2.75 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Travelling.						
Direction of travel	Southwest.						
Associated species	None.						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
7-3-99	0845	<i>Stenella longirostris</i>	500-600	Splash	10°35.40'N, 45°15.00'E	3	?
Juveniles/calves	Juveniles and calves present.						
Max/min size	0.5-1.75 m.						
Appearance	Typical tripartite colour pattern. Some smaller animals pink-bellied.						
Behaviour	Travelling, spinning, leaping.						
Direction of travel	West.						
Associated species	None.						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
7-3-99	0915	<i>Tursiops cf aduncus</i>	25-35	Dorsal fin	10°39.82'N, 45°18.76'E	3	?
Juveniles/calves	None.						
Max/min size	2.75 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Travelling.						
Direction of travel	West.						
Associated species	None.						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
7-3-99	0945	<i>Stenella longirostris</i> and <i>Delphinus delphis</i>	100 <i>Stenella longirostris</i> and 120 <i>Delphinus delphis</i>	Splash	10°40.90'N, 45°18.76'E	3	35
Juveniles/calves	Juveniles and calves of both species present.						
Max/min size	<i>Stenella longirostris</i> 0.5-1.75 m, <i>Delphinus delphis</i> 0.5-2 m.						
Appearance	Typical tripartite colour pattern. Some smaller animals pink-bellied.						
Behaviour	Travelling, spinning, leaping.						
Direction of travel	West.						
Associated species	None.						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
7-3-99	1045	<i>Tursiops cf aduncus</i>	8-10	Dorsal fin	10°38.22'N, 45°18.65'E	3	2-3
Juveniles/calves	2 juveniles, 1 calf.						
Max/min size	0.75-2.75 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Milling.						
Direction of travel	No definite direction.						
Associated species	None.						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
8-3-99	0750	<i>Tursiops cf aduncus</i>	2-4	Dorsal fin	10°26.55'N, 44°58.60'E (mouth of Berbera harbour)	2-3	8-15
Juveniles/calves	None.						
Max/min size	2.75 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Feeding on shoaling fish.						
Direction of travel	No definite direction.						
Associated species	None.						
Human activity in area	17 large (>45 m) vessels in port and 10-15 smaller boats. 2-3 people fishing using handlines from end of spit at mouth of harbour.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
8-3-99	0800	<i>Delphinus delphis</i>	350-400	Leap	10°32.18'N, 45°08.28'E	4	35
Juveniles/calves	?						
Max/min size	?						
Appearance	Long snout – <i>capensis</i> type.						
Behaviour	Travelling, leaping.						
Direction of travel	East.						
Associated species	1 juvenile Masked Booby.						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
10-3-99	0700	<i>Tursiops cf aduncus</i>	3-5	Dorsal fin	10°26.55'N, 44°58.60'E	1-2	5-15
Juveniles/calves	None.						
Max/min size	2.5 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Feeding along sand bank at edge of spit at mouth of Berbera harbour.						
Direction of travel	Heading slowly east into harbour.						
Associated species	None.						
Human activity in area	17 large (>45 m) vessels in port and 10-15 smaller boats. 2-3 people fishing using handlines from end of spit at mouth of harbour.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
10-3-99	0715	<i>Tursiops cf aduncus</i>	35-45	Dorsal fin	10°30.50'N, 45°06.04'E	2-3	?50
Juveniles/calves	Juveniles present.						
Max/min size	2-2.5 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Dispersed groups of 2-15 animals/per group, feeding, travelling.						
Direction of travel	East.						
Associated species	Crested Terns (3).						
Human activity in area	Two small, paddle-driven fishing boats within 1 km.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
10-3-99	0735	Unidentified (probably <i>Tursiops</i> , but observed from a distance only)	20-30	Dorsal fin	10°32.35'N, 45°09.14'E	3	?
Juveniles/calves	?						
Max/min size	?						
Appearance	?						
Behaviour	Travelling.						
Direction of travel	East.						
Associated species	Phalaropes (50-60).						
Human activity in area	One small, paddle-driven fishing boat within 2 km.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
10-3-99	0745	<i>Tursiops cf aduncus</i>	15-20	Dorsal fin	10°33.55'N, 45°11.17'E	3	?
Juveniles/calves	Juveniles and one calf.						
Max/min size	1-2.5 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Travelling.						
Direction of travel	East.						
Associated species	Crested Terns (3), Phalaropes (30-35).						
Human activity in area	One small, paddle-driven fishing boat within 1 km.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
10-3-99	0805	<i>Stenella longirostris</i>	150-200	Splash	10°35.40'N, 45°14.04'E	3	?
Juveniles/calves	Juveniles and calves present.						
Max/min size	0.6-1.75 m.						
Appearance	Typical tripartite colour pattern. Some smaller animals pink-bellied.						
Behaviour	Spinning, leaping, travelling.						
Direction of travel	East.						
Associated species	Phalaropes (35-40).						
Human activity in area	None.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
10-3-99	0815	<i>Delphinus delphis</i>	800-1000	Splash	10°36.85'N, 45°17.90'E	3	6-25
Juveniles/calves	Juveniles and calves present.						
Max/min size	2 m max, calves less than 1 m.						
Appearance	Long snout – <i>capensis</i> type.						
Behaviour	Feeding on steep underwater sandbank 0.5 from shore. Bowriding, leaping, travelling.						
Direction of travel	East.						
Associated species	<i>Tursiops</i> less than 1 km away (see separate sighting record).						
Human activity in area	Fishermen in two small, hand-paddled fishing boats using hook and line.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
10-3-99	0825	<i>Tursiops cf aduncus</i>	15-20	Dorsal fin	10°36.72'N, 45°16.01'E	2-3	6
Juveniles/calves	Juveniles present.						
Max/min size	2-2.5 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Milling 200 m from shore.						
Direction of travel	No definite direction.						
Associated species	None.						
Human activity in area	One small fishing boats (hand paddled) within 1 km laying gill net and two fishermen on the beach repairing a gill net.						

DATE	TIME	SPECIES	NO. OF INDIVIDUALS	INITIAL SIGHTING CUE	LOCATION	SEA STATE	DEPTH (m)
11-3-99	0945	<i>Tursiops cf aduncus</i>	15-20	Dorsal fin	10°24.63'N, 44°54.94'E	2	3
Juveniles/calves	Juveniles present.						
Max/min size	2-2.5 m.						
Appearance	Long snout and pale undersides – <i>aduncus</i> type.						
Behaviour	Over sand and coral reef, milling, bowriding.						
Direction of travel	Slowly west.						
Associated species	None.						
Human activity in area	None.						

Beach Surveys

DATE	GPS LOCATION START TO FINISH	SITE DESCRIPTION
5-3-99	10°48.58'N, 45°42.07'E (see site description)	Beach surveyed 1 km to the east and 700 m to the west of a headland near Karin village. Medium coarse sand (largely non-biogenic). Gently sloping beach with low primary dunes (1-2.5 m). Distinct erosion feature is a low cliff (5-30 cm) marking the high tide berm at several points. Also notable is the monsoon storm berm, just 1-2 m from primary dunes. Primary dunes colonised by dune grass (? <i>Halopyrom</i>). Scattered halophytes on sabkha beyond. Beach to the west of the headland backed by steep rocky slope. Other observations: Sand/mud flats associated with Khor environment which runs along the eastern side of the headland (at 10°48.58'N, 45°42.07'E). Relatively dense vegetation along the banks of the standing water of the khor, with bird song indicating abundant birdlife. Khor connected to the sea only at high tide. Sand bars (exposed at low tide) fringe much of this beach 10 to 100 m from shore.
TURTLE NESTS	One nest found by MS at approximately 10°48'08N, 45°41'50E, including tracks. Thought to be <i>C. mydas</i>	
TURTLE REMAINS	None	
BIRDS	Sooty Gulls (4), Herring Gulls (4), Reef Heron, grey phase (1).	
BEACH FAUNA	Abundant hermit crabs. Hyena tracks on beach east of start location.	
BEACH FLORA	Relatively sparse vegetation (? <i>Halopyrom</i> and low halophytes) on primary dunes and sabkha.	
STRANDLINE	<i>Dictyota</i> , <i>Stoechospermum</i> , <i>Padina</i> . Abundant shells washed ashore.	
HUMAN ACTIVITY	Use of the Khor environment, evidenced by human footprints. No direct evidence of use of the beach.	

DATE	GPS LOCATION START TO FINISH	SITE DESCRIPTION
5-3-99	10°46.38'N, 45°37.96'E to 10°45.99'N, 45°36.95'E	Gently sloping beach of medium sand, with large proportion of large shell and coral fragments (including fungiid corals - ? <i>Fungia</i>) and many beached shells (including large <i>Lambis truncata</i>) above high tide line. High tide berm forming a small eroded cliff (5-30cm in height) in many places and monsoon storm berm reaching low primary dunes (1-2.5 m in height). Rock/dead coral visible at low tide. Sabkha with sparse, low halophytic vegetation beyond narrow primary dune belt (30-40 m). Other observations: Several piles of 6-8 <i>Lambis truncata</i> (in neat piles) above high tide line.
TURTLE NESTS	One shallow nest from a previous season, possibly of <i>Eretmochelys imbricata</i> . No tracks.	
TURTLE REMAINS	One carapace and bones of <i>Eretmochelys imbricata</i>	
BIRDS	Sooty Gulls (6), Herring Gulls (3), Ringed Plover (2).	
BEACH FAUNA	Abundant hermit crabs and some <i>Ocypode cf saratans</i> . Jackal tracks.	
BEACH FLORA	Relatively sparse vegetation (? <i>Halopyrom</i> and low halophytes) on primary dunes and sabkha.	
STRANDLINE	Abundant shells washed ashore. Also <i>Stoechospermum</i> , <i>Padina</i> .	
HUMAN ACTIVITY	Human footprints on beach.	

DATE	GPS LOCATION START TO FINISH	SITE DESCRIPTION
6-3-99	10°44.13'N, 45°33.15'E to 10°45.53'N, 45°35.86'E	Beach immediately west of Raas Cuuda, between this headland and the next headland to the west. Gently sloping beach of medium sand (largely non-biogenic), but with large proportion of large shell fragments. Many beached shells above high tide line. High tide berm forming a small eroded cliff (5-30 cm in height) in many places and monsoon storm berm reaching low primary dunes (1-3 m in height). Secondary dunes extend beyond the primary dune belt (30-50 m wide) up to the arid jebel. Dip in beach after crest in places suggests possibility of flooding between crest and primary dunes in places. Beach has evidently accreted 6 m or more in places following monsoon erosion. Pollution: Very little litter (two tin cans, one plastic bag around fires at Raas Cuuda). Other observations: Raas Cuuda headland – raised beach rock and seabed, with abundant fossil bivalves and gastropods, but little coral. Scattered <i>Limonium</i> , <i>Cyprus</i> and ? <i>Halopeplis</i> , growing on headland. <i>Saccostrea cucullata</i> on intertidal rocks. Sand exposed at low tide fringing headland and sloping gently seaward. Currents scour headland from east to west.
TURTLE NESTS	Four shallow nests (one half way along beach and three in lee of Raas Cuuda headland) from a previous season, possibly of <i>Eretmochelys imbricata</i> . No tracks.	
TURTLE REMAINS	One carapace of <i>Chelonia mydas</i> (butchered) and two remains of <i>Eretmochelys imbricata</i> , (no evidence of butchering).	
BIRDS	Sooty Gulls (3), Herring Gulls (5), Crested Terns (50), Gull-billed Terns (25), White-eyed Gulls (120), unidentified Wheatears (3-4) in primary dunes.	
BEACH FAUNA	Hyena tracks (relatively abundant), jackal and camel tracks. Abundant hermit crabs and some <i>Ocypode cf saratans</i> . Jackal tracks. Abundant hermit crabs in places.	
BEACH FLORA	Primary dunes dominated by sparse dune grass (? <i>Halopyrom</i>), secondary dunes dominated by <i>Cyprus</i> of <i>conglomeratus</i> . Scattered <i>Acacia</i> noticeable on distant jebel.	
STRANDLINE	Abundant shells washed ashore. Also relatively abundant algae, including <i>Dictyota</i> , <i>Hypnea</i> , <i>Eucheuma</i> , <i>Stoechospermum</i> , <i>Padina</i> , ? <i>Jania</i> , <i>Ulva</i> , <i>Colpomenia</i> .	
HUMAN ACTIVITY	Human footprints on beach. Two fires on beach at Raas Cuuda.	

DATE	GPS LOCATION START TO FINISH	SITE DESCRIPTION
7-3-99	10°41.55'N, 45°3.46'E to 10°40.06'N, 45°28.46'E	Long beach between Raas Cuuda and Raas Xaatib. Relatively steeply sloping (up to 5°), cusped beach. Coarse, shelly sand to medium sand (largely biogenic), with large shell and coral fragments. Many beached shells and coral fragments above high tide line. Monsoon storm berm typically reaching primary dunes, except where there are raised beach cusps. Primary dunes 1-3 m in height, beyond which are secondary dunes and distant jebel. Other observations: Gazelle tracks observed in secondary dunes.
TURTLE NESTS	Two shallow nests at approximately 10°41.50'N, 45°31.32'E and a total of 22-23 nests scattered between this point and 10°40.06'N, 45°28.40'E, where there is a denser concentration of 12 nests. One false crawl of <i>Eretmochelys imbricata</i> 500 m to the east of this point. Nests are all shallow and from a previous season, with no tracks. Their depth suggests <i>E. imbricata</i> , but anecdotal evidence suggests that this is an important <i>Chelonia mydas</i> nesting beach.	
TURTLE REMAINS	Two carapaces of <i>Eretmochelys imbricata</i> , two <i>Chelonia mydas</i> skulls and four skeletal remains of unidentified turtles.	
BIRDS	Sooty Gulls (8), Crested Terns (70), Gull-billed Terns (35), White-eyed Gulls (30), Saunders Little Terns (8), Kentish Plovers (4), Hoopoe Larks (3) in primary dunes.	
BEACH FAUNA	Jackal and ?honey badger tracks. Few hermit crabs, <i>Ocypode cf saratans</i> .	
BEACH FLORA	Primary dunes dominated by sparse dune grass (? <i>Halopyrom</i>), secondary dunes dominated by <i>Cyperus</i> of <i>conglomeratus</i> .	
STRANDLINE	Abundant shells washed ashore. Relatively little algae - <i>Dictyota</i> , <i>Padina</i> .	
HUMAN ACTIVITY	Human footprints on beach and fishing camp (named 'Abu Saif'), consisting of a grass windbreak made from dune grass with a fire hearth. Nearby were three relatively large middens (1-1.5 m in height) comprising almost exclusively <i>Pinctada</i> shells (reputedly no longer fished). Pearl oyster beds occur in shallow water near to this site.	

DATE	GPS LOCATION START TO FINISH	SITE DESCRIPTION
7-3-99	10°39.11'N, 45°19.20'E to 10°38.22'N, 45°18.65'E	Long beach west of Raas Xaatib. Gently sloping, cusped beach (1-2 m), very steeply sloping beach (up to 5 m). Medium to coarse sand (largely biogenic). Relatively few shells/coral fragments. Monsoon storm berm typically reaching primary dunes, except where there are raised beach cusps. Dunes of up to 8 m in height reaching beach, beyond which dunes may be significantly higher and bank up steeply against jebel. Pollution: Little litter.
TURTLE NESTS	14 shallow nests from a previous season at approximately 10°38.23'N, 45°18.01'E, possibly <i>Eretmochelys imbricata</i> (no tracks). One additional old nest at 10°38.22'N, 45°18.65'E.	
TURTLE REMAINS	One <i>Chelonia mydas</i> skull and bones.	
BIRDS	Sooty Gulls (4), Crested Terns (2), Saunders Little Terns (9), Hoopoe Larks (1) in primary dunes.	
BEACH FAUNA	Few hermit crabs.	
BEACH FLORA	Very sparse dune grass (? <i>Halopyrum</i>) and low halophytes in places.	
STRANDLINE	Relatively abundant algae in places, mostly <i>Sargassum</i> sp., and some <i>Padina</i> , <i>Ulva</i> , <i>Gracilaria</i> .	
HUMAN ACTIVITY	People on beach, including women cutting dune grass (apparently to construct water containers) and men with makeshift raft.	

DATE	GPS LOCATION START TO FINISH	SITE DESCRIPTION
8-3-99	10°32.380'N, 45°10.945'E to 10°31.068'N, 45°08.648'E	Started at Khor west of El Girdi. Wadi reaching sea as a khor containing small amount of fresh water and supporting relatively dense vegetation, most notably a Tamarisk, small shrubs (woody succulent halophyte - ? <i>Zygophyllum</i>) and grasses. Wadi noticeably eroded at edges. The beach in this area and for a further 2 km west is littered with dead wood, abundant camel droppings and heavily fouled by mud from this wadi and several other tributary wadis. Overgrazing by livestock is very noticeable on the coastal plains and eroded soils may be impacting offshore areas. Beach at the start of the walk sloped quite steeply, with eroded berms 1-2 m from the start of the primary dunes, which range in height from 1-4 m. Beach became progressively less steep westwards (although monsoon storm berm still reaches primary dunes), and the general geomorphology included a low beach crest and gently sloping depression between the crest and primary dunes, resulting in flooding up to the primary dunes at high tides. Heavy black mineral sand deposits on beach (ilmenite, rutile). A raised shoreline ran parallel to the coast approximately 750-1000 m inland. Shells (semi-fossilised) lie scattered in great abundance in between the primary dunes and the raised shoreline, including <i>Lambis truncata</i> , <i>Strombus tricornis</i> , <i>Tectus dentatus</i> , <i>Chicoreus ramosus</i> . Pollution: Very little litter, mostly flip-flop sandals (used as fishing floats?). Other observations: Sea state 3-4 (Beaufort Scale) causing wave-generated turbidity to a distance of 200-250 m offshore
TURTLE NESTS	None.	
TURTLE REMAINS	Bones of two unidentified turtles.	
BIRDS	Saunders Little Tern (16+8), Crested Tern (4), Grey Reef Heron, white phase (1), Crab Plovers (6), Sanderling (5), Whimbrel (2).	
BEACH FAUNA	Relatively few hermit crabs. Jackal, hyena, honey badger (?), camel and goat tracks on beach.	
BEACH FLORA	Relatively sparse vegetation (Tamarisk and low shrubby halophytes) on primary dunes and dunes rolling inland to coastal plain.	
STRANDLINE	Relatively sparse <i>Padina</i> (attached to coral rubble/pebbles), also other scattered algae including <i>Dictyota</i> , <i>Halimeda</i> , <i>Hypnea</i> , <i>Rhizoclonium</i> , <i>Centroceras</i> , ? <i>Sarconema</i> , <i>Stoechospermum</i> , unidentified brown alga. <i>Thalassia hemprichii</i> on beach near tidal inlet created by sand bar. Few shells.	
HUMAN ACTIVITY	Fishing nets spread on beach, including one 32mm mesh cotton-nylon gill net (with polystyrene head floats and crude stone foot weights) and two 75 mm mesh cotton-nylon gill nets. Also a makeshift raft with two paddles and high strength monofilament fishing line with a 'jig' to foul-hook turtles in shallows.	

DATE	GPS LOCATION START TO FINISH	SITE DESCRIPTION
8-3-99	10°28.919'N, 45°03.657'E to 10°28.365'N, 45°02.859'E	Gently sloping beach, with flooding beyond beach crest to primary dunes, which range in height from 1-3 m. Black mineral sand deposits on beach (ilmenite, rutile). Primary dunes colonised sparsely by low shrubby halophytes. A raised shoreline (fossilised reef and beach rock) runs parallel to the coast approximately 50-100 m from shore, beyond which a flat sandy, coastal plain with scattered <i>Acacia</i> extends to the distant jebel. Other observations: Sea state 3-4 (Beaufort Scale) causing wave-generated turbidity to a distance of 200-250 m offshore.
TURTLE NESTS	None.	
TURTLE REMAINS	None.	
BIRDS	Saunders Little Tern (25), Crested Tern (2), Redshank (2).	
BEACH FAUNA	Jackal and camel tracks on beach	
BEACH FLORA	Relatively sparse vegetation (tamarisk and low shrubby halophytes) on primary dunes and dunes with some tamarisk.	
STRANDLINE	Very few shells, and scattered coral fragments. No algae.	
HUMAN ACTIVITY	Shack on beach constructed from Tamarisk.	

DATE	GPS LOCATION START TO FINISH	SITE DESCRIPTION
9-3-99	10°24.200'N, 44°53.250'E	Approximately 12kms west of Berbera harbour. Relatively gently sloping beach (3), with extensive flat intertidal/shallow water area, with breakers approx. 100 m from beach. Sabkha behind beach, beyond which is open scrub forest. Beach of medium, largely biogenic sand. Intertidal area with much scattered coral/rock rubble.
TURTLE NESTS	None.	
TURTLE REMAINS	None	
BIRDS	None observed	
BEACH FAUNA	Few <i>Ocyropsis cf saratans</i> , camel tracks	
BEACH FLORA	Very little halophytic vegetation on beach or sabkha	
STRANDLINE	Abundant algae, including <i>Nizamuddinia</i> , <i>Sargassum</i> (2 spp.), <i>Dictyota</i> , <i>Halymenia</i> , <i>Halimeda</i> , <i>Amphiroa</i> , <i>Centroceras</i> , <i>Gelidiella</i> , <i>Gelidium</i> , <i>Galaxura</i> , <i>Turbinaria</i> , <i>Padina</i> , calcareous reds. Also scattered <i>Thalassia hemprichii</i> and <i>Halophila ovalis</i> . <i>Acanthella</i> sponges.	
HUMAN ACTIVITY	None observed	

DATE	GPS LOCATION START TO FINISH	SITE DESCRIPTION
9-3-99	10°24.476'N, 44°51.073'E to 10°24.599'N, 44°50.478'E	<p>Approximately 17 km west of Berbera harbour. Gently sloping beach (1-2'), with extensive shallow water area - breakers on sand bar approx. 100-150 m from beach. High primary dunes (up to 5 m) forming hummocks extending 0.5 kms inland. Very densely vegetated dunes (a succulent, woody halophyte - ?<i>Zygophyllum</i>). Sand largely biogenic and medium-fine. Coral rubble and drift wood abundant on upper shore. Beach broken by occasional rock outcrops, extending into intertidal area, but not colonised by sessile marine organisms (few <i>Saccostrea cucullata</i>).</p> <p>Pollution: Some litter washed ashore, mostly empty plastic containers.</p> <p>Other observations: Camel herders unfriendly and aggressive</p>
TURTLE NESTS	Two from previous season, probably <i>Chelonia mydas</i> at approximately 10°24.476'N, 44°50.950'E	
TURTLE REMAINS	One butchered <i>Chelonia mydas</i> in dunes, two butchered <i>Chelonia mydas</i> on beach near wooden shacks, one scute from <i>Eretmochelys imbricata</i> .	
BIRDS	Very abundant in dunes, as evidenced by song, including Larks and Wheatears. 4-5 Sooty Gulls, 1 Sandwich Tern	
BEACH FAUNA	Few <i>Ocyropsis</i> cf <i>saratans</i> , camels, jackal tracks	
BEACH FLORA	Very densely vegetated dunes (a succulent, woody halophyte - ? <i>Zygophyllum</i>) and some tamarisk, especially in wadi areas (e.g. at 10°24.599'N, 44°50.478'E).	
STRANDLINE	Abundant algae in places, including <i>Nizamuddinia</i> , <i>Sargassum</i> (2 spp.), <i>Dictyota</i> , <i>Hypnea</i> , <i>Ulva</i> , <i>Enteromorpha</i> , <i>Rhizoclonium</i> , <i>Padina</i> , calcareous reds. Also scattered <i>Thalassia hemprichii</i> . Few shells.	
HUMAN ACTIVITY	Camels on beach, particularly youngsters coralled in makeshift shelters. Adults grazing in dunes. Camel herders on beach.	

REEF SURVEYS

DATE	GPS LOCATION	SITE DESCRIPTION	DEPTH	VISIBILITY	DIVE TIME
4-3-99	10°24.88'N, 44°57.55'E	Approx. 1 km west of lighthouse, west of Berbera harbour. Low-cliffed (2-3 m) shore line of fossilized seabed. Subtidally, rock boulders and rubble with scattered coral communities and algal beds at 1-4.5 m, sloping gently to sand.	1-4.5 m	2-5 m	1 h
		NUMBER OF SPECIES	COMMENTS		
CORALS		32 species	Scattered and mostly dead with a max. of 5% live cover. Small colonies, most being <20 cm in diameter. Silty conditions favouring faviids, which are dominant. Note: Coral rubble included <i>Acropora</i> cf. <i>formosa</i> (or <i>A. nobilis</i>).		
FISHES		38 species	Notably abundant (particularly <i>Scarus</i> and <i>Epinephalus</i>).		
ALGAE		-	Relatively dense, but not extensive beds dominated by <i>Nizamuddinina zanardinii</i> and <i>Sargassum</i> spp. (2) on bedrock/rubble with thin sand veneer in 1-4 m depth. <i>Padina</i> sp., <i>Halimeda</i> sp., <i>Chlorodesmis</i> sp., <i>Galaxura</i> sp., <i>Caulerpa</i> sp. unidentified small, brown alga on rocks in shallower water. Small quantities of the genera <i>Gelidium</i> , <i>Caulerpa</i> , <i>Stoechosperma</i> , <i>Amphiroa</i> and <i>Turbinaria</i> .		
OTHER		-	<i>Xestospongia</i> sp., <i>Dysidea</i> cf. <i>herbacea</i> , <i>Cryptodendron adhaesivum</i> , <i>Palythoa</i> cf. <i>natalensis</i> , <i>Lambis truncata</i> , <i>Pinctada margaritifera</i> , hawkbill (45 cm) and green (70 cm) turtles, unidentified hydrozoan.		

DATE	GPS LOCATION	SITE DESCRIPTION	DEPTH	VISIBILITY	DIVE TIME
5-3-99	10°49.01'N, 45°44.79'E	Approx. 1 km west of Karin village near Raas Khansir. Scattered <i>Porites</i> bommie field on sand in 2-4 m depth, apparently extending westwards from Karin to the next headland and possibly beyond.	2-4 m	2-5 m	20 min
		NUMBER OF SPECIES	COMMENTS		
CORALS		8 species	Scattered on sandy substratum, with a max. of 5% live cover. <i>Porites solida</i> dominant, forming small 'bommies'. Silty conditions.		
FISHES		17 species	Notably abundant, but low in diversity.		
ALGAE		-	Abundant <i>Padina</i> sp., <i>Dictyota</i> sp., unidentified filamentous greens.		

DATE	GPS LOCATION	SITE DESCRIPTION	DEPTH	VISIBILITY	DIVE TIME
6-3-99	10°42.98'N, 45°33.37'E	A site just west of Raas Cuuda. Shallow "reef" comprising a flat and algal covered area interspersed with mats of pale and dark mats of zoanths (<i>Zoanthus sansibaricus?</i>); some appeared a deep blue in the dim light. Clearly a productive area (see below).	4-5 m	2-3 m	10 min
		NUMBER OF SPECIES	COMMENTS		
CORALS		-	Very sparse and small, a few faviids and <i>Stylophora pistillata</i> .		
FISHES		-	Extremely abundant juvenile <i>Lutjanus</i> sp. Two sandbar sharks (<i>Carcharhinus plumbeus</i>) and one guitar shark (<i>Rhynchobates</i> sp.).		
ALGAE		-	<i>Sargassum</i> spp. (2) dominant but nonetheless sparse, growing on rock rubble.		
OTHER		-	<i>Xestospongia</i> sp., <i>Zoanthus sansibaricus</i> .		

DATE	GPS LOCATION	SITE DESCRIPTION	DEPTH	VISIBILITY	DIVE TIME
6-3-99	10°42.21'N, 45°31.30'E	Approx. 1 km west of Raas Cuuda. Shallow reef composed largely of stands of <i>Millepora squarrosa</i> and <i>Porites lutea</i> bommies ranging from 0.5-4 m in diameter. Also considerable <i>Pocillopora verrucosa</i> . Most of the coral was dead, apparently from bleaching, and the mortality ranged from 60-100%.	2-5 m	2-5 m	30 min
		NUMBER OF SPECIES	COMMENTS		
CORALS		27 species	<i>Millepora</i> and <i>Porites</i> previously dominant, now 99% dead, apparently from a bleaching event. Note: Evidence of continued bleaching was observed. Two very small <i>Acropora</i> colonies were totally bleached and a colony of <i>Galaxea</i> and a small <i>Montipora</i> were partially bleached. This site was photographed.		
FISHES		35 species	Notably abundant.		
ALGAE		-	Relatively abundant, particularly <i>Gracilaria</i> cf. <i>crassa</i> , which occurs in the cavities of the dead colonies of <i>Millepora</i> sp. Other algae growing on rock and coral rubble, including <i>Ulva</i> , <i>Halymenia</i> , <i>Dictyota</i> , <i>Halimeda</i> , <i>Hypnea</i> , <i>Padina</i> , <i>Galaxura</i> and some coralline algae.		
OTHER		-	<i>Xestospongia</i> sp., <i>Acanthella</i> sp., <i>Dysidea</i> cf. <i>herbacea</i> , <i>Panulirus versicolor</i> (4), <i>Palythoa</i> sp. and a single <i>Tridacna</i> sp.		

DATE	GPS LOCATION	SITE DESCRIPTION	DEPTH	VISIBILITY	DIVE TIME
7-3-99	10°41.55'N; 45°31.46'E - to 10°41.22'N; 45°30.69'E - to 10°40.63'N; 45°28.37'E	Initially sparse rubble (with very corals) interspersed with sand inhabited by numerous holothurians at 4-5 m depth. A few alive and dead specimens (40 cm) of <i>Lobophyllia</i> cf. <i>corymbosa</i> were conspicuous here. One <i>Acanthaster planci</i> (40 cm) was observed under a small bommie and one (30 cm) was moving rapidly across the sand. No COTS feeding scars were seen. A large, almost mono-specific stand of <i>Pocillopora verrucosa</i> with some <i>Porites lutea</i> emerged at the above GPS fix in bold, ranging in depth from 2-5 m. Patches of this were dead and overgrown with turf algae; the average cover being +/-60%. A single <i>A. planci</i> (35 cm) was associated with a dead patch but no feeding scars were observed. The approx. size of the outcrop was 50 x 50 m. The individual, massed <i>Pocillopora</i> colonies, if discriminated on the basis of colour, were the size of <i>Porites</i> domes and had possibly overgrown such. The outcrop was inhabited by a rich fish fauna. The above outcrop appeared to be fairly unique and gave way to a shallower (1-2 m) area of broken reef consisting almost entirely of dead coral with very few faviids, a single <i>Stylophora pistillata</i> , a few specimens of <i>Montipora stellata</i> and sponge (<i>Haliclona</i> sp.). The dead coral community was mixed but mostly unidentifiable as it was largely encrusted by coralline algae. This reef petered out at at the western GPS fix; it is thus +/-7 km long.	4-5 m 2-5 m 1-2 m	3-5 m	1 h
		NUMBER OF SPECIES	COMMENTS		
	CORALS	8 species.	Note: The site was photographed. No COTS feeding scars were observed; the reef damage appeared to have arisen from bleaching rather than COTS.		
	FISHES	28 species	Most of the fishes were observed on and around the <i>Pocillopora</i> outcrop. Very few were observed on the shallow, dead part of the reef.		
	ALGAE	-	<i>Padina</i> sp.		
	OTHER	-	<i>Holothuria atra</i> , <i>H. scabra</i> , <i>Acanthaster planci</i> , <i>Asterodiscides belli</i> , <i>Heteractis magnifica</i> , <i>Hyotissa hyotis</i> , <i>Haliclona</i> cf. <i>tulearensis</i> and <i>Ciocalypa</i> sp., green and hawksbill turtle.		

DATE	GPS LOCATION	SITE DESCRIPTION	DEPTH	VISIBILITY	DIVE TIME
7-3-99	10°39'02"N, 45°26'21"E	In between Raas Cuuda and Raas Xaatib. Coarse sandy substrate at 6.5 metres depth.	6.5 m	3-5 m	10 min
		NUMBER OF SPECIES	COMMENTS		
CORALS		-	? <i>Heterocyathus</i> sp.		
FISHES		-	Very few observed, but include <i>Cryptocentrus ?lutheri</i> , <i>Scomberomorus commerson</i> .		
ALGAE		-	Unidentified brown and red algae.		
OTHER		-	<i>Clypeaster ?humilis</i> , <i>Cerianthus</i> sp., both at a density of approximately 1 per 10 sq. m, unidentified hydroids and urchins.		

DATE	GPS LOCATION	SITE DESCRIPTION	DEPTH	VISIBILITY	DIVE TIME
7-3-99	10°39'91"N, 45°25'27"E	In between Raas Cuuda and Raas Xaatib. Coral and rock rubble, with some bedrock under coarse sand veneer at 6.5 metres depth.	6.5 m	3-5 m	15 min
		NUMBER OF SPECIES	COMMENTS		
CORALS		-	Very scattered live corals, including <i>Platygyra daedalea</i> , <i>Favia</i> sp., <i>Porites solida</i> , <i>P. lutea</i> , <i>Coscinarea</i> sp.		
FISHES		7 species	Very abundant (particularly <i>Sphyraena</i> sp.), but low in diversity.		
ALGAE		-	Relatively dense, but not extensive, beds dominated by <i>Nizamuddinina zanardinii</i> and <i>Sargassum</i> sp. A.. Other algae present in very low density, including <i>Hypnea</i> , <i>Ulva</i> and <i>Halimeda</i> .		
OTHER		-	<i>Dysidea</i> sp., <i>Plakortis</i> sp., <i>Xestospongia</i> sp., <i>Sepia pharaonis</i> , unidentified colonial encrusting ascidian (? <i>Didemnum</i> sp.).		

DATE	GPS LOCATION	SITE DESCRIPTION	DEPTH	VISIBILITY	DIVE TIME
7-3-99	10°39'65"N, 45°25'04"E	In between Raas Cuuda and Raas Xaatib. Coral rock rubble at 2-3 metres depth.	2-3 m	3-5 m	15 min
		NUMBER OF SPECIES	COMMENTS		
CORALS		14 species	Scattered live corals forming max 1-2% live cover in very silty conditions.		
FISHES		28 species	Abundant.		
ALGAE		-	Relatively dense bed dominated by <i>Sargassum</i> spp. (2), <i>Nizamuddinina zanardinii</i> , <i>Padina</i> sp. also relatively abundant. Other algae included <i>Gracilaria</i> , <i>Galaxura</i> , <i>Halimeda</i> , <i>Turbinaria</i> , <i>Gelidium</i> , <i>Dictyota</i> , <i>Udotea</i> , unidentified brown algae.		
OTHER		-	<i>Thalassodendron ciliatum</i> (scattered among algae), <i>Holothuria edulis</i> , <i>Sepia pharaonis</i> , unidentified sponges.		

DATE	GPS LOCATION	SITE DESCRIPTION	DEPTH	VISIBILITY	DIVE TIME
10-3-99	10°36.09'N; 45°15.85'E	Reef off village at Siyara at base of 40 m cliff. The reef commences with exposed rock immediately offshore off Siyara and slopes to a depth of 10 m where the substratum again becomes sand. The reef covers ±40% of the seafloor and generally consists of boulders overgrown with coral and small bommies. The rocks at a depth of 1-3 m have a few encrusting algae and sponges. Scattered sponges and some <i>Litophyton</i> cf. <i>liltveldi</i> were found up to a depth of 6 m with a number of hard corals, the average coral cover being 40%. The extent of the rock cover diminished from 6-10 m, averaging 30% of the seafloor, with a coral cover of ±40%. The coral cover is diverse and uniformly mixed up to 6-7 m, whereafter <i>Astreopora</i> mounds with a few <i>Montipora</i> plates were conspicuous. Many of the former bore old COTS feeding scars; those that had not been entirely eaten were showing good recovery.	1-10 m	8 m	1 h
		NUMBER OF SPECIES	COMMENTS		
	CORALS	33 spp.	-		
	FISHES	70 species	Abundant and diverse.		
	ALGAE	-	Small patches of <i>Enteromorpha</i> sp., a slimy green film overgrowing some of the COTS scars on some of the <i>Astreopora</i> mounds.		
	OTHER	-	Exceptionally large specimens of <i>Xestospongia</i> ; <i>Dysidea</i> cf. <i>herbacea</i> , <i>Palythoa</i> cf. <i>natalensis</i> .		

DATE	GPS LOCATION	SITE DESCRIPTION	DEPTH	VISIBILITY	DIVE TIME
10-3-99	10°33.65'N 45°13.15'E (approx.)	<p>Reef east of El Girdi adjacent to a narrow dune belt on the shore backed by a steeply sloping jebel. On the approach to El Girdi, the subtidal sand gradually gives way to broken, submerged rock which develops into reef, probably ±1 sq. km in extent. In its shallow reaches (1-2 m to the reef top), the reef consists of what appears to be very regular spurs, raised up to 2 m above the intervening patches of sand. The spurs are at right angles to the shore-line, giving the clear impression that they are fossilized dune rock which has been overgrown by coral so that the reef tops are flat and the sides vertical. The deeper margin of the reef (2-3 m to the reef top) forms a complete fringing reef which falls away to reef similar to that found at Siyara, i.e. <i>Porites</i> and <i>Astreopora</i> bommies in water ranging in depth from 5-10 m, giving way to sand.</p> <p>The shallower regions of the reef were almost entirely dead and encrusted and accreted with coralline algae. There were only very few small fragments of <i>Montipora stellata</i> on the reef and isolated colonies of e.g. <i>Pocillopora</i> and <i>Stylophora</i>. The mortality was so uniform and complete that it must have resulted from bleaching some time ago.</p> <p>More coral had survived on the outer fringe of the reef and <i>Porites</i> bommies of up to 3 m were conspicuous; one of 4 m was observed. These gave way to a coral community similar to that found in the deeper water at Siyara. Plates of <i>Montipora</i> were more conspicuous and there were no COTS feeding scars.</p> <p>The reef cover ranged from ±40-100% and the coral cover on the reef averaged from 0-60% depending on the region under consideration.</p> <p>Despite the heavy mortality from bleaching, some species were encountered on this reef not found heretofore.</p>	1-10 m	3-6 m	1h
		NUMBER OF SPECIES	COMMENTS		
	CORALS	38 spp.	See above.		
	FISHES	65 spp.	Diverse and abundant (especially surgeonfishes and parrotfishes, <i>Flammeo sammara</i> also abundant in shallows).		
	ALGAE	-	<i>Turbinaria ornata</i> , <i>Halimeda</i> , <i>Halymenia</i> (3spp), <i>Champia</i> , <i>Ulva</i> , <i>Dictyota</i> , <i>Padina</i> , <i>Sargassum</i> (2 spp).		
	OTHER	-	3 individuals of <i>Tridacna</i> sp., <i>Holothuria scabra</i> , grey holothurian, <i>Haliclona</i> cf. <i>tulearensis</i> , several large <i>Lambis truncata</i> .		

DATE	GPS LOCATION	SITE DESCRIPTION	DEPTH	VISIBILITY	DIVE TIME
11-3-99	10°24.75'N; 44°56.56'E	<p>Reef west of Berbera lighthouse in front of a low cliff (1-2 m) backed by a plain of scrub forest. The reef appears to be very long, stretching for kilometres to the west. It starts close to the beach as broken rubble interspersed by sand and algae, develops into a flat platform which is shallow and causes the backline surf to break, and then drops away from well-developed, fringing reef to scattered boulders and bommies at 10 m.</p> <p>The shallow, inshore area is typified by small <i>Porites</i> bommies, a few colonies of <i>Acropora</i> and a few faviids with quite a large number of stands of algae, particularly <i>Sargassum</i>. The depth ranges from 0.75-1 m. Sand covers ±60% of the seabed, and the coral cover on the rock averages 0-40%.</p> <p>The reef platform is nearly all dead where it is shallowest (0.5 m), probably from tidal exposure. It is accreted with coralline algae. Before and behind the backline, though, it is heavily colonised with a low forest of <i>Montipora stellata</i> (70-100%).</p> <p>The offshore reef falls rapidly away to 10 m and is heavily colonised by the best coral community encountered during the survey. <i>Porites</i> domes and a mix of plate and digitate <i>Montipora</i> colonies were dominant with a good mix of faviids. The cover ranged from 60-100%.</p>	1-10 m	8 m	1.75 h
		NUMBER OF SPECIES	COMMENTS		
	CORALS	59 spp.	See above.		
	FISHES	93 spp.	Diverse and abundant.		
	ALGAE	-	<i>Sargassum</i> (2 spp.), <i>Padina</i> sp., <i>Halimeda</i> in the inshore region. Small quantities of <i>Turbinaria ornata</i> throughout. <i>Gracilaria</i> (2-3 spp.), <i>Halymenia</i> , <i>Champia</i> , <i>Gelidiella</i> , <i>Ulva</i> , <i>Dictyota</i> , <i>Padina</i> , <i>Chlorodesmis</i> , unidentified brown alga, calcareous reds.		
	OTHER	-	An isolated clump of <i>Thalassodendron ciliatum</i> in the inshore region, large <i>Xestospongia</i> , <i>Acanthella</i> sp., <i>Tridacna</i> sp., <i>Lambis</i> ? <i>lambis</i> , <i>Palythoa</i> ? <i>natalensis</i> , <i>Holothuria scabra</i> , <i>H. edulis</i> , 3 <i>Chelonia mydas</i> at surface.		

DATE	GPS LOCATION	SITE DESCRIPTION	DEPTH	VISIBILITY	DIVE TIME
11-3-99	10°24.63'N; 44°54.94'E	A less differentiated version of the previous site, consisting of broken spurs and grooves running perpendicular to the coast. The reef shelved gradually from 1-10 m. A faviid dominated site due to increased sedimentation. Coral cover was lower, being in the region of 40%.	1-10 m	5-7 m	30 min
		NUMBER OF SPECIES	COMMENTS		
CORALS		47 spp.	See above.		
FISHES		49 spp.	Diverse and abundant.		
ALGAE		-	<i>Turbinaria</i> (relatively abundant), <i>Gracilaria</i> , <i>Halimeda</i> , <i>Champia</i> , <i>Gelidium</i> , <i>Dictyota</i> , <i>Padina</i> , <i>Sargassum</i> (2 spp.), unidentified brown alga, calcareous reds		
OTHER		-	<i>Palythoa natalensis</i> , <i>Holothuria scabra</i> , <i>H. edulis</i> , <i>Lambis truncata</i> , <i>Sepia</i> sp., <i>Chelonia mydas</i> (1).		