

Status and preliminary assessment of the sea cucumber fishery in Eritrea

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Abstract

In Eritrea, sea cucumbers — especially those from the families Holothuridae and Stichopodidae — form an important part of a multi-species invertebrate fishery. There is no domestic demand for sea cucumber products and so they are exported. In Eritrea, there are no rules or regulations governing sea cucumber fishing activities, and no reasonable stock status estimates are available. As a result, the sea cucumber fishery faces managerial and technical capacity limitations.

The UN Food and Agriculture Organization (FAO) — through the United Nations Development Programme (UNDP) — provided funds to the Ministry of Fisheries, State of Eritrea for a preliminary survey of the status of sea cucumber stocks, and a study of the socioeconomic and environmental impacts of sea cucumber fishing. This report outlines the ecological and biological aspects of Eritrea's sea cucumber fishery.

Eritrea's northern fishing ground is relatively abundant with diverse species of commercial sea cucumbers. The sea cucumber fishery in Eritrea is relatively better condition than the sea cucumber fisheries in other parts of the Red Sea (e.g. Egypt). The density of animals in offshore and deeper areas is higher than in shallow and nearshore areas. This study shows the habitat preference and depth distribution of commercial sea cucumber species. Length-frequency data for each commercial sea cucumber species, and baseline information for the important sea cucumber fishing grounds, was recorded for comparison with future studies. Finally, monitoring sites were chosen in all of the important fishing grounds, and, permanent monitoring sites will be placed at Green and Dissie islands, which have been proposed as marine protected areas.

Based on this study of the sea cucumber fishery, the following recommendations have been made to the Ministry of Fisheries, State of Eritrea:

- conduct in-depth research on sea cucumber biology (i.e. growth, reproductive rate, etc.);
- develop management strategies specific to the sea cucumber fishery (using a precautionary approach that includes the formulation of a national fishing advisory committee);
- develop post-harvest handling and mariculture techniques for stock replenishment; and
- formulate regulations to protect wild sea cucumber stocks.

Introduction

The current high demand for dried sea cucumber product is likely to continue and increase in many Southeast Asian countries (FAO 2003). The commonly exported product is the dried body wall known as beche-de-mer or trepang. Global stocks of sea cucumbers have declined over the years, mostly due to overharvesting in many countries. Sea cucumber fisheries have undergone cycles in which the total catch decreased despite an increase in the fishing effort. This has led to the overexploitation of the resource and low economic returns to coastal communities (Ibarra and Soberon 2002). Due to the high value placed on sea cucumbers, the ease with which they can be harvested, and their particular biology, population dynamics and habitat preferences, they are vulnerable to overexploitation

(Bruckner et al. 2003). Hence, the fishery is characterized by boom and bust cycles with biological overexploitation often occurring before economic overexploitation (Preston 1993; Conand 1997).

In Eritrea, sea cucumber harvesting has been occurring for less than 50 years, and was initially confined to shallow waters. Since 2000, however, there has been intensive exploitation and sea cucumber catches and export rates have dramatically increased. Eritrea has now become a supplier of dried sea cucumber products (beche-de-mer) to outside markets (Tewelde and Woldia 2007).

In 2000, about 11 tonnes (t) of gutted and dried sea cucumbers were produced. Since then, the amount has steadily increased (Table 1). In 2007, the fishery was closed by an administrative deci-

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sion to stop illegal fishing and export (Tewelde and Woldia 2007).

Table 1. Eritrea's beche-de-mer production (2000–2006).

Year	Beche-de-mer production (t)
2000	11
2001	80
2002	242
2003	452
2004	283
2005	380
2006	278

The principal objective of the present survey was to assess the stock status, establish baseline information on ecological and biological parameters, and introduce some preliminary recommendations for more sustainable exploitation of sea cucumbers.

Study area

Eritrea is on the northeast coast of Africa (between 12–18°N and 36–43°E) and stretches along the Red Sea between Sudan and Djibouti. Eritrea's mainland

coastline is approximately 1350 km long, extending from Ras Quesar (northern border with the Sudan) to Ras Dumera (southern border with Djibouti). The coastline of the numerous offshore islands is about 1900 km long.

Survey area

For the purpose of this study, Eritrea's coast was divided into three sea cucumber fishing grounds: northern, central and southern (Fig. 1). The selection of survey sites was based on the presence of important sea cucumber habitat (e.g. coral reef, sand substrate, muddy beaches, mangrove beds, seagrass beds and macroalgae), areas of fished and non-fished grounds, and areas nearshore and offshore from an island or the mainland. In total, 150 sites were selected: 60 sites in the central fishing grounds, 45 sites in the southern fishing grounds, and 45 sites in the northern fishing grounds.

Survey methodology

Two teams of divers surveyed a 100-m-long transect, recording information that was 1 m on either side of the transect (i.e. 2 m total width). When the visibility was poor, the total width of the observation was reduced to 1 m. The transect was placed perpendicular to or, sometimes parallel to, the beach depending on the local topography. The study was carried out from the reef flat to a depth of 30 m.

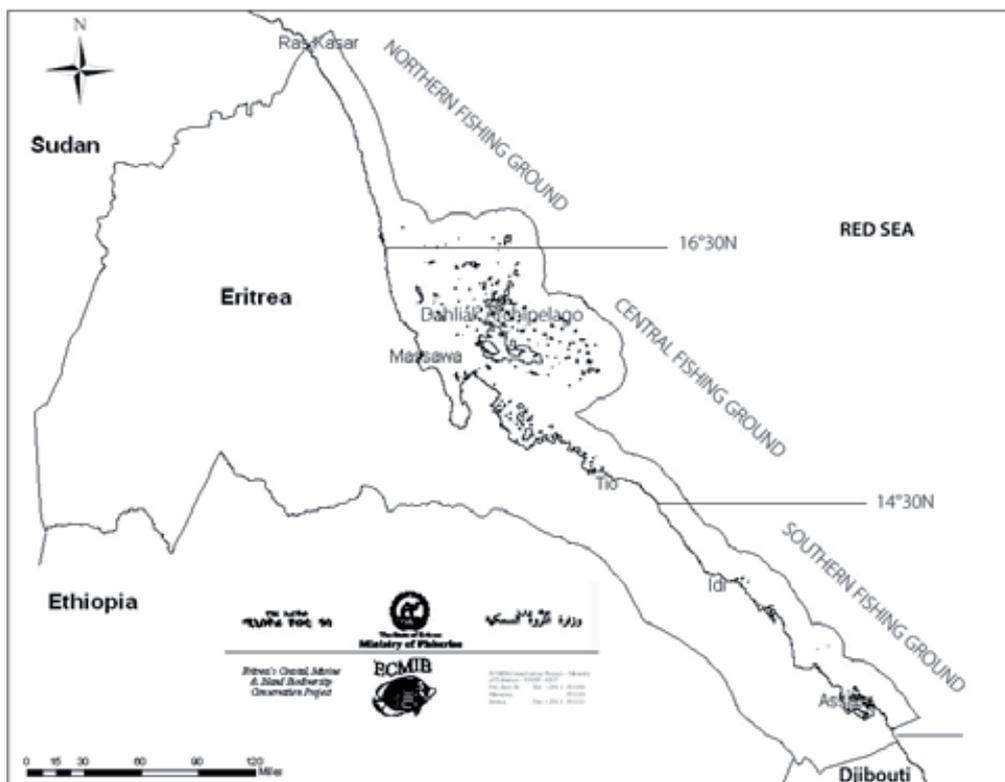


Figure 1. Eritrea's coastal area and numerous offshore islands.

Data recorded included length measurements of all sea cucumber species observed, substrate type (described in terms of percent cover of coral, seagrass, micro-algae beds, sand, mud or mangrove stands).

Results

Sites and species

To date, 91 sites (out of the total 150 sites selected) have been surveyed: 16 sites in the northern fishing ground, 60 sites in the central fishing ground, and 15 sites in the southern fishing ground. The remaining 59 sites will be surveyed next year. Thus far, 16 sea cucumber species have been identified and two have been recorded as unidentified (Table 2).

Abundance and species diversity among the different fishing grounds

Sea cucumber abundance and species diversity varies among the three fishing grounds. The highest diversity was recorded in the northern fishing ground with the presence of eight of the nine main commercial sea cucumber species found in Eritrea (Fig. 2).

Comparison between fished and non-fished areas

To determine the impact of sea cucumber fishing activities on stocks, the abundance of sea cucumbers in non-fished (or very little fished) areas was compared with the abundance in heavily fished areas. The average abundance values were 21.6 individuals per transect for non-fished areas, and 11.8 indi-

viduals per transect for heavily fished areas. Figure 3 shows a clear pattern of increasing fishing impact on the overall abundance of sea cucumber populations.

Comparison of sea cucumber densities from other studies

To determine the status of sea cucumbers in Eritrea, the density of animals per hectare was compared with the density recorded in Egypt (Lawrence et al. 2004) (Table 3).

Table 3. Density of some commercial sea cucumber species in Eritrea and Egypt.

Species	Density (ind ha ⁻¹) in Eritrea	Density (ind ha ⁻¹) in Egypt
<i>Holothuria scabra</i>	7.5	0.0
<i>H. atra</i>	295.0	155.48
<i>H. edulis</i>	48.5	-
<i>H. fuscogilva</i>	3.0	1.2
<i>H. nobilis</i>	1.0	0.66
<i>Stichopus horrens</i>	10.0	0.654
<i>S. herrmanni</i>	3.0	-
<i>Actinopyga mauritiana</i>	35.0	11.45
<i>A. miliaris</i>	157.5	-
<i>Thelenota ananas</i>	3.5	-

Table 2. Sea cucumber species encountered during field surveys along the Eritrean coast.

No.	Species name	Common English name	Local name	Value/grade	Commercial value
1	<i>Actinopyga mauritiana</i>	Surf redfish	Abu Sanduk Hager	2 nd grade	Yes
2	<i>A. miliaris</i>	Blackfish	Abu Shelalik	3 rd grade	Yes
3	<i>Holothuria atra</i>	Lollyfish	Lega	3 rd grade	Yes
4	<i>H. edulis</i>	Pinkfish	Abu Sanduk Tina	2 nd grade	Yes
5	<i>H. fuscogilva</i>	White teatfish	Abu Habhab Abyed	1 st grade	Yes
6	<i>H. hilla</i>	-	-	No grade	No
7	<i>H. impatiens</i>	-	-	No grade	No
8	<i>H. nobilis</i>	Black teatfish	Abu Habhab Aswed	1 st grade	Yes
9	<i>H. scabra</i>	Sandfish	Hedra Beyda	1 st grade	Yes
10	<i>H. spinifera</i>	-	-	No grade	No
11	<i>Pearsonothuria graeffei</i>	Flowerfish	-	No grade	No
12	<i>Stichopus chloronotus</i>	Greenfish	Abu Jezma	no grade	No
13	<i>S. herrmanni</i>	Curryfish	Hamra	2 nd grade	Yes
14	<i>S. horrens</i>	Dragonfish	Abu Jezma	No grade	No
15	<i>Synaptula media</i>	-	-	No grade	No
16	<i>Thelenota ananas</i>	Prickly redfish	Abu Mud	1 st grade	Yes
17	unidentified (1)	Unknown	Unknown	Unknown	Unknown
18	unidentified (2)	Unknown	Unknown	Unknown	Unknown

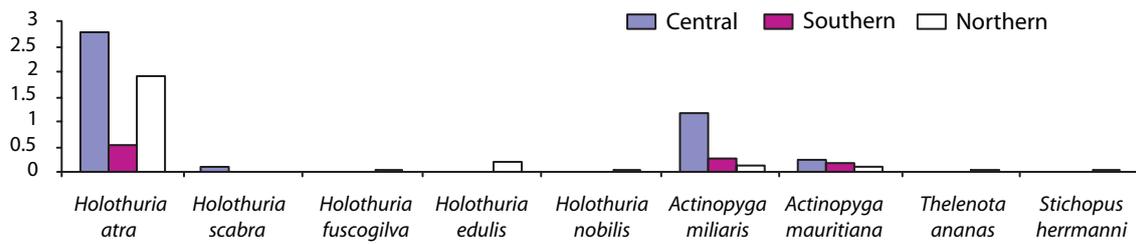


Figure 2. A comparison of the abundance of nine sea cucumber species in the northern, central and southern fishing grounds in Eritrean waters. Values are expressed as the mean number of individuals per transect

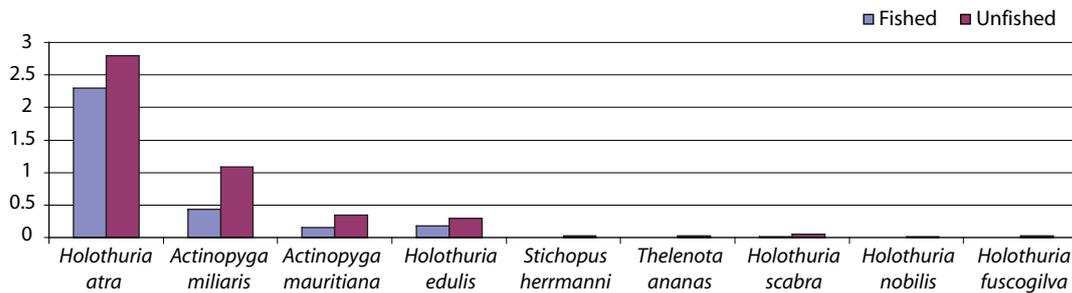


Figure 3. Comparison of abundance between fished and unfished areas in the Eritrean Red Sea. Values are expressed as mean number of individuals per transect.

Table 4 is a preliminary listing of sites where smaller individuals of commercially important sea cucumber species (i.e. ≤ 10 cm) were found.

Table 4. Sites with juveniles of commercially important sea cucumber species.

Site	Species	Length (cm)
Barasole (island)	<i>A. mauritiana</i>	6.0
Umm Namus	<i>A. miliaris</i>	10.0
Green Island	<i>H. atra</i>	10.0
	<i>S. chloronotus</i>	8.0
Arabi Seil	<i>H. atra</i>	6.5
Martaban	<i>H. atra</i>	9.0
Barasole (mainland)	<i>H. atra</i>	10.0
Museri	<i>H. edulis</i>	10.0
Yermalkau	<i>H. edulis</i>	9.0

Depth and habitat distribution of commercial sea cucumber species

The depth distribution of the commercial sea cucumber species shows that sea cucumbers were found from the outer reef flat to depths of 30 m, although most were found in depths ranging between 6 m and 15 m. The commercial species (*H. atra*, *H. edulis*, *A. miliaris* and *A. mauritiana*)

were found mainly on coral and sand substrates. *H. scabra* was primarily found in muddy areas and seagrass beds.

Environmental impact of the sea cucumber fishery

Commercial harvesting of sea cucumbers leads to environmental impacts on land near sea cucumber processing camps. Terrestrial environmental impact surveys were conducted specifically on the central and south-central islands where sea cucumber fishermen have established processing camps. During the survey, mangrove destruction, halophyte clearing, and littering and solid waste disposal were recorded. Evidence of turtle consumption (carapaces found) and bird nest disturbance were observed. The survey did not record underwater damage caused by trawling for sea cucumbers.

Discussion

The abundance and species diversity comparison among the three different fishing grounds shows that the northern fishing ground is more diverse with commercial sea cucumber species. Eight out of the nine commercial species (*H. atra*, *H. nobilis*, *H. fuscogilva*, *T. ananas*, *H. edulis*, *S. herrmanni*, *A. miliaris* and *A. mauritiana*) were found in the northern area. The reasons for this high diversity include greater depth, remoteness, and exposure of

the area to strong winds and rough sea conditions, all of which make it more difficult for fishermen to harvest sea cucumbers.

Small-sized individuals (≤ 10 cm) were recorded in several sites (in particular Museri, Yermalkau, Arabi Seil, Martaban, Umm Namus, Barasole, Salima and Dorrum). These areas may possibly be nursery grounds for commercial species and may need some conservation status, such as the establishment of no-take marine reserves.

With the exception of *H. scabra*, which was predominantly found in muddy and seagrass substratum, other commercial sea cucumber species were found mainly on coral reefs and sandy substrates.

Although Eritrea's commercial sea cucumber are found in depths ranging between 6 m and 15 m, *H. fuscogilva* and *H. nobilis* are typically found in deeper water, although in this study, they were found in shallow areas, in depths of 6–10 m.

Sea cucumbers must be thoroughly processed before the final product is ready for export. This processing has detrimental impacts on the terrestrial environment, including the fauna and flora of the area. Mangroves are cut to provide firewood for boiling the sea cucumbers, plastic and other garbage is disposed off at the sites or in the sea, bird nests are destroyed and turtles are caught and eaten by the fishermen.

A comparison of sea cucumber abundance between fished and non-fished areas shows clear patterns of increasing fishing intensity (but not yet overfished) for all commercial species. Therefore, fishing intensity has a pronounced impact on the overall abundance of sea cucumber species. In the absence of catch per unit of effort data for the sea cucumber fishery, it is difficult to give evidence of overexploitation. At present, most fishing effort has been concentrated on the central fishing ground, and the decrease in sea cucumber production is related to this area.

In Eritrea, there are many problems with the current status, regulation and management of sea cucumber fishery resources. In fact, there is no legislation specific to the sea cucumber fishery. A seasonal closure (October–February) applies to all types of fisheries. The total allowable catch of 500 t and the minimum legal size (5 cm wet length), are terms of agreement between the National Fisheries Corporation and fishermen engaged in the sea cucumber fishery. There is a lack of information on the population dynamics of exploited species. Illegal fishing and exporting activities are occurring. In conclusion, there is little concern about this resource, despite its ecological role and economic importance to small coastal communities.

The establishment of adequate management and regulation measures, bans and closures (both in season and fishing ground), size and catch limits are needed. Also needed are regular monitoring and surveying programmes and the development of mariculture for sea cucumbers. These actions could allow Eritrea to develop a sustainable sea cucumber fishery.

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