CHAPTER 6

SEA CUCUMBERS IN TANZANIA

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Introduction

Sea cucumbers constitute one of the important marine resources of Tanzania (Semesi *et al.* 1998) and there has been a rapid expansion of sea cucumber exploitation at some sites in Tanzania (Mgaya *et al.* 1999). The sea cucumber fishery developed without baseline biological data and without any monitoring. Therefore to-date, Tanzania has unknown and unquantified sea cucumber resources though the fishery provides income to local collectors and generates export earnings (Mmbaga and Mgaya 2004). The fishery is largely artisanal with a small commercial operation monopolised by a few exporters. Exploitation occurs year-round on reefs close to shore with collection peaking during periods of light winds and trips can be made to the outer reefs. The level of exploitation differs from shore to shore depending on fisher folk experience, number and category of fishers, fishing techniques and season. Sea cucumbers are purchased by a number of traders based in Dar es Salaam, Tanga and Zanzibar from where they are exported to eastern Asia mainly Hong Kong SAR (China) and Singapore (Unpublished data). The increase in export of beche-de-mer was observed from 1980s (< 200 mt per annum) to 1992 (617 mt); exports have continued to decline thereafter (Marshall *et al.* 2001). These authors report further that the number of official beche-de-mer exporters on the Tanzania mainland has decreased from 23 in 1993 to 8 in 1997 and that the exporters have largely halted exports as a result of the declining profits.

State of the Resource

A study by Mgaya *et al.* (1999) on sea cucumbers in Bagamoyo reported that local exploitation occurred year-round on reef flats close to the shore or sheltered from the prevailing winds and that the main collection seasons were October to December and April to May, when the winds were usually light, and trips could be made to the off-shore reefs. Collection methods in Bagamoyo included: (i) hand-picking either from the intertidal reef flats or by snorkel diving over sand and seagrass areas, (ii) collection by free diving, using both manufactured and home-made goggles and (iii) collection using SCUBA. The latter technique is becoming increasingly popular as shallow water areas are depleted and fishers move to deeper waters. Free-diving and the use of SCUBA equipment by fishermen who are not taught to SCUBA dive correctly place the lives of collectors at risk, and drownings have been reported in Tanzania (Mgaya *et al.* 1999). The use of SCUBA diving to collect even the deepest animals makes the species vulnerable to over-harvesting and can deplete breeding stocks causing recruitment overfishing.

Mmbaga (2002) conducted a survey on the number of fisher folks involved in the fishery, the time taken per trip and interviewed fishers on distances traveled at three beaches in Dar es Salaam, namely, Kunduchi, Mjimwema and Buyuni is shown in Table 6.1.

Table 6.1. Observations made from a survey carried out at three locations in Dar es Salaam involving sea cucumber fisher folk. H: = Hand; M: = Male; F: = Female; C: = Children.

Sites	Kunduchi	Mjimwema	Buyuni	Observations
Collection method	H	H	H	Common to all shores
No. of collectors	4-5	1	4	Some are opportunists
Category of people	M 4-5	1	3	Go far into deeper waters
	F 0	0	0	Not involved in fishing
	C 0	0	1	Collect in shallow water
Fishing vessel	3 boats	0	0	Boats are used for distant trips
	1 canoe	1	1	
Time taken per trip (hr)	7-9	4-5	3-4	Depends on the abundance of sea cucumbers at the fishing grounds
Middlemen	3	0	1	Some didn't like to be interviewed
Owner of vessels and gear	Middlemen	Fisher	Fisher	Insist on availability of high-grade species

From the data in Table 6.1 and field observations (Mmbaga 2002) the presence of boats was an indicator of the availability of high grade species as middlemen were ready to offer facilities and equipment to collectors, while the presence of children in the fishery indicated relatively easy availability of the sea cucumbers (in shallow water) although this also encouraged collection of under-sized sea cucumbers. The length of the trip also indicated availability with the longer trips indicating depletion of stocks in the shallow waters. Males between the ages of 31 – 50 years dominated (99%) the fishery and and 60% of the fishers were married. Only male fishers were reported to venture into deeper water and dive for larger animals (Mmbaga 2002). Women and children periodically glean the intertidal flats on foot (Marshall *et al.* 2001; Figure 6.1.)



Figure 6.1. Sea cucumber fishery activities in Tanzania: from collection, to boiling to drying.

Awareness about the fishery was low amongst fishers with most of the knowledge being derived from delears (84%) and the rest from the media (TV, newspapers and radio). This lack of awareness had an impact on livelihoods since fishers had little negotiating power - high value species such as *H. scabra* were sold at the same price as low value species to dealers. This was partly due to the low level of education amongst fishers, but higher level amongst dealers and traders who were educated up to secondary level. There was little awareness about the management issues of the fishery including over-collection and processing, although there was some awareness not to collect juveniles. The general lack of knowledge about fishing was blamed on the weakening of the traditional system of fisheries management during pre and post-colonial times (Mmbaga and Mgaya 2004).

Biology and Ecology

Very few studies have been carried out on the general biology of sea cucumbers in Tanzania. Mmbaga (2002) and Kithakeni and Ndaro (2002) conducted a study on some aspects of the biology of *H. scabra* along the coast of Dar es Salaam at Kunduchi, the most exploited shore, and Buyuni, a shore with no history of exploitation. The total catch of *H. scabra* at Buyuni was significantly higher throughout the study period compared to that from Kunduchi. The stomach contents revealed sand, small gastropods, detritus, debris of red algae and fresh pieces of polychaetes and unidentified animal parts mixed with sediments (Mmbaga, 2002). Studies of the gonads indicated that although reproduction was continuous throughout the year, gonad indices showed two peak periods, June to August and December to January.

No studies on the growth, larval ecology, recruitment, or mortality of any sea cucumber species has been conducted in Tanzania. However, using the length distribution for 240 specimens of *H. scabra* measured between January and December 1999, Kithakeni and Ndaro (2002) showed that the frequency distribution was unimodal, with most individuals ranging in length between 8.5 and 26.5 cm. The most frequent length category was 17.5 cm. The total catch consisted of individuals measuring between 7 and 27 cm. Mmbaga (2002) conducted multiple comparisons of size frequency distributions of *H. scabra* among stations and revealed significant differences ($p<0.001$). Kithakeni and Ndaro (2002) reported size at first maturity of *H. scabra* at Dar es Salaam coast as 16.8 cm.

Management and Legal Framework

The new Fisheries Act of 2003 and the Fisheries (General amendment) regulations of 1997 (under the old Fisheries Act of 1970) recognise three types of license fees paid annually by dealers and exporters of fisheries products. These include, (i) Local individuals or companies with approved shore-based fish processing facilities, (ii) Local–individuals or companies without approved shore-based fish processing facilities, and (iii) Foreigner–individuals or companies with approved shore-based fish processing facilities. Foreigner–individuals or companies without approved shore-based fish processing facilities are prohibited from getting a license. There is no specific legislation that exists in Tanzania that refers to sea cucumbers; consequently indicators of overexploitation are seen in many landing sites (Mgaya *et al.* 1999; Marshall *et al.* 2001; Mmbaga 2002). In addition, fisheries regulations vary between the mainland and Zanzibar; for example, a ban prohibiting sea cucumber fishing was implemented in September 2006 on mainland Tanzania but not on Zanzibar. The impacts of such regulations on the fishery are difficult to assess due to the lack of adequate monitoring of the catch during the period the ban is in force.

Sea cucumbers do not constitute part of the diet in Tanzania but are fished for sale to exporters. In some places e.g., in Songo Songo, divers collect sea cucumbers at a depth of about 18 m (Darwall 1996). Sea cucumbers are also collected on an opportunistics basis by fishers looking for other marine resources – there have been reports that trawlers also collect sea cucumbers (Mmbaga and Mgaya 2004). In a discussion with 72 traders Marshall *et al.* (2001) reported that daily catches of sea cucumbers varied between 5 and 50 specimens per fisher. In the Songo Songo archipelago the average catch rate per person per trip was 8.1 sea cucumbers, and on Mafia Island it was 3.7 per person (Darwall, 1996). The difference between the two areas was attributed to the size of the fishing areas.

Sea cucumber prices have fluctuated over time ranging from US$ 0.10 to 0.50 per fresh animal; processors sell the dried product to middle men for US$ 0.9 to 6.00 / kg, who in turn sell to exporters at US$ 3.00 to 17.00 / kg dry weight (Marshall *et al.* 2001). The export prices range from US$ 1.80 to 23.70 / kg dry weight (Mmbaga and Mgaya, 2004). Along this value chain among 28 interviewed dealers only 5 had a license that is not specific for sea cucumbers but specified sea products (pers.

obs.). Despite this information on the value of sea cucumbers, the level and potential contribution of sea cucumbers to the national economy as well as to the livelihoods of coastal communities, is not yet known due in part to a lack of comprehensive data on the extent of the sea cucumber fishery in Tanzania.

Depletion of sea cucumber resources was first reported at Songo Songo by Darwall (1996) as indicated by the harvest of juveniles. Other reported cases of depletion included Jiddawi (1997) in Zanzibar, Guard (1998) in Mtwara, Horsfall (1998) and Mgaya *et al.* (1999) in Bagamoyo, and Kithakeni and Ndaro (2002) at Kunduchi, Dar es Salaam. Interviews conducted by Mgaya *et al.* (1999) with sea cucumber collectors in Bagamoyo indicated that the stocks were declining and the average size of individuals was decreasing. Removal of large individuals may affect reproduction and lead to recruitment overfishing. Although the collectors recognize that part of the problem is the harvest of juveniles, due to lack of effective policing, they continue to collect juveniles as "others will do if they don't"—a typical tragedy of the commons scenario (Hardin 1968). Open access to unmanaged sea cucumber resources will definitely lead to depletion of the stock.

Importation statistics for sea cucumbers reported in Hong Kong during January–March 1996 showed that Tanzania ranked high in the Western Indian Ocean region (Table 6.2) – Tanzania produced up to 1644mt by the end of that year (Conand 2004). Although it is difficult to accurately estimate historical and current production of sea cucumbers in Tanzania the available data indicates a very serious decline in production in the last decade from >1500mt in 1994 to 10 mt in 2004 (Table 1.1). The number of exporters has also decreased over time from 23 to 8 on mainland Tanzania and 6 to 2 in Zanzibar between 1993 and 1997, an indication of the lowered profitability of the fishery (Marshall *et al.* 2001).

Table 6.2. Imports of sea cucumber in Hong Kong for the period January – March 1996 from selected Western Indian Ocean countries.

Country	Import Statistics (mt)	Value 1000 HK$
Tanzania	73.8	1,676
Madagascar	40.3	4,242
Kenya	7.4	250
South Africa	6.6	285
Mauritius	2.7	448
Mozambique	23	480

Source: Infofish Trade News 11/96, 17/6/96 (1996). Reported exports from Tanzania include those from the Mainland and Zanzibar.

Twenty species of sea cucumbers are harvested in Tanzania (Table 6.3); their distribution is described in Rowe and Richmond (2002). The importance and age of this fishery to the local coastal communities is indicated by the presence of at least 50 different Swahili names for different species (Marshall *et al.* 2001). A study conducted in Mafia Island from May to September 1998 revealed that *Actinopyga miliaris, Bohadschia argus, B. marmorata and Stichopus variegatus* occurred in the highest quantities in the trade while the most valuable species including *Holothuria scabra, H. nobilis, H. spinifera and Holothuria* sp. composed a very small percentage of the catch (Marshall *et al.* 2001). These results indicated that there has been a shift from the more highly valuable commercial species such as *H. scabra* and *H. nobilis* that previously dominated the catch (Marshall *et al.* 2001). The state of sea cucumber resources in Tanzania remains poorly documented and cross border transfers of beche-de-mer from Tanga to Vanga in Kenya and from Mozambique to Mtwara in Tanzania complicate the export statistics. The need for generating up-to-date information on the status of the resources cannot be overemphasized.

Table 6.3. Sea cucumber species traded in Tanzania. (Source Rowe and Richmond 2002; Marshall *et al.* 2001; Mmbaga and Mgaya 2004).

Scientific Name	Common Name	Local Name	Depth and Substrate Type
Actinopyga echinites	Deep water Redfish		Lower eulittoral, common on reef crests; rock, algae
A. mauritiana	Surf Redfish	Mbura-Khaki	Lower eulittoral and deeper; rock, coral
A. miliaris	Blackfish	Kijino	Shallow sublittoral
Bohadschia argus	Leopard Tigerfish	Barango	Shallow sublittoral; sand, seagrass, reef
B. marmorata			
Holothuria atra	Lollyfish/Blackfish	Pesa	Shallow sublittoral; sand
H. cinerascens			Shallow to deep water; sand, lagoons, rock
H. edulis	Pinkfish		Shallow; various substrate types
H. fuscogilva	White Teatfish	Pauni-nyeupe	
H. fuscopunctata	Elephant Trunkfish		
H. leucospilota		Sumu	
H. nobilis	Black Teatfish	Pauni-nyeusi/Chui	Shallow; Seagrass, coral
H. parva			Mid eulittoral; boulders, fine sand and mud
H. scabra	Sandfish	Jongoo mchanga	Lower eulittoral and deeper; sand
H. spinifera			
Pearsonothuria graeffei			Shallow; reefs, coral
Stichopus chloronotus			
S. herrmanni	Curryfish		Shallow; sand, coral
Thelenota ananas	Prickly Redfish	Spinyo mama	Shallow; reef, rubble
T. anax	Amberfish		Shallow; reef and on sand and rubble

The quality of beche-de-mer from Tanzania is also a cause for concern. Poor quality beche-de-mer from Tanzania has been reported in the international market (Ferdouse 2004) and this is reflected in the lower value of the product compared to other countries like Madagascar (Table 6.2). There are technological gaps in the various stages of processing including species-specific pre-treatments of fresh animals, processing environment, drying, packing, storage conditions and the generally poor hygienic and sanitary standards in all stages during the processing protocols. Poor processing leads to bacterial and fungal attack of the beche-de-mer, which gives the product a foul smell hence lowering its value. Marshall *et al.* (2001) reported that the worst quality beche-de-mer comes from southern Tanzania (Mtwara) and attributed this to poor preparation resulting from insufficient time spent on the process, or from efforts to increase weight with excess water, sand and gut content. The best quality beche-de-mer was reported from Mafia Island and Songo Songo.

With the increase in collection effort it is likely that the stocks of sea cucumbers will be even more seriously depleted over the next few years. Thus, the need for some form of management of the fisheries is obvious. The shape that this management will take, in a financially constrained country like Tanzania remains to be seen. Possible management approaches to ensure sustainable harvest include closed areas (reserves), closed seasons, quotas, gear restriction, and a legal size limit for collection. Since beche-de-mer from Tanzania is for export, monitoring of legal size limits can be done at the level of the middlemen, buyers and exporters. The biggest problem facing Tanzania, however, is not the development of appropriate legislation, but rather developing the capacity to enforce regulations initiated to protect the sea cucumber fishery. Legislation is useless without its three counterparts, political will, education and enforcement, but education and enforcement are expensive, hence casting a shadow of doubt on compliance by the fisher folk to existing regulations. It is hoped that the MASMA sea cucumber project will increase the knowledge required to improve the management of this fishery in Tanzania.

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