Traditional sea cucumber fisheries in southwest Madagascar: A case-study of two villages in 2002

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Introduction

The sea cucumber fishery has a long history in Madagascar and it is still very active in the south-western region of Toliara (Conand et al. 1997; Rasolofonirina and Conand 1998) (Fig. 1). Traditional fisheries in general represent a key source of income and food in this region, which is characterized by arid climatic conditions (restricting coastal vegetation to drought resistant species) and which limits agricultural production (Laroche and Ramananarivo 1995). The increasing human population size in the Toliara region (324% between 1975 and 1993 – Cooke et al. 2000) coupled with limited employment opportunities and low agricultural productivity, has resulted in five-fold increase in the number of fishers in the region in in a period of 17 years (DRH/FAO 1992). This increase has been due, in part, to the migration of traditionally farming and gathering ethnic groups (e.g. the Mahafaly, Andandroy and Mikea) to coastal areas in order to supplement their incomes and diets through fishing. The result has been an increase in fishing pressure on marine resources (including finfish, turtles, molluscs, crustaceans and sea cucumbers) leading to concerns about the majority of these fisheries' sustainability at present rates of exploitation.

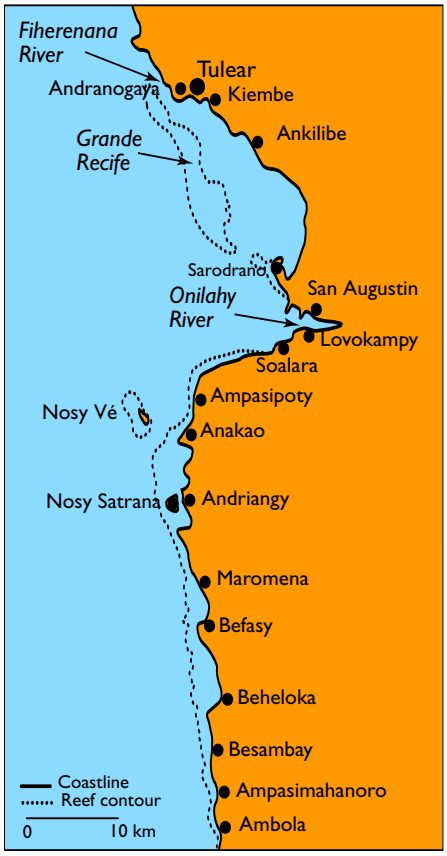

Figure 1. Southwest Madagascar with villages surveyed.

As part of a survey of intertidal and shallow subtidal collecting activities of two villages south of Tulear during May 2002, information regarding the collection, preparation and trade of sea cucumbers was obtained and is summarised here. Data were collected through direct observations and a series of questionnaire-based interviews with gleaners (inter/shallow subtidal collectors) (Fig. 2) and local authorities from two villages: Anakao, approximately 20 km south of Tulear (Fig. 1) and Ampasipoty, approximately 2 km north of Anakao. These villages were chosen because of their locations, being situated at either end of a large, shallow (<1 m deep at spring low tide), lagoonal area that is enclosed by a section of fringing reef approximately 500 m offshore. The area is known to be regularly used for collecting by residents of these two villages.

Species collected

Four species of sea cucumbers were identified as being collected by gleaners from the two villages surveyed (Table 1) (Conand 1999). All species were generally collected in water depths of less than 1 m, with fishing generally considered to be better after low tide due to increased sea cucumber activity at that period. All four species were typically found on sand patches, in seagrass beds, or in the rubble/debris areas near the backreef, but not on rocky substrates around small coral heads or in algal beds. *Holothuria scabra* was more often found in seagrass *Actinopyga miliaris* was more common in the debris zone near the backreef, and *H. nobilis* and *Stichopus hermanni* were found more on sand banks close to the spring low water mark. Gleaners stated that February and March were considered to be the best months for sea cucumber collecting as this marked the end of the reproductive season (January). This conflicts, however, with results ob-

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tained by Rasolofonirina and Conand (1998) during their study of sea cucumber fishing in two villages situated approximately 20 km north of Ampasipoty. Direct observation in those villages indicated that catches were highest from November to January in Ankiembe, and from April to June in Besakoa (Rasolofonirina and Conand 1998). However, February to March roughly correlates with the end of the annual period of high turbidity in the area studied here. This turbidity is due to increased outflow from the Onilahy River (Fig. 1) between November and December, following the rains inland. The turbidity reduces visibility and hampers gleaning in shallow waters. This could account for the differences between the villages studied here and those studied by Rasolofonirina and Conand (1998), with the latter villages fishing on reefs farther offshore and, therefore, potentially less impacted by sediment from river outflow.

Figure 2. Sea cucumber gleaners

Table 1. List of sea cucumber species collected by gleaners in the villages of Anakao and Ampasipoty with local names and minimum dry lengths purchased by village collectors.

Scientific name	Local name	Minimum dry length for sale
Actinopyga miliaris	stylo or kalalijaky	15 cm (12 cm on occasions)
Holothuria nobilis	fotsytretrake	not available
Holothuria scabra	zanga foty	4 cm
Stichopus hermanni	tracteur or jijaty	8 cm

Sea cucumbers collected typically ranged between 6 cm and 20 cm wet length. Lengths of dried sea cucumbers varied by species, with dry *H. scabra* ranging from 4–21 cm but with 80 per cent of individuals under 12 cm in length. *S. hermanni* individuals were typically around 8 cm in length; larger individuals are rare and smaller individuals are not purchased by village buyers. Similarly, the minimum dry length accepted for *A. miliaris* was 15 cm (although individuals as small as 12 cm were accepted in some circumstances). No information was available for dry *H. nobilis*.

Preparation and drying

The gutting of sea cucumbers prior to boiling and drying varies with species. *H. nobilis* and *A. miliaris* individuals are cut along the whole length while *H. scabra* and *S. hermanni* individuals are only cut in the centre. In the case of *H. nobilis*, this is to ensure that individuals dry more quickly to prevent spoiling. *S. hermanni* individuals are gutted immediately after capture as otherwise they will deform and spoil.

After gutting, the sea cucumbers are processed and dried. The processing begins with boiling in seawater until the sea cucumbers take on a rubber-like consistency. The boiled individuals are then buried under 10–20 cm of sand for 24 hours before being scraped with a knife to remove the skin. They are then boiled again in fresh water with salt added. The final stage involves leaving the skinned, twice boiled sea cucumbers to dry in the sun on wooden planks until completely ready for sale. Gleaners stated that sea cucumbers are harder to prepare between November and January, this being attributed to the reproductive season in January. From February–March, sea cucumbers become less fragile and easier to process again.

Sale and trade

Prices paid to the gleaners vary by species, but the average price paid by the collectors in the villages is between USD 5.20 and USD 6.00 kg^{-1} of dry sea cucumber. The most valuable species is *H. scabra*, which sells for USD 9.00 kg^{-1} (dry weight), followed by *H. nobilis*. *S. hermanni*, which ranks third in terms of value, sells for USD 3.75–4.50 kg^{-1} (dry weight) while *A. miliaris* is the lowest valued species.

After being purchased from the gleaners, the sea cucumbers are sold to three collectors based in Toliara (the administrative capital of the region and one of the largest cities in Madagascar). These collectors visit Anakao on a weekly basis to purchase sea cucumbers from the two village collectors there (one

collects from Anakao Bas, which is inhabited by members of the Vezo tribe, and the other from Anakao Haut, which is inhabited by members of the Tanalana tribe). The village collector for Ampasipoty, however, usually travels to Toliara twice a month to sell the accumulated sea cucumbers. The prices paid by the Toliara collectors again varies and ranges between USD 3.00 and USD 11.00 kg^{-1} (dry weight), depending on species and quality, although good quality *H. scabra* can fetch up to USD 15.00 kg^{-1} (dry weight). From Toliara, the sea cucumbers are then transported to the capital, Antananarivo, where they are sold to exporters to Asian markets. No figures were obtained regarding the prices paid to the Toliara collectors by the exporters as they were unwilling to divulge the information. However, it was discovered that due to their low quality, dry *A. miliaris* are usually only bought by the exporters every two to three months to supplement the total weight and complete shipments for export.

Socioeconomic importance of sea cucumber collecting

In total, 57 individuals were interviewed during the study to determine the importance of gleaning to the villages surveyed: 26 from Ampasipoty (10 men and 16 women) and 31 from Anakao (5 men and 25 women), including 2 collectors.

In Ampasipoty, gleaning was named as the primary activity for 100 per cent of women, and for children under 10 years of age. Of the men, 60 per cent gleaned and/or fished with nets as a primary activity, while the remaining men relied on spearfishing or hook-and-line fishing as their primary activity, with gleaning or raising livestock (cattle or goats) as a secondary activity. Gleaning at night was also important, with 95 per cent of villagers gleaning during the night tides. In Anakao, these figures were reduced, with only 60 per cent of households relying on gleaning as their principal activity, with others relying on other forms of fishing, running village stores or raising livestock, with gleaning a secondary source of food/income.

Only a few gleaners limit their activity to sea cucumbers. Most gleaners also collect fish and a variety of invertebrate species including molluscs, bivalves, echinoids and crustaceans for subsistence, or limited local sale. Generally, fish are collected by men while women tend to focus on collecting invertebrates, including sea cucumbers. The estimated value of sea cucumber for the families involved was USD 15.00–30.00 $family^{-1}$ $week^{-1}$. This equates to 2.5–5.7 kg of dry sea cucumber $family^{-1}$ $week^{-1}$ (based on the average prices detailed above) or roughly 7.5–17.1 kg of wet sea cucumber (based on the rough wet-dry conversion of 3:1 given by the gleaners). On a monthly basis, this gives an estimated income of USD 30–60 for families collecting sea cucumbers as gleaning is typically restricted to 8–12 days per month during spring low tides (with the exception of tides between 16:00 and 20:00 when no gleaning takes place).

This average income from collecting sea cucumbers compares favourably with other livelihoods. Gleaners collecting *Euchema* sp., which they sell to a processing company based in Toliara, earn USD 18–22 $week^{-1}$ or USD 37–44 $month^{-1}$, and the estimated average income for the region is USD 41 $month^{-1}$. This has, as a result, led to an increase in the number of people collecting sea cucumbers according to the village leaders. The population of Ampasipoty has increased due to people moving to the village to collect sea cucumbers, and traditional farmer/gatherer Tanalana villagers from Anakao Haut also now glean due to the good revenues to be gained from sea cucumber collecting. (Fishing began amongst the Tanalana in 1986 when a drought led to poor harvests but the low income they were able to earn from fishing led them to continue with their traditional activities.)

Discussion and conclusions

This study demonstrates the socioeconomic importance of sea cucumber collecting in the two villages investigated; sea cucumber collecting provides the primary source of income for significant proportions of both populations. Unfortunately, due to the small number of collectors, their demographics could not be compared with results obtained by Rasolofonirina and Conand (1998). However, figures for Ampasipoty and anecdotal observations suggest that sea cucumber collecting is predominantly an activity undertaken by women and children, as was the case for Ankiembe in the 1998 study. This predominance of women and children in Anakao and Ampasipoty is probably due to the proximity of the collecting areas to the villages, and their accessibility from the shore, eliminating the need for boats and therefore for men to drive them. This thereby frees the men to participate in other fisheries that require boats, such as spearfishing, netting, and line fishing for larger reef fish, turtles and sharks. To this extent at least, the villages surveyed in this study are likely to be representative of a number of the villages south of Soalara (Fig. 1), where the fringing reef lies close to shore and shallow lagoonal environments offer good collecting areas. This would seem to be supported by comments by the village collector from Anakao Haut, who stated that he also purchased sea cucumbers from Maromena, Befasy and Beheloka to the south of Anakao (Fig. 1), with estimates of up to 100 kg of dried sea cucumbers per week being collected for

the four villages combined. This amount of 100 kg per week does not seem unfeasible considering catches of up to 18 kg family^{-1} are claimed for a single tide during daylight hours, and up to 25 kg family^{-1} at night. However, the few records of individual catches seem to indicate individual daily catches only in the range of 1–8 kg (average = 3.5 kg, n = 10). These figures compare well with those of 1.7–9.8 (mean = 4.86) and 1.7–11.8 (mean = 5.43) kg fisher^{-1} day^{-1} reported for the two villages studied by Rasolofonirina and Conand (1998).

Based on the estimated average monthly earnings, between 1500 and 3500 kg of dry sea cucumber may be collected annually by the 26 families in Ampasipoty. This again is similar to the figures for Ankiembe and Besakoa (Fig. 1) reported by Rasolofonirina and Conand (1998). Converting mean monthly wet catch weight figures reported for these villages to dry weight (using Conand and Byrne's 1993 estimate of a 10-fold weight loss during drying) gives estimates of 1100 and 2128 kg of dry sea cucumber per year for Ankiembe and Besakoa, respectively. However, anecdotal reports from the gleaners in the two villages suggest that these catch rates are unsustainable, as both overall catch and individual sizes of sea cucumbers collected are declining each year. The gleaners involved attribute this decline in part to the increasing numbers of people moving to coastal areas to harvest easily exploitable, high value products such as sea cucumbers.

These indications of declines in the fishery support concerns raised previously regarding the sustainability of current exploitation levels of sea cucumbers in Madagascar, with reports that fishing on foot is in decline and that scuba divers collecting sea cucumbers are noticing that it is harder to find sea cucumbers (Conand et al. 1997). At present, exploitation in the two villages surveyed is restricted to collecting on foot, which limits the area fished to lagoonal and shallow reef areas; the accessibility of these fishing areas and the period of collecting also restricted to approximately 2.5 hours each spring low tide. However, as catches decline, prices are likely to increase, as has been observed in traditional fisheries supplying export trades in other parts of the world, maintaining the incentive to collect sea cucumbers for those that depend on the fishery for their primary source of income. This could lead to increased collection of sea cucumbers in deeper waters outside intertidal areas and put more pressure on sea cucumber populations in the region, further jeopardising this potentially already declining fishery.

In response to the threats facing sea cucumber populations in the Toliara region, a sea cucumber hatchery and mariculture project started in Tulear in 1999 (Jangoux et al. 2001). The goal was to breed and grow-out juveniles of commercially important species for restocking fished areas and reducing fishing pressure on wild populations. However, at the time of this study, this goal has not yet been attained. Therefore, while more in-depth work is required to evaluate the status and exploitation levels of sea cucumber stocks, it is clear that some form of education and interim management at the village level is required to ensure the long-term future of this important source of income.

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