The sea cucumber fishery in Semporna, Sabah, Malaysia

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Introduction

Fishing for sea cucumbers, pearl shells, abalone and other marine products in Southeast Asia dates back many centuries ago. Trepang (dried, processed sea cucumber) was an important trade item in the 1700s and was exported to China together with turtle and pearl shells (Butcher 2004). Coastal communities in Southeast Asia have a long history of fishing for sea cucumbers.

Butcher (2004) provided descriptions of the fishery in this region during the 1600s to 1800s. In Sulawesi, fishers located sea cucumbers in shallow waters by feeling them with their feet, but collected samples from deeper waters by diving. In the Kangean Islands, women collected sea cucumbers by hand in shallow waters while men collected them from deeper waters by lowering a weighted, three-pronged spear. In the 1800s, the Sultan from Sulu employed the Bajau Samal Laut people and slaves to collect marine products. As demand for these marine products grew in China, the Sultan and his chiefs encouraged the Iranun and the Balangingi Samal to capture people to provide the necessary labour to procure these products. People from the islands and those from the Malay Peninsula were captured and forced to work as slaves for the Sulu Sultanate. At the height of the pearl shell and trepang trade in the 1830s, as many as 68,000 people were engaged each year in collecting marine products (Butcher 2004).

In present day Malaysia, sea cucumber landings are relatively insignificant in comparison to fish and prawn catches that average approximately a million tonnes a year. Almost all commercial sea cucumber landings are from the state of Sabah in East Malaysia, and catches are landed mostly by artisanal fishers. In 2005, 139 t of sea cucumbers were landed in Sabah (Annual Fisheries Statistics, Sabah, 2000–2005).

This study describes the sea cucumber fishery in Semporna, Sabah and examines the size and sustainability of the fishery. Information on fishing methods, time of fishing, species and amount caught, earnings derived from the fishery, and downstream activities were documented. Information was gathered through 1) interviews using a structured questionnaire, 2) informal observations in the fishing villages visited, and 3) conversations with fishers. In total, 51 fishers were interviewed.

Several sites in Semporna were visited (Fig. 1), including Kampung Balembang, Kampung Berjasa, Kampung Sejati, Pulau Denawan, Pulau Kulapuan, Pulau Nusa Tengah and Pulau Omadal.

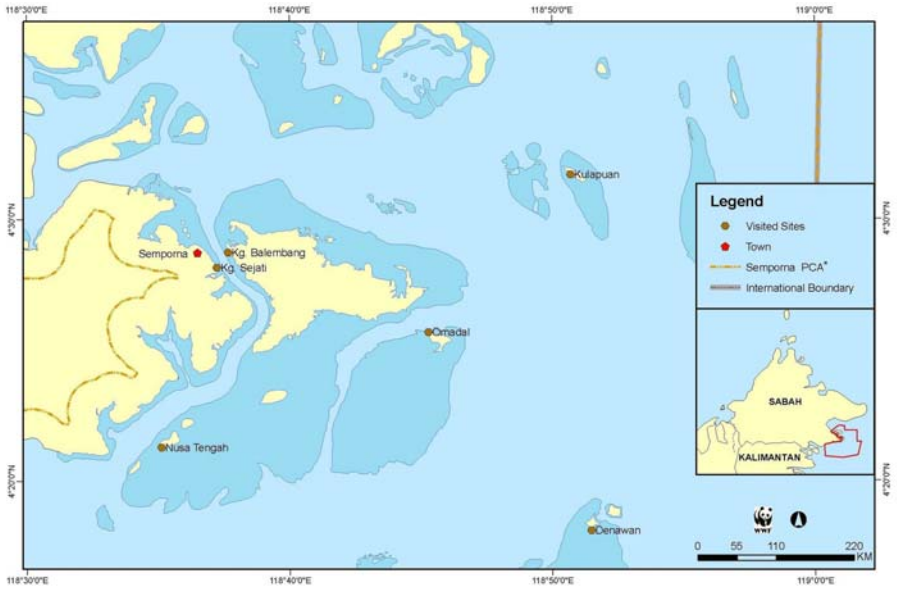

Figure 1.

Study area, showing places visited during the survey of fishers involved in abalone and sea cucumber fishing (Map© WWF Malaysia).

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Findings

The gender of sea cucumber fishers

Fishers who collect sea cucumbers in Semporna belong to either the Bajau Tempatan or Bajau Laut communities. Most of the fishers are men who mainly fish at night either alone, with friends or with family members (usually their sons). A small number of fishers in Denawan and Nusa Tengah fish with their wives and daughters. In areas where sea cucumbers are still found on shallow reef flats (e.g. Nusa Tengah), women and children frequently glean for sea cucumbers during low tide.

Species targeted

There are no regulations regarding the size of fresh sea cucumbers that can be fished as well as the processed sea cucumbers that are allowed to be sold locally. Fishers normally target both abalone and sea cucumbers. All respondents from Kampung Balembang (five) and Pulau Kulapuan (six) reported targeting both abalone and sea cucumbers. In Pulau Denawan, 92% of fishers targeted both abalone and sea cucumbers, with two fishers or 8% fishing only for sea cucumbers. In Pulau Omadal, six out of seven fishers (or 86%) fished for abalone and sea cucumbers, with only one fisher fishing for sea cucumbers. In Nusa Tengah, six out of seven fishers fished for both abalone and sea cucumbers, with one fisher fishing for only sea cucumbers. Table 1 shows the number of respondents from the various localities and the number who fished for both abalone and sea cucumbers.

Table 1. Number of respondents from various locales in Semporna and the number of fishers from each locality who fished for both abalone and sea cucumbers.

Location	No. of respondents	No. and percentage of fishers who fished for both abalone and sea cucumbers
Kampung Balembang	5	5 (100%)
Kampung Berjasa	0	0 (0%)
Kampung Sejati	1	0 (0%)
Pulau Denawan	25	23 (92%)
Pulau Kulapuan	6	6 (100%)
Pulau Nusa Tengah	7	6 (86%)
Pulau Omadal	7	6 (86%)
Total	51	46 (90%)

The most abundant species of sea cucumbers landed include: *Stichopus herrmanni* (curryfish), *Holothuria coluber* (snakefish), *Actinopyga lecanora* (stonefish) and *Actinopyga echinites* (deep-water redfish) (Fig. 2). Species frequently sold to processors in the wet market in Semporna include: *Stichopus herrmanni* (curryfish), *Bohadschia vitiensis* (brown sandfish), *Bohadschia* sp., *Bohadschia argus* (tigerfish), *Holothuria coluber* (snakefish) and *Actinopyga echinites* (deep-water redfish). *Holothuria whitmaei* (black teatfish) and *Holothuria scabra* (sandfish), both high-value species, are still occasionally caught in waters off Semporna (Fig. 3) but were rare and both species could be overfished. In the early 2000s, sea cucumber landings from Semporna comprised an estimated 50% of the total landings from Sabah (Annual Fisheries Statistics, Sabah, 2000–2005).

Sea cucumber fishing grounds

Due to decades of overfishing, fishers are no longer able to find enough sea cucumbers in areas close to their village and so need to scour the islands to sustain their livelihood. Information gathered for this study shows that fishers from different villages

Table 2. Scientific, English common names and local names of sea cucumbers collected in Semporna, Sabah.

Scientific name	Common name	Local name
Actinopyga echinites	Deep-water redfish	Brown beauty
Actinopyga lecanora	Stonefish	*Boli-boli*
Bohadschia argus	Tigerfish/Leopardfish	*Kulirau*
Bohadschia sp.	-	*Tadik*
Bohadschia vitiensis	Brown sandfish	Mother *tadik*
Holothuria coluber	Snakefish	*Sumping*
Holothuria edulis	Pinkfish	*Merah perut*
Holothuria fuscopunctata	Elephant trunkfish	*Gajah*
Holothuria whitmaei	Black teatfish	*Susu*
Holothuria scabra	Sandfish	*Putian*
Stichopus herrmanni	Curryfish	*Gamat*
Thelenota ananas	Prickly redfish	*Talipan, Lipan*

Figure 2. Sea cucumbers landed in Kampung Balembang: *Actinopyga lecanora* (stonefish) (bottom center); *Actinopyga echinites* (deep-water redfish) (left); *Stichopus herrmanni* (curryfish) (top center); *Holothuria coluber* (snakefish) (top right) (photo © Choo P.S.).

Figure 3. Fisher holding *Holothuria scabra* (sandfish) caught in Semporna waters (photo © Choo P.S.).

fished in overlapping grounds. Table 3 shows the areas where fishers from various villages frequently fished. Those interviewed from Kampung Sejati are mainly processors and traders and most of them obtain their sea cucumber supplies from other fishers, with a couple of fishers engaged in part-time fishing on an irregular basis.

Table 3. Fishing grounds for sea cucumbers in various localities in Semporna, Malaysia.

Fishers' village	Fishing grounds
Kampung Balembang	Boheyan, Omadal and Menampilik
Denawan	Denawan, Ligitan, Mabul, Buasan
Kulapuan	Mantabuan, Denawan, Boheyan, Omadal, Timbun Mata
Nusa Tengah	Nusa Tengah, Menampilik
Omadal	Balimbang, Omadal, Mabul, Ligitan, Kapalai, Tawau

Fishing methods

Due to almost two decades of intense fishing in shallow reef areas, gleaning for sea cucumbers is becoming increasingly difficult. In Balembang, 2 out of 5 fishers (or 40%) gleaned, in Denawan, 3 out of 25 of fishers (or 12%) gleaned, in Kulapuan, 2 out of 6 (or 33%) gleaned, and in Omadal 2 out of 7 (or 29%) gleaned. In Nusa Tengah, however, 6 out of the 7 fishers still gleaned for sea cucumbers. Most fishers free-dived at night with a small percentage using compressors, fins and goggles.

Processing

This study found that a considerable number of fishers sold sea cucumbers in processed or semi-processed form. In Pulau Denawan, 80% of fishers sold sea cucumbers in either semi-processed or processed form; in Omadal, 71%; in Nusa Tengah, 70%; in Kampung Balembang, 33%; and in Pulau Kulapuan, 22%. In the Bajau Laut community, both men and women are actively involved in processing sea cucumbers. Women in the more remote Bajau Laut communities participate in many livelihood activities, including fishing and processing (Fig. 4).

Small-scale processors *cum* traders were mainly in Kampung Sejati in Semporna town. They obtained their sea cucumber supplies from Bajau Laut or Suluk fishers in Semporna as well as fishers from the Philippines and Indonesia. Some of the sea cucumbers obtained from fishers were semi-processed but most were brought in fresh to the processors from the previous night's fishing. Monthly earnings of processors *cum* traders were significantly higher than that of fishers.

Earnings

Sea cucumber fishers consistently reported low monthly earnings. Of the 48 respondents who reported on their monthly income, only 5 registered monthly earnings of USD 330 or more.[2] Fishers night fishing with compressors, hook fishing and diving with accessories such as goggles and fins earned more than gleaners whose monthly incomes ranged from less than USD 33–231. Taking into account that Sabah's household poverty level income for a family of 5 is USD 317, about 90% of those surveyed lived below the poverty line.

The average monthly income of processors *cum* traders was documented from only one respondent and appeared to be significantly higher than the income from fishers. An interviewee involved only in processing and trading reported a monthly income of USD 990 from the sale of sea cucumbers. Apart from selling sea cucumbers, most processors *cum* traders also traded in other marine products, including dried molluscs and fish as well as tapioca dough. Some of them were also part-time fishers, fishing two to three times a month.

Sea cucumber prices

Generally, prices of sea cucumbers per kilogram of dry or wet weight quoted by fishers varied, and prices of trepang (processed sea cucumber) quoted by them were well below the market price quoted in the Tawau market.[3] For example, dried tigerfish was quoted by fishers in Semporna to be around USD 18–30 kg^{-1} whereas in Tawau, the better quality ones were quoted at USD 192 kg^{-1}. One explanation is that sea cucumbers processed by fishers or small backyard processors are not very dry (still containing 20–30% water content) and were only semi-processed; therefore, they fetched lower prices. Fishers gave the impression that they were not aware of the global market prices for trepang. Fishers have no control over the price of sea cucumbers and trepang, and accepted whatever price paid to them by processors; as as one processor said, "the fishers needed instant cash". Table 4 shows the prices reported by fishers for their catch (wet weight) and their processed trepang (still with at least 20–30% water content).

A small-scale processor from Semporna town reportedly paid below-normal prices to fishers for different species of sea cucumbers (according to size, which determines the grade: XL, L, M, S):

- *Actinopyga lecanora* (wet): USD 6.60 kg^{-1}
- *Bohadschia* sp. (9–10 cm in size, wet): USD 1.00 kg^{-1}
- *Holothuria whitmaei* (wet): USD 16.50 kg^{-1}
- *Actinopyga echinites* (wet): USD 2.65–3.00 kg^{-1}
- *Holothuria coluber* (wet): USD 2.00–2.65 kg^{-1}

Figure 4. Fishers in Nusa Tengah; both women and men participated actively in our interviews (photo © Choo P.S.)

Table 4. Prices of sea cucumbers (wet and semi-dry) quoted by fishers in Semporna.

Scientific name (English common name and local name)	Price USD kg^{-1} (wet)	Price USD kg^{-1} (dry)
Actinopyga echinites (deep-water redfish, brown beauty)	2.60–3.00	8.30
Actinopyga lecanora (stonefish, *boli-boli*)	10–20	50–53
Bohadschia argus (tigerfish or leopardfish, *kulirau*)	8.30	18-30
Bohadschia vitiensis (brown sandfish, mother *tadik*)	2.60	10
Bohadschia sp. (*tadik*)	3.30	6.60–13.20
Holothuria coluber (snakefish, *sumping*)	2–4	15–16.50
Holothuria edulis (pinkfish, *merah perut*)	1.60–4.95	11.60
Holothuria fuscopunctata (elephant trunkfish, *gajah*)	3.30	8.30
Holothuria scabra (sandfish, *putian*)	10	92.50
Holothuria whitmaei (black teatfish, *susu*)	26.50	99
Stichopus herrmanni (curryfish, *gamat*)	5–10	46
Thelenota ananas (prickly redfish, *talipan*)	13	73

[1] Note from the Editor. All values have been converted from Malaysian ringgits (MYR) to US dollars (USD). 1 USD = 3.02600 MYR (as of February 2012)

[2] Tawau is a bigger city that is about one hour's drive by car from Semporna.

In the Semporna wet market, sandfish are not sold because they are rarely caught. Brown beauty (*Actinopyga echinites*), which is commonly caught in Semporna, is sold to traders in Tawau who then export them to Hong Kong, where they are re-exported to China. Common species of sea cucumber sold in Semporna include *Bohadschia* sp., *B. argus, Thelenota ananas*, *Actinopyga lecanora* and *A. echinites*. Processed sea cucumbers are sold in the Semporna market for the following prices:

- *Holothuria whitmaei* (5–6 pieces kg^{-1}): USD 115 kg^{-1}
- *Actinopyga echinites*: USD 8.25 kg^{-1};
- *Bohadschia* sp. (100–150 pieces kg^{-1}): USD 33 kg^{-1}
- *Holothuria coluber:* USD 5.00 kg^{-1}
- *Thelenota ananas* (6 pieces kg^{-1}): USD 66 kg^{-1}

Large sandfish are not sold in the Tawau market, and small-sized sandfish are imported from Indonesia. Trepang are also sold vacuum-packed. Prices of trepang in the Tawau market and marine products specialty shops are:

- *Holothuria whitmaei* (2–3 pieces kg^{-1}): USD 413 kg^{-1}
- *Holothuria scabra* (60–65 pieces kg^{-1}, from Indonesia): USD 132 kg^{-1}
- *Thelenota ananas* (6 pieces kg^{-1}): USD 73 kg^{-1};
- *Bohadschia argus* (13 pieces kg^{-1}): USD 192 kg^{-1}

Changes in sea cucumber landings

Overall, fishers seem to agree that sea cucumber landings have decreased over the last 10 years . In Kampung Sejati, all five respondents agreed that landings have decreased. In Denawan and Omadal, 88% and 86% (respectively) agreed that there was a decrease in catch over the last 10 years. In Kulapuan, Kampung Balembang and Nusa Tengah, 67%, 50% and 50% (respectively) thought that catches had dropped. In view of the fact that wild-caught fisheries have declined, most fishers showed interest in sea cucumber farming.

Regulating sea cucumber fisheries

Fishers were equally divided on whether sea cucumber fisheries should be regulated. More fishers favoured imposing a minimum size limit on fresh individuals of sea cucumbers than imposing a closed season. Table 5 shows feedback from fishers on whether sea cucumber fisheries should be regulated.

Processing sea cucumbers

There are some small variations in the methods of preparing dried, processed sea cucumbers. One method involves the following steps.

Fresh sea cucumbers are placed in boiling freshwater and boiled for one hour. Sea cucumbers with hard skins (such as *Bohadschia* sp. and *Bohadschia argus*) are then placed in a basin where slices of unripe papaya are added to soften the skins. The boiled sea cucumbers, together with the sliced papaya, are stirred with a wooden pole for 30 minutes to an hour and kept overnight. They are boiled a second time the following day for another 30 minutes. The sea cucumbers are cooled to room temperature and fishers then rub them with hands to remove the hard skin. Any remaining hard skin from sea cucumbers is gently brushed off with a plastic brush and the sea cucumbers are taken out to dry in the sun for two to three days.

Discussion

Sea cucumbers in Semporna appear to be heavily fished. In general, fishers have moved away from gleaning to free-diving at night (in some cases using compressors), which indicates that overfishing is occurring on the shallow reef flats. The sea cucumber fishery in Semporna has also followed the boom-and-bust trend observed in neighbouring countries, and species that are of high value (such as *Holothuria whitmaei* and *Holothuria scabra*) and were abundant in the 1980s and mid-1990s are now rare, while medium- and low-value species that were not fished before are now being harvested. *Actinopyga echinites* and *Bohadschia* sp. are caught in greater abundance as compared with other species.

There are no regulations that prevent the overfishing of sea cucumbers. Regulations governing

Table 5. Responses by fishers on whether sea cucumber fisheries should be regulated.

Locality	Regulation (No)	Regulation (Yes)	Comments
Kampung Balembang	4	2	1 fisher suggested imposing a minimum size limit on fresh individuals, and 1 person suggested a closed season.
Denawan	10	13	12 fishers suggested implementing a minimum size limit on fresh individuals, and 1 person suggested implementing a closed season.
Kulapuan	2	4	3 fishers suggested implementing a minimum size limit on fresh individuals, and 1 fisher suggested a minimum size limit as well as a closed season.
Nusa Tengah	7	3	3 fishers suggested imposing a minimum size limit on fresh individuals.
Omadal	3	4	4 fishers suggested imposing a minimum size limit on fresh individuals.
Kampung Sejati	3	2	1 fisher suggested imposing a minimum size limit on fresh individuals, and 1 fisher suggested a minimum size limit as well as a closed season.

a minimum size limit on fresh individuals and a closed season should be given high priority to prevent a collapse of the fishery. We should learn from other countries such as India, which has banned sea cucumber fishing and serving sea cucumbers in restaurants (Varma 2010), and from the Pacific Islands region where moratoriums on fishing, closed seasons and minimum size for harvesting are often used to regulate the fishery (Kinch et al. 2008).

The processing of sea cucumbers by small-time processors needs to be improved to enhance the quality and value. Fishers should have access to bank loans that would help them acquire processing tools (such as drums and drying racks), and training to process their catch and to enhance their earnings. Fishers say they need instant cash for their catch because many of them earn incomes below Sabah's poverty line of USD 320 per month per household.

Prices of wet and dry sea cucumbers quoted by fishers during the interview are inconsistent and varied significantly among fishers. At times, it was difficult to find out the actual price they received from processors. During field visits, a few sale transactions were observed between processors and fishers, and these figures were more reliable than those quoted by fishers during interviews.

It is generally believed that fishers received the least profit in the supply chain from the sale of freshly harvested products. The dry weight of most properly processed sea cucumber is 5–12% of the wet weight (Choo 2008). Price of processed sea cucumbers quoted by small-scale processors is generally 10 times the price they paid for the wet product. However, most processors in Semporna did not dry the sea cucumbers thoroughly and even if they sell their products 10 times higher than the price they pay for the sea cucumbers, they would have made substantial profits. Traders in Tawau were seen to label their products at very high prices, in some cases almost 20 times the price of the wet weight. For example, *Holothuria whitmaei* (black teatfish) is sold in one shop at USD 413 kg^{-1} when the wet weight paid to fishers is about USD 16.50 kg^{-1}.

The Bajau communities (including the Bajau Laut and Bajau Tempatan) are among the poorest of the poor in Sabah and are solely dependent on sea cucumber (and abalone) fishing for their livelihood. Providing Bajau communities with training and financial resources to initiate sea cucumber farming will be beneficial and will help them to earn a supplementary income.

Conclusion

The government should take immediate steps to address the issue of the fast-depleting sea cucumber resource. Regulating the fisheries by imposing a minimum size for harvest could be a first step and, if necessary, could be supported by closed seasons. Steps should be taken to aggregate juveniles and adults of highly threatened species in pens located in areas where collection is banned (such as marine parks) so as to enhance recruitment and restore the sea cucumber population.

Fishers should be frequently informed of the global market price for the various commercial species of sea cucumbers so that they are aware if processors underpay them. Fishers and processors should be provided with resources and training on correct processing methods so as to help them add value to their products. Coastal communities in Semporna appear to be interested in sea cucumber farming and should be given an opportunity to secure an alternative livelihood.

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