EIGHTEEN SEA CUCUMBER SPECIES FISHED IN KARIMUNJAWA ISLANDS, JAVA SEA

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ABSTRACT

Indonesia has been supplying the highest diversity of dried sea cucumbers (trepang) to world markets for decades even though species validation on the trepang from any producing areas throughout the country is still needed. Karimunjawa (Islands off north coast of Java) is one of trepang habitats. Several visits from May to November 2009 had been made to collect trepang from the fishers and collectors in that area. Eighteen aspidochirote species were identified, more varied than those reported in 1988 and 1992 although 7 species have no longer been found. Three species among those: *Actinopyga banwarthi*, *Bohadschia subrubra,* and *Holothuria fuscocinerea* have never been reported in Indonesia before, neither on the list of commercial sea cucumbers in Asia nor world trade provided by Choo (2008) and Toral-Grande (2007). These species composition shifts may indicate a threat to species diversity, starting with excessive removal of natural stock. Up to now, 28 species of trepang have been recognized from Karimunjawa waters.

Keywords: Trepang, Aspidochirotes, Karimunjawa

INTRODUCTION

Choo (2008) successfully collects many sources on trepang industries in Asia, and ends up with identifies 35 species of trepang originating from Indonesia. From that list, Indonesia produces more species compare to other countries in Asia, Central Pacific, Indian Ocean and Africa (Choo, 2008; Kinch *et al.*, 2008; Massin *et al.*, 1999). The word trepang in this report only refers to sea cucumbers in trade.

The Food and Agriculture Organisation of the United Nations (FAO), due to the high intensity of world exploitation on holothurians, has identified problems faced concerning trepang trade regulation. Main aspects which should be solved are species identification, origin, and the stock potential of each producer countries (Bruckner *et al.*, 2003; Kinch *et al.*, 2008; Massin *et al.*, 1999).

The FAO recommends that each producer country should have a species list of commercial sea cucumber species as an entry point of managing the resources. Trepang in trade is mostly in dry form, making species recognition difficult due to processing procedures which results in alteration in color and shape, and broken spicules (Uthicke *et al.*, 2009). Indonesia faces more difficulties due to the large areas to be covered and varied fishing practices among communities.

In general, two types of sea cucumber fishing occur in Indonesia: short distance fishing, in which the fishers collect holothurians from nearby waters, and long distance fishing which may take weeks or months of sailing. In the second fishing type, the fresh collected sea cucumbers must be processed during the journey, otherwise it will be decomposed. It is possible that the harvest is landed in any place a long the way. In addition, competition among fishers makes each fishing group unwilling to speak about their fishing

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areas. As a consequence, determining the origin and local potential of sea cucumbers fished are not simple. This kind of fishing has been popular among people of Madura, Makassar, Bugis, dan Buton (Dwyer, 2000; Fox, 2000; Macknight, 1976; Stacey, 1999; Gimin *et al.*, 2005; Nuraini *et al.*, 1990).

Collecting sea cucumbers in a day trip is commonly conducted in nearby waters, during low tide in the evening. Using canoes, the fishers approach the areas where holothurians dwell. Commonly, the harvest is sold to local collectors who process the trepang afterward. This type of fishing occurs in Tukang Besi Islands (More, 1998), Seram, Maluku (Yusron, 2001), and Karimunjawa (Wagiyo *et al.*, 1999; Nuraini and Wahyuni, 1989). From this type of fishing, determining the origin and local potential of the resources become easier.

Considering the vast area of Indonesian waters, it is possible to have different trepang species composition among areas, as well as local names of each species. In several national publications, local names are used instead of scientific names as in Andamari *et al.* (1989), Hartati *et al.* (2002), and Nuraini & Wahyuni (1989). In Purwati (2005), it is explained that a scientific name of particular species can be subjected to different local names, or the other way around. This brings ambiguity, moreover if the authors refer more to local names rather than the scientific one.

This paper is results of species identification on sea cucumbers fished in Karimunjawa Islands. The present harvested species composition may demonstrate not only the trends of market demand, but also threats to particular species.

MATERIALS AND METHODS

The Karimunjawa Islands (5°42'–6°00' S, 110°07'–110°37' E), located in north of Semarang, cover 110.117,3 hectares, with 27 small islands. Even though most of the area has been under the National Park (Taman Nasional) authority since 2001, this does not prevent local fishers to collect sea cucumbers.

Fresh holothurians for identification and their local names were provided from trepang fishers and collectors at Karimunjawa Island, during several visits from May to November 2009. Most specimens were sized ca. 15 cm or larger. Specimens were labelled, and fixed in 95% ethanol overnight. The following day, the previous ethanol was removed and the specimen was preserved in 70% ethanol for longer preservation. To prepare spicules, small cuts of dorsal and ventral integument were dipped in domestic bleach for several minutes. The spicules were rinsed with tap water followed by 70% ethanol before being identified under a compound microscope. This technique has been adopted by Purwati and Wirawati (2009) and Wirawaty *et al.* (2007). Both morphology and spicules were carefully observed. The referred guides to species identification included Sluiter (1901), Clark and Row (1971), Rowe (1969), Massin (1996; 1999), Massin *et al.* (1999), and Samyn *et al.*, (2006).

RESULTS

There were 24 boats operating in the Karimunjawa Islands, with a capacity of 15 ton (12 meters long, 1.5-2.0 meters wide) and 20 HP engines. Most boats took 4-6 crew members, including 3 compressor-divers who were able to reach up to 30 m water depth.

Eighteen sea cucumber species were fished in Karimunjawa waters (Table 1) which belonged to shallow water families of Holothuriidae dan Stichopodidae (Order Aspidochitorida). This was confirmed with trepang originating from Asia, Indo-West Pacific, and Indian Oceans as listed by Choo (2008), Kinch *et al.* (2008), and Massin *et al.* (1999).

Holothuriidae and Stichopodidae from Karimunjawa were distinguished using several characters:

a) Overall body shape: Holothuriidae were more or less circular in transverse section, tapering on both ends. Stichopodidae showed a trapezium in transverse section and similar diameter along the length of the body.

b) Body surface: All Sticopodidae species from Karimunjawa have rough dorsal surface due the presence of enlarged papillae or tubercular structures. These structures were absent or much smaller in Holothuriidae.

c) Spicules: All Stichopodidae have C- and/ or S–shaped spicules, or only dichotomous rods (in *Thelenota*). These types of spicules were absent in Holothuriidae.

Three genera represented Family Holothuriidae from Karimunjawa. Morphological differences among these genera were:

a) Body shape: *Bohadschia* was stout, one or both ends were rounded, while *Holothuria* tended to be slender. *Actinopyga* had varied body shape, with five small teeth encircling the anal pore.
b) Type of spicules: *Holothuria* was dominated with tables and bottons, *Bohadschia* was typically with grain and rossetes, *Actinopyga* was mainly possessed rossetes or rods. See Wirawati *et al. (*2007) and Purwati and Wirawati (2009, 2010) for illustration.

DISCUSSION

Forty species of holothurians have been recorded in the world market (Toral-Granda, 2007). In the following year, Choo (2008) published a list of commercial holothurians exploited from Asia countries alone, and ends up with 52 species. Like in most producer countries, sea cucumbers fished in Indonesia were subjected to export. Logically, every exploited species must be in the list of Toral-Granda (2007) or Choo (2008), except, the volume was insufficient to be recognized or there has been inconsistent supply.

Purwati (2005) make an effort to list sea cucumbers which have once or still been fished in Indonesian waters for trade. Only ecological and fishery publications were available, from which data on commercial species were provided. From 26 species in the trepang fishery, several species were not in the list of Toral-Granda or Choo. It was difficult to determine whether misidentification had occured. Otherwise, any sea cucumber species had been fished and the fishers and collectors took the risks of rejection.

In fact, trepang fishers tended to collect all species from the sea floor up to 30 meters depth. Karimunjawa was one example of such a trend. Out of 18 fished species, *A.banwarthi*, *H. fuscocinerea,* and *B. subrubra* had never been reported in Indonesian trepang fishery or ecological and taxonomical studies. The first species was not in the list of Toral-Granda (2007), nor in Choo (2008), while the second species was only listed in Choo (2008) which was produced by the Phillipines, Malaysia, and China. The last mentioned species came from Africa and the Indian Ocean. Because of limited taxonomic studies in Indonesia, misidentifications were possible. Moreover, there are still taxonomical problems in Holothuroidea as occur in genus *Bohadschia* (Conand, 2008; Massin *et al.*, 1999).

Due to similarity in morphology, *A. bannwarthi* and *A. miliaris* have the same local name in Karimunjawa. *A. bannwarthi* was one of the rarely reported species, distributed in Red Sea, Djibouti and Madagaskar (Massin *et al.* 1999). In Indonesia, this species has been once found in Timor in 2007 (Purwati *et al.*, 2008).

Repeated visits to Karimunjawa gives more chance to collect most (if not all) fished species from local people. Sea cucumber fishers usually were more familiar with the fishing grounds and covered larger areas then researchers who did time and space framed-research. Table 2 may reflect this situation, that researchers collect less species than the fishers.

Research in 1988 by Nuraini and Wahyuni (1989) found 12 species of trepang in Karimunjawa waters. Dominated species were *A. miliaris*, *H. ocelata*, *S. variegatus* (not valid any more), teripang pasir (sandfish/*H. scabra*), teripang nanas (pricklefish/*T. ananas*), and teripang koro (teatfish/*H. nobilis*). The last three mentioned species are in the first rank of price. Four years later (mid 1992), Wagiyo *et al.* (1999) found 9 species of trepang with density of 0.009 ind./m^2. They distributes in 88 km^2 area, with standing stock of 79.200 kg. Wagiyo *et al.* (1999) ended the report with a conclusion that holothurians in Karimunjawa have been over-exploited. Data on species composition year to year from the collectors, if available, would be sufficient to determine the condition of natural stocks.

The present study finds that the composition of fished species has altered over time (Table 2). Compared with 1989 and 1999 reports, 8 species were no longer present in the harvest including *H. nobilis*, *T.ananas* and *S. variegatus* (possibly *S.hermanni* or *S. horrens*), and other species

Table 1. Sea cucumbers fished in Karimunjawa in 2009. Species in bolt was not in the list of Choo (2008) and Toral-Grande (2007); world market names were provided in those lists; See detailed description and spicules in Wirawati *et al*. (2007) and Purwati and Wirawati (2009; 2010).

No.	Species	Morphological characteristics	Habitat	Local names	World market names
1	*Actinopyga banwarthi*	Stout, thick integument, black; rod spicules dominate	coral reefs	teripang sepatu	-
2	*A.miliaris*	Stout, thick integument, black with fine papillae all over the dorsal surface	coral reefs	teripang sepatu	blackfish
3	*A. lecanora*	Stout, light brown with darker blotches; whitish circular area on the posterior end.	dead corals and boulders and	teripang kapuk	stonefish
4	*Bohadschia vitiensis*	Stout, rounded at both ends, brownish grey with several brown bands on the dorsal surface.	-	teripang pulut pasir	brownfish
5	*B.subrubra*	Stout, rounded at both ends, brown with irregular pattern of white thick lines	-	teripang bintik	leopardfish
6	*Holothuria atra*	Slender, reddish black all over the body	sand, boulders and sea grass	lakling hitam	black lollyfish
7	*H. edulis*	Slender, rounded at both ends, black on dorsal surface, and light red on ventral surface	hard substrate with boulders	lakling merah	pink lollyfish
8	*H. leucospilota*	Slender, soft skin, medium thickness. Papillae fine, tubules of Cuvier readily expelled	under rocks and dead corals	teripang getah	-
9	*H. fuscocinerea*	Grayish brown on dorsal with darker transverse bands, papilla base reddish brown; pale on the ventral surface	sea grass and boulders	lakling coklat	-
10	*H. impatiens*	Brown with dark transversal bands, papilla base enlarged, integument soft, medium thickness	under the boulders	teripang pulut	-
11	*H. scabra*	Grey with black lines on dorsal, thick integument with rough surface, pale grey on ventral	muddy, fine sand and seagrass	teripang pasir	sandfish
12	*H. coluber*	Slender, black with yellow papillae and tentacles	-	-	snakefish
13	*Pearsonothuria graeffei*	Large species, tentacles white with black crowns. Thick integument with rough surface due to enlarge papilla base, many black small blotches on dorsal	hard substrate or seagrass, slope and dead corals	gamet gombyok	flowerfish
14	*Stichopus horrens*	Greenish brown, thick integument, translucent., papillae enlarge with red tip when fresh	sand area with boulders and seagrass	gamet rengget	-
15	*S. herrmanni*	Greenish brown, thick integument, dorsal surface with two rows of shallow folds more or less regular in arrangement	sand area with boulders and seagrass	gamet emas, gamet kacang goreng, gamet tril	curryfish
16	*S. vastus*	Greenish brown with discontinuous black lines encircling papillae	muddy sand area with boulders and seagrass	gamet, gamet pace, gamet kacang goreng,	curryfish
17	*S. chloronotus*	Dark green or bluish black, enlarged papillae in four rows along each ambulacral	corals and boulders	jepun	greenfish
18	*Thelenota anax*	Large species, color red all over, trapezium in cross section, papillae enlarge to leaf-shape which were arranged in group,	sandy substrats in coral reefs	teripang babi	amberfish

Table 2. Diversity of trepang species of Karimunjawa (t and g in column local name stands for teripang and gamet)

No.	Species	Local names		
		Present study (2009)	**Wagiyo *et al.* (1999)**	**Nuraini and Wahyuni (1989)**
1	*Actinopyga banwarthi*	t sepatu -	-	
2	*A.miliaris*	t sepatu	t kapuk	t kapuk
3	*A. lecanora*	t kapuk	-	-
4	*A.echinites*	-	-	t kapuk, kunyit
5	*Actinopyga sp.*	-	t talengko	-
6	*A.mauritiana*	-	-	t kunyit, bilabo
7	*Bohadschia vitiensis*	t pulut pasir	-	-
8	*B.subrubra*	t bintik	-	-
9	*B.marmorata* -	-		t pulut, olok-olok, getah putih
10	*Bohadschia spp.*	-	NA	-
11	*B.tenuissima*	-	-	t karet
12	*B.argus* -	-		t ular mata
13	*Holothuria atra*	t hitam		-
14	*H. edulis*	t merah	t lakling	-
15	*H. leucospilota*	t coklat	-	-
16	*H. fuscocinerea*	t getah	-	-
17	*H. impatiens*	t pulut	t donga	t donga, t babi
18	*H. scabra*	t pasir	-	t pasir, gosok, buang kulit
19	*H.coluber*	*NA* -	-	
20	*H.ocelata*	-	g emas, g kacang goreng, g tril	g emas, g kacang goreng, g tril
21	*H.nobilis*	-	t koro t	susu, hitam
22	*Pearsonothuria graeffei*	g gombyok	-	-
23	*Stichopus horrens*	g rengget	-	-
24	*S. herrmanni*	g emas, g kacang goreng, g tril	-	-
25	*S. vastus*	g pace, g goreng,	-	-
26	*S. chloronotus*	Jepun	-	-
27	*S.variegatus**	-	t gamet t	gamat, kasur
28	*Thelenota anax*	t babi	-	-
29	*T.ananas*	-	t nanas	t nanas

Note: It was unclear whether Wagiyo *et al.* (1999) and Nuraini and Wahyuni (1989) involved spicules in their species identification.; * : not valid name (*S.variegatus* possibly refer to *S.hermanni* or *S.horrens*); -: absent; NA: not available).

entered the market. This condition may illustrate overfishing as indicated in previous report of Massin *et al.* (1999). So far, 28 species of sea cucumbers have been fished in Karimunjawa waters (excluding invalid name *S.variegatus*).

When local names of sea cucumbers of Karimunjawa was compared with those in Purwati (2005), several names differed. In addition, 2 species (*S.hermanni* and *S.vastus*) of Karimunjawa had more than one local name. Ambiguity appeared when two or more species had the same local name. Possibly, misidentification had occured. On the other hand, several local names had similar meaning with world market for each given species, such as teripang pasir —sand fish for *H.scabra* and teripang susu—teat fish for *H.nobilis*, lakling merah—pink lolly fish (*H.edulis*). When local names would be used, we recommend to translate from world market names for given species, as those names have been well-known and practiced worldwide.

Trepang used to be sold in dried form. Lately, markets demanded better processed trepang, and the buyers prefer to collect it in gutted and salted form, without any cooking procedures. Kupang (East Nusa Tenggara) and Bone Bay (South Sulawesi) have been practicing this technique for more than 5 years (personal observation).

In the case of trepang, most producer countries did not play as the main consumers. Commonly the trepang fishery was instituted by middlemen who came to coastal communities, asking for particular species of sea cucumbers. The local fishermen and collectors then hunt the resources from the nearby waters or farther, sold them in fresh or dried form. This operation occurs not only in Indonesia but also in Mahout Bay (Oman), and several countries in Asia, the central Indo-West Pacific, and Indian Oceans.

Generally, when intensive exploitation which brought significant income began to threaten the resources, then the goverments started to be concerned and manage the fishery (Choo, 2008; Kinch *et al* ., 2008; Conand, 2008; A-Rashdi *et al*., 2007). Fishermen may not be fully responsible for the depleted trepang resources. Common phenomenon of 'no market, no hunting' was a general issue. When buyers at any level applied sustainable fishery which practiced allowable catch (species, individual size and volume), fishers would obey the rules, and the trepang fishery became more sustainable. Science is required to develop management tools.

CONCLUSION

In the last 3 decades, at least 28 sea cucumber species (excluding *S.variegatus*) have been removed from the sea floor of Karimunjawa. However, this number is possible to alter following taxonomical validation which shoud be encouraged, racing with removal rate of natural sea cucumber stocks.

During 20 years or so, several species disappeared, replaced by other species in Karimunjawa trepang fishery. This composition shift may be an early warning of depleted populations or even species. Such experience is possibly occurring in other areas throughout Indonesian waters as well.

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