SEA CUCUMBER FISHERIES, UTILIZATION AND TRADE IN THE PHILIPPINES

By Ms. Ludivina L. Labe [7]

1. Introduction

Over-harvesting of shallow-water holothuroids, commonly known as sea cucumbers, throughout their geographical range has become an international concern. The alarming volume of extraction and trade in the high value processed meat, known by the trade names "trepang" and "beche-de-mer" came to the attention of international bodies such as the United Nations Food and Agriculture Organization (FAO) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora(CITES). The aforesaid entities initiated separate fora that provided the avenues to discuss the varied and country-specific issues on sea cucumber fisheries and trade. To wit: the FAO's Advances in Sea Cucumber Aquaculture and Management Workshop (ASCAM) in 2003 and the CITES International Workshop for the Conservation of Sea Cucumbers in the Families Holothuriidae and Stichopodidae in 2004. The CITES has been looking into listing the species in its Appendices according to the category of threat on the survival of wild populations. Recently, the International Union for the Conservation of Nature (IUCN) conducted the "Red List Categories" training for Filipino taxonomists and marine biologists. The clamor to have a National Red List for Marine Species was put forward identifying sea cucumbers as possible candidates for "red" listing.

Cognizant of the fact that the leading exports of sea cucumber products come from its geographical region, the Association of Southeast Asian Nations (ASEAN) and the Southeast Asian Fisheries Development Council (SEAFDEC) responded to the call for more initiatives to sustainable utilization of this economically and ecologically valuable resource. The ASEAN-SEAFDEC placed the outcome of the said international fora in the agenda of Council meetings. The Council came up with a resolution for the regional study on sea cucumber fisheries, utilization and trade. This initiative of the Council underscored its stand that fisheries management should be under the purview of the nations concerned. The results of the regional study would serve as bases of national and regional plans of action towards sustainable and responsible management of sea cucumber fisheries in the region. The ASEAN member nations, with funding from the program "Environmental Related Task in Southeast Asia", carried out secondary data collection from July to November 2007 through their respective designated National Focal Point, hence this report.

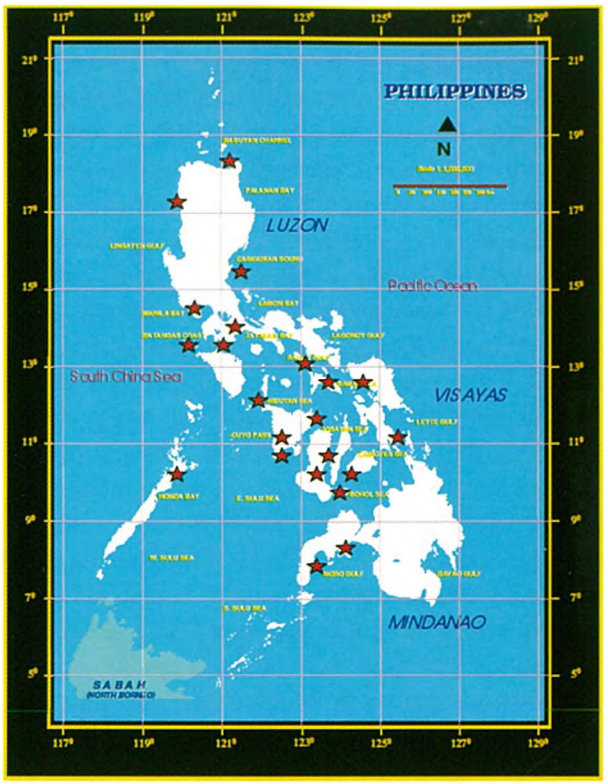


Figure 1. Traditional sea cucumber fishing grounds

The Philippines reportedly is the 2nd largest exporter of dried sea cucumber meat (Lovatelli, et. al, 2004). Since the advent of the fisheries in the 18th century, sea cucumber products have consistently been among the top export commodities of the country forming the basis of a multi-million dollar industry (BAS Fish. Stat. Philipp; Schoppe, 2000; Akamine,

[7] Member of the Ad hoc Regional Working Group on Sea Cucumber Fisheries and National Focal Point for the Philippines; National Fisheries Research and Development Institute (NFRDI)

2002; Ganchero, 2007). Artisanal fishers from about 60 municipalities in 14 regions of the country depend on sea cucumber collection as alternative to finfish fishing during off period (Labe *et. al, to be published*) (**Figure 1**).

The succeeding sections provide details on the current state of Philippine sea cucumber fisheries, utilization and trade and the major issues confronting the industry. Likewise presented are the multi sectoral initiatives to save the fisheries and effect sustainable and responsible utilization of this valuable fishery resource.

2. Taxonomic Information

One of the barriers to holothuroid stock monitoring for conservation and fisheries management purposes is the problem in species identification (Samyn, 2000). The animal loses the key morphological characteristics, e.g. color and body markings, once it is out of the natural habitat. It retracts its tentacles and podia, which are useful in identifying the species. Even more difficult is the identification of the processed products. The key to species identification remains the shape and structure of the tiny, calcareous skeletal pieces, technically termed "ossicles" that are embedded all over the skin of the animal. Using ossicles for taxonomic work also has problems as studies show ossicle shapes and structure change even within an individual depending on age, habitat and geographical location (Massin, 1994; Cutress, 1996; Kerr, 2000). Nowadays, molecular biology is being used in combination with classical taxonomy to confirm the identity of organisms.

Semper (1868), a French taxonomist did the earliest taxonomic investigation of Philippine shallow-water holothuroids using ossicles as key to species identification. The first Filipino to carry out similar work was Domantay (1933) in Port Galera Bay, Occidental Mindoro and adjacent waters. Other works include those of Tan Tiu (1981) in Mactan and neighboring islands, Central Philippines, Leonardo and Cowan (1984) in Calatagan, Batangas and Schoppe (2000) in the waters of Palawan and Leyte. Yllano and Lopez (1999) were the first to use ossicle as key character in identifying four species in Negros Occidental, Lingayen Gulf and Kalatagan, Batangas Islands. Published works on holothurians biodiversity by foreign scientists were those of Gosliner, Williams and Behrens (1996) in the waters of Central Philippines and Batangas Islands; Kerr, Netchy and Gawel (2006) in the waters of Negros Oriental, Cebu and Bohol and Groenewold and Wegmann (2007) along the coast of Negros Occidental.

The National Fisheries Research and Development Institute (NFRDI) through the National Sea Cucumber Research Program (NSCRP) of the Marine Invertebrate Research Section undertook a comprehensive taxonomic and fishery investigation of the commercial holothuroids from 15 sites in 14 regions of the country (Labe, *et. al, to be published*). Confusion regarding the identity and price of the traded holothuroids, particularly of the low value dried species, stems from the different local names given to each species depending on the dialect. Almost all local names are based on the striking characteristics of the animal. Although the NSCRP has the price data of fresh and dried holothuroids given by collectors and cooperative local traders, this has yet to be validated vis-à-vis the species identity. One of the assumptions was that species belonging to the same genus have more or less the same price except for the diverse genus Holothuria with several low value species. The NSCRP will soon come out with publications on the taxonomy and fisheries of commercial holothuroids.

Thus far, 47 commercially valuable species belonging to families Holothuriidae, Stichopodidae and Phyllophoridae have been accounted by the above-cited biodiversity undertakings in the Philippines (**Tables 1** and **2**). The price information is incomplete due to the confusion previously mentioned. One glaring result of recent surveys is the confirmation of the critical state of sea cucumber fisheries based on low densities and disappearance of a number of high value species in most of the historically rich fishing areas.

Table 1. Summary of Sea Cucumber Species Composition in the Philippines

Species	Family Name	Local Names	Commercial Value (Price Range: USD/Kg)[a]		
			2000[b]	2001[b]	2007[c]
Actinopyga mauritiana	Holothuriidae	bakungan	4.0-14.4	2.4-12.7	12.8-46.5
Actinopyga caerulea [d]	Holothuriidae	khaki			
Actinopyga caroliniana [d]	Holothuriidae	khaki			
Actinopyga echinites	Holothuriidae	brown beauty; khaki	15.6	12.7	27.9-53.5
Actinopyga lecanora	Holothuriidae	buli-buli; boli-boli; monang	10.4-24.4	7.8-21.6	19.8-66.3
Actinopyga miliaris	Holothuriidae	khaki			
Actinopyga obesa [d]	Holothuriidae	khaki			
Actinopyga palauensis [d]	Holothuriidae	khaki			
Bohadschia argus	Holothuriidae	leopard; matang-itik	8.4	8.2	15.1 – 26.7
Bohadschia bivittata d lawayan	Holothuriidae	lawa yan			
Bohadschia koellikeri [d]	Holothuriidae	lawa yan			
Bohadschia marmorata	Holothuriidae	lawa yan; pulutan	4.0-6.9	3.3 - 6.3	9.3 – 22.1
Bohadschia paradoxa [d]	Holothuriidae	lawa yan	5.3	4.3	10.9
Bohadschia sp. [d]	Holothuriidae	lawa yan			
Bohadschia vitiensis [d]	Holothuriidae	lawayan			
Holothuria arenicola [d]	Holothuriidae				
Holothuria atra	Holothuriidae	black beauty	2.2-5.3	1.6-3.9	20.9
Holothuria canaliculata	Holothuriidae				
Holothuria coluber	Holothuriidae	patola white; tambor	5.6	4.5	20.9
Holothuria edulis	Holothuriidae	red beauty	4.9 – 5.3	3.9 – 4.7	8.1 – 20.9
Holothuria excellens [d]	Holothuriidae				
Holothuria fuscocinerea [d]	Holothuriidae		0.4	0.4	2.9
Holothuria fuscogilva	Holothuriidae	susuan	12.1– 35.6	9.8 – 35.3	41.9 – 88.4
Holothuria fuscopunctata	Holothuriidae	sapatos	2.9	2.7	8.6
Holothuria hilla	Holothuriidae	bat-tuli	0.4	0.4	2.9
Holothuria impatiens	Holothuriidae	sunlot	0.4	0.4	2.3
Holothuria inhabilis	Holothuriidae	batunan	0.4	0.4	0.5
Holothuria leucospilota	Holothuriidae	patola	4.9	3.9	
Holothuria nobilis	Holothuriidae	susuan	11.1 – 26.7	9.8 – 19.6	34.9 – 69.8
Holothuria pervicax	Holothuriidae		0.4	0.4	2.9
Holothuria pulla	Holothuriidae	patola red, unotunot	5.6	4.5	12.8
Holothuria rigida [d]	Holothuriidae	batunan	0.4	0.4	2.9
Holothuria scabra	Holothuriidae	putian; kurtido	12.2 – 36.7	12.7–37.3	41.9 – 104.7
Holothuria scabra var. versicolor	Holothuriidae	kurtido bato			
Holothuria sp. [d]	Holothuriidae				
Holothuria turricelsa [d]	Holothuriidae				
Holothuria whitmae	Holothuriidae	susuan			23.3 – 104.7
Pearsonothuria graeffei	Holothuriidae	piña; lawayan; mani-mani	2.4	1.8	4.7
Thelenota ananas	Holothuriidae	talipan; taripan	10.0 – 14.4	13.7 (L)	34.9 – 62.8
Thelenota anax	Holothuriidae	legs	4.9	3.7	13.0
Thelenota rubralineata	Holothuriidae	talipan	4.9	3.7	13.0
Neocucumis proteus–	Phyllophoridae	bola-bola; balo-balo			0.5-1.2[e]

Species	Family Name	Local Names	Commercial Value (Price Range: USD/Kg)[a]		
			2000[b]	2001[b]	2007[c]
Stichopus chloronotus	Stichopodidae	kuatro kantos	23.3	19.6	60.5
Stichopus hermanni	Stichopodidae	hanginan	6.7 – 21.1	5.9 – 21.6	34.9 – 58.1
Stichopus horrens	Stichopodidae	hanginan	6.7 – 21.1	5.9 – 21.6	34.9 – 58.1
Stichopus noctivagus	Stichopodidae	hanginan			
Stichopus variegatus	Stichopodidae	hanginan; gadul			

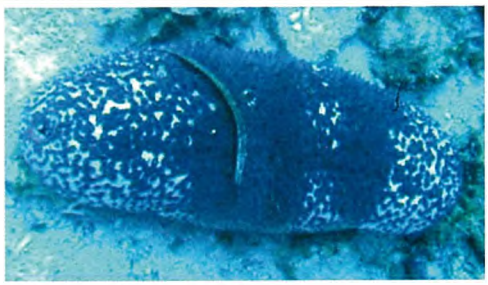
Legend:
a price range based on sorted size labels: extra small (XS), small (S), medium (M), large (L) and extra large (XL); unranged prices are unsorted.
b Akamine (2002); USD1 = Php 45.00 (2000); USD1 = Php 51.00 (2001)
c Labe, et. al (to be publ): USD1 = Php 43.00 (2007)
d photographs and species descriptions taken from Kerr, et. al (2006)
e price range per piece
***Note:** Prices not reflected for those species whose prices vis-à-vis species are being confirmed*

Table 2. Biology of Sea Cucumbers in the Philippines

FAMILY: Holothuriidae

Scientific Name: *Actinopyga caerulea*
Common Name: blue sea cucumber
Local Name: unknown

Description: Mottled variably in grayish blue on a white background; newly described species by Samyn, VandenSpiegel & Massin, 2006; length reaches to about 40 cm.



Taken from Kerr, et. al. (2006)

Scientific Name: *Actinopyga caroliniana*
Common Name: Caroline's sea cucumber
Local Name: unknown

Description: Light brown with teat-like protuberances bearing papillae along dorso-lateral side; grows to about 15 cm.

Taken from Kerr, et. al. (2006)

Scientific Name: *Actinopyga echinites*
Common Name: deep-water redfish
Local Name: brown beauty; khaki; hudhud

Description: Dark-brown; dorsally transverse black bands; smaller individuals have large conical papillae as shown by this specimen; grows to about 30 cm.

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Scientific Name: *Actinopyga lecanora*
Common Name: stonefish
Local Name: buli-buli; monang; manapaw

Description: Mottled chestnut brown and white blotches dorsally; characteristic white posterior; grows to about 25 cm.

Scientific Name: *Actinopyga mauritiana*
Common Name: surf redfish
Local Name: khaki

Description: Dark brown with more or less white spots; bivium sometimes wrinkled; densely covered with tube feet; grows to about 35 cm

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Scientific Name: *Actinopyga miliaris*
Common Name: hairy blackfish
Local Name: khaki

Description: Dark brown to almost black body color; body covered with papillae; grows to about 35 cm.

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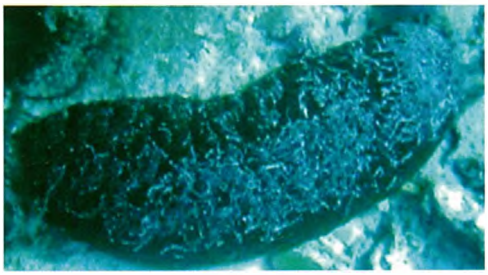
Scientific Name: *Actinopyga obesa*
Common Name: plump sea cucumber
Local Name: khaki

Description: Body robust; reddish brown or yellowish brown body color covered with spots of light brown; some individuals with large light brown spots ringed with yellow; partially covered by sediments.

Scientific Name: *Actinopyga palauensis*
Common Name: Palauan sea cucumber; Panning's blackfish
Local Name: unknown

Description: Bivium black generally covered by mucus and sediment dorsally; trivium lighter, dark brown; grows to about 40 cm.



Scientific Name: *Bohadschia argus*
Common Name: leopard fish
Local Name: leopard; matang-itik

Description: The species is easily identifiable with the numerous ocelli circled with white that are orange to yellow-brownish in color; the body markings are retained even in dried form; grows to about 60 cm in length; one of the most abundant species.

Scientific Name: *Bohadschia bivittata*
Common Name: two-ribboned sea cucumber
Local Name: putlan

Description: Distinguished by two transverse brown bands over the dorsum; bands visible in dried form; length reaches to 25 cm.

Scientific Name: *Bohadschia marmorata*
Common Name: chalky sea cucumber
Local Name: lawayan; pulutan

Description: Distinguished with large angular dark patches dorsally; patches become one wide vertical band on the biviumas shown in the photo; cuvierian tubules readily ejected; grows to about 20 cm.

Scientific Name: *Bohadschia paradoxa*
Common Name: paradoxical sea cucumber
Local Name: lawayan

Description: Yellowish in color with darker circles and somewhat short papillae; length reaches to 50 cm.

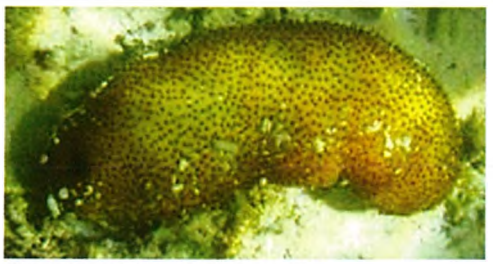
Taken from Poppe-Images, 2005
(www.poppe-images.com)

Scientific Name: *Bohadschia similis*
Common Name: brown-spotted sea cucumber
Local Name: lawayan; tagukan

Description: Bivium whitish to light yellow with small black spots and grayish patches; triviumwhite with black tiny spots; two rows of yellowish podia; grows to about 26 cm.

Scientific Name: *Bohadschia vitiensis*
Common Name: brown sandfish; speckled sea cucumber
Local Name: lawayan

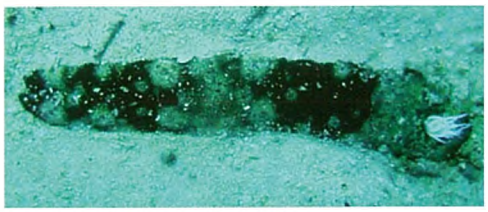
Description: Yellow in bivium with brown bands; trivium lighter; 20 small, short and yellowish tentacles; length reaches to 40 cm.



Taken from Kerr, et.al. (2006)

Scientific Name: *Bohadschia koellikeri*
Common Name: mottled sea cucumber
Local Name: unknown

Description: Bold camouflage pattern in deep brown and beige; tube feet spread over surface; grows to about 40 cm.



Taken from Kerr, et.al. (2006)

Scientific Name: *Holothuria arenicola*
Common Name: sand sea cucumber
Local Name: unknown

Description: Creamy white to grayish with two longitudinal rows of brown spots; trivium white; grows to about 30 cm.

Scientific Name: *Holothuria atra*
Common Name: lollyfish
Local Name: black beauty

Description: Entirely black and smooth body often covered by sand leaving two rows of round patches on the bivium; grows to about 45 cm.

Scientific Name: *Holothuria canaliculata*
Common Name: chanelled sea cucumber
Local Name: unknown

Description: Grayish cream splattered by numerous dark brown blotches dorsally; length reaches to 15 cm.

Scientific Name: *Holothuria coluber*
Common Name: snakefish
Local Name: patola white; tambor

Description: Black with white or yellow papillae all over the body; yellow tentacles; grows to about 60 cm.

Scientific Name: *Holothuria edulis*
Common Name: pinkfish
Local Name: red beauty; red powder; hotdog

Description: Sausage-shaped (Schoppe, 2000) with black dorsal surface and pink or reddish ventrally with small, dark dots; grows to about 35 cm.

Scientific Name: *Holothuria fuscocinerea*
Common Name: ashen sea cucumber
Local Name:bat-tuli, brown beauty

Description: Grey to brown mottled with dark white-ringed papillae dorsally; whitish ventrally; length reaches to 25 cm.

Scientific Name: *Holothuria fuscogilva*
Common Name: white teatfish
Local Name: susuan

Description: Yellowish white with dark brown markings; 6 to 8 teats on each side; grows to a maximum length of 57 cm.

Scientific Name: *Holothuria fuscopunctata*
Common Name: elephant trunkfish
Local Name: sapatos

Description: Distinguished with brown wrinkles over its stout,firm and rigid body; grows to about 70 cm.

Scientific Name: *Holothuria gracilis*
Common Name: yellow-bellied sea cucumber
Local Name: unknown

Description: Grayish dorsally with numerous papillae of equal size; trivium lighter, yellowish; length reaches to 25 cm. (Kerr, et al. 2006)

Scientific Name: *Holothuria hilla*
Common Name: Tigertail sea cucumber
Local Name: Bat-tuli

Description: Light brown with yellowish or whitish papillae; grows to about 25 cm.

Scientific Name: *Holothuria impatiens*
Common Name: bottle sea cucumber
Local Name: sunlot

Description: Brown or grayish body traversed with light and dark stripes; grows to about 30 cm.

Scientific Name: *Holothuria inhabilis*
Common Name: sandy sea cucumber
Local Name: batunan, nuog-nuog

Description: Long, slender, worm-like sea cucumber in different shades of brown; white colored mouth at posterior end; length reaches to about 50 cm.

Scientific Name: *Holothuria leucospilota*
Common Name: white threadfish
Local Name: patola

Description: Uniformly black, cylindrical, elongate body with soft papillae and black tentacles; grows to about 30 cm.

Scientific Name: *Holothuria nobilis*
Common Name: black teatfish
Local Name: susuan,; bakungan

Description: Generally black with 5 to 8 teats on each side; grows to about 55 cm.

Scientific Name: *Holothuria pervicax*
Common Name: stubborn sea cucumber
Local Name: Bat-tuli; sunlot

Description: Mottled with in grey and cream with variably sized papillae; length reaches to about 15 cm.

Scientific Name: *Holothuria pulla*
Common Name: brown sea cucumber
Local Name: unot-unot; patola red

Description: Deep reddish brown or black, thin and soft body; grows to about 40 cm. (Batoy, et al. 1998)

Scientific Name: *Holothuria rigida*
Common Name: rigid sea cucumber
Local Name: batunan

Description: Uniformly white to grayish white with small dark spots; worm-like species; grows to about 18 cm.

Taken from Kerr, et.al. (2006)

Scientific Name: *Holothuria scabra*
Common Name: sandfish
Local Name: putian; kurido; kiskisan

Description: Highly variable colors from whitish to dark brown bivium with dark transverse markings and strong folds; lighter trivium, generally whitish; length reaches to about 35 cm.

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Scientific Name: *Holothuria scabra versicolor*
Common Name: white sandfish
Local Name: kurtido bato

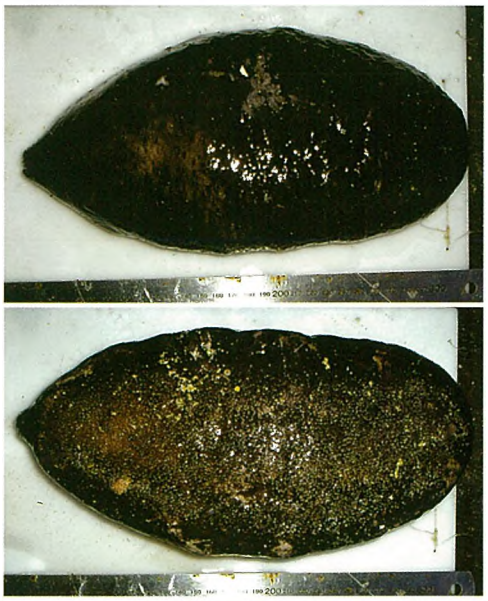
Description: Differ from *H. scabradue* to absence of strong folds on the dorsal body wall (bivium); colors in 3 main patterns (speckled, with moderate black areas, or black overall (as shown in the picture); grows to about 45 cm.

Scientific Name: *Holothuria turriscelsa*
Common Name: warty sea cucumber
Local Name: to be determined

Description: Uniformly grey, few individuals are lighter; cream colored ventrally; easily ejects cuveriantubules; recently described species (1980); grows to 30 cm in length.

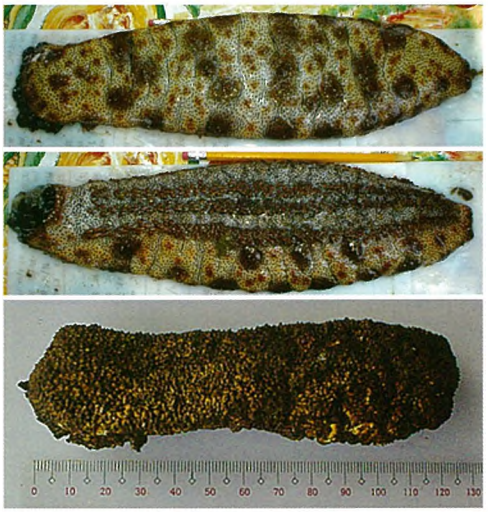
Scientific Name: *Holothuria whitmaei*
Common Name: teatfish; mammy blackfish
Local Name: susuan

Description: Bivium black and lighter trivium; no papillae dorsally; prominent teats but when disturbed it can no longer be seen; grows to about 35 cm.



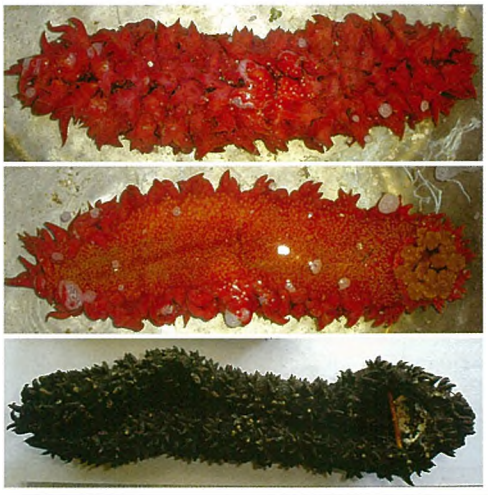
Scientific Name: *Pearsonothuria graeffei*
Common Name: black-spotted sea cucumber
Local Name: piña; mani-mani; hanginan; bulaklak; trompa

Description: Whitish with irregular big brown spots and small black spots; three longitudinal bands of tube feet; black tentacles with white crown; grows to about 45 cm.



Scientific Name: *Thelenota ananas*
Common Name: prickly redfish; pineapple sea cucumber
Local Name: talipan; taripan; tinikan; tres; kantos; pinyahan

Description: Distinguished by its reddish color and numerous large papillae; 20 large brown or yellowish tentacles; grows to about 80 cm.



Scientific Name: *Thelenota anax*
Common Name: amberfish; giant beche-de-mer
Local Name: legs

Description: Tan to whitish in color with brown or orange blotches; quadrangular in cross section; grows to about 80 cm.

Photo: N.C. Gatdula - Dapa, Surigao DN

Scientific Name: *Thelenota rubralineata*
Common Name: red-striped sea cucumber; candy cane sea cucumber
Local Name: legs

Description: Covered with red and white stripes; numerous, large papillae on dorsal side; trapezoidal in cross section; grows to about 50 cm.

FAMILY: Stichopodidae

Scientific Name: *Stichopus chloronotus*
Common Name: greenfish
Local Name: kuatro kantos; hanginan black

Description: Dark green to black in color characterized with double row of large papillae; quadrangular in cross section; grows to about 35 cm.

Photo: S. Tagaro - Pangiao Proj. 2004

Scientific Name: *Stichopus hermanni*
Common Name: curryfish
Local Name: hanginan

Description: Variable colors from olive green to orange with grayish spots; quadrangular in cross sections; grows to about 50 cm.

Scientific Name: *Stichopus horrens*
Common Name: Selenka's sea cucumber; horrendous sea cucumber
Local Name: hanginan

Description: Tan to grey in color with numerous brown or greenish irregular papillae; 4 rows of stout podia in the trivium; grows to about 50 cm.

Photo: S. Tagaro - Pangleo Proj. 2004

Scientific Name: *Stichopus noctivagus*
Common Name: curryfish
Local Name: hanginan

Description: Mottled orange-red and white with occasional dark blotches and white papillae; length reaches to about 20 cm. (Kerr, et al. 2006)

Scientific Name: *Stichopus variegatus*
Common Name: curryfish
Local Name: hanginan

Description: Greenish in color with black spots and covered with irregular warts dorsally; yellow podia arranged in rows; grows to about 50 cm

FAMILY: Phyllophoridae

Scientific Name: *Neocucumis proteus*
Common Name: ball-shaped sea cucumber
Local Name: bola-bola; balo-balo

Description: The species is ball-shaped when freshly caught; beige to light brown body covered with papillae that contract when disturbed; the animal takes a long time to assume the cucumber shape after collection; ball shape body is retained when processed.

3. Production and Utilization

3.1 Sea cucumber fisheries

The Philippine sea cucumber fishery depends solely on natural stocks. Commercial holothuroids are the target of artisanal fishery particularly during the lean months of finfishing. Around 100 target species once abound in nearly all shallow-water areas of the country. Only 47 species, each known by various local names, have been accounted by recent surveys. The methods and equipment used in sea cucumber collection remained the same since the advent of the Philippine sea cucumber fisheries in the 18th century, as reported by various authors (Domantay, 1933; Trinidad- Roa, 1987; Schoppe, *et. al*, 1998; Labe, 2005; Labe, *et. al*, *to be published*).

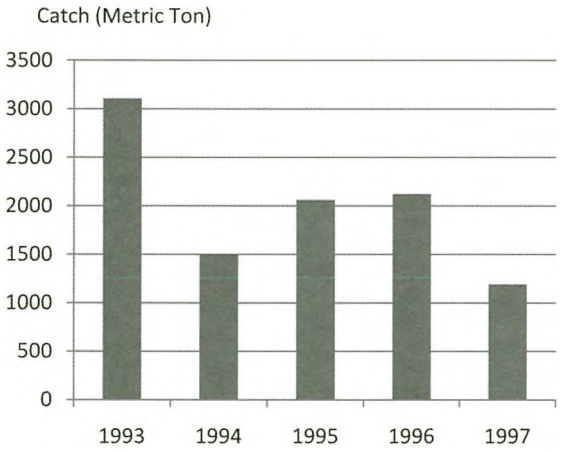


Figure 2. Sea cucumber production 1993-1997 (Labe, 2004)

Species in the families Holothuriidae and Stichopodidae are heavily collected by gleaning during low tide by members of fishing families in coastal villages all over the country. The local divers aided by the life-threatening improvised air compressor locally called "capandra" or "hookah" collect species inhabiting deeper areas such as those in the genera *Thelenota, Stichopus* and the newly discovered populations of *Neocucumis proteus* (family Phyllophoridae). Due to the "open access" fisheries in municipal waters, gatherers from neighboring towns and provinces could collect seacucumbers at any time putting additional pressure on the meager resource.

Sea cucumber production from artisanal fisheries showed fluctuating annual landed catches from the early 1970s to the present as reflected in the compilation of fisheries statistics by the Bureau of Agricultural Statistics (BAS). The highest production volume of 3109 MT was accounted in 1993 to a low 1191 MT in 1997 (**Figure 2**). Production data in the succeeding years and socio-economic information such as the number of coastal families who depend on sea cucumber fisheries for livelihood are unavailable. The scarcity of fisheries data and the inability of the BAS enumerators to breakdown production statistics into species have diminished the usefulness of these data in resource conservation and management.

The results of the NSCRP fishery investigations and recent biodiversity surveys validated the BAS accounts (Kerr, et. al, 2006; Groenewold and Wegmann, 2007; Labe, *et. al*, *to be published*). These further confirm the general perception and anecdotal reports of natural populations in traditional collection sites like the Jolo-Sulu-Tawi-Tawi strongholds are on the verge of collapse (**Figure 3** and **4**), collection sizes of commercial species are getting smaller (**Figure 5**) and the

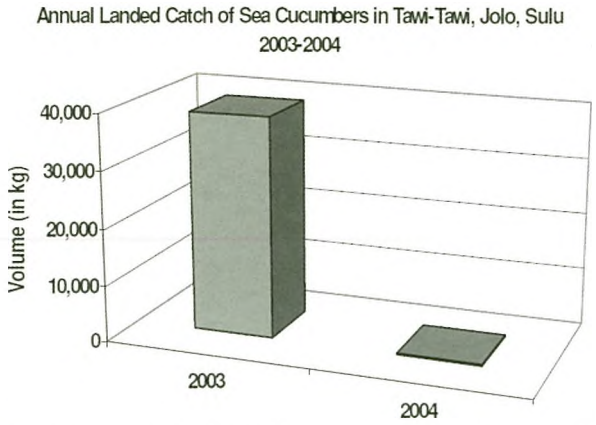


Figure 3. Sea cucumber production based on landed catch in Tawi-Tawi, 2003-2004.
The Sulu Archipelago was once a stronghold of sea cucumber (Source: BFAR ARMM, 2005),

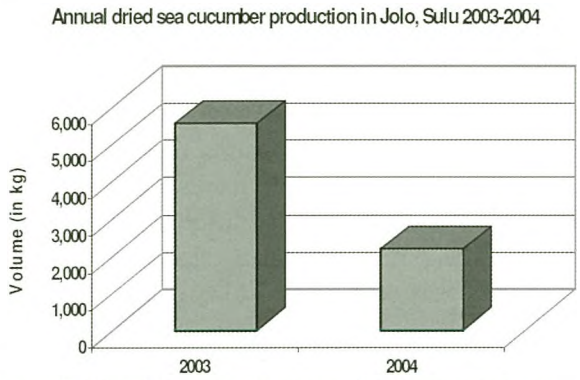


Figure 4. Abrupt decrease in annual dried sea cucumber production in Jolo, Sulu, 2003-2004 (Source: BFAR ARMM, 2005).

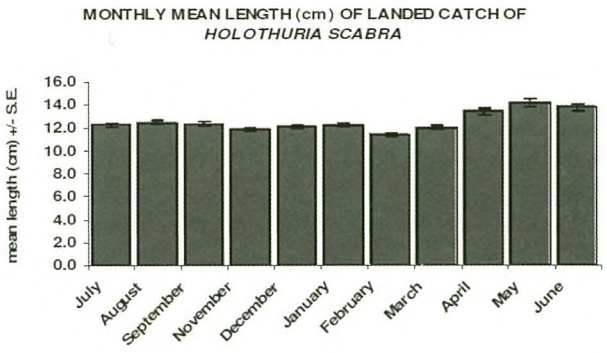


Figure 5. Undersized Holothuria scabra taken from the landed catches in Honda Bay, Puerto Princesa, Palawan based on the size limit (22 cm) set by Papua New Guinea for fresh/unprocessed meat of the species (Labe, et. al, to be published).

collection sites that were within the littoral zone, have now moved to deeper waters. Heavily fished areas have low densities or are now deplete of the high value species such as *Holothuria scabra, H. fuscogilva, H. nobilis, H. whitmae* and *Actinopyga* spp. The above-cited surveys carried out in different sites showed similar result as to the dominance of

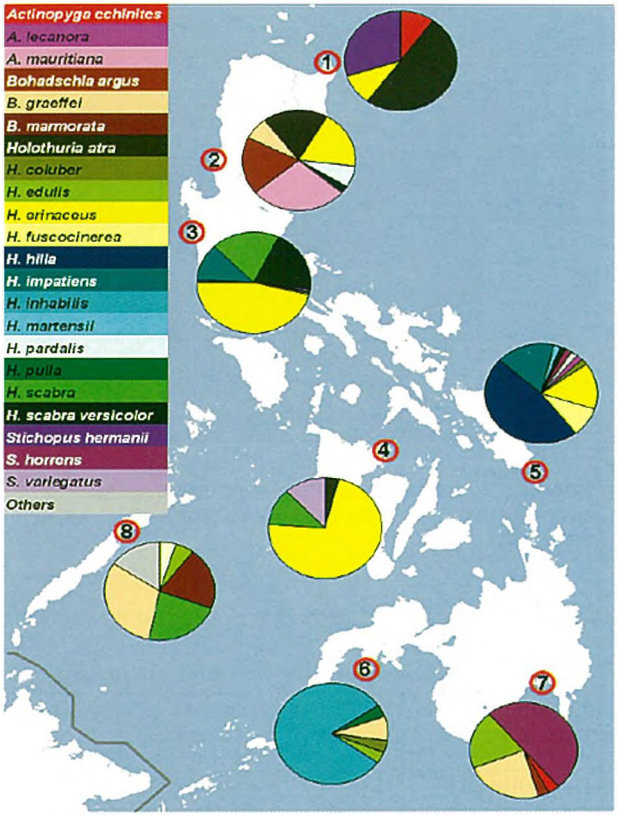


Figure 6. Relative abundance (number of individuals) of commercial holothuroids in survey sites of NSCRP showed dominance of low value species in all the sites and non-appearance of high value species in the landed catches in most sites (Labe, et. al, to be published).

low value species from the landed catches, such as *Bohadschia argus, B. marmorata, Pearsonothuria graeffei, Holothuria atra, H. fuscocinerea, H. leucospilota, H. hilla, H. impatiens, Stichopus spp.*, among others (**Figure 6**).

3.2 Local usage and processing

Sea cucumbers are not a basic food source of Filipinos, but fresh meat is a delicacy in some coastal villages. The fresh/frozen, salted/in brine, smoked and dried sea cucumber products are marketed locally in supermarkets and form part of cuisines in local hotels and restaurants. The bulk of processed products, particularly the dried and smoked forms are intended for the export markets where they remain in demand and high priced products. The crude method of processing sea cucumber meat: gutting, boiling, smoking, and sun drying is still the common practice in fishing communities nationwide (**Figure 7**). In some areas, major local buyers/middlemen invest on setting up their kiln for the final drying process before selling the product to middlemen in Manila or directly to exporters.

Figure 7. Crude method of processing sea cucumber commonly practiced in fishing villages (Labe, et. al, to be published)

Efforts to standardize sea cucumber processing method that is HACCP compliant has been initiated by the Post-Harvest Research and Development Division (PHRDD) of the NFRDI and some of the counterpart Division from the Regional Offices of the Bureau of Fisheries and Aquatic Resources (BFAR). Other initiatives to develop value-added products from sea cucumbers have been carried out by the above-mentioned entities. However, efforts to transfer such technology to stakeholders are still lacking.

Besides being high value commodity as food source, the pharmaceutical potential and other commercial uses of sea cucumbers have been discovered by scientists from the University of the Philippines in Los Banos, Laguna (UPLB). The chloroform extracts called lectins from *Holothuria nobilis, Bohadschia marmorata* and *Stichopus chloronotus* have been found to have anticancer and antibacterial activity (Mojica, et. al, 2003). More medical and pharmaceutical uses of sea cucumbers are being discovered by local and foreign research institutions.

3.3 Marketing

The existence of a market chain for sea cucumber products have been traced by the works of Schoppe (2000), Akamine (2002), Gamboa, *et. al* (2007), Labe, et. al (to be published). The chain includes the gatherers, local buyers, middlemen and exporters as key players (**Figure 8**). The gatherers themselves before selling the product to the major local buyers within their community do the gutting, boiling, smoking and sun drying. Some local buyers buy the fresh catch and do the processing themselves before the products change hands from the local buyers to middlemen from different parts of the country. These middlemen have the knowledge of the trading season in each locality.

The prices from the gatherers to local buyers depend on the species, size (extra small, small, medium, large, extra large), and are further graded into class A, B, C. The condition of the fresh and dried products and if the product requires final kiln or sun drying also determine the buying price from the gatherers to local buyers. The middlemen dictate and have control over the prices. Some of the high value species are *Holothuria fuscogilva, H. scabra, H. nobilis, Actinopyga lecanora, Stichopus hermanni* and the deep-water species *Neocucumis proteus*. The price of dried products ranged from Php 200.00-4,500.00 (USD 5.00-105.00), which even goes up to about Php 6,000.00 (USD 140.00) during the lean months for sea cucumber collection (**Table 3**).

Table 3. Summary for Consumption and Marketing of Sea Cucumber

Species	Family Name	Product Form	Locally Consumed (C), Discarded (D), Traded (T)	Local Price (P/Kg)
Actinopyga echinites	Holothuriidae	Dried	T	1,200 - 2,300
Actinopyga lecanora	Holothuriidae	Dried	T	850 – 2,850
Actinopyga mauritiana	Holothuriidae	Dried	T	550 – 2,000
Actinopyga miliaris	Holothuriidae	Dried	T	500 – 1,500
Actinopyga obesa	Holothuriidae	Dried	T	unknown

Species	Family Name	Product Form	Locally Consumed (C), Discarded (D), Traded (T)	Local Price (P/Kg)
Bohadschia argus	Holothuriidae	Dried; fresh	T	650 – 1,200
Bohadschia marmorata	Holothuriidae	Dried	T	400 - 950
Bohadschia paradoxa	Holothuriidae	Dried	T	500
Bohadschia vitiensis	Holothuriidae	Dried	T	500
Holothuria arenicola	Holothuriidae	Dried; fresh	C	20
Holothuria atra	Holothuriidae	Dried; fresh	T	900
Holothuria coluber	Holothuriidae	Dried; fresh	T	900
Holothuria edulis	Holothuriidae	Dried; fresh	T	350 – 900
Holothuria fuscocinerea	Holothuriidae	dried; fresh	C	120
Holothuria fuscogilva	Holothuriidae	Dried	T	1,800 – 3,800
Holothuria fuscopunctata	Holothuriidae	Dried	T	370
Holothuria hilla	Holothuriidae	Dried; fresh	T, C	120
Holothuria impatiens	Holothuriidae	Dried; fresh	C	100
Holothuria inhabilis	Holothuriidae	Dried; fresh	C	20
Holothuria leucospilota	Holothuriidae	Dried; fresh	C	150
Holothuria nobilis	Holothuriidae	Dried	T	1,500 – 3,000
Holothuria pulla	Holothuriidae	Dried; fresh	T,C	550
Holothuria rigida	Holothuriidae	Dried; fresh	C	120
Holothuria scabra	Holothuriidae	Dried	T	1,800 – 4,500
Holothuria scabra var. versicolor	Holothuriidae	Dried; fresh	T	400 - 950
Holothuria whitmae	Holothuriidae	Dried	T	1,000 – 4,500
Neocucumis proteus	Phyllophorida	Dried	T	20–50 per piece
Pearsonothuria graffei	Holothuriidae	Dried; fresh	T	200
Stichopus chloronotus	Stichopodidae	Dried	T	2,600
Stichopus hermanni	Stichopodidae	Dried	T	1,500 – 2,500
Stichopus horrens	Stichopodidae	Dried	T	1,500 – 2,500
Stichopus noctivagus	Stichopodidae	Dried	T	500 – 1, 500
Sticopus variegatus	Stichopodidae	Dried	T	1,500 – 2,500
Thelenota ananas	Holothuriidae	Dried	T	1,500 – 2,700
Thelenota anax	Holothuriidae	Dried	T	550
Thelenota rubralineata	Holothuriidae	Dried	T	550

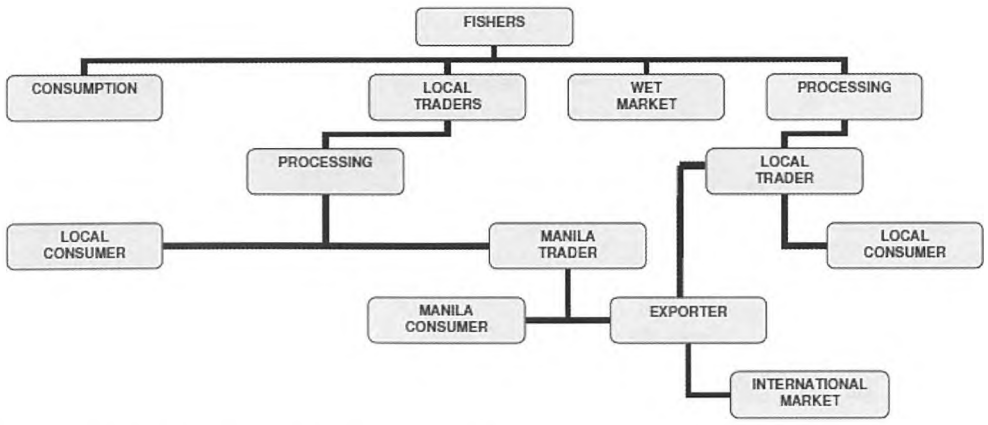


Figure 8. Market chain of sea cucumbers from fishers to consumers (Gamboa, 2007)

The international market is dominated by dried sea cucumber products with the Philippines as the 2nd major producer and supplier. Processed sea cucumber export was reported to rank 8th in the Philippines' top 10 major export commodities. Ganchero (2007), however, opined that the commodities might be on the 4th or 5th rank based on the increasing number of exporters and continuously increasing value of processed sea cucumber products despite the diminishing production volume. During the 1970s, Philippine export statistics showed increased export volume from 1970-2000 with 1984 having the highest at 3500 metric tons (MT) as shown in the works of Akamine (2002). However, in the 1990s, export volume started to fluctuate then showed decline up to the present time based on the compilation of export data from the Bureau of Export Trade Promotion (BETP) under the Department of Trade and Industry (DTI).(). Although the Philippines has maintained a 1000 MT export level (Akamine, 2002), it consists of few high priced species such as *Holothuria scabra, H. fuscogilva, H. nobilis, H. whitmae, Actinopyga lecanora and Stichopus* spp. and mostly undersized individuals (Labe, *et al, to be published*).

Asia is the biggest market for processed sea cucumber meat from the Philippines with an annual export value of USD 43.00 to USD 4.6 million from 1993 to 2006. To date, there are about 46 Filipino owned or partly owned companies engaged in processed sea cucumber export registered in the Bureau of Export and Trade Promotions (BETP) under the Department of Trade and Industry (DTI) supplying the markets of Hongkong, Korea, Singapore, Thailand, Malaysia, Canada, USA and Taiwan in the decreasing order of market dominance (Ganchero 2007). Export to China commenced in 2000 with the highest value of USD 231,000 decreasing annually. Vietnam started its trade with the Philippines in 1988 with a meager import until it reached a high USD 748,000 in 2006 ().

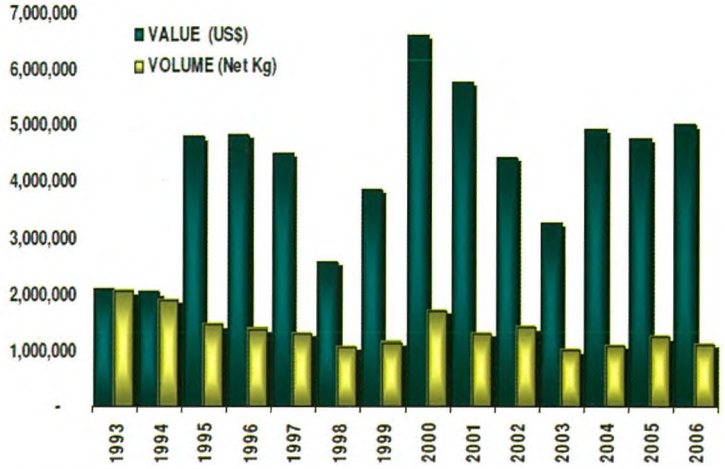


Figure 9. Fluctuating export volume and increasing export value sea cucumber exports from the Philippines, 1993-2006 (Sources: Labe, 2004; Ganchero, 2007).

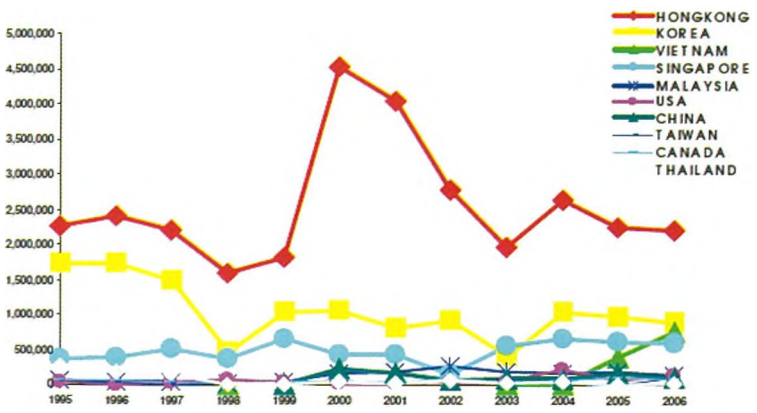


Figure 10. Major markets of Philippine sea cucumbers (USD) from 1993-2006 (Source: Ganchero, 2007)

Research initiatives by government, academic and non-governmental institutions have confirmed the critical state of the Philippine sea cucumber resources and fisheries. The most comprehensive investigation in terms of area and data coverage is the NFRDI Marine Invertebrate Research Section's National Sea Cucumber Research Project (NSCRP). The current socio-economic and governance condition, inability of government to provide management intervention, lack of baseline data, e.g. species, ecological, biological, production and trade; lack of efforts to develop aquaculture and postharvest techniques are only some of the major issues confronting sea cucumber fisheries, utilization and trade in the Philippines.

To date, the first and most significant government initiative to save the country's sea cucumber resources and heed the call of regional and international bodies was a national forum spearheaded by the NFRDI and BFAR, in collaboration with Philippine Council for Aquatic and Marine Research and Development (PCAMRD) and the University of the Philippines Marine Science Institute (UPMSI). The First National Forum on Sea Cucumber Fisheries Management was held on June 6-9, 2007 at the BFAR National Integrated Fisheries Technology Development Center (NIFTDC) in Dagupan City, Pangasinan in Northern Luzon. The forum gathered together participants from relevant government agencies, strategically located academic research institutions, BFAR Regional Field Offices, Local Government Units (LGUs); and stakeholders (sea cucumber collectors; growers and traders). The forum served as venue for all sectors concerned to share information and exchange views regarding the complex management and development issues on Philippine sea cucumber fisheries.

The general objectives of the forum were: 1) to assess the status of sea cucumber fishery and industry and develop management recommendations/input to national policy to ensure sustainability of the resource and equitable benefits to stakeholders; and 2) to formulate a multi-sectoral action plan towards a comprehensive management strategy for Philippine sea cucumber resources. Specifically, the forum intended to provide an overview of current state of knowledge and practices related to Philippine sea cucumber fisheries and culture, to facilitate information sharing and leveling of understanding among various stakeholders, and to identify key issues and strategic actions to improve the management of fishery and emerging culture practices.

During the forum workshops, two major sectors of sea cucumber fisheries were identified: production and post-harvest. The major sectors were further divided into subsectors, i. e., capture fisheries (production), grow-out culture (production), processing and value adding (post-harvest), and marketing and trade (post-harvest). The workshop groups identified the key environmental, socio-cultural and economic issues confronting each of the subsectors, their causes and recommended possible actions to address these issues through institutional policy, technical/management intervention, capacity building, and research and development initiatives. The following are the workshop outputs by subsector and the pre- and post-forum accomplishments by the entities concerned.

This scarcity of basic information on sea cucumbers i.e. identity of species in trade (holothuroid

ISSUES	CAUSES
A. Environmental	
Lack of taxonomic identification (Scientific names, common name, local names{cebuano, tagalog, ilocano})	Few taxonomists; limited access to field guides; no molecular studies
Lack of data on population status, impact of overexploitation in traditional & nontraditional fishing grounds	No standardized assessment methods; No inventory of sea cucumber per regions, province & municipality
Limited knowledge on reproductive biology of commercially important species	Limited funding & qualified expert to conduct basic research
Depletion of sea cucumber	Destructive fishing method, land based pollution; Deterioration of habitat; Unregulated harvest methods
Pollutants of sea cucumber	Destructive fishing method, land based pollution
No Philippine atlas of sea cucumber	Lack of information/ proposals/ financial assistance
No national catch data per species	Lack of trained field enumerators and insufficient funds

B. Socio-cultural and Economic	
Lack of understanding by stakeholders on sea cucumber	No IEC for sea cucumber; lack of information in popular form; no collated information; no socio-economics studies of sea cucumber fishery

RECOMMENDATIONS

A. Institutional Policy (National/Local)

1. To develop a comprehensive national management plan for sea cucumber.
2. To strengthen inter-institutional information networking.
3. In policy formulation, integrate holothurian conservation with MPA.
4. NFRDI to complete information gathering for sea cucumber atlas; coordinate with possible funding partners
5. DEPED, CHED to mainstream IEC materials

B. Technological/ Management Intervention

1. Collect production data
2. Develop MIS
3. Establish MPA and stock enhancement program

C. Capability Building

1. Conduct trainings on grow-out culture and proper postharvest (e.g. handling, sorting, processing).
2. Conduct trainings on taxonomic ID at various level (fisherfolk, managers, LGU, traders, NGA)
3. Conduct training on stock enhancement.
4. Conduct training for BAS enumerators

D. R&D

1. Develop bio-economic model on sea cucumber fishery.
2. Support scholarships for graduate studies related to taxonomy.
3. NFRDI spearheads inter-agency national R&D program for sea cucumbers.
4. Conduct studies on reproductive biology of other commercially important species.
5. Research on ecotoxicology.

E. Others

1. Production of taxonomic guides by DOST-PCAMRD or NFRDI.
2. NFRDI to collate information for the Phil. Atlas of sea cucumber.

taxonomy is complicated especially the processed forms), status of wildstocks and fisheries, their ecology and biology, ecological impacts of over-harvesting has been addressed by the NFRDI, which is the research arm of BFAR. The Marine Invertebrates Section of NFRDI carried out the National Sea Cucumber Research Project, the results of which would be the bases for BFAR to formulate and enact management policies for the threatened sea cucumber populations.

The significant accomplishments of NSCRP to date include identification of sea cucumber species in trade both fresh and processed forms; standardization of methods for the fishery independent and dependent surveys for sea cucumbers; development of database for sea cucumbers that could be expanded to cover other invertebrates; conduct of the national training/workshop on sea cucumber taxonomy and stock assessment with the technical personnel of BFAR Regional Field Offices as participants; production of poster of commercial sea cucumbers of the Philippines; preparation of materials for sea cucumber atlas, taxonomic guides, handbooks, field guides and other IEC materials; organization of the 1st National Forum on Sea Cucumber Fisheries Management; and submission of the proposed Fisheries Administrative Order (FAO) on sea cucumber size regulation.

Other academic institutions and the Fisheries Division of the LGUs have started stock assessment works following or modifying the NFRDI methodologies depending on the research objectives. Some BFAR Regional Offices have integrated sea cucumber stock monitoring into their regular activities depending on the availability of funds and work force.

Management strategies to curtail over-harvesting of natural stocks are now in place in some marine areas of the country. Worth mentioning are the Marine Protected Areas (MPAs) in Sagay City, Negros Occidental through the efforts of the Northern Negros Aquatic Resources Advisory Council (NNARMAC) and the Baliangao Marine Reserve that was established by Danao Bay Resource Management Office, both under the respective Local Governments. The Sagay City government also imposes rotational collection of sea cucumber by dividing their marine areas into collection zones. The DA-BFAR and NFRDI as the national government authorities assist their local counterparts through collaborative site selection works for the establishment of MPAs, resource assessment and monitoring.

The University of the Philippines Marine Science Institute (UPMSI) leads the grow-out, hatchery

and stock enhancement initiatives for the country in collaboration with other academic research institutions within and outside the UP System and the BFAR-NFRDI-NIFTDC in Dagupan City. UPMSI together with UP in the Visayas (UPV) and UP in Mindanao (UPMin) has initiated the hatchery breeding of sandfish (Holothuria scabra) funded by Philippine Council for Aquatic together and Marine Research and Development (PCAMRD) and Australian Cooperation in Agricultural Research (ACIAR) through World Fish (formerly International Center for Living Aquatic Resource Management or ICLARM). The BFAR-NFRDI-NIFTDC in Dagupan City was recently involved in the project with the on-going construction of sandfish hatchery farm at NIFTDC and consequently be the training center.

ISSUES	CAUSES
A. Environmental	
Degradation of habitat	Illegal fishing (e.g. cyanide, dynamite); coastal development (i.e. siltation)
Resource depletion or declining catch	Increased fishing pressure; weak law enforcement; lack of political will; no resource map to determine juvenile collection sites
Lack of technical knowhow (about species	Limited access to information; no baseline data; no production data available; secondary priority commodity of the gov't.; limited R&D support program
ID, production, and grow-out culture technology)	No commercial hatcheries; no reserved area for wild source; no regulation on harvest size
B. Inadequate supply of juveniles for grow-out	
Disparity in buying prices	Lack of information
Capitalization need	Limited credit window or access to credit
Uncertain feasibility of sea cucumber farming	Limited experience or expertise
C. Socio-cultural	
Possible conflict in resource allocation (usezonation-tenure)	Lack of zonation; LGUs not able to come up with zonation plan or water use plan; lack of regulations or policies
RECOMMENDATIONS	
A. Institutional Policy (National/Local) 1. Strict enforcement of fishery laws. 2. Develop a clear management guidelines & policies. 3. Develop guidelines on permit and licensing of grow-out area. 4. Zonation or identification of potential sites for culture 5. Formulate management plan (National & local)	
B. Technological/ Management Intervention 1. Formulation of management plan (FAO) 2. Ordinances on conservation management (c/o LGU) 3. Establish marine reserve or sanctuary	
C. Capability Building 1. Conduct training on entrepreneurial skills for the growers. 2. Conduct forum on investment. 3. Conduct training on responsible aquaculture. 4. Conduct training on proper utilization, conservation, and management of the resources 5. Conduct trainer's training on hatchery and grow-out culture. 6. Training on values formation (i.e. responsible parenthood)	
D. R&D 1. Piloting of grow-out of high value species in selected areas. 2. Broodstock sourcing and management 3. Refinement of hatchery protocols for culturable species. 4. Conduct studies on reproductive biology and ecology of other commercially important species.	

In some areas of the country, fishermen are already practicing the wild sea cucumber grow-out culture in pens or cages. Grow-out endeavors could be seen in Puerto Princesa City, Palawan; Bolinao, Pangasinan; Sta. Cruz, Davao del Sur; and Mauban, Quezon. Growers received technical advice on grow-out techniques during the national forum.

To conclude, the Philippine initiatives paved the way for a close linkage and strong information networking between and among Philippine

government institutions involved in sea cucumber conservation and management and the stakeholders. What remains the major constraint for the Philippine initiatives is funding and logistics support to implement various projects that have been identified in the action plan for each sector.

ISSUES	CAUSES
A. Quality and Safety	
High Moisture content	Lack of knowledge on proper handling and processing; trainings on processing is not provided
Poor packaging	
Poor hygiene and sanitation practices ID, production, and grow-out culture technology)	
Lack of knowledge on GMP/SSOP by the fisherfolk and processors	
Inconsistent quality of the final products	
Presence of toxic substances	
Product contamination with Pathogenic bacteria	
RECOMMENDATIONS	
A. Technological/ Management Intervention 1. Characterize the set quality standards. 2. The product must meet consumer expectations and quality standards. 3. Product must comply international standards. 4. The product must be competitively priced.	
B. Capability Building 1. Conduct training on effective application of GMP/ SSOP in the whole stages of processing. 2. Conduct training to improve collecting, handling, processing, and packaging technologies.	
C. R&D 1. Continuous R&D for processing and value-added product formulations. 2. Conduct more research to improve collecting, handling, processing, and packaging technologies.	

ISSUES	CAUSES
A. Economic	
Absence of formal marketing system in the local trade of sea cucumber products	Based on trust and loyalty; lack of formal negotiable instrument or contract; lack of information
Traders have no absolute idea on the export market system level	
No pricing standards or different price range	
Huge amount of transportation cost	Also based on trust
Credit assistance	
Poor standards, lack of quality control and not proper handling	Lack of information
Product contamination with Pathogenic bacteria	
RECOMMENDATIONS	
A. Institutional Policy (National/Local) 1. Implementation of LGU Coastal regulations (e.g. issuance of auxiliary invoice; fishery code regulations)	
B. Technological/ Management Intervention 1. Linkage of traders with the grow-out sector or to engage in sea cucumber	
C. Capability Building 1. Engage in direct exporting.	
D. R&D 1. To conduct a rapid market system study and value chain analysis. 2. Gather market information, and document market/ trade practices.	

On the regional level, the Philippines, through this Report hopes to have been able to lay the groundwork for other ASEAN members in developing national and regional management plans for sea cucumbers, for which, this ASEAN-SEAFDEC Regional study on sea cucumber fisheries, utilization and trade in Southeast Asia was carried out.

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