

Sea Cucumber Fishery in Aurora, Philippines

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Abstract

This study was conducted to provide a preliminary assessment of the sea cucumber fishery in Aurora, Philippines. This was conducted from February to June 2013. All sea cucumber gatherers and traders, obtained through snow-ball sampling, in each identified sea cucumber fishery area in six coastal municipalities (Baler, Dipaculao, Dinalungan, Casiguran, Dilasag and Dingalan) were interviewed using a structured interview schedule and focused group discussions (FGD). Results revealed that gathering sea cucumbers were accomplished by handpicking, skin diving or compressor diving. A total of 15 commercial species were regularly gathered. Out of this, three species are of very high economic value (\geq Php 4000/kg) (*Holothuria nobilis*, *Holothuria scabra*, and *Actinopyga lecanora*). The average number of kilograms harvested per hour per trip ranges from 0.21 (*Holothuria fuscopunctata*) to 2.71 (*Holothuria scabra*), while the average size of commonly gathered sea cucumber varies among species with *Holothuria lecanora* showed an average length (29.26 cm) greater than recorded 24 cm. Processing mainly involves washing, slicing, boiling, drying and packing. Processed sea cucumbers or trepan were sold to middlemen or direct buyers who usually offered higher prices (36.36% up to 69.20%) than the former. Problems encountered by sea cucumber gatherers and traders include a decline in total catch, a shift in area of collection from intertidal zones to deeper waters, an increase in the number of hours spent in finding and gathering sea cucumbers, the use of compressors in gathering, the decline of larger species and gathering of smaller sizes in huge amount, the absence of conservation program for sea cucumber, and the lenient implementation of government policies with regards to coastal resources management.

Keywords

Assessment, Sea Cucumber, Trepang, Fishery

1. Introduction

Sea cucumber fishery in the Philippines dates back in the late eighteenth century [1]. Since then, sea cucumber gathering for trepan has formed part of a source of livelihood for coastal communities. Sea cucumbers known as *beche de mer* or trepan when dried or processed are valued for their different economic uses e.g. delicacy, traditional medicine, source of protein and fatty acids, antiviral, anti-tumoral and anticancerous [2] [3]. The expanding international markets for these species ranked the Philippines as the 2nd major producer and exporter in the world, 2nd to Indonesia, with catches of around 20,000 tonnes (live) per year [4].

The increase in demand for trepan has resulted to a considerable decline of stock due to overexploitation, with some species (*Holothuria scabra* and *Stichopus* sp.) now listed in the International Union for Conservation of Nature (IUCN) [5] as endangered species. Issues on the possible collapse of sea cucumber fishery in the Philippines have prompted the need to assess the fishery status in key biogeographic regions in the Philippines.

In Aurora, anecdotal records revealed that sea cucumber gathering has long been in existence, and areas of gathering have expanded from the usual intertidal zones in the late 60s, which was done by hand picking, to the deeper water recently, which is now accomplished through skin diving or by the aid of an air compressor. This is done year-round, mostly at night and early morning, whenever a sea cucumber is sighted during each gleaning and fishing trip. However, the status of sea cucumber fishery in the province has never been studied. No proper document on areas and methods of collection; species, volume and size of harvested sea cucumbers; and marketing practices have ever been recorded. Therefore, the present study assessed the status of the sea cucumber fishery in Aurora province. Specifically, it determined the sociodemographic profile of sea cucumber gatherers and traders; and determined their gathering, processing, and marketing practices. The results will serve as a basis for concerned agencies to formulate appropriate management strategies.

2. Methodology

All sea cucumber gatherers and traders, obtained through snowball sampling, in each identified sea cucumber fishery area in six coastal municipalities (Baler, Dipaculao, Dinalungan, Casiguran, Dilasag and Dingalan) (Figure 1) were interviewed using a structured interview schedule and focused group discussions (FGD). This study was conducted from February to June 2013.

Information obtained from sea cucumber gatherers were sociodemographic profile; sea cucumber gathering, processing and marketing practices; and historical trends. For sea cucumber traders, information on product grading, pricing and market requirements was surveyed. Official receipts were also gathered to confirm the information.

The distribution of the respondents was as follows:

A. For sea cucumber traders (middlemen)

Municipality	Total
Baler	3
Dipaculao	2
Dilasag	5
Dingalan	1
Casiguran	2
Dinalungan	0
	13

B. For sea cucumber gatherers

Municipality	Total
Baler	6
Dipaculao	1
Dilasag	26
Dingalan	7
Casiguran	25
Dinalungan	16
	81

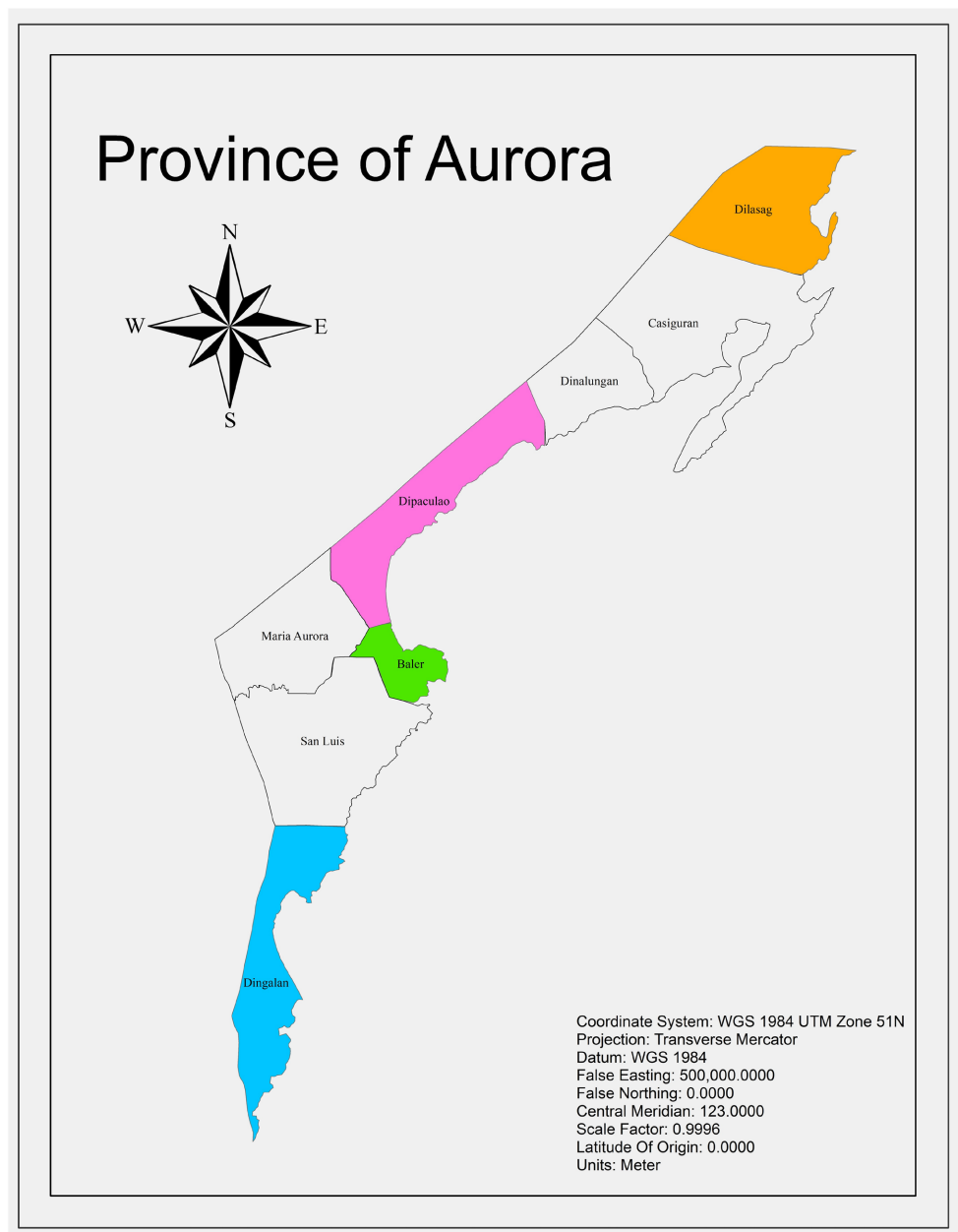


Figure 1. Location of the six identified sea cucumber fishery areas.

3. Results and Discussion

3.1. Sociodemographic Profile of Sea Cucumber Gatherers and Traders

Most of the gatherers were males (87.65%), with ages ranging from 24 to 68 years old (**Table 1**). The majority were between 33 - 41 years old (28.40%), similar to the age range of most gleaners in Davao, Philippines [6]. Only a few were between 60 and 69 (6.17%). More than half were married (85.19%) and obtained an elementary education (61.73%). Most of them were involved in fishing (82.72%), while some were into farming (9.88%) as their main source of income. To augment their income, most of the sea cucumber gatherers were into farming (37.04%) as their alternative livelihood. Most of the gatherers have less than 1 year to 8 years of experience (30.86%), while only a few have 41 to 48 years of experience (2.47%). The length of experience of these sea cucumber gatherers revealed that sea cucumber resources in the province were already exploited since the late 60s.

Table 1. Sociodemographic profile of sea cucumber gatherers and traders.

	Gatherers (n = 81)		Traders (n = 14)	
	Frequency	Percentage (%)	Frequency	Percentage (%)
Gender				
Male	71	87.65	11	78.57
Female	10	12.35	3	3.70
Age				
24 - 32	19	23.46	1	7.14
33 - 41	23	28.40	4	28.57
42 - 50	19	23.46	5	35.71
51 - 59	15	18.52	2	14.29
60 - 68	5	6.17	1	7.14
69 - 77	0	0	1	7.14
Civil Status				
Single	9	11.11	0	0
Married	69	85.19	14	100
Separated	1	1.23	0	0
Widower	2	2.47	0	0
Education Attainment				
No formal schooling	4	4.94	0	0
Elementary	50	61.73	8	57.14
Secondary	23	28.40	4	28.57
College	2	2.47	1	7.14
Vocational	2	2.47	1	7.14

Continued

Primary Source of Income				
Fishing	67	82.72	9	64.29
Farming	8	9.88	1	7.14
Sea cucumber gathering	1	1.23	0	0
Lobster gathering	1	1.23	0	0
Carpenter	2	2.47	0	0
Sari-sari store owner	1	1.23	1	7.14
Hired labor	1	1.23	0	0
Aquaculture farming	0	0	1	7.14
Government employee	0	0	1	7.14
Electronic technician	0	0	1	7.14
Secondary Source of Income				
Fishing	12	14.81	0	0
Farming	30	37.04	4	28.57
Sea cucumber gathering	1	1.23	0	0
Lobster gathering	0	0	1	7.14
Carpenter	1	1.23	1	7.14
Sari-sari store owner	1	1.23	1	7.14
Hired labor	9	11.11	1	7.14
Government employee	2	2.47	1	7.14
Fish processor	1	1.23	0	0
Crab gathering	1	1.23	0	0
Tricycle operator	2	2.47	0	0
Fish vendor	0	0	1	7.14
None	21	25.93	4	28.57
No. of Years of Experience				
0 - 8	25	30.86	9	64.29
9 - 16	21	25.93	4	28.57
17 - 24	22	27.16	1	7.14
25 - 32	7	8.64	0	0
33 - 40	4	4.94	0	0
41 - 48	2	2.47	0	0

Middlemen traders in the province were mostly males (78.57%) with age ranges from 32 to 72 years old (**Table 1**). The majority were 42 - 50 years old (35.71%), and all were married (100%). The results also revealed that the educational level of sea cucumber traders with elementary education is the highest (57.14%), similar to the result of [6] in Davao. Vocational and tertiary education

was the gleaners' lowest, with 7.14% each. Most were into fishing (64.29%) as the primary source of income, while others were involved in aquaculture, farming, small-scale store operation, or were working as electronic technicians and as government employees with 7.14% each. The majority were into farming (28.57%) as an alternative source of livelihood. All of the traders were relatively new to the business, with less than 24 years of experience. More than half of them even have less than 1 to 8 years of experience (64.29%).

Most of the gatherers and traders were members of certain organization such as the Fisherfolk Organization and Barangay Fisheries and Aquatic Resources Management Council (BFARMC), the most prevalent. This could mean that they are aware of the importance of the sea's resources as a source of their livelihood.

3.2. Gathering Practices

A total of 15 commercial species were regularly gathered in Aurora waters (Table 2). Out of this, 3 species are of very high economic value (\geq Php 4000/kg) (*Holothuria nobilis*, *Holothuria scabra*, and *Actinopyga lecanora*), 7 species are of high economic value (Php 1000 - 4000/kg) (*Actinopyga mauritiana*, *Thelenota ananas*, *Actinopyga echinites*, *Bohadschia* sp., *Bohadschia argus*, *Stichopus chloronotus* and *Stichopus* sp.), 4 species are of medium value (Php 500 - 1000/kg) (*Holothuria leucospilota*, *Holothuria atra*, *Holothuria edulis*, and *Thelenota anax*) while only 1 species is of low economic value (\leq Php 100/kg) (*Holothuria fuscopunctata*). The results revealed an increase economic value of most species, for example, from high to medium economic values of *Holothuria nobilis*, *Holothuria scabra* and *Actinopyga lecanora* [4] [7] to very high economic value recently.

Sea cucumbers were usually handpicked by female gleaners along with sea shells, crabs and seaweeds in the intertidal zones during low tide, commonly at night, as sea cucumbers of high economic value are usually nocturnal [6] [7]. This is accomplished by turning over rocks, looking inside crevices and raking the substrate. The male fishers usually skin dive and hand-pick any sea cucumber species sighted along their fishing trip, usually during the early morning. Some males prefer the use of air compressors to reach deeper waters to collect larger sea cucumbers [8].

Air compressors are common among sea cucumber gatherers [6] [7] [8]. This technique is known as not safe for the health of fishers and may also cause damage to marine habitat; thus, its use is prohibited in some municipalities in Aurora. However, due to the depleting stock of sea cucumber resources, gatherers were forced to use air compressors even within Marine Protected Areas (MPAs) in Dipaculao and Dinalungan (Table 2).

The average number of kilograms harvested per hour per trip ranges from 0.21 (*Holothuria fuscopunctata*) to 2.71 (*Holothuria scabra*) (Table 2). The highest range is followed by *Stichopus chloronotus* (2.31) and *Thelenota anax* (2.04).

Based on this result, it is obvious that gatherers prefer collecting species of very high to medium economic value over species of low economic value.

Table 2. Sea cucumber species commonly gathered from Aurora waters.

Scientific Name	Local Name	Area of Collection	Method of Collection	Catch Per Unit Effort (CPUE)* (kg/hr)	Average Size	
					Length (cm)	Width (cm)
Order Aspidochirotida						
Family Holo thuriidae						
<i>Holothuria leucospilota</i>	Brown beauty	Casiguran	Hand picking, skin diving, compressor diving	0.62	17.67	6.02
		Dilasag	Hand picking			
		Dingalan	Skin diving			
<i>Holothuria nobilis</i>	Susuan	Dipaculao	Hand picking, Skin diving	1.32	28.60	6.93
		Dinalungan	Skin diving			
<i>Holothuria fuscopunctata</i>	Sapatos	Dilasag	Skin diving, compressor diving	0.21	25.04	5.46
		Casiguran	Hand picking, skin diving, compressor diving			
		Baler	Skin diving			
		Dinalungan	Hand picking, skin diving			
<i>Holothuria atra</i>	Black beauty	Casiguran	Hand picking, skin diving, compressor diving	1.69	19.41	6.02
		Dingalan	Hand picking, skin diving, compressor diving			
		Dinalungan	Skin diving			
<i>Holothuria scabra</i>	Putian	Casiguran	Hand picking, skin diving, compressor diving	2.71	22.82	4.95
		Dilasag	Skin diving			
<i>Holothuria edulis</i>	Pulahan	Dingalan	Hand picking, skin diving	0.83	30.48	5.08
		Dilasag	Skin diving			
<i>Actinopyga echinites</i>	Khaki	Baler	Hand picking, skin diving	0.40	18.08	7.16
		Dilasag	Skin diving			
		Casiguran	Skin diving, compressor diving			
		Dipaculao	Skin diving			
<i>Actinopyga mauritiana</i>	Bacungan	Dinalungan	Hand picking, skin diving	1.14	10.13	5.82
		Casiguran	Hand picking, skin diving, compressor diving			
<i>Actinopyga lecanora</i>	Buli-buli	Dilasag	Skin diving, compressor diving	0.46	29.26	7.16
		Dinalungan	Hand picking			
<i>Bohadschia</i> sp.	Lawayan	Casiguran	Hand picking, skin diving, compressor diving	0.55	19.23	8.99
		Baler	Hand picking, skin diving			
		Dinalungan	Hand picking, skin diving, compressor diving			
<i>Bohadschia argus</i>	Matang-itik	Casiguran	Skin diving, compressor diving	1.46	24.74	5.11
		Dilasag	Skin diving, compressor diving			

Continued

Family Stichopodidae

<i>Stichopus chloronotus</i>	Kwatro kantos	Dilasag	Hand picking, skin diving, compressor diving	2.13	30.48	2.51
		Baler	Hand picking, skin diving			
		Dingalan	Skin diving			
<i>Stichopus</i> sp.	Hanginan	Dipaculao	Skin diving, compressor diving	0.91	25.45	6.30
		Dinalungan	Hand picking, skin diving, compressor diving			
		Casiguran	Hand picking, skin diving, compressor diving			
		Dilasag	Hand picking, skin diving, compressor diving			
		Dinalungan	Skin diving			
<i>Thelenota anax</i>	Legs	Dilasag	Hand picking, skin diving, compressor diving	2.04	36.27	5.16
		Casiguran	Hand picking, skin diving, compressor diving			
		Dipaculao	Skin diving			
<i>Thelenota ananas</i>	Pinya-pinya	Casiguran	Hand picking	1.02	35.64	5.23
		Dinalungan	Skin diving, compressor diving			

*Average number of hour per trip = 8; *Average number of person per trip = 4.

The average size of commonly gathered sea cucumbers varies among species. Out of three species of very high economic value, only *Holothuria lecanora* showed an average length (29.26 cm) greater than those recorded by [9], which is only 24 cm. On the other hand, the average length (28.60 cm and 22.82 cm) and width (6.93 cm and 4.95 cm) of gathered *Holothuria nobilis* and *Holothuria scabra* in the province were almost half of its average maximum length (60 cm and 40 cm) and width (35 cm and 24 cm). The obvious absence of larger species of very high economic value would indicate the overexploitation of these species. An undated report by Heinen, as cited by [10], suggested that overfishing of sea cucumbers is severe and widespread in the Philippines. This data coincides with the number of kilogram gathered per hour per trip where *Holothuria scabra* emerged as the most heavily collected species (2.71 kg/hr). The smaller sizes, a lower amount of gathered *Holothuria nobilis* and *Holothuria lecanora*, and the use of a compressor per fishing trip would imply a decrease in the number of these resources such that when the collection is not regulated, given their density-dependent mode of reproduction, these resources will collapse compromising the source of livelihood of the coastal communities.

3.3. Processing Practices

Sea cucumber species gathered were processed into *tre pang*. The processing mainly involved washing, slicing, boiling, drying and packing, depending on the species. As soon as the species were gathered, this was washed with fresh water to remove any attached foreign materials. The species were then sliced along the median plane at the ventral side to remove the entrails and washed again before boiling them with salt water.

The number of hours of boiling depends on the species; for example, *Actinopyga echinites* and *Stichopus horrens* were usually boiled for 30 minutes to 3 hours. Other species like *Bohadschia argus*, *Actinopyga lecanora*, *Stichopus*

horrens, *Holothuria fuscopunctata*, and *Holothuria nobilis* aside from boiling for 2 hours after scrubbing the body of these species to remove any deeply attached foreign materials and expose the real skin color, these were reboiled for another 6 hours. After boiling, the sea cucumbers were subjected to smoke or sun drying.

The smoke drying process usually takes a minimum of one day up to a maximum of five days, depending on the species. Smoke drying was done during the wet season either with the aid of an improvised oven or by placing the sea cucumber on top of a conventional oven which is also used by coastal communities in cooking their meals. To ensure the desired dryness of processed sea cucumber, the species was subjected to sun drying for an average of two days before packing.

The processed sea cucumbers were stored in baskets, sacks, nets or cardboard box containers. These containers were left open to ensure continuous air circulation so that stored products would not be damaged by molds that would lessen their economic value.

3.4. Marketing Practices

The processed sea cucumbers or trepan were either sold to middlemen or direct buyers. Direct buyers usually offer higher prices (36.36% up to 69.20%) than middlemen (**Table 3**). Most sea cucumber gatherers sold their products to middlemen either as fresh or processed. Although middlemen offer lower prices than direct buyers, the easy return of money from their hard work is more important to support the daily basic needs of their family. Those who were selling their products to direct buyers in Binondo, Sta. Cruz and Las Piñas usually had to wait for an ample amount of time until their containers were filled, which would usually take up to one year for one sack of processed sea cucumber.

The traders usually grade processed sea cucumbers according to size (**Table 3**). However, the actual marketing practice revealed that most sellers sold their produce to middlemen on an “all-in” basis, although direct buyers usually paid the sellers according to the size, grade and quality of their products, similar to what buyers in the Toliara region in Southwestern Madagascar did [10]. Both traders (middlemen) and gatherers disclosed that there is no particular requirement regarding species, size, amount in kg, and packaging of processed sea cucumbers sold and bought. Although other traders (direct buyers) required that the product is not overcooked, not smelly, the body shape is intact, and the product is clean. Traders pay less when trepan products sold by processors need further treatment.

3.5. Problems Encountered

Based on informal interviews and focused group discussions (FGD), the problems encountered by sea cucumber gatherers and traders were the following:

- 1) The total catch of sea cucumbers has declined due to the increased number of gatherers.

Table 3. Price per kilogram of processed sea cucumber.

Scientific Name	Local Name	Price/kg of Processed Sea Cucumber (Php)			
		Size Grade	Size or pc/kg	Middlemen	Direct Buyer
<i>Holothuria leucospilota</i>	Brown beauty	L	Taba	200.00	550.00
		S	Payat	100.00	350.00
		XL	3 to 4 pcs	3875.00	5600.00
<i>Holothuria nobilis</i>	Susuan	L	5 to 7	3675.00	5100.00
		M	8 to 10	2160.00	4200.00
		S	10 to 15	1200.00	3200.00
<i>Holothuria fuscopunctata</i>	Sapatos	XS	16 to 25	900.00	2700.00
		L	-	300.00	300.00
		S	-	(assorted)	50.00
<i>Holothuria atra</i>	Black beauty	L	>5 inches	600.00	700.00
		M	4 to 5	325.00	500.00
		S	2 to 4	113.00	220.00
		XXL	<15 pcs	-	6000.00
		XL	15	3500.00	5500.00
<i>Holothuria scabra</i>	Putian	L	25	2800.00	4500.00
		M	40	2100.00	3300.00
		S	60	1600.00	2500.00
		XS	80	1400.00	2300.00
		XXS	>80	-	1700.00
<i>Holothuria edulis</i>	Pulahan	Assorted	-	500.00	1,000.00
		L	>3 inches	1500.00	2400.00
<i>Actinopyga echinites</i>	Khaki	M	2.5 to 3	800.00	2000.00
		S	1.5 to 2.5	600.00	1500.00
		XS	1 to 1.5	300.00	1200.00
		XXS	<1	-	800.00
<i>Actinopyga mauritiana</i>	Bacungan	L	5 to 6 pcs	2500.00	4000.00
		M	7 to 8	2000.00	3200.00
		S	8 to 10	1300.00	2300.00
		XS	11 to 15	1100.00	2000.00
		L	≥3 inches	2737.50	4500.00
<i>Actinopyga lecanora</i>	Buli-Buli	M	2.5 to 3	1650.00	3200.00
		S	1 to 2.5	1100.00	2400.00
		XS	<1 inch	500.00	1600.00
		XXS	-	-	1000.00
<i>Bohadschia</i> sp.	Lawayan	L	≥4 inches	400.00	1100.00
		M	-	200.00	900.00
		S	-	100.00	600.00
		XS	-	-	300.00
<i>Bohadschia argus</i>	Leopard/ Matang-itik	L	-	800.00	1750.00
		M	-	500.00	1250.00
		S	-	300.00	700.00
<i>Stichopus chloronotus</i>	Kwatro kantos	Assorted	-	2000.00	3000.00
		L	≥3 inches	2567.00	3850.00
<i>Stichopus</i> sp.	Hanginan/Gadul	M	2.5 to 3	900.00	3400.00
		S	2 to 2.5	750.00	2800.00
		XS	<2	1300.00	2400.00
<i>Thelenota anax</i>	Legs	Assorted	-	-	850.00

Continued

<i>Thelenota ananas</i>	Tinikan/	L	≥5 inches	2916.50	4000.00
	Pinya-pinya	M	4 to 5	1200.00	3000.00
		S	-	400.00	2200.00

- 2) The shift in sea cucumber collection from intertidal zones to deeper waters.
- 3) The number of hours spent finding and gathering has increased due to decreased species stock.
- 4) The use of compressors has exacerbated the rapid stock depletion.
- 5) The overexploitation of the species shifted the collection from larger to smaller sizes in massive amounts.
- 6) The absence of programs for the conservation of sea cucumber resources.
- 7) The lenient implementation of government programs concerning the management of coastal resources.

4. Summary

The present study assessed the status of the sea cucumber fishery in Aurora province. Specifically, it determined the sociodemographic profile of sea cucumber gatherers and traders; and determined their gathering, processing, and marketing practices. The results will serve as a basis for concerned agencies to formulate appropriate management strategies. This was conducted from February to June 2013. All sea cucumber gatherers and traders, obtained through snowball sampling, in each identified sea cucumber fishery area in six coastal municipalities (Baler, Dipaculao, Dinalungan, Casiguran, Dilasag and Dingalan) were interviewed using a structured interview schedule and focused group discussions (FGD). Results revealed that gathering sea cucumbers were accomplished by handpicking, skin diving or compressor diving. A total of 15 commercial species were regularly gathered. Out of this, three species are of very high economic value (\geq Php 4000/kg) (*Holothuria nobilis*, *Holothuria scabra*, and *Actinopyga lecanora*). The average number of kilograms harvested per hour per trip ranges from 0.21 (*Holothuria fuscopunctata*) to 2.71 (*Holothuria scabra*), while the average size of commonly gathered sea cucumber varies among species with *Holothuria lecanora* showed an average length (29.26 cm) greater than recorded 24 cm. Processing mainly involves washing, slicing, boiling, drying and packing. Processed sea cucumbers or trepan were sold to middlemen or direct buyers who usually offered higher prices (36.36% up to 69.20%) than the former.

5. Conclusions

Based on the results, the following conclusions are drawn:

- 1) The coastal communities were utilising the sea cucumber resources as an alternative source of livelihood through the production of trepan for decades that started in the late 60s.

2) The commercially important sea cucumber species gathered in Aurora waters are declining, as exhibited by the average catch per hour per trip of fishers, such that areas of the collection have now shifted from intertidal zones, where these species were handpicked, to deeper waters, where fishers had to skin dive or even use an air compressor.

3) The sea cucumber resources were not given enough time to reproduce, given their density-dependent mode of reproduction, as revealed by the average size of sea cucumbers gathered. If management intervention is done, the resources will stay intact and, in effect, will not jeopardize coastal communities' alternative livelihood (trepan production).

4) The "all in" marketing practice has led to the gathering of even smaller size species that exacerbates stock depletion.

6. Implications and Recommendations

The sea cucumber fishery in the province has served as an alternative source of livelihood for coastal communities for decades resulting in the apparent stock depletion. Immediate attention must be provided by concerned agencies before these sea cucumber resources will collapse. In connection with this, the following were highly recommended:

1) A management program may be implemented to conserve the remaining sea cucumber resources in the province so as not to jeopardise the alternative source of livelihood of coastal communities.

2) The critical collection areas can be given enough time to recover from over-exploitation by formulating the "no take zone" policy.

3) A guideline may be formulated regarding allowable size so that smaller species will be given enough time to grow and achieve their maximum length. This, in turn, will allow species to repopulate overfished areas.

4) A strict imposition on banning the use of compressors in order to regulate the gathering of the already overfished sea cucumber resources.

5) A permanent survey site may be established by the provincial government to regularly monitor the status of sea cucumber fishery in the province so that appropriate management strategies will be implemented.

6) A sea cucumber mariculture for species of medium to very high economic values that will serve as a source of seeds to replenish depleted stock can be established by the Local Government Units (LGUs).

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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