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1. INTRODUCTION

This study examined the sea cucumber industry in the Philippines through the value chain lens. The intent was to identify effective pathways for the successful introduction of sandfish culture as livelihood support for coastal communities. Value chain analysis is a high-resolution analytical tool that enables industry examination at a detailed level. Previous industry assessments, from Gamboa et al. 2007 and Labe, 2010 for example, have provided a general picture of the sea cucumber industry in the country. The present study builds on the earlier work and supplies additional details for a better understanding of the industry's status and problems, especially their implications for the Australian Center for International Agricultural Research (ACIAR) funded sandfish project "Culture of sandfish *(Holothuria scabra)* in Asia-Pacific" (FIS/2003/059).

Value chain analysis is integral to the ACIAR project's expanded aim of developing sea ranching and pond culture of sandfish as an alternative livelihood for marginalized people in coastal communities in the Philippines. Effective pathways for marketing the produce from sea ranching and pond culture have to be identified and developed. These pathways should yield the highest possible benefits, especially to small-scale fisher folk. Existing market chains (for wild caught sea cucumber) have to be assessed, and the potential impact of increased supply from sea ranching and pond culture has to be understood.

The paper is organized into three sections. The methodology is discussed in the first section while the second section provides the results of the study. A discussion of these results and specific recommendations are presented in the third section.

2. METHODOLOGY

2.1 CONCEPTUAL FRAMEWORK

A value chain is a sequence of related enterprises (referred to as operators) that conduct activities (functions) to add value to a product, from primary production, processing and marketing, up to the final sale to the consumer. Value chain analysis consists of two major steps. The first involves the assessment of existing market(s) to put the chain analysis within the proper context. The second step is value chain mapping aimed at answering six key questions: (1) who are the key customers and what are their product requirements in terms of species, volume, quality, packaging, delivery schedules, as well as grades and standards? (2) who are the key players in the chains and what are their respective roles? (3) what are the activities and processes along the chain? (4) what is the flow of product, information and payment along the chain? (5) what are the logistic issues? and finally (6) what are the external influences (e.g., ordinances, regulatory requirements, policies, etc.)? For sea cucumbers, the functions of each link in the chain involve sourcing inputs, collecting, processing and delivering/selling product to the next link in the chain.

Value chain analysis facilitates the identification of constraints to industry growth and competitiveness that include both the product and factor markets and other market-related issues. It also leads to better understanding of relationships and linkages among buyers, suppliers and a range of market actors in between.

Value chain analysis is carried out primarily to identify areas for upgrading the chain. Upgrading may cover the process, product, function or the overall chain itself. Process upgrading aims to reduce costs by improving internal processes and efficiency within the business. Product upgrading may be achieved through the introduction of new products or improving existing ones. Changing the activity mix may result in function upgrading. Overall chain upgrading entails shifting the whole chain to new and higher value products. Upgrading may also be achieved through interventions of entities external to the chain. Policy and institutional reforms or improvements in infrastructure may go a long way towards improving the effectiveness and efficiency of a particular value chain.

2.2 ANALYTICAL PROCEDURE

The analysis consisted of two parts. The first part was a general industry/market assessment based on existing literature and available secondary data. The second part was a tracer study intended to build a detailed value chain map covering the six key questions given above. The tracer study covered the entire upstream and downstream components of the chain. The divers/collectors, village-level assemblers/processors and local traders constitute the upstream part of the chain. The trading firms, buying stations, exporters in Manila and other key cities, and the importers and distributors in importing countries form the downstream players.

Upstream players were interviewed to derive information on quantity of collection, specific activities and cost schedules, technologies/practices, grades/standards being employed and information about their major buyers. Traders/middlemen and processors were interviewed on procurement, processing and distribution related activities and costs, as well as prices and margins. The mapping exercise was both qualitative and quantitative. The qualitative part involved identifying the players and their roles, the relationships/linkages among players, the product requirements, the activities/processes along the chain as well as the logistics and policy issues. The quantitative part entailed the construction of a costs and earnings schedule covering the entire upstream and downstream components of the chain.

2.2.1 CALCULATION OF VALUE ADDED ALONG THE CHAIN

Value added is the amount of wealth created by a player in the chain; it is measured from net sales less the costs of bought-in goods and services. Value added along the

sea cucumber value chain was calculated based on activity and cost schedules. It represents payment to owners of factors of production (capital, labor, and land) plus taxes (Figure 1). Value is created by form, time and place. Form value refers to product transformation, such as transforming the sea cucumber from live/raw/fresh to the processed/dried form. Time value means making the product available at different times, for example by means of storage. On the other hand, place value is created when the product is moved from point of production to point of consumption (i.e., through transport).

2.2.2 PARTICIPATORY SYSTEMS ANALYSIS

As a complementary tool to Value Chain Analysis (VCA), Participatory Systems Analysis (PSA) was employed to determine what factors could lead to the successful introduction/adoption of sea ranching and pond culture in coastal communities. This tool is designed to evaluate the relationships among relevant elements or factors within the context of the problem being assessed. It reveals which elements can be potential starting points for project activities, and which ones may require further investigation and better understanding.

As a PSA procedure, a group of divers/collectors were asked to exhaustively identify the factors that would lead to the successful introduction/adoption of sandfish culture in their community. The factors were then arranged in a matrix and the degree by which a factor influences another factor was examined. The ratings used were as follows:

Strong influence = 2.0
Moderate influence = 1.0
Weak influence = 0.5
Very weak influence = 0.1

The various factors were then categorized depending on the degree by which they influence and are being influenced by other factors. A PSA quadrant was constructed to clearly situate the factors based on four systems of coordinates. Each coordinate implies a certain character or function within the system:

a. Symptom

A symptom is an element that is greatly influenced by other elements but may not have much power to change the system itself. Symptoms can be useful indicators of context changes, but development activities in this sector may only amount to a "treatment of the symptom, not the cause".

b. Buffer

A buffer is characterized by low importance in the context. It is unremarkable because it neither influences other elements much nor is it influenced much by others. Development activities in this sector are expected to have little impact on the context.

c. Critical element

A critical element is an accelerator or catalyst in the system. It changes many things quickly, but may also create many

Figure 1. Value added framework

Assessing value added along the chain		
Components of total value generated by a value chain: (Value added) = (Total sales value) – (Value of intermediate goods)		
Total value generated by the chain = price x volume of final product sold	Value added: • Wages • Interest and rents • Depreciation • Direct taxes • Profit	Used to pay claims of the owners of the factors of production (labor, land, capital and taxes)
	Intermediate goods • Raw materials • Finished products • Operational services	Transferred to suppliers of intermediate goods

unexpected and undesired side effects. Development activities in this sector can be highly uncertain, and impacts may be unpredictable. Therefore, critical elements have to be treated very carefully. It is particularly important when formulating impact hypotheses for this sector.

d. Motor or Lever

A motor or lever is an active element with predictable impacts. This is the most interesting sector for development activities.

An example of a PSA matrix is shown in Figure 2. The matrix is constructed based on ratings provided by participants on the degree by which one factor affects another and vice-versa. The active sum refers to the total influence of a particular factor on the rest of the factors included in the exercise. On the other hand, passive sum refers to the combined influence of the other factors on the factor under consideration. The degree of influence was calculated as the product of the active sum and the passive sum. It is a measure of the degree by which a particular factor influences the other factors and the degree by which it is influenced by these other factors. To determine relative degree of influence, the activity ratio was calculated which simply refers to the ratio between the active and passive sums.

The results of the PSA are then translated into a PSA quadrant to clearly situate the different factors in relation to the four major factor classifications (a-d) discussed above. The unit influence is where the active sum is equal to the passive sum hence, the activity ratio is 1. This number divides the quadrant into east and west. To divide the quadrant into north and south, the rule of thumb in PSA was used, that is add 30 to the highest degree of influence and divide the result by 2.

2.2.3 AREA COVERAGE, DATA SOURCES, AND DATA GATHERING TECHNIQUES

The specific value chain tracer study covered Pangasinan, Palawan, and Davao as supply sources and Metro Manila as the main trading destination (Figure 3). Types of respondents are given in Table 1. The study followed or traced local assemblers/processors from the divers/collectors, while traders/exporters in Manila were identified from the local traders interviewed. The tracer study therefore covered upstream and downstream players to complete the answers to the six key questions enumerated earlier, construct the activity and cost schedules as well as the corresponding margins. Key informant interviews (KIIs) and focus group discussions (FGDs) (particularly for the construction of the PSA quadrant) were also conducted (Figure 4). In Pangasinan, some local fishery technicians as well as researchers from the University of the Philippines Marine Science Institute (UPMSI) station at Bolinao served as key informants. Figure 5 shows the outputs of the PSA procedure in Palawan.

Figure 2. Example of a PSA matrix/table

No	Elements Factors	1	2	3	4	5	6	7	8	Active sum (AS)	Degree of Interrelation (AS x PS)
1											
2											
3											
4											
5											
6											
7											
8											
Passive sum (PS)											
Activity ratio (AS/PS)											

Rating system: Strong influence = 2; Moderate influence = 1; Weak influence = 0.5; Very weak influence = 0.1

Figure 3. Locations of the major fishing areas in the Philippines and sites of the value chain tracer study

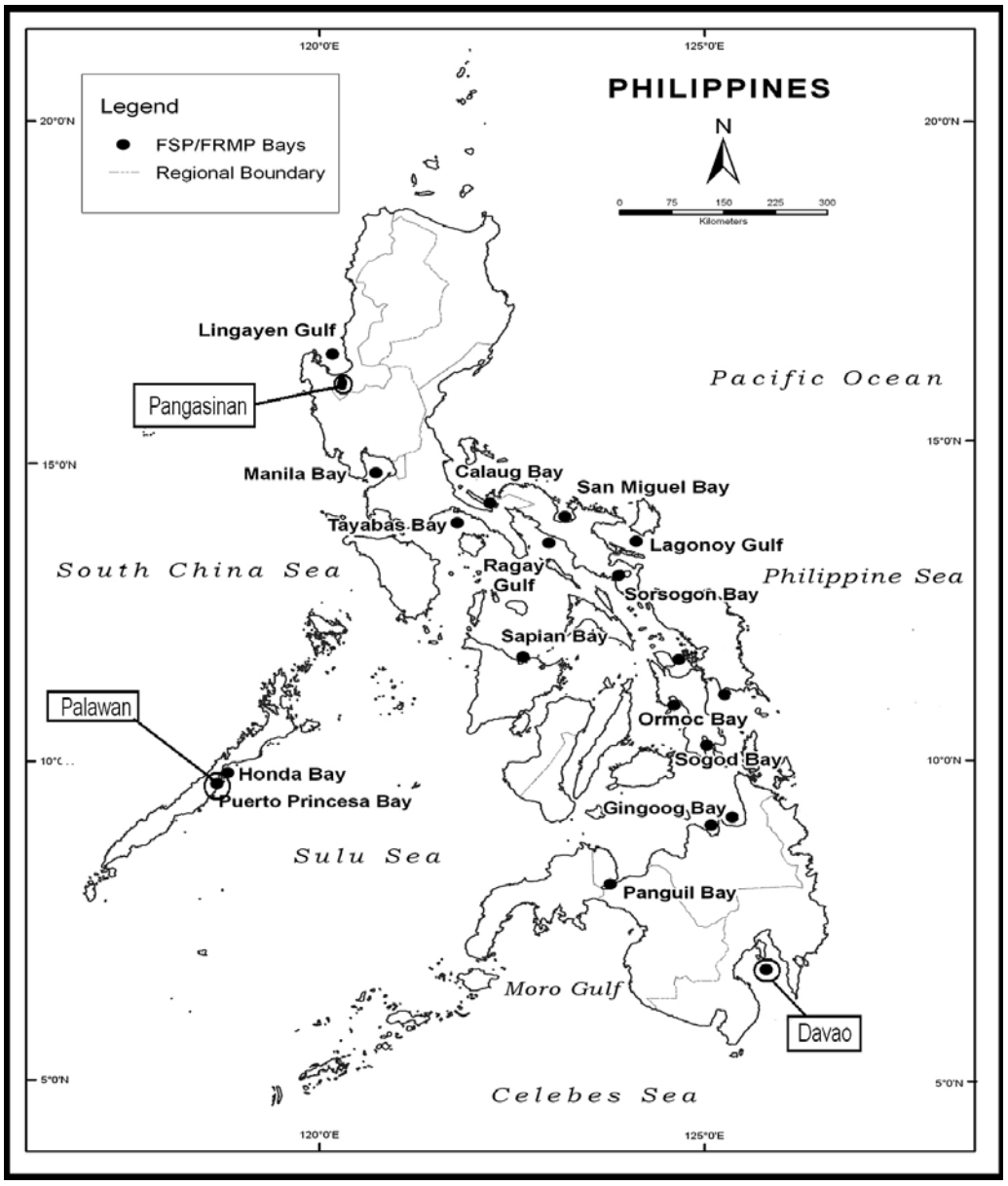
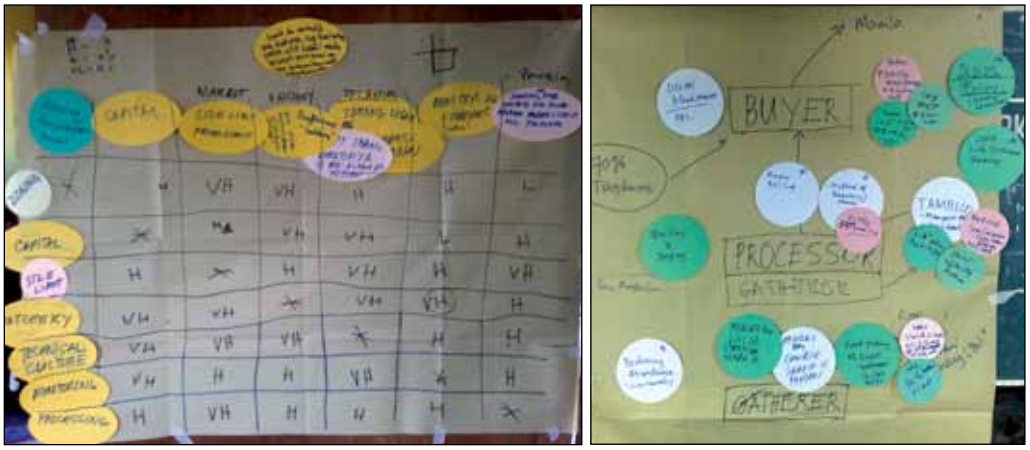


Figure 4. Data gathering through KIIs in Palawan (left photo) and Pangasinan (right photo)

Photo © Rosa Bassig

Photo © Ester Zaragoza

Figure 5. Examples of PSA output from Palawan



Photos © Len Garces

Table 1. Sources of primary data/information

Item	Pangasinan	Davao	Palawan	Manila	Data Collection Technique
Divers/collectors	5	3	5		Questionnaire; FGD
Local assemblers, processors, traders	6	2	5		Questionnaire; FGD
Large traders/exporters				5	KII
Fishery technicians	1	1			KII
Researchers	3				KII
Private investor			1		KII
Total	**15**	**6**	**11**	**5**	

3. RESULTS AND DISCUSSION

3.1 OVERVIEW OF THE SEA CUCUMBER INDUSTRY

Sea cucumbers are fished worldwide, particularly in tropical regions (FAO, 2008). There are more than 50 species exploited commercially throughout the world. However, little is known of the ecology, biology and population status of most commercial species (Macfadyen et al., 2009). The magnitude and value of the global trade in sea cucumber is shown in Table 2. On the world market, sea cucumber is traded live, fresh, chilled, dried or soaked in brine. About 99% of the global trade however, comes in the dried form. Global trade in 2005 was 6,463 metric tonnes (MT) valued at USD 46.3 million. This declined to 4,883 MT in 2006 valued at USD 42 million, then increased to 5,734 MT in 2007 valued at USD 55.8 million. While the 2007 volume was lower than that in 2005, the value of trade was much higher indicating the increasing price of this product on the world market.

The Philippines is a major player in the global trade of sea cucumber. Commercial exploitation dates back to the late eighteenth century. There are about 25 commercially exploited species out of more than 100 species known to exist (Gamboa et al., 2007; Choo, 2008). Artisanal fishers from about 60 municipalities in 14 regions of the country depend on sea cucumber collection as an alternative to fishing during off periods (Labe, 2010).

The country's export of sea cucumber was about 1,155 MT in 2007 valued at USD 6 million (accounting for over 10% of global trade value). However, this declined to just about 875 MT in 2008 valued at about USD 5.8 million (Table 3). Major export destinations are Hong Kong, China, Japan, Korea and Singapore. Export to Hong Kong remained almost the same between 2007 and 2008, but export value increased considerably from about USD 3 million to about USD 4 million. Exports to China during the same period declined drastically from 160,543 kg to merely 26,550 kg. It is generally known, though, that a portion of the volume exported to Hong Kong (a trans-shipment point) finally ends up in mainland China. Similarly, export to Japan, Korea and Singapore declined between 2007 and 2008. However, export volume to Taiwan and the USA increased during the same period.

Recent reviews of the global state of sea cucumber fisheries have indicated that many are overexploited. Overfishing in recent years has led to local extinction of high-value species in some localities and prompted closure of many national fisheries to allow stocks to recover and to allow more sustainable management plans to be established (FAO, 2010). The alarming volume of extraction and trade in the high value processed meat has come 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 Flora and Fauna (CITES) (Labe, 2010). International workshops have developed management procedures to conserve these resources as sea cucumber populations do not recover easily from overfishing and must be managed conservatively (Purcell et al., 2009).

In the Philippines, the Bureau of Fisheries and Aquatic Resources (BFAR) considers sea cucumber as a heavily exploited resource and acknowledges that localized depletion exists in many fishing grounds. But the Bureau possesses no quantitative census to support this claim (Gamboa et al., 2007). 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. Due to the open access fisheries in municipal waters, gatherers from neighboring towns and provinces could collect sea cucumbers at any time putting additional pressure on the meager resource (Labe, 2010).

In response to overfishing and declining catches, and spurred by high international prices, aquaculture, sea ranching and restocking have been attempted in a number of countries (Macfadyen et. al., 2009). A particularly overexploited species

is the sandfish *(Holothuria scabra)* since it is easily harvested from inshore habitats. This prompted ACIAR to implement projects designed to develop and apply technologies for producing sandfish in hatcheries (ACIAR Project No. FIS/1995/703) and for releasing them into the wild (ACIAR Project No. FIS/1999/025) (WorldFish, 2003), in three ways:

1. To test a new livelihood option in the Philippines, Vietnam and Australia, releasing cultured sandfish into managed inshore habitats and allowing communities to harvest them at market size after three years;

2. To further investigate and develop options for pond-based mono- and co-culture of sandfish in Vietnam and the Philippines; and

3. To replenish selected sandfish populations in the Philippines through restocking into marine reserves, designed to rebuild a critical mass of spawning adults.

In the Philippines, research effort on sea cucumber is led by the University of the Philippines (UP), particularly the Marine Science Institute (MSI), UP Visayas and UP Mindanao in cooperation with the WorldFish Center, the Southeast Asian Development Center–Aquaculture Center (SEAFDEC/AQD), and the National Fisheries Research and Development Institute (NFRDI). A relatively large national research program entitled "Resource management and culture of the tropical sea cucumber" is being implemented by these institutions with financial support from ACIAR, Department of Science and Technology–Philippine Council for Aquatic and Marine Research and Development (DOST/PCAMRD) and Department of Agriculture–Bureau of Agricultural Research (DA-BAR). The program has three project components and aims to fast track the development and refinement of the resource management approach and culture technologies for sea cucumber (specifically *H. scabra*), in Luzon, Visayas and Mindanao. The UPMSI's project focuses on increasing juvenile production, developing reseeding strategies and sea ranching (grow out culture) for sandfish *(H. scabra)* and assessing the impacts of these activities in selected municipalities in northwestern Luzon. The UPV component is assessing the sea cucumber stock and fishery in Guimaras, refining hatchery protocols and grow out of hatchery produced juveniles while the UP Mindanao group is undertaking collaborative efforts with local government units (LGUs) to enhance restocking and culture of sea cucumber in the natural environment.

Prospects for culture of other species of sea cucumber are high. In UPMSI, natural populations of *Stichopus horrens* and *H. favomaculata* are being monitored. Larval and early benthic stages of *S. horrens* have been documented in the laboratory including growth and survival of early juveniles using different feeds. Grow out culture of early juveniles is being tried in fish ponds and ocean nurseries. In UPV, two species of sea cucumber, *Bohadschia marmorata* and *Actinophyga echinites* were successfully spawned and juveniles produced in the laboratory. To improve the survival of early juveniles, an ocean nursery was established at the Igang substation of SEAFDEC/AQD in Guimaras, while in the UPV Brackishwater Aquaculture Center, pond canal nursery is being tested.

Among other objectives, the project is testing sandfish culture in hapa nets, fish cages, sea pens and ponds. In other developments, another species of sea cucumber, *Neocucumis proteus* is commercially exploited in Sagay Marine Reserve, in Negros Occidental, albeit with LGU regulations on the method, duration and amount of harvest (1,000 pieces, 3 cm diameter) per day. There is a sharing scheme which gives income to the city, incentive to the barangay and other support activities. This initiative to protect the sea cucumber resources can serve as a model to other municipalities (Dacles, 2007). Mariano Marcos State University in Ilocos Norte is another academic institution doing research on sea cucumber.

3.2 MAPPING THE VALUE CHAIN

3.2.1 KEY CUSTOMER AND PRODUCT REQUIREMENTS

Sea cucumber is a globally traded commodity with mostly oriental consumers as its key customers. It is eaten raw, boiled, or pickled. In Japan and Korea the body wall and viscera of sea cucumbers are eaten raw or pickled. Small niche markets also exist in the pharmaceutical and cosmetic industries. The most important sea cucumber product however, is the dried body wall which is marketed as *beche-de-mer,* also called *trepang* (Conand and Byrne, 1993). The high demand in Japanese and Chinese markets for both fresh and dried sea cucumbers has given them a very high price tag.

Species, size and quality are the most important product requirements. Prices vary considerably depending on species (Table 4, Figure 6). Species may be classified as high, medium, or low value based on the prices they fetch in the market (Figure 7). The most prized species include the white teatfish *Holothuria fuscogilva* (susuan) and the sandfish *Holothuria scabra* (putian). *Stichopus hermanni* and *Sticophus horrens* (hanginan) are also high value species preferred especially in the Korean market. The number of size classes varies by species. At a local trader in Davao City, there were as many as eight size classes for putian (shown also in Table 4), six for susuan, five for bakungan and hanginan and four for buli-buli and khaki. Other species are classified only into large, medium and small, or are not classified by size. What appears alarming is that even very small sizes of high value species have a price tag. For instance, putian below 7 g can still be sold for PhP 400/kg. The fresh weight of this is certainly below 100 g, still way below what may be considered as a sustainable harvest size.

Just like other products, quality is the most important requirement in the sea cucumber trade. The way the product is processed is the single most important quality

Figure 6. Processing and sorting of sea cucumber for marketing

Photo © Rosa Bassig

Photo © Len Garces

Photo © Ernie Brown

Table 2. Global trade in sea cucumber

Product Form	Year		
	2005	2006	2007
Live, Fresh, Chilled			
Quantity (MT)	56	34	67
Value (USD '000)	375	392	424
Dried, Salted in Brine			
Quantity (MT)	6,463	4,883	5,734
Value (USD '000)	46,342	42,021	55,852

Table 3. Philippine sea cucumber export by quantity (kg) and value (USD)

Item	Year			
	2007		2008	
	Quantity (kg)	**Value (USD)**	**Quantity (kg)**	**Value (USD)**
Total Export	**1,155,468**	**6,001,840**	**875,303**	**5,819,698**
Export Destinations				
Hong Kong	627,116	2,976,398	639,265	4,033,379
China	160,543	115,171	26,550	24,340
Japan	9,609	12,025	128	203
South Korea	59,252	1,015,263	36,762	667,255
Singapore	51,017	642,446	3,970	658,568
United States of America	3,132	87,651	5,203	131,809
Taiwan	3,845	10,132	6,135	15,108

Source: Bureau of Agricultural Statistics (BAS), on-line statistics.

Table 4. Wholesale prices by species, size, and grade at a large local trader, Davao City, 2010

No	*Scientific Name/* **ENGLISH NAME/ Filipino Local Name**	Size		GOOD		'B'	
		Code	**Measurement weight or length**	**PHP**	**USD**	**PHP**	**USD**
1	*Holothuria (M.) scabra/* SANDFISH/ Putian, Cortido or Curtido	PXL	75 g up	4,000	8.89	1,000	22.22
		XL	55-74 g	3,800	4.44	1,000	22.22
		L	35-54 g	3,000	6.67	1,000	22.22
		M	25-34 g	1,600	5.56	1,000	22.22
		S	15-24 g	1,200	6.67	500	11.11
		XS	11-14 g	1,000	2.22	500	11.11
		PSS	7-10 g	800	7.78	100	2.22
		PSSSS	below 7g	400	8.89	100	2.22
2	*Holothuria (M.) nobilis, H. (M.) whitmaei/* WHITE TEATFISH/ Susuhan, Susuan or Susan	XL	251-350 g	4,000	88.89	1,000	22.22
		L	201-250 g	3,800	84.44	1,000	22.22
		M/L	151-200 g	3,000	66.67	700	15.56
		M	101-150 g	2,300	51.11	600	13.33
		S	71-100 g	1,500	33.33	500	11.11
		XS	below 70 g	1,100	24.44	200	4.44
3	*Actinopyga mauritiana c.f.* BLACK TEATFISH/ Bakungan or Bacungan	L	170 g up	2,400	53.33	700	15.56
		M	130-169 g	1,700	37.78	500	11.11
		S	100-129 g	1,700	37.78	300	6.67
		XS	70-99 g	800	17.78	150	3.33
		XXS	below 70 g	700	15.56	50	1.11
4	*Actinopyga lecanora/* STONEFISH/ Buli-buli, Monang or Munang	L	3.1 in up	2,900	64.44	700	15.56
		M	2.6-3.0 in	1,800	40.00	500	11.11
		S	2.1-2.5 in	1,000	22.22	400	8.89
		XS	1.6-2.0 in	600	13.33	300	6.67

Continue Table 4. Wholesale prices by species, size, and grade at a large local trader, Davao City, 2010

No	*Scientific Name*/ ENGLISH NAME/ Filipino Local Name	Size		GOOD		'B'	
		Code	Measurement weight or length	PHP	USD	PHP	USD
5	*Stichopus hermanni or S. horrens*/ CURRYFISH/ Hanginan	L	3.0 in up	2,300	51.11	700	15.56
		M	2.5-2.9 in	2,200	48.89	500	11.11
		S	2.0-2.4 in	1,300	28.89	100	2.22
		XS	below 2.0 in	1,000	22.22	100	2.22
		XS Barok		500	11.11	100	2.22
6	*Actinopyga obesa or A. miliaris*/ DEEP-WATER REDFISH/ Khaki	L	above 3.0 in	1,500	33.33	500	11.11
		M	2.5-2.9 in	1,100	24.44	400	8.89
		S	1.5-2.5 in	750	16.67	100	2.22
		XS	1.0-1.5 in	500	11.11	100	2.22
7	BLACKFISH/ Hud-Hud or Hod-Hod	L	above 5.1 in	2,000	44.44	400	8.89
		S	4.1-5.0 in	1,200	26.67	300	6.67
		XS	below 4.0 in	300	6.67	100	2.22
8	*Thelenota ananas*/ Talipan or Taripan	L	above 4.1 in	2,100	46.67	700	15.56
		S	below 4.0 in	1,000	22.22	300	6.67
9	*Bohadschia armorata*/ BROWN SANDFISH/ Lawayan or Pulutan	L	above 4.1 in	600	13.33	200	4.44
		M	3.1-4.0 in	500	11.11	100	2.22
		S	below 3.0 in	350	7.78	100	2.22
10	*Bohadschia argus*/ TIGER FISH/Matang Itik or Leopard	L	above 3.1 in	900	20.00	200	4.44
		S	below 3.0 in	400	8.89	100	2.22
11	*Holothuria (H.) edulis*/ Red Beauty	L	above 4.1 in	550	12.22	100	2.22
		M	3.1-4.0 in	450	10.00	100	2.22
		S	below 3.0 in	300	6.67	100	2.22
12	*Holothuria (H.) atra*/ LOLLY FISH/ Black Beauty	L	above 5.1 in	400	8.89	30	0.67
		M	4.1-5.0 in	250	5.59	30	0.67
		S	2.0-4.0 in	80	1.78	30	0.67
		XS	below 2.0 in	30	0.67	30	0.67
13	*Stichopus chloronotus*/ GREENFISH/ Cuatro Cantos or Hanginan Black			2,200	48.89	700	15.56
14	Powder Beauty			500	11.11	50	1.11
15	Yellow Beauty			380	8.44	50	1.11
16	Brown Taba Assorted			700	15.56	50	1.11
17	*Actinopyga echinites*/Brown Beauty			380	8.44	50	1.11
18	Brown Small			50	1.11	50	1.11
19	CHALKFISH/ Chocolate Brown or Choco Brown			420	9.33	50	1.11
20	*Holothuria (M.) leucospilota* c.f./ SNAKEFISH/ Patola			380	8.44	50	1.11
21	*Holothuria (H.) pulla c.f.*/ Red Patola			380	8.44	50	1.11

determinant. Primary processing involves gutting, brushing, boiling, smoking and sun-drying for several days. The details of these steps may vary by species. Regardless of the product though, the aim is to achieve very low moisture content ("stone-hard") and to ensure that the dried skin should not separate from the flesh. At the trader level, both at the source and in Manila, the product is classified either as good, class "B", or reject. The price difference between good and class "B" is enormous. A good quality putian may fetch as high as PhP 4,000/kg while class "B" is only bought for PhP 1,000/kg.

Figure 7. Market price of sea cucumber

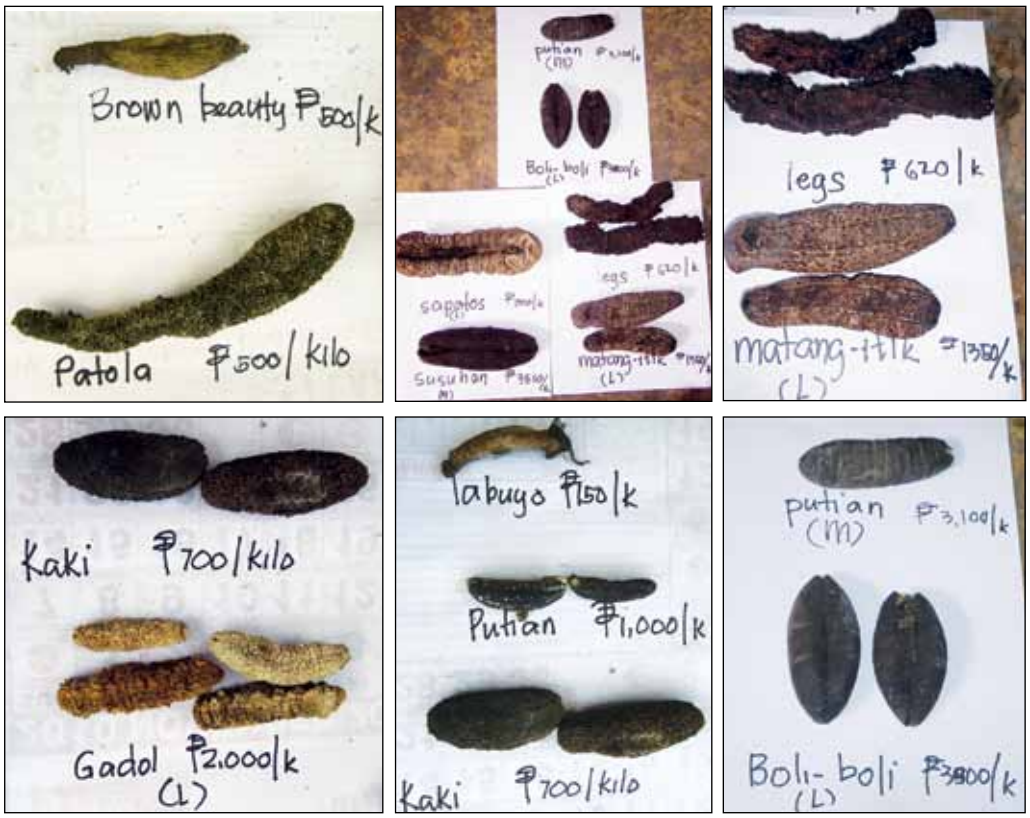


Photo © Ester Zaragoza

The extent by which product requirements at the local trader level reflects the product requirements (in terms of form, species, size and quality) in the importing countries remains to be established. It is well known that once exported to Hong Kong, these products are re-graded according to species, size and quality before being sold to domestic or re-export markets.

3.2.2 KEY PLAYERS AND THEIR ROLES

The divers/collectors, local assemblers/processors, local traders (traders at supply source), buying stations/exporters in Metro Manila and other key cities, importers/processors and distributors in importing countries are the major players in the sea cucumber industry. The trading firms/exporters in Metro Manila and key cities as well as the importers and distributors in the importing countries are the downstream players while the divers/collectors, local assemblers/processors and local traders constitute the upstream part of the chain. The market for sea cucumber can be characterized as a buyers' market; the downstream players possess the dominant power and influence along the entire chain.

The Downstream Players

Worldwide, there are at least 635 firms from about 38 countries (Table 5) supplying sea cucumber products (dried, fresh, frozen and preserved). Most of these are trading companies, distributors/wholesalers and processors. The supplier firms operating in the Philippines are shown in Table 6. There are 44 supplier firms of which 21 are in Luzon, 14 in the Visayas and 9 in Mindanao. Of the 22 supplier firms in Luzon, 15 are based in Metro Manila. The majority of supplier firms in the country are trading companies (Table 7). They trade a wide variety of products such as sea cucumber, abalone, dried squid, dried seaweeds, and other marine as well as agricultural products. The four largest exporters of sea cucumber in the country are: Ocean Aquamarine Products Enterprises with branches/buying stations in Binondo, Cavite (Bacoor), Puerto Princesa and Zamboanga; Royal Aquamarine Trading

Table 5. Number of supplier firms of sea cucumber by country

Country	FREQUENCY (No. of supplier firms by country)	PERCENTAGE
Indonesia	81	12.76
Malaysia	61	9.61
United States	55	8.66
Philippines	50	7.87
China (Mainland)	42	6.61
Peru	32	5.04
Singapore	32	5.04
Vietnam	26	4.09
Japan	25	3.94
Sri Lanka	21	3.31
Egypt	19	2.99
Canada	18	2.83
Mexico	18	2.83
Maldives	17	2.68
South Korea	17	2.68
Turkey	14	2.20
Hong Kong	13	2.05
India	12	1.89
Chile	9	1.42
Thailand	9	1.42
Australia	7	1.10
Cameroon	7	1.10
Taiwan	7	1.10
United Arab Emirates	7	1.10
Mauritania	5	0.79
Mauritius	5	0.79
Morocco	4	0.63
Pakistan	4	0.63
Russian Federation	4	0.63
Spain	4	0.63
New Zealand	3	0.47
Colombia	1	0.16
Fiji	1	0.16
Iceland	1	0.16
Italy	1	0.16
Mozambique	1	0.16
United Kingdom	1	0.16
Uruguay	1	0.16
Total	**635**	**100**

Table 6. Supplier firms of sea cucumber in the Philippines by location and by business type, 2010

Island	Province	No	Company Name	Business Type					
				Agent	Buying Office	Trading Company	Distributor/ Wholesaler	Manufacturer	Retailer
	Batanes	1	LUCY CASTILLEJOS						√
	Batangas	2	SEAMASTER			√			
	Cavite	3	OBICO MARINE PRODUCTS			√	√	√	
	Laguna	4	MEIJI INTERNATIONAL			√			
	Metro Manila	5	CESMEL MARINE AND IDUSTRIAL TRADING			√	√		
		6	HENRY CHO KING		√		√		
		7	ICENREIN INTERNATIONAL COMPANY			√		√	
		8	INTO MANPOWER AND GENERAL ENTERPRISE	√					
		9	JS MARKETING			√			
		10	LEXCO			√			
Luzon		11	MARIANO TRADING			√			
		12	NEREO PE	√					
		13	OCEAN AQUAM ARINE PRODUCTS ENTERPRISES		√	√	√		
		14	RAMZEL INTERNATIONAL TRADING CORPORATION			√			
		15	ROYAL AQUA MARINE TRADING			√			
		16	TAIYO TRADING			√			
		17	VICTORY SHIPMANAGEMENT & TRADE SERVICES CORPORATION			√			
		18	XINAGASIA		√				
	Pampanga	19	J.R.C. INTERNATIONAL TRADING COMPANY			√			
	Quezon	20	WAREN MARINE PRODUCTS DEALER			√	√	√	
	Rizal	21	RAJBETH INTERNATIONAL TRADING		√	√			

Continue Table 6. Supplier firms of sea cucumber in the Philippines by location and by business type, 2010

Island	Province	No	Company Name	Business Type					
				Agent	Buying Office	Trading Company	Distributor/ Wholesaler	Manufacturer	Retailer
Visayas	Bacolod	22	SEBASTIAN CIOCON MENDOZA				√	√	
	Cebu	23	AKO TRADING/GAAC BROKERAGE			√	√		
		24	ALPAS SOUTHERN TRADING	√		√			
		25	BROD TRADING	√					
		26	FLOAN & AUVILMARKIM			√			
		27	SHEM EXPORT			√		√	
		28	VW MARINE RESOURCES INTERNATIONAL			√			
		29	WILLSMARINEPRODUCT			√			
	Iloilo	30	COSTA BUENA SEAFOOD CORPORATION	√	√	√	√	√	
		31	MMM SEAFOODS					√	
	Leyte	32	CRAFT WORLD VENTURES			√			
		33	FORTUNE TRADING			√			
	Samar	34	KOUN TRADING			√			
		35	SAMAR SHELLS TRADING & MFG. ENTERPRISES					√	
Mindanao	Cotabato	36	PHILIPPINE S&P CORPORATION				√	√	
	Davao	37	HAEWANG						√
		38	Y88 SEAFOODS & AQUAMARINE PRODUCTS			√	√		
	General Santos	39	SALUDIN MULTI-PURPOSE COOPERATIVE			√			
	Maguindanao	40	ANG CHIN HUA TRADING			√			
	Sarangani	41	REGINALD NADELA CASTANARES	√			√	√	
	Zamboanga	42	888 TRADING COMPANY		√	√	√		
		43	EARL AND SAM SEAFOODS			√			
		44	MGY MARINE PRODUCT		√		√	√	

Table 7. Classification of suppliers of sea cucumbers in the Philippines by business type, 2010 (Note: see also Table 6)

Business Type	Frequency (N=4)	Percentage (%)
Agent	6	13.64
Buying Office	7	15.61
Trading Company	31	70.45
Distributor/Wholesaler	13	29.55
Manufacturer	11	25.00
Retailer	2	4.55

in Tondo, Manila; VW Marine Products with branches/buying stations in Palawan, Estancia, Bacolod and Manila; and Obico Marine Products with branches/buying stations in Cavite (Bacoor), Batangas, Puerto Galera and Pangasinan (Alaminos).

Five firms were included in the tracer study; they were: Ocean Aquamarine Products Enterprises (OAPE) and Obico Marine Products (OMP) (both major exporters); Ramzel Trading (RT) (a small exporter); Xinagasia (buying office); and Into Manpower and General Services (IMGS) (agent) (Table 8). These firms were selected to represent the typology of firms involved in the sea cucumber trade; they are also the major buyers of sea cucumber from local traders.

The IMGS and Xinagasia are very small establishments with less than five employees. IMGS acts as an agent for exporters in Manila. It has regular suppliers from Davao, Zamboanga and Tawi-Tawi and passes on the supply to Manila-based exporters. Similarly, Xinagasia is a Manila-based trader with regular suppliers from Marinduque, Mindoro, Palawan and Masbate. Xinagasia's average procurement volume of dried sea cucumber is only about 1,200 kg per year. The IMGS did not disclose its procurement quantity, but it most likely approximates that of Xinagasia.

The two exporters (RT and OMP) fall within the category of small- and medium-scale enterprises. However the largest exporter (OAPE) can be considered a large enterprise. RT sources its supply from Quezon Province, Palawan, Romblon, Cebu, Samar and Pagadian. It exports to China, Hong Kong, Korea, Japan, Taiwan and Singapore. On the other hand, OMP's major supply sources are Batangas and Puerto Galera with China, Hong Kong and Korea as its main export markets. OMP procures and exports about 4 MT of sea cucumber per month with hanginan as the major species.

The largest exporter (OAPE) sources its supply from all parts of the country (nationwide) and even from Malaysia and Saudi Arabia. Based on interviews, some Malaysian fishers sell sea cucumber to the

Table 8. Profile of Manila-based firms included in the tracer study

Name	Business Type	No. of Employees	Source	Destination	Quantity of Procurement	
					Month	Year
Into Manpower & General Enterprises	Agent	1-2	Davao, Zamboanga, Tawi-tawi	Metro Manila	-	-
Xinagasia	Buying Office	3-5	Marinduque, Mindoro, Palawan, Masbate	Metro Manila	100 kg	1,200 kg
Ramzel International Trading	Small Exporter	6-10	Quezon, Palawan, Romblon, Cebu, Samar, Pagadian	China, Hong Kong, Korea, Japan, Taiwan, Singapore	2,000 kg	24,000 kg
Obico Marine Products	Medium Exporter	11-100	Batangas, Puerto Galera	China, Hong Kong, Korea	4,000 kg	50,000 kg
Ocean Aquamarine Products Enterprises	Large Exporter	101-500	Nationwide, Malaysia, Saudi Arabia	Worldwide	8,000 kg	100,000 kg

OAPE buying station in Palawan because of certain catch regulations in their own country. With regard to the quantity coming from Saudi Arabia, Filipino contract workers allegedly hand carry a certain amount of dried sea cucumber when they return to the Philippines and sell this to OAPE. In Palawan alone, OAPE procurement is about 10 MT/month. It is estimated that its total procurement could reach or exceed 20 MT/month, which is then exported all over the world.

The Upstream Players

As mentioned earlier, divers/collectors, local assemblers/processors and local traders constitute the upstream part of the sea cucumber supply chain. The Davao region and the provinces of Pangasinan and Palawan, which are considered major sources of supply, were covered in the tracer study to better understand the upstream part of the sea cucumber value chain. In Davao region, the areas covered were barangay Bato (Sta. Cruz, Davao del Sur), one collector and one assembler/processor; and barangay Tibagon (Pantukan, Davao del Norte), one former assembler/processor and two collectors; the fishery technician of Pantukan was also included as a key informant. The specific locations covered in Pangasinan were barangay Luciente Uno (Bolinao), involving two assembler/processors, five divers/collectors, one fishery technician and three researchers from UPMSI; four barangays in Anda involving mostly assemblers/processors (one in each barangay); and Santoy (Alaminos), involving a local trader. In Palawan, data gathering was focused in barangay Tagburos (Puerto Princesa City) and included five collectors, three assembler/processors, two local traders and one private investor.

Divers/Collectors

The divers/collectors of sea cucumber are fishers collecting sea cucumber as an incidental catch. Their average age is 39, half of which has been spent fishing and collecting sea cucumber, with an average education of 8 years, household size of 5 and an annual household income of PhP 75,000 (Table 9). It is estimated that there are about 100 fishers/sea cucumber collectors in Luciente Uno (Bolinao, Pangasinan), 50 in Sablig, 100 in Karot, and 100 in Imbo (Anda, Pangasinan); 30 in barangay Bato (Sta. Cruz, Davao del Sur); 10 in Tibagon (Pantukan, Davao del Norte), and about 120 in barangay Tagburos (Aplaya, Puerto Princesa City). These estimates were obtained from collector-respondents in the study.

Collection of sea cucumber is highly seasonal. Peak collection in all areas is from March to June when fishers can stay longer underwater as the water is relatively warm. It is difficult for fishers to stay underwater for long periods when the water is cool which also restricts collecting in deeper water. Respondents claim that the sea cucumber in shallow water has already declined considerably, thus collection is now done more often in deeper water. Sea cucumber collection also becomes very limited during the typhoon season.

During peak season, a fisher could collect from 10 to 100 individuals of assorted species and sizes. These are sold fresh directly to the assembler/processor in their village. The quantity of each specific species collected by each diver/collector is difficult to establish. However, an example of catch profile is given in Table 10, provided by one respondent from barangay Bato, (Santa Cruz, Davao del Sur).

Assemblers/Processors

Assemblers/processors are mostly village residents who buy and process sea cucumber collected by divers/collectors from their own village or nearby villages. On average they are 48 years old, have 11 years in school, a household size of 6, annual household income of PhP 113,600 and have an average of 16 years as an assembler/processor of sea cucumber (Table 11). Typically, there are two to three of these players in each coastal village where sea cucumber is collected. They are often former fishers themselves, former overseas contract workers or simply a village resident who got interested in the business. They are relatively better-off than the ordinary fisher, judging from the quality of their houses and their higher annual household income.

Table 9. Profile of divers/collectors (Palawan, Pangasinan and Davao)

Characteristlcs	Values are Averages for Pangasinan, Davao and Palawan (N= 13)
Age (years)	39
Number of years in school	8
Household size	5
Annual household income (PhP)	75,000
Major sources of livelihood	Fishing, sea cucumber collection, selling/vending
Number of years collecting sea cucumber	20

Table 10. Species profile, volume and prices, from diver/collector in Sta. Cruz, Davao

Species/Local Names	Selling Price (PhP)	Volume	Revenue (PhP)
Stichopus hermanni or S. horrens/ CURRYFISH/Hanginan	700/pail	1 pail	700.00
Actinopyga lecanora/STONEFISH/ Buli-buli, Monang or Munang	200/pail	1 pail	200.00
Actinopyga echinites/ Brown Beauty	5/pc	20/pcs	100.00
Holothuria (H.) atra/ LOLLY FISH/ Black Beauty	1/pc	2 pail	60.00

Table 11. Profile of assemblers/processors (Palawan, Pangasinan and Davao)

Characteristics	Values are Averages for Pangasinan, Davao and Palawan (N= 13)
Age (years)	48
Number of years in school	11
Household size	6
Annual household income (PhP)	113,600
Major sources of livelihood	Buying/processing sea cucumber, shell handicraft and buri bag making, fish vending in the market
Number of years collecting sea cucumber	16

Competition among assemblers/processors becomes tight during the off-peak season. Some processors will wait at fish landing sites to get the first opportunity to buy the fishers' collection. While their largest procurement volume is from their own village, many will buy from other villages or even other municipalities when supplies are tight.

Assemblers/processors sell to Manila-based agents or directly to exporters. They also trade among themselves depending on financial circumstances. When a particular assembler/processor has too small a volume to warrant transport to Manila and he needs immediate cash, he sells it to another assembler/processor in the area.

Village-based assemblers/processors play a crucial role in the sea cucumber value chain. The nature of the fishery and the product itself necessitate their existence. Sea cucumber is a small-scale fisheries activity. Daily collection by each diver/collector is small (less than 10 kg/day, fresh weight) thus the need to assemble/consolidate collection at the village level. In addition, the quality of dried sea cucumber is dependent almost entirely on the way the product is processed. Assemblers/processors have years of experience in primary processing of the different species of sea cucumber and use this experience in assessing the quality of the products traded.

The different species found in the possession of assemblers/processors reflect the species profile collected in the area. The assemblers/processors in barangay Luciente Uno (Bolinao), had sapatos, susuan, matang itik, legs, boli-boli, talipan, red powder and putian (Table 12). There were very few pieces of putian, all of which were very small indicating it is a scarce species in the area.

Local Traders

Local traders are those who buy and sell sea cucumber within a given

Table 12. Species of sea cucumber in the possession of assemblers/processors in Luciente Uno, Bolinao, Pangasinan

Species/Local Names	Buying Price PhP (Fresh)	Selling Price PhP (Dried)	Size
Sapatos	40/5kg or 8/kg	300/kg	
Susuan	400/kg	4,000/kg	Large
	400/kg	3,500/kg	Medium
	No data	2,500/kg	Small
Matang Itik	50/700 grams	1,350/kg	
Legs	50/kg	620/kg	
Boli-boli	300/kg		
Putian	150/kg	3,100/kg	Medium
Talipan	3,300/kg		Large
Red Powder	800/kg		Large

locality (municipality or city). Unlike the assemblers/processors that are generally located in coastal villages, these traders are generally based in key towns or cities. In addition, their procurement is mostly limited to dried product in contrast to assemblers/processors who primarily buy fresh sea cucumber. They can also be distinguished from the buying stations of Manila-based exporters since the latter are mere extensions (procurement arms) and therefore an organic part of the exporting company. Two local traders were interviewed to determine details of their operation. One trader is located in Sta. Cruz, Davao del Sur. The trader operates at a much larger scale compared to ordinary village-based assemblers/processors. Her procurement is about 120 kg/week during peak season and 30 kg/week during lean periods. Her supply comes from assemblers/processors in Sta. Cruz and adjacent municipalities. She also has a regular supplier from General Santos City. She sells directly to Ocean Aquamarine in Manila and has already developed a relational marketing arrangement with this company. She sends her product to this exporter through air freight. Ocean Aquamarine then deposits the payment to her bank account. At times when she is short of capital, she asks for some advance payment which the firm readily provides. The species bought and the corresponding prices are shown in Table 13.

Stakeholder Interactions

The interactions between the upstream and downstream players, together with the other stakeholders in the sea cucumber value chain (for export) are depicted in Figure 8. The key upstream players are the divers/collectors who take sea cucumber as an incidental catch while exporters constitute the key downstream players. Fuel and fishing gear are important inputs for fishing/sea cucumber collection so these suppliers are crucial to divers/collectors. In between the key upstream and downstream players are layers of intermediaries composed of village-based assemblers/processors, local traders, agents and exporters' buying stations.

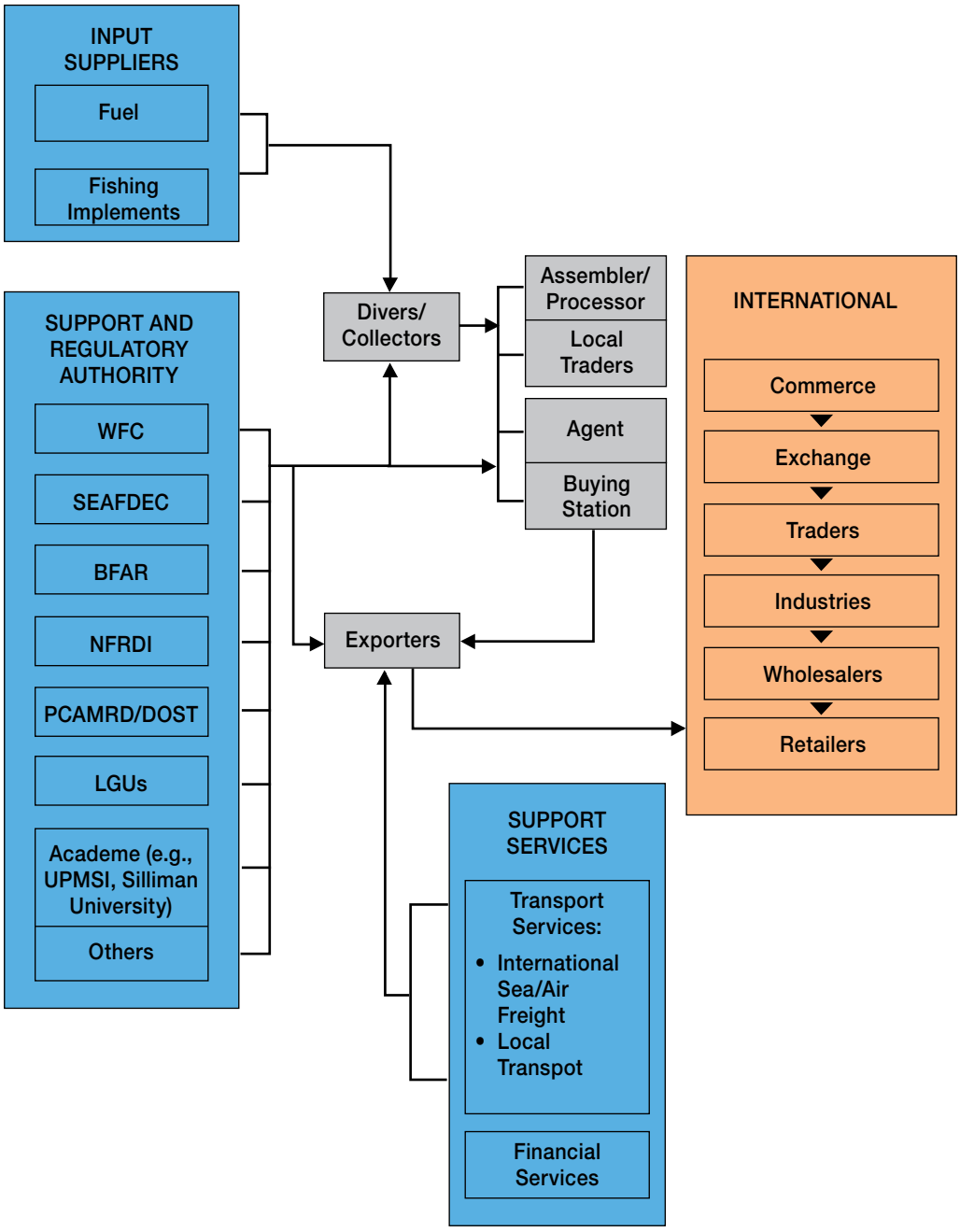
Assemblers/processors play an important role given the nature of sea cucumber fisheries in the country. Primary processing,

Table 13. Species bought by local trader in Bato, Sta. Cruz, Davao del Sur

Species/Local Names	Buying Price * PhP	Selling Price* PhP	Size
Susuan	250/kg	5,100/kg	L
Buli-buli	250/kg	3,900/kg	L
Red Powder	10/3pcs	550/kg	S
Brown Beauty	5/pc	-	-
Brown Taba	30/kg	700/kg	-
Hanginan	50/kg	1,500/kg	S-M

* Buying price is based on fresh weight, selling price is based on dry weight.

Figure 8. Stakeholder interactions in the sea cucumber industry



which is the fundamental determinant of dried sea cucumber quality, is performed by these players. In addition, collection from one village is relatively small, thus the need to assemble/accumulate enough volume to warrant transport to Manila or key cities. However, the role of local traders and agents appears redundant. As will be discussed in a later section, there appears to be no actual value addition that could be attributed to these players.

On the other hand, exporters' buying stations in supply areas may be viewed as an effective strategy of Manila-based exporters to extend their procurement arms to ensure they can secure their needed volume. Transport services, both local and international, as well as financial services (banking, insurance, etc.) are among the important support services in the export business. Suppliers of these facilities are therefore crucial to exporters.

Support agencies and regulatory authorities are important for the continual improvement of the sea cucumber value chain. Among these are Research and Development (R&D) institutes, both international (e.g., The WorldFish Center and SEAFDEC) and local (NFRDI and DOST/PCAMRD) as well as academic institutions carrying out R&D activities on sea cucumber such as the UPMSI, UPV and UP Min. Their interaction with the upstream and downstream players may be less direct, nonetheless, their role in generating technologies and information to better manage the resource, improve processing and handling and elevate the efficiency of the whole chain cannot be overemphasized.

In countries where sea cucumber is imported, the product moves through a new set of players. They are involved in further processing the sea cucumber into other higher value products, in wholesaling, and retailing as the precursors to final consumption. It is in final consumption where customer value is realized. Developments in export markets, or countries of destination, are therefore most important for export commodities such as sea cucumber, e.g., product requirements in terms of size, moisture content, etc.

3.2.3 ACTIVITIES/PROCESSES AND COSTS

A number of activities are carried out in the collection, processing and trade of sea cucumber. Value chain mapping of activities is imperative since every activity has a corresponding cost. Eliminating redundant activities or carrying out important activities correctly is often an important means of chain upgrading.

The step-by-step process and the costs involved in the collection of sea cucumber are shown in Table 14. The process involves gleaning in shallow water. The first step entails travel to nearby islands where gleaning will be done. Boat, lamp, container (pail, basin) and fuel are the important resources needed. Cost of fuel for the boat is about PhP 125.00/fishing trip on average while fuel for the lamp is about PhP 44.00/ trip. Depreciation cost for boat is about PhP 9.00/fishing trip. Sea cucumbers are hand collected upon arrival at the site and placed in a pail with a little water; they are then transferred to a basin filled with water inside the boat. The collector goes back home after about 6 hours of gleaning.

Skin diving is another way of collecting sea cucumber, specifically in deeper water. In

Table 14. Step-by-step process involved in collecting sea cucumber, the corresponding resources needed, and associated daily costs, Palawan, 2010 [a]

Steps	Resources Needed	Costs (Php/Day)		
		Average	Minimum	Maximum
1. Travel to the island	• Boat or banca (3-6 hp)	9.03	6.67	11.11
	• Boat fuel (far, 2-3 l)	125.00	100.00	150.00
	• Boat fuel (near, 1-2 l)	75.00	50.00	100.00
	• Lamp or Petromax	2.17	1.85	2.78
	• Gasoline/kerosene (1.0-1.5 l)	44.00	33.00	54.00
2. Hand collect or glean the sea cucumbers and put inside a pail with a little water	• Pail			
	• Knife			
3. When the pail is filled with 30 pieces of sea cucumber, transfer the contents to a basin filled with water inside the boat	• Basin			
4. Go home and start processing the sea cucumbers collected				
Total	**Near**	130.82	91.96	168.82
	Far	180.82	141.96	218.82

a Assumption: 12 kg sea cucumber collected per fishing trip.

much deeper water, divers use compressors to be able to stay under water for longer. When skin-diving though, sea cucumber is just an incidental catch since the primary target is fish.

Most divers/collectors sell their collection fresh to assemblers/processors while some process the sea cucumber themselves before selling them to assemblers/ processors or other traders. Primary processing is tedious and time consuming. In addition, the processing steps involved depend on the species being processed. Primary processing generally involves gutting, boiling, brushing, smoking and sun drying. Examples of processing methods employed by traders in Palawan are shown in Tables 15 and 16. On average, gatherers incur a cost (except labor) of PhP 180.80 per fishing trip of about 6 hours. On the other hand, processing incurs a cost of PhP 248.50 per 12 kg product (Table 17).

Activities and costs incurred in trading are shown in Table 18. The data came from the Palawan buying stations of two large exporters of sea cucumber. When dried, sea cucumber are brought to the buying station by sellers, they are received, classified according to species, weighed and graded and the sellers are paid the corresponding amount. In cases where the product is not sufficiently dried however, they are re-dried at the station to achieve the desired level of moisture content or until "stone dried".

Table 15. Processing methods employed by processors in Palawan

Lorenza Ortega	Ruben Ormido	Jessie Teroa
Gut using knife	Gut in the mouth using knife	Gut using knife
Par-boil for 5 minutes in an aluminum basin	Boil for 2 hours	Boil for 2 hours
Remove from fire	Remove from fire	Smoke for 1 day
Place in container (pail or basin) and add papaya leaves	Place in container (pail or basin) and add papaya leaves. Mix for 1 hour	Sun dry on iron sheet or on cement
Brush using papaya leaves	Boil for a few minutes	
Boil for 3 hours with the addition of salt	Remove from fire	
Remove from fire	Brush to remove the outer skin	
Brush off remaining outer layer using laundry brush or toothbrush and then wash	Smoke for 1 hour	
Smoke for 1 day using wood Sun dry for 3-4 days on iron sheet if they are not yet "stone dried"	Sun dry for 5 days or until "stone dried"	
This processor sells her products to a local buyer even if they are not yet stone-dry as the buyer buys them and does further drying. This happens particularly when the processor needs money to pay the divers/collectors.	This processor does not care whether the dried sea cucumber is totally cleaned, whether or not the outer layer has been completely removed. He says the sea cucumber is being bought anyway. However, he said the sea cucumber is classified as "clean" or "unclean". However the price of the "unclean" sea cucumber is reduced by PhP 100 per kilogram.	This processor is the diver/ collector/gatherer of his own product.

Table 16. Various techniques employed in gutting and brushing

Gutting	Brushing
• Allowing to self-gut or self eviscerate	• Using papaya leaves
• Making a slit in the stomach	• Using knife
• Making slits in both stomach and mouth	• Burying in the sand or sandy soil for several hours or overnight
• Making a cross slit in the stomach or in the mouth	• Placing on top of moist sand for several hours or overnight
• Slitting from mouth to anus	

Table 17. Step-by-step process involved in processing sea cucumber, the corresponding resources needed, and the associated costs, Palawan, 2010

STEPS	RESOURCES NEEDED	COSTS (PhP/Day)		
		Average	Minimum	Maximum
1. Gutting at the mouth	• Petromax or lamp	2.17	1.85	2.78
	• Flashlight	0.28	0.28	0.28
	• Gasoline or kerosene	44.00	33.00	54.00
	• Knife (good for 3 years)	0.03	0.06	0.06
2. Boiling from 5 minutes to 2 hours	• Aluminum basin or big pan (good for 1-3 years)	0.63	0.32	1.11
	• Scoop made of net (good for 7 months)	0.29	0.29	0.29
3. Mixing with papaya leaves for 1 hour	• Pail (good for 1 year)	0.23	0.19	0.28
	• Papaya leaves (can ask children to collect)	1.00	1.00	1.00
4. Boiling with salt for 1 hour	• Match	1.00	1.00	1.00
	• Salt	7.50	5.00	10.00
	• Water	5.00	5.00	5.00
5. Brushing to remove outer layer	• Used laundry brush or toothbrush	-	-	-
6. Smoking from 1 to 24 hours	• Wood (for both boiling and smoking)	17.00	5.00	10.00
	• Screen	0.33	0.33	0.33
7. Sun-drying from 3 to 5 days until "stone dried"	• Galvanized iron	0.06	0.06	0.06
8. Packing in plastic bag (holding until a volume is attained, 2.5-5.0 kg)	Plastic cellophane (100 pc x PhP 0.5-2.0/pc)	125.00	50.00	200.00
9. Transporting (tricycle)	Fare (to buying station and back)	44.00	44.00	44.00
Total		**248.52**	**147.39**	**330.19**

Table 18. Step-by-step process involved in trading sea cucumber, the corresponding resources needed, and associated monthly costs, Palawan, 2010

STEPS	BUYING STATIONS			
	OBICO		OCEAN AQUAMARINE	
	Resources Needed	Costs (PhP/mo)	Resources Needed	Costs (PhP/mo)
Go to buying station	Fare	-	Fare	-
Buy dried sea cucumber	Weighing scale (15 kg and 100 kg capacity)	139	Weighing scale	139
Further drying if needed	(Note: Do not conduct further drying, their trading office in Manila does further drying, if needed)	NA	Galvanized iron	-
Sorting according to species	Plastic tray (10 pc x PhP 50/tray)	83	Plastic tray (10 pc x PhP 50/tray)	83
	Laborers (4 people x PhP 252/day x 26 days)	26,208	Laborers (6 people x PhP 252/day x 26 days)	39,312
		1,140	• Sacks (125 pc x PhP 22.80/pc)	2,850
		250	• Plastic cellophane (125 pc x PhP 5/pc)	625
			• Serving machine	
		50	• Plastic straw (1 pc x PhP 50/roll)	50
Sorting according to size or weight				
Packing in sacks				
7. Shipping	• Procurement range: 640 to 4,000 kg/month		Average procurement: 10,000 kg/month	
	• Forwarder rental: PhP 220-230/sack; delivery is weekly; minimum is 4 sacks/ delivery and maximum is 10-20 sacks/delivery; 1 sack is 40-50 kg dried sea cucumber	3,600-8,000	• Forwarder rental: PhP 18,000/transaction x 2 deliveries/month	36,000
	• Shipment fee (0.64-4.0 tons x PhP 250/ton)	160 to 1,000	• Shipment fee (5 tons x PhP 250/ton x 2 deliveries/month	2,500
	• Auxiliary fee (13 units x PhP 15/50 kg)	192 to 1,200	• Auxiliary fee (100 units x PhP 15/50 kg x 2 deliveries/month)	3,000
	• Philippine Port Authority fee (PhP 60/transaction)	60	• Philippine Port Authority fee (PhP 60/transaction x 2 transactions/month)	120
Receipt of report of products rejected from Manila	YES		YES	
Products rejected in Manila are sent back through LBC (a local courier service)	YES		NA	
Rejected products are sold for domestic consumption	YES		-	
The dried sea cucumber are hydrated or reconstituted with water so that it will become four times its original size	YES		-	
TOTAL	**Minimum**	**31,882**		**84,679**
	Maximum	**48,130**		
COST PER KILO (PhP)	**Minimum**	**49.82**		**8.47**
	Maximum	**12.03**		

Products are then packed in sacks lined with polyethylene plastic and stored for several days until a sufficient volume has accumulated for shipment to Manila. Costs associated with trading amount to PhP 8.40 to PhP 12.50 per kilogram.

3.2.4 PRODUCT INFORMATION AND PAYMENT FLOW

The flow of product from the source to the final markets is shown in Figures 9 and 10. The temporal dimension of the flow is included to achieve a better understanding of the chain. Live/raw/fresh sea cucumber collected by divers/collectors is sold to village-level assemblers/processors. One fishing trip takes about six hours. Since assemblers/processors are in the same village, it takes just a little over six hours before the product first changes hands. Assemblers/processors then carry out primary processing. The whole process takes about 3 days to one week to achieve a "stone dried" condition. At this point, the product has been completely transformed and is ready for packing and storage.

The dried product will be stored for several days to a few weeks until a sufficient quantity has accumulated for sale to the next buyer. This next buyer could be a local trader, buying station or agent. In most cases however, especially in Pangasinan, assemblers/processors sell directly to exporters in Manila. Local traders, agents and buying stations are located in key municipalities or cities. In Palawan, most of these intermediaries are based in Puerto Princesa City. In Davao, one large trader is located right at the Santa Ana Wharf, Davao City. In Pangasinan, one local trader is based in the town of Bolinao. There is also a buying station in Alaminos City.

There is practically no product transformation taking place as the product moves from assemblers/processors to local traders, agents or buying stations. The product merely changes hands and is, at most, reclassified by grade and size. In a few instances though, when the product is not sufficiently dried, it is re-dried for a few more hours or days by these intermediaries. The product stays with these intermediaries for several days or weeks until a sufficient quantity has again been accumulated to warrant transport to Manila.

Product from Pangasinan is brought to exporters in Manila by bus, which generally takes from 5 to 6 hours. Transport cost per 60 kg sack is about PhP 200. Product from Palawan is brought to Manila mainly by sea freight (1 day), at a freight cost of about PhP 230 per 60 kg sack. Product from Davao is brought to Manila by air freight (one and a half hours) at PhP 650 per 20 kg box.

Product is weighed, reclassified, graded and repacked in plastic bags then stored in the warehouse. These are eventually shipped to export destinations.

3.2.5 LOGISTICS ISSUES AND EXTERNAL INFLUENCES

Problems related to logistics are shown in Table 19 and Figure 11. Declining volume of catch and increasingly smaller sizes are the primary problems for divers/collectors. Sea cucumbers are now also sourced from deeper water (shallow water areas having been effectively fished-out in many cases) so the use of a compressor has become necessary. Scuba diving gear is expensive, hence the use of cheaper, improvised, albeit more dangerous alternatives. Another problem is the increasing cost of fuel. In Pangasinan, fuel costs amount to as much as PhP 600 to PhP 700 per fishing trip. In Palawan, where fishing/sea cucumber collection sites are relatively nearer, expenses on fuel are about PhP 150 per fishing trip. Those who are now participating in the sea ranching project (in Bolinao and Anda, Pangasinan) also complained that cultured sea cucumber are being stolen and that it is difficult to guard the area continuously.

Village-level assemblers/processors also cited the declining volume and smaller sizes of sea cucumber as primary logistics problems. Declining volume means that it takes a longer time to assemble sufficient volume to warrant transport to Manila. The increasingly smaller size is particularly true for high value species such as putian. They have allegedly instructed divers/collectors not to collect very small individuals to allow the stock to grow. However, divers/collectors reasoned that if they do not collect the small ones, others will anyway. Assemblers/processors have no option but to buy even the small ones once they have been collected, following the same logic.

Figure 9. Value chain mapping of activities

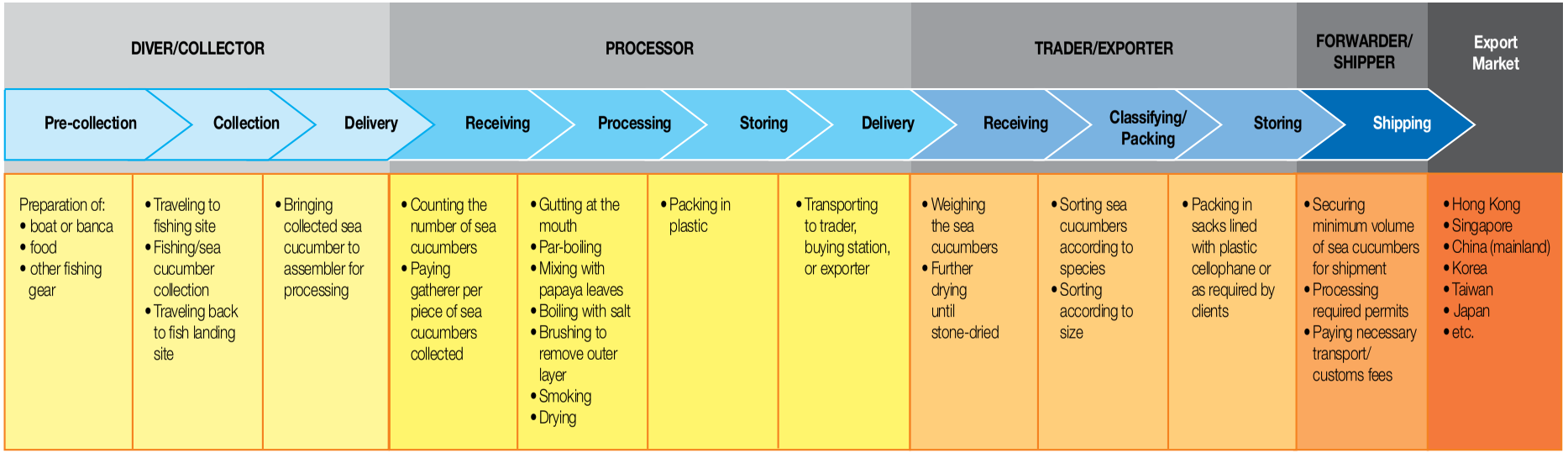


Figure 10. Sea cucumber product flow in the Philippines

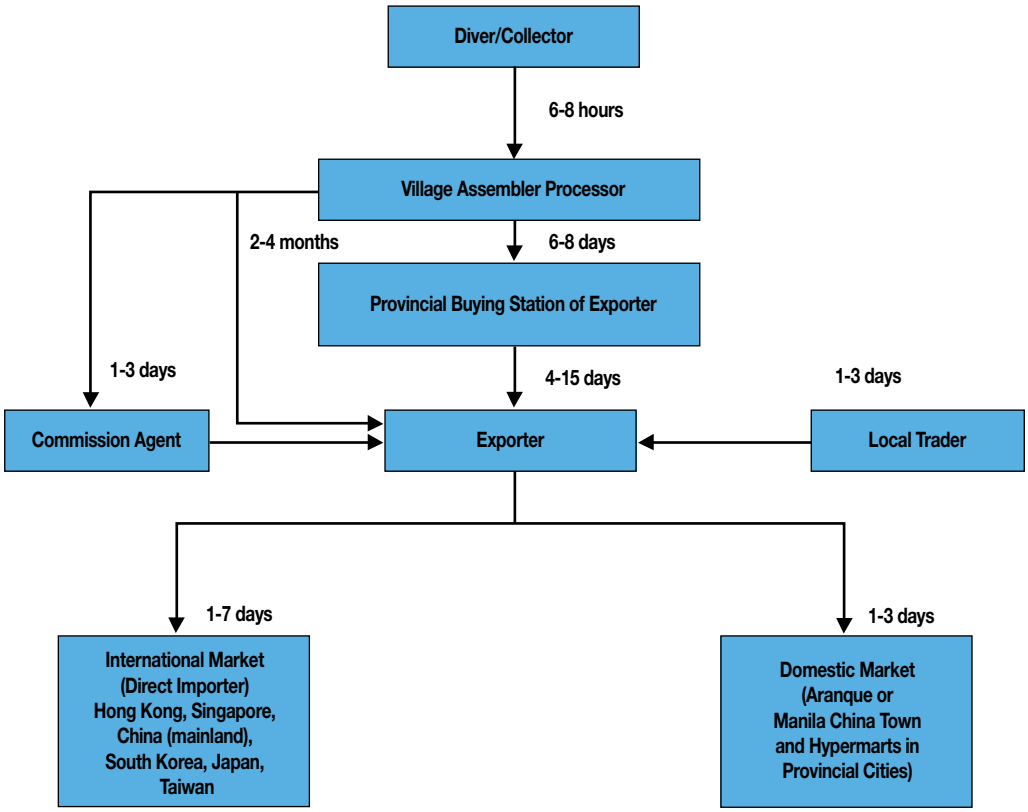


Table 19. Logistics related problems/issues, Palawan, Pangasinan, and Davao, 2010

Sea Cucumber Industry	Major Problems	Suggested solutions
Divers/Collectors	• High fuel costs	• Sea ranching, associated culture technologies, training and capital from government
	• Decreasing catch of wild-caught sea cucumbers	• Municipal ordinance to limit sizes that can be collected
	• Sea cucumbers are now found in deeper areas	• Ensure security of sea farms (such as hiring of guards)
	• Collecting very small sizes of sea cucumbers or juveniles which command very low prices	
	• Cultured sea cucumbers are being stolen	
	• Wary of government/NGOs teaching them to culture (e.g., from previous mud crab culture experience)	
	• Ban on compressors	
Processors	• Declining supply of fresh sea cucumbers	
	• It takes longer to assemble a minimum volume for delivery than before	• Size limit for buyers
	• No size limits	• Standards for quality
	• Poor quality of processed sea cucumbers	• Training for proper processing
	• Insufficient capital for procurement; need to borrow sometimes to pay gatherers of sea cucumbers	• Capital
Traders/Exporters	• Declining supply of dried/processed sea cucumbers	• Actively participate in the conservation efforts for sea cucumbers
	• Seasonality of supply (peaks from March to June only);	• Adhere or help enforce size limit regulations
	• Need to improve quality of processed sea cucumbers	• Proper handling and monitoring by government
	• Size regulations may be a problem to implement	

Figure 11. Value chain mapping of exported sea cucumber, Philippines

DIVER/COLLECTOR			PROCESSOR				TRADER/EXPORTER			FORWARDER/ SHIPPER	Export Market
Pre-collection	Collection	Delivery	Receiving	Processing	Storing	Delivery	Receiving	Classifying/ Packing	Storing	Shipping	
Preparation of: • boat or banca • food • other fishing gear	• Traveling to fishing site • Fin-fishing/ sea cucumber collection • Traveling back to fish landing site	• Bringing collected sea cucumber to assembler for processing	• Counting the number of sea cucumbers • Paying gatherer per piece of sea cucumbers collected	• Gutting at the mouth • Parboiling • Mixing with papaya leaves • Boiling with salt • Brushing to remove outer layer • Smoking	• Packing in plastic	• Transporting to trader, buying station, or exporter	• Weighing the sea cucumbers • Further dry sea cucumbers that are not yet stone-dry	• Sorting sea cucumbers according to species • Sorting according to size	• Packing in sacks lined with plastic cellophane or as required by clients	• Securing minimum volume of sea cucumbers for shipment • Processing required permits • Paying necessary transport/ customs fees	• Hong Kong • Singapore • China (mainland) • Korea • Taiwan • Japan • etc.
COST (PhP/kg)	15		21				9				
BUYING PRICE (PhP/kg)			300				4,200				
SELLING PRICE (PhP/kg)	300		4,200				5,364				
NET INCOME (PhP/kg)	285		1,179				1,155				
TIME (days)	0.3		6				15				

DIVER/COLLECTOR			PROCESSOR				TRADER/EXPORTER			FORWARDER/ SHIPPER	Export Market
Pre-collection	Collection	Delivery	Receiving	Processing	Storing	Delivery	Receiving	Classifying/ Packing	Storing	Shipping	
CONSTRAINTS • Declining volume • High fuel costs	• Ban on compressors • Increasingly smaller sizes		• Declining volume • Poor processing/product quality	• Inadequate capital • Slow turn-over time			• Declining volume • Poor quality	• Increasingly smaller sizes			
OPPORTUNITIES • Increasing price due to increasing demand • Increasing number of alternative uses • Possibility of sea-ranching/culture			• Increasing price due to increasing demand • Increasing number of alternative uses				• Increasing price due to increasing demand • Increasing number of alternative uses				

The declining volume of sea cucumber is also a problem for other downstream players, the exporters, as is the poor quality of processed/dried sea cucumber. In addition, they complain of very high transportation costs, especially sea freight and air freight. A buying station in Palawan has to employ the services of a forwarder to ensure that the product will be delivered to Manila on time and in good condition. However, it has to pay as high as PhP 18,000 for a shipment of about 5 tonnes.

3.3 VALUE ADDED ALONG THE CHAIN

Value added at the level of exporters is shown in Table 20. The current export price of *H. scabra* is about USD 120/kg (price quotes obtained from Hong Kong importer) or PhP 5,368.80/kg at an exchange rate of PhP 44.74 to 1 US dollar. Value added, (i.e., after deducting costs of intermediate inputs) at the level of the exporter is estimated at PhP 1,164/kg. Transport costs from Palawan to Manila and then to Hong Kong, including the associated handling fees as well as payment for direct labor, are among the important components of value added. When all these are deducted, the remaining value added of PhP 1,145/kg is what remains to exporters to cover overhead costs, management, capital and realize profit.

Table 20. Value added at exporter level

	Value in PhP
Gross Value Received on sales (USD 120/kg at PhP 44.7/USD)	5,364.00
Cost of Intermediate Inputs:	
Cost of product (PhP 4,200/kg)	4,200.00
Other Intermediate Inputs:	
Sacks	0.28
Plastic cellophane	0.06
Straw	0.06
Sub-total	4,200.35
Less: Costs of services and permits	
Shipment from Palawan to Manila	3.60
Shipment from Manila to Hong Kong	2.70
Permits and other fees:	
Auxiliary permit	3.00
Transhipment fee (Palawan-Manila)	2.50
Phil. Port Authority fee	0.01
Terminal handling fee (Manila-Hong Kong)	3.22
Documentation fee (Manila-Hong Kong)	0.11
Sub-total	15.14
Total Expenses	4,215.49
Value Added (Gross value received less total expenses)	1,148.51
Value Added by Factor of Production: (Exporters' hired direct labor)	3.93
Value Added by indirect (overhead) labor, exporters' management, and capital (depreciation and profit)	1,144.58

The cost of the product to the exporter (PhP 4,200) represents the value transferred to the preceding player in the chain (i.e., assembler/processor). The value added at this point is estimated at PhP 1,192 after deducting the cost of product, other intermediate inputs as well as transport services (Table 21).

The value transferred to divers/collectors amounts to PhP 3,000 (Table 22). There is no cost of product at this point since sea cucumbers are merely collected from the wild. Intermediate inputs are also limited to the fuel used for the boat (PhP 10.42) and lamps (PhP 3.67). Value added, which represents payment for diver/collectors' labor and capital (e.g., depreciation of boat and other fishing implements), amounts to PhP 2,986 after deducting cost of inputs.

Table 21. Value added at assembler/processor level

	Value in PhP
Value received on sale to exporter level (PhP 4,200/kg)	4,200.00
Cost of Intermediate Inputs:	
Cost of product (PhP 3,000/kg)	3,000.00
Other Intermediate Inputs:	
Sacks	0.28
Plastic cellophane	1.00
Match/salt/water (PhP 1.35/kg)	1.35
Fuel wood (PhP 1.42/kg)	1.42
Sub-total	3,004.05
Less: Cost of services	
Transport from the village to buying station	4.40
Value Added (Labor, management and capital)	1,191.55

Table 22. Value added at diver/collector level

	Value in PhP
Gross Value Received (PhP 3,000/kg)	3,000.00
Intermediate Inputs:	
Fuel (boat) (PhP 10.4/kg collection of 1 kg equivalent dry weight)	10.42
Kerosene for lamp (PhP 3.67/kg for collection of 1 kg equivalent dry weight)	3.67

It would take at least 10 days of collection (at an estimated rate of 1 kg sea cucumber collected per day; equivalent dry weight, assuming a 10% fresh to dry weight conversion).

As mentioned earlier, 'value added' represents the wealth created as a result of employing the different factors of production. Total wealth created in the Philippines by a kilogram of dried, good quality *H. scabra* is estimated at PhP 5,326.11 (Table 23). Assuming a 10% fresh to dry weight conversion, this means that a kilogram of fresh *H. scabra* (at least 5 inches length; 2 to 3 pcs/kg) could generate PhP 532.60 per kilogram or at least PhP 177.50/pc.

Several important observations can be derived from the series of value added along the sea cucumber value chain. First, the largest value added (wealth) is created at the level of divers/collectors, while that at the exporter and assembler/processors' levels value added is more or less the same. The reason for the large value added by divers/collectors stems from the fact that the product is merely extracted from the wild. Value is created by making an otherwise non-available product available to the market. The largest contributor to value added at this stage is primarily the labor or effort exerted to collect sea cucumber from the wild.

Secondly, the gross value received by the exporter (i.e., price received) for good

Table 23. Value added by individual player, per kilogram of *H. scabra* export (good quality)

Player	Value Added (PHP)	Factor of Production
Exporters	1,148.61	Management; capital
Assemblers/Processors	1,192.00	Operators' labor and management; family labor; capital (depreciation); profit
Divers/Collectors	2,986.00*	Operators' labor, family labor; capital (e.g. boat and compressor)
Gross Value Added (Total Wealth Created)	**5,326.61**	

* It would take at least 10 days of collection (at an estimated rate of 1 kg sea cucumber collected per day; equivalent dry weight, assuming a 10% fresh to dry weight conversion)

quality *H. scabra* is almost similar to the gross value added created along the entire value chain. This reflects the minimal cost of intermediate inputs and services. At the exporter level, intermediate inputs merely consist of simple packaging materials while at assembling/processing, intermediate inputs are limited to firewood and materials for boiling and smoking, and simple packaging materials. Unlike other agricultural or fishery products that undergo a series of product transformations along the chain, the only transformation taking place in the sea cucumber value chain is drying (i.e., from live/raw/fresh form to dried product form). This transformation happens mostly at the village level by the assemblers/processors.

Thirdly, form and place value are created by assemblers/processors, while exporters are limited to creating place value. The sea cucumber export business is essentially a buying-selling operation. What has been bought from the assembler/processor is packed in simple materials and shipped to importers in foreign countries.

Fourthly, since value added reflects payment to factors of production plus profit, it is clear that exporters and assemblers/processors reap the largest benefit from the value chain. A simple cost and return analysis validates this observation (Table 24). Unlike value added analysis, cost and return analysis includes depreciation costs, interest payments and opportunity cost of capital. Thus net income represents returns to management, return to overhead expenses, plus profit. As shown, the net income of the exporter is PhP 1,102.33 while that of assembler/processor is PhP 1,142.00. On the other hand, net income of diver/collector per kilogram of fresh *H. scabra* is PhP 284.93.

It should be noted that the analysis was done on a per kilogram basis. Since the volume handled by an individual exporter is considerably larger than that of an individual assembler/processor, it is clear that aggregate net income (i.e., for the whole business volume) of exporters is largest among the different players in the value chain.

3.4 PARTICIPATORY SYSTEMS ANALYSIS

Two separate focus group discussions (FGDs) were conducted in Pangasinan and Palawan to determine the factors affecting fishers' decision to engage in sea ranching/pond culture. The launching question used for the FGD was: **"if the technical viability of sea ranching and pond culture can be demonstrated to you, what are the factors that would encourage you to engage in the said practice?"**

3.4.1 LUCIENTE UNO, BOLINAO, PANGASINAN

Fishers in this area who participated in the PSA exercise identified the following factors (Table 25) in response to the launching question:

The PSA matrix and quadrant are shown in Figures 12 and 13, respectively. The need to know how sea cucumber culture is done, provision of technical assistance

Table 24. Cost and return, per kilogram of sea cucumber *(H. scabra)*, good quality

Item	Diver/Collector (Fresh)	Assembler/Processor (Dried)	Exporter (Dried)
Price Received	300.00	4,200.00	5,364.00
Cost of Product	0.00	3,000.00 **	4.200.00
Other Costs ***	15.07	58.21	61.67****
Total Costs	15.07	3,058.21	4,261.67
Net Return	284.93	1,142.00*****	1,102.33

*Based on USD 120/kg @ PhP 44.7/USD
**Based on PhP 300/kg fresh (10% dry-equivalent weight)
***Based on Tables 14, 17 and 18 (Note: for exporter, Aquamarine cost was used)
****Includes PhP 8.47 cost/kg (see Table 18) plus PhP 0.70/kg shipment cost to Hong Kong (i.e. PhP 7,000/10,000 kg) and opportunity cost of procurement capital of PhP 52.50 (i.e. 4,200* 1.25%/month)
*****Includes all costs in Table 17 plus opportunity cost of procurement capital of PhP 37.50 (i.e., PhP 3,000*1.25%/month)

Table 25. Factors identified in PSA exercise, Barangay Luciente Uno, Bolinao, Pangasinan

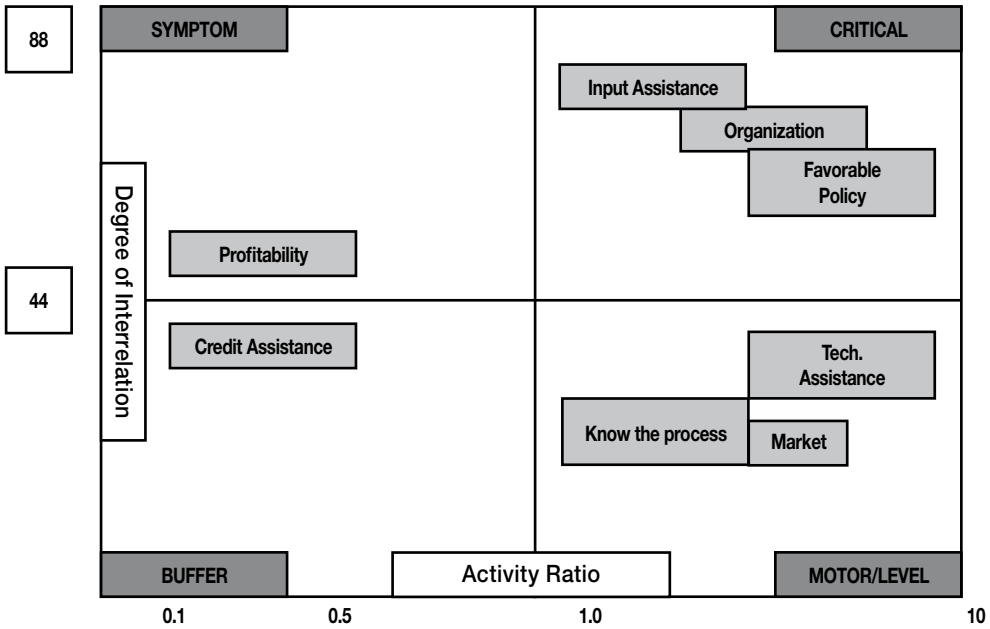
Factor	Code	Definition
Knows the Process	KP	They should be taught exactly how to do it
Credit Assistance	CA	They should be provided access to credit
Organization	O	Should be done at community level; needs to organize fishers
Technical Assistance	TA	They should be provided technical assistance by agencies concerned
Market	M	There is sure market for the cultured product
Input Assistance	IA	Sure supply of juveniles; should be assisted on inputs they will need in the business
Favorable Policy	FP	Local policies/ordinance should be supportive
Profitability	P	Sea cucumber culture should be profitable

Figure 12. PSA matrix, Barangay Luciente Uno, Pangasinan

No.		1	2	3	4	5	6	7	8		
	Elements	*Know the Process*	*Credit Assistance*	*Profitability*	*Organization*	*Market*	*Technical Assistance*	*Favorable Policy*	*Input Assistance*	**Active sum (AS)**	**Degree of Interrelation (AS x PS)**
1	*Know the Process*		0.50	2.00	1.00	1.00	0.10	0.50	1.00	6.10	29.90
2	*Credit Assistance*	0.50		1.00	0.50	0.50	1.00	0.10	1.00	4.60	32.66
3	*Profitability*	0.50	1.00		0.50	1.00	0.50	0.50	1.00	5.00	47.50
4	*Organization*	1.00	2.00	1.00		1.00	2.00	2.00	2.00	11.00	50.60
5	*Market*	0.50	1.00	2.00	0.50		0.50	0.50	0.50	5.50	22.00
6	*Technical Assistance*	2.00	1.00	2.00	1.00	1.00		0.50	1.00	8.50	36.55
7	*Favorable Policy*	1.00	2.00	2.00	2.00	1.00	2.00		2.00	12.00	57.60
8	*Input Assistance*	1.00	2.00	2.00	1.00	1.00	1.00	0.50		8.50	56.10
	Passive sum (PS)	4.90	7.10	9.50	4.60	4.00	4.30	4.80	6.60		
	Activity ratio (AS/PS)	1.24	0.65	0.52	2.40	1.38	1.98	2.50	1.30		

Ranking system:
1. Strong influence = 2 2. Moderate influence = 1 3. Weak influence = 0.5 4. Very weak influence = 0.1

Figure 13. Factor quadrant, sea ranching/pond culture in Barangay Luciente Uno, Bolinao, Pangasinan



in sea cucumber culture and processing, and ensuring good market for the product turned out as the motor/levers in the PSA exercise. Motor/lever refers to factors or interventions which would likely be key to the adoption of sea ranching and pond culture in the area.

Results of PSA also underscored the critical role of policy, organization and input support. While the motor/levers may spur adoption, the issue of whether it would be successful will depend on the presence of a favorable policy environment, strong fish farmer organizations and sustained provision of input support which are considered critical factors. Favorable policy may take the form of local ordinances which would allow the culture (e.g., sea ranching) of sea cucumber in the area and would define access rights/privileges to sea ranchers. On the other hand, organization refers to the need to build and strengthen fish farmer organizations which would venture into sea ranching or pond culture. The critical role of the sustained provision of input support, particularly ensuring the supply of juveniles, is also emphasized in the PSA results.

Finally, profitability turned out as only a symptom, while credit assistance appeared as a buffer. Other things being equal, demonstrating that sea cucumber culture is profitable or providing credit assistance alone, would not lead to adoption, much less successful introduction of sea cucumber culture in the area.

3.4.2 TAGBUROS, PALAWAN

The factors identified in the PSA exercise are shown and defined in Table 26. While the factors would appear very different at first glance from those discussed earlier, the similarity becomes clearer on closer inspection. The factors “Zoning” and “Size Limit” in the Palawan PSA could be viewed as specific derivatives of the factor “Favorable Policy” in the Pangasinan PSA. Similarly, “Capital” is a specific derivative of “Input Assistance” or “Access to Credit”. Information/data availability in Palawan is similar to “Knowing the Process” while “Processing” (i.e., they want to be trained on processing) is similar to “Technical Assistance”. On the whole, it could be said that the factors identified in the two separate PSA exercises are more or less the same.

Results of PSA are shown in Figures 14 and 15. Except for “capital” which appeared merely as a symptom, all the factors identified turned out to be quite important either as motor/levers or critical factors. The results also mirror to some degree those from the Pangasinan PSA.

Table 26. Factors identified in PSA exercise, Barangay Tagburos, Puerto Princesa City

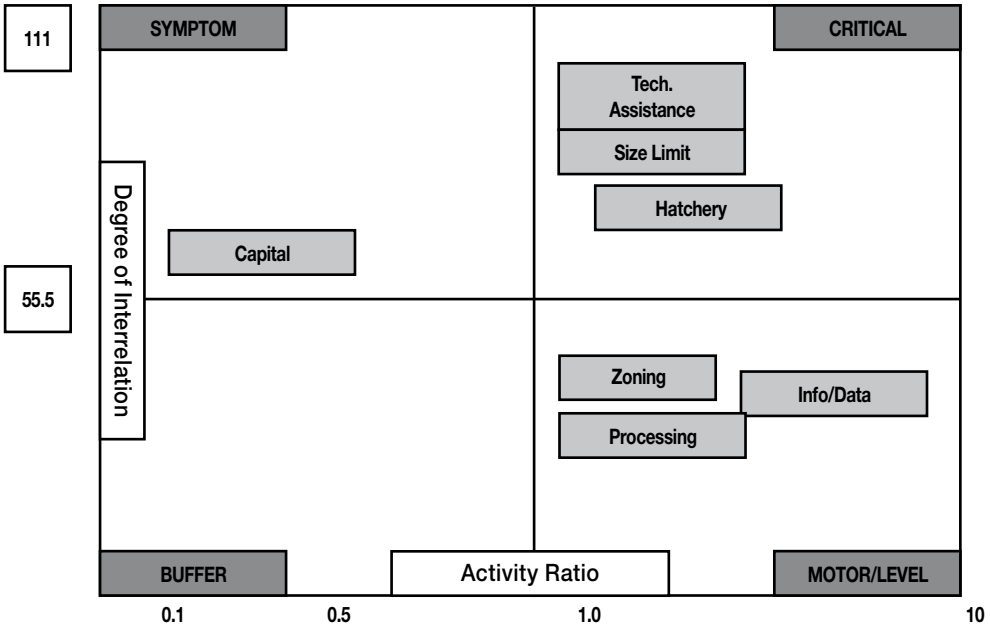
Factor	Code	Definition
Zoning	Z	Areas for sea ranching should be identified and certain areas should be allotted for this venture
Capital	K	They should be provided capital assistance
Size limit	SL	Policy should be formulated and regulated regarding size limits
Hatchery	H	There should be a strong hatchery program to ensure supply of juveniles
Information	I	They should be provided data/information regarding the industry
Technical Assistance	TA	They should be provided technical assistance
Processing	P	They should be trained on correct processing practices

Figure 14. PSA matrix, Tagburos, Palawan

No.	Elements	1 *Zoning*	2 *Capital*	3 *Size Limit*	4 *Hatchery*	5 *Technical Assistance*	6 *Info/Data Availability*	7 *Processing*	**Active sum (AS)**	**Degree of Interrelation (AS x PS)**
1	*Zoning*		1.00	1.00	2.00	1.00	0.50	0.50	6.00	36.00
2	*Capital*	1.00		1.00	2.00	1.00	1.00	1.00	7.00	63.00
3	*Size Limit*	2.00	1.00		1.00	2.00	1.00	2.00	9.00	81.00
4	*Hatchery*	0.50	2.00	2.00		2.00	1.00	1.00	8.50	76.50
5	*Technical Assistance*	1.00	2.00	2.00	2.00		1.00	1.00	9.00	81.00
6	*Info/Data Availability*	1.00	2.00	1.00	1.00	2.00		1.00	8.00	44.00
7	*Processing*	0.50	1.00	2.00	1.00	1.00	1.00		6.50	42.25
	Passive sum (PS)	6.00	9.00	9.00	9.00	9.00	5.50	6.50		
	Activity ratio (AS/PS)	1.00	0.77	1.00	1.31	1.00	1.45	1.00		

Ranking system:
1. Strong influence = 2 2. Moderate influence = 1 3. Weak influence = 0.5 4. Very weak influence = 0.1

Figure 15. Factor quadrant in Barangay Tagburos, Puerto Princesa City, Palawan



4. SYNTHESIS/IMPLICATIONS/RECOMMENDATIONS

Sea cucumber is a high-value export whose sustainability is threatened by over-exploitation. It is clear that over-exploitation is market induced, resulting from high export demand and increasing prices. In contrast, existing programs to address industry problems are conservation-driven, inspired primarily by the need to arrest declining stocks. To date though, initiatives on conservation, both in terms of policies, research and development work are still at preliminary stages and have yet to prove their effectiveness in addressing the current state of the industry.

An examination of the sea cucumber value chain reveals a number of industry characteristics with considerable implications on current industry interventions as well as future courses of action. These characteristics are summarized below.

Species, Size and Quality

The sea cucumber industry is highly species, size and quality oriented. Willingness to pay by the final consumers is reflected in the price received by exporters. As shown, prices vary widely by species, size and quality. Consumer preferences are heavily focused on a few species, among which is *H. scabra*. In fact, species can be classified as high, medium and low value depending on prices they fetch in the market. Size preference is also remarkable, with prices varying by several hundred to a few thousand pesos depending on size. For good quality *H. scabra*, a trader in Davao City pays as high as PhP 3,800/kg for large individuals (55-74 g/pc) to as low as PhP 1,200/kg for smaller ones (15-24 g/pc). Similarly, tremendous price differences exist between good quality product (Grade A) and those of lower quality (Grade B).

Despite the high market premium for species, size and quality, the industry operates in the absence of officially formulated grades/standards that could guide the transactions along the value chain. In addition, government initiatives to improve primary processing are recent and at best very limited.

Highly Customer Specific Industry

Despite the fact that sea cucumber was found to be edible hundreds if not thousands of years ago, consumption remains largely within oriental countries. In the Philippines, domestic consumption remains small and mostly limited to residents of oriental descent. Nevertheless, the oriental market is large and consumers with oriental descent are widely dispersed all over the world. For instance, Philippine export of sea cucumber to the USA has increased, most likely due to the significant number of Chinese residing in that country.

This has considerable implications both on the demand and supply of sea cucumber and on conservation efforts. Oriental economies are among the fastest growing in the world. In China alone, per capita income has grown by leaps and bounds in recent years. This probably explains the increasing trend in the price of sea cucumber on the world market. Increasing price would certainly lead to greater over-exploitation of the sea cucumber resource, unless effective measures are in place to prevent this.

A Mystery-Based Industry

The sea cucumber industry is as mysterious as the sea cucumber itself. The weird looking animal can force itself through small crevices; it shrinks to a very small size and turns as hard as stone when dried, enlarges and regains its fresh appearance when hydrated. The industry itself thrives on the allegedly mysterious characteristics of the product to improve human health and vigor, and cure many ailments.

Traditional knowledge on sea cucumber as medicine exists, such as the Cuverian tubules as crude plaster for minor wounds, and the extracts from the muscular body for tumors, fungal infection, high blood pressure, arthritis and muscular disorders (Trinidad-Roa, 1987). Their meat is said to contain chemicals that many believe to be aphrodisiacs, able to cure certain forms of cancer (lymphoma and breast cancer), and

act as anti-bacterial and anti-fungal agents. Modern research has confirmed that they are beneficial for musculoskeletal inflammatory diseases, especially rheumatoid arthritis, osteoarthritis, and ankylosing spondylitis (a rheumatic disease that affects the spine). In addition, sea cucumbers provide vitamin A, B-1 (thiamine), B-2 (riboflavin), B-3 (niacin), and vitamin C, and the minerals calcium, iron, magnesium, and zinc. Unfortunately, very little research and development effort has been invested in this area by the government (Ragaza, 2010).

An Incidental Catch Based Industry

Despite its reputation as a high value export, the sea cucumber industry is merely an incidental catch based industry. It is an industry incidental to the fishing industry. In general, divers collect sea cucumbers when they happen to find them in the course of their fishing. This suggests that fishers' marginal return to fishing effort is still higher in fishing. Otherwise, they would have devoted their effort more to the collection of sea cucumber.

This has implications on sea ranching programs. Sea ranching models which would require fishers to render security service in the ranch (therefore skip fishing) would likely fail unless alternative livelihood or income sources can be provided. Every fisher depends on their daily catch of fish to support daily household expenses. While they may take turns in guarding the ranch and may end-up providing security services just once or twice a month, this would still be a major problem to a cash-strapped fisher. This suggests that efforts to address over-exploitation should be cast within the context of the livelihood system in coastal communities. In Anda (Pangasinan), those who are already engaged in one pilot sea ranching project related that their major problem is "Bantay Salakay", meaning those who are supposed to guard the ranch are the ones stealing from it. In Luciente Uno (Bolinao), fishers said they would likely engage in sea ranching if it was established in seagrass beds fronting their residence (their houses are along the coast) so that provision of security would be minimal.

Season Dependent Industry

Sea cucumber collection is highly seasonal. Not that species grow only in certain seasons, but because venturing into the sea to collect sea cucumber is difficult during certain periods. The volume that moves along the value chain therefore varies considerably by time period. Interestingly, the price of sea cucumber does not show a distinct seasonal variation.

This has several implications. First, over-exploitation can only take place during certain periods of the year owing to natural constraints. Second, the profitability/ viability of functions/activities (e.g., assembling/processing) along the value chain would vary by season as volume handled varies. Third, since price does not show any seasonal variation, price pegging by dominant players (exporters) is apparent.

An Hour-Glass Model Industry

The sea cucumber industry is like an hour-glass. The number of upstream players is very large, considering that collection takes place in so many coastal areas in the country. In contrast, the number of downstream players is fairly small. In the Philippines, there are only 45 to 50 firms involved in sea cucumber trade/export, out of which four are very large firms which easily account for the bulk of the product moving along the value chain. The number of key customers (oriental population) catered to by the existing value chains however is very large. Hence just like an hour glass, the industry is broad at each end and narrow in the middle.

This suggests that industry control is in the hands of a few players (primarily large exporters) who capture much of the value generated by the industry. As shown, net income of an exporter from a kilogram of *H. scabra* could reach more than a thousand pesos. This becomes even more significant considering the volume that passes through each exporter. The exporter is the hub, so dense that volumes from all over the country gravitate towards it. It may not be readily visible at first glance, but their

power and influence along the entire chain becomes apparent on closer inspection. Large exporters have already established a vast network of buying stations, agents, and set up marketing relationships with assemblers/processors. The industry could easily fall under CR 4 (concentration ratio) category, where the four largest exporters probably account for the bulk of the product that moves along the chain.

Information Asymmetric Industry

Information asymmetry is fairly evident along the sea cucumber value chain. Divers/collectors are generally not aware of the real prices of sea cucumber in major trading areas, much less are they aware of the species, size and grade requirements for dried sea cucumber. Assemblers/processors, local traders and agents have greater access to price information since they can be directly in contact with exporters. Divers/collectors just bring their collection to assemblers/processors and have to contend with the price quoted by this player upon cursory examination of the catch.

A Multi-Layered Industry

The marketing chain for sea cucumber is typically multi-layered. While there are cases where product moves only along three layers (diver/collector-assembler/processor-exporter), there are many instances where the product moves through two to three additional layers involving local traders and commission agents. Local traders and agents appear redundant and contribute to marketing inefficiency rather than add real value to the product.

A Self-Policed Industry Doomed to Fail

Policies to regulate size (minimum length, diameter or weight) are, at best, at the contemplation stage in many local government units (LGUs). The capacity of LGUs to effectively implement such policies when finally passed is also doubtful. There is already a semblance of self-policing especially at the level of assemblers/processors, who allegedly advise divers/collectors not to collect very small individuals in order to allow the stock to grow. However, such initiatives may prove to be exercises in futility given the open-access nature of the fisheries. Divers/collectors believe others would collect what they leave behind, so why leave them in the first place?

4.1 VALUE CHAIN UPGRADING AND EFFECTIVE PATHWAYS FOR SEA RANCHING AND POND CULTURE

Based on the foregoing discussion, the country's sea cucumber industry may aptly be characterized in a nutshell as follows:

A high value food export with bright potential for alternative uses; incidental to the fishing industry, catering to specific markets with distinct species, size and quality preferences; where seasonal volume gravitates towards an olygopsonistic[1] export sector after moving along multi-layered channels operating under information asymmetry and absence of government standards and regulations; and where market-induced over-exploitation is currently being addressed with government-led conservation programs.

Several key measures may be suggested to upgrade the sea cucumber value chain, achieve a more effective conservation program and improve the success of sea ranching and pond culture in the country. As discussed earlier, upgrading may involve process, function, product or the whole chain itself. These are discussed as follows:

Process Upgrading

'Process' refers to the activities undertaken along the value chain. Activities involved in collecting, trading and export are straightforward. Except for the use of compressors which pose dangers to fishers and the indiscriminate collection of very small (almost juvenile) sea cucumber,

1 Olipopsony is a market form in which the numbers of buyers is small while the number of sellers in theory could be large. (Wikipedia.org)

not much improvement can be effected at these nodes in the value chain. The use of compressors will probably continue despite regulations unless cheaper and less dangerous alternatives can be provided. On the other hand, size regulation can be addressed only through policy instruments which will be discussed in a later section of this report.

The most important activity where concrete measures can readily be taken is in primary processing. This is the single most important determinant of quality and considerable value can be created by improvements in this area. Primary processing is carried out at the village level mostly by assemblers/processors. Some fishers who opt to sell dried sea cucumber to assemblers/processors also carry out primary processing.

Even involving similar species, primary processing methods currently in use are highly variable. No standard protocol is being followed which tends to result in highly variable quality of the processed product. The methods employed are very traditional without knowledge and consideration of existing standards for processed food products (e.g., Good Manufacturing Practices - GMP, Sanitation Standards Operating Procedures - SSOP, Hazard Analysis and Critical Control Points - HACCP). The NFRDI has developed a protocol for processing *H. scabra*, but this remains to be disseminated throughout the country. In addition, protocols have yet to be developed for other species of sea cucumber.

The formulation of grades and standards is crucial to guide transactions along the value chain. Processors may not find the incentive to improve processing if they know that exporters would end-up classifying good quality product at a lower grade based on arbitrary standards developed unilaterally by the exporters themselves.

Function Upgrading

Redundant functions are apparent in the sea cucumber value chain. Collecting, assembling/processing and export appear to be the only essential functions for a more efficient chain. There are many cases however, when the product moves through two to three additional players involving local traders and agents. The functions being done by local traders and agents are already carried out by assemblers/ processors, thus making them redundant in the market. In addition, large exporters have already established buying stations at major supply sources.

Local traders and agents are engaged in purely arbitrage activity and thrive through information asymmetry. Fully aware of prices offered by exporters in Manila, they buy products at lower prices from those players who have less access to market and price information and sell these to exporters for a given margin.

Making the value chain more efficient would necessitate efforts to achieve more direct linkage between the assembler/ processor and exporter. Provision of market information could prove to be a key measure.

Product Upgrading

Most of the product moving along the sea cucumber value chain is already very small. Assemblers/processors, traders and exporters identified this as a major problem. As shown earlier, the market has considerable price preference reflected in the wide difference between the prices of small and large products, i.e., the individual size of each sea cucumber.

Aside from reflecting the over-exploitation problem, increasingly smaller sizes sold in the market reflects poor business practice. Much more value would have been generated if small pieces were allowed to grow to more optimal market size. However, this is easier said than done in an open access fishery situation. Product upgrading through size improvement should be attempted, nonetheless. Since this is tied to measures to regulate minimum size of catch, this will be discussed further in a later section.

Improvement in product quality is also an important area for upgrading. This may be achieved through correct processing,

packaging, handling and transport along the chain. The formulation and adoption of appropriate processing protocols, as discussed earlier, is imperative to achieve this. Proper packaging, handling and transport however, are also crucial since quality may deteriorate along the chain when not packaged and handled correctly. Current handling practices involve putting the product in a sack lined with plastic. Even though they are "stone hard" considerable damage can still occur through rough and repeated handling along the chain. Studies should be done to assess quality losses along the chain and to determine the most appropriate packaging materials for this product.

Whole Chain Upgrading

The value chain map provided opportunities to identify measures that can be pursued to achieve whole chain upgrading. Such upgrading necessitates the role of players external to the chain. The important areas are: regulating minimum size at catch, introduction of sea cucumber culture to lessen pressure on wild stocks, and raising the whole chain to a higher level through product development.

Regulating Catch Size

As mentioned, regulating the size at which individual sea cucumber can be taken is crucial to sustain the resource and improve product value. Over-exploitation is market induced, arising from increasing demand and prices. However, measures to address the problem remain purely government led. Some LGUs are contemplating passage of ordinance that would impose size limits for catch and processing. In particular, the municipality of Bolinao, through advocacy by the UPMSI, has already drafted one and may pass the ordinance soon. The question though, is how effective and to what extent can the LGUs implement such policy instruments.

Information from the value chain map provides much insight on how regulating minimum size of catch can be achieved. First, since over-exploitation is market induced, it makes perfect sense to try to address it through a market-based approach. Such an approach entails examining the system of market incentives and involves market players who would tend to gain the most from the improvements that would ensue.

Very small pieces of sea cucumber are already being collected since exporters provide the market incentive (they buy even the small ones). Since it has become clear that exporters are the ones to gain most from improvement in product size, these players may be convinced to stop providing the market incentive. As shown, the sea cucumber industry could fairly well be a CR4 industry. Convincing the four largest exporters should not be difficult, especially if they are made aware of the implications of this measure on the profitability of their business. Collection of very small pieces is sure to stop, once market incentive is removed. Unlike other fishery products which may be consumed at home, very few households consume sea cucumber.

It should be realized however, that natural oligopsonistic behavior may result in a situation where exporters would continue to buy small pieces despite agreeing not to do so initially. If institutional mechanisms are absent, the equilibrium situation would degenerate to where each exporter would find it better to procure small ones when they begin to suspect that other exporters have started buying. In the language of game theory, the situation will result in sub-optimal equilibrium.

The government may provide the institutional mechanisms to make the market solution work. The BFAR for instance, could convince the exporters that it will closely monitor the size profile in each exporter's possession and administer certain penalties for non-compliance.

Introduction of Sea Cucumber Culture

Another important measure that could upgrade the sea cucumber value chain is the introduction of sea cucumber culture. This is already underway, albeit to a limited extent. In addition, there are insights that can be drawn from the value chain map as well as from the PSA exercises that could help improve the probability of success of this program.

As shown, sea cucumber is an incidental catch within the fishing industry. Introduction of culture methods such as sea ranching and pond culture however, open the opportunity for the activity to achieve a more distinct status and generate further value and wealth especially for coastal communities.

Insights drawn from value chain mapping suggest that effective pathways for the successful introduction of sea cucumber culture should have the following characteristics: (1) sea cucumber culture as a livelihood model should be crafted in consideration of the overall livelihood system of coastal communities; (2) information dissemination, provision of technical assistance, and ensuring a viable market are given special emphasis, while providing input support (particularly the juveniles), strengthening organizations, and an enabling policy environment are critical; (3) the pathway involves the participation of the key players in the chain.

The present model of sea ranching where beneficiaries are required to render security services falls short in considering the very limited livelihood opportunities in coastal communities. Fishing is the primary means by which fishers in the area support their families. Foregoing a night of fishing to provide security at the ranch may be difficult. This is especially important considering the long production cycle of sea ranching. In addition, resisting the temptation of "Bantay Salakay" or stealing from the ranch they are supposed to guard, may be a tough test of integrity in dire income situations. In Anda, Pangasinan, the pilot sea ranching project which started with 21 members now only has 11 because of these problems.

The present model also falls short in tapping key players in the sea cucumber value chain. The program is limited to fishers in the area who are envisioned to pass their harvest through existing market chains.

Sea ranching models should attempt to involve exporters at the outset. Sea ranching could ensure stable and significant volume of good size high value species (e.g., *H. scabra*) which exporters are looking for in the first place. In fact, they are willing to set-up (as they have done already) a costly network of buying stations to be able to secure significant supply. Some form of integration must be explored by linking the sea ranchers directly with exporters. In addition, mechanisms can be devised where the exporters could keep the ranchers afloat during the long production cycle.

There are existing integration models that could be examined and tested for application in the program. The literature is replete with experiences in poultry, banana, mango, tuna (e.g., General Santos City) and possibly aquaculture and other products.

The success of the program also hinges on what fishers identified as driving as well as critical factors of success. Foremost among these is the need to educate them fully on the technical (this includes culture and primary processing) and other aspects of the livelihood project, continuous provision of technical assistance, ensuring input support particularly the supply of juveniles, building and creating strong organizations (they have to be organized and capacitated) and the putting in place of policies or ordinances (e.g., zoning) that would enable the project to operate effectively.

The market for harvest from existing and future sea ranches is huge. The impact on existing market chains (especially impact on prices) may not be significant considering the increasing trend in demand and prices. Much higher value or wealth for coastal communities may be created however, by integrating the ranchers with exporters to by-pass market intermediaries and, teaching the sea ranchers and their families correct and efficient primary processing protocols to ensure good product quality.

Product Development

A more exciting area that must be explored to upgrade the whole sea cucumber value chain is product development. Increasingly, scientific literature is giving credence to traditional claims that sea cucumber have tremendous pharmaceutical and health improving properties. Most of the studies however, are being done in other countries. The Philippines may find it worthwhile

to engage in more serious programs to study and derive products of commercial value from this lowly animal. This may not only lead to product upgrading, but to catapulting the sea cucumber value chain to a higher level.

4.2 LIMITATIONS OF THE STUDY

The areas covered in the study (Pangasinan, Davao and Palawan) are significant sources of sea cucumber in the Philippines. However, there remain a number of areas which are major sources of sea cucumber (e.g., Tawi tawi, Zamboanga City) that were not included due to limitations in time and resources. While the results generated may already provide a generic picture of sea cucumber value chains, it would be interesting to cover the other major supply areas in future research to achieve a more comprehensive assessment of the sea cucumber value chain in the country.

Data on Philippine export of sea cucumber were obtained from the Bureau of Agricultural Statistics (BAS), the official source of agriculture and fishery statistics in the country. While some experts claim that the volume of Philippine exports appears underestimated in the BAS statistics, there is no other alternative but to use the official data.

The research design includes a quick survey in Hong Kong and Singapore as major markets for Philippine sea cucumber. Pending the conduct of the survey, the present results may still be viewed as partial.

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Appendix Table 1. Freight Rates Value for Exporter Level

Freight Rates for Containerized Cargoes for Selected Routes:

Another category of cargo transport involves non-containerized break bulk cargoes. Tabulated below are the attendant freight rates for selected routes:

Route	Distance (n.m.)	Freight (per cbm or ton)	Rate/n.m.
Manila – Hong Kong	633	USD 5.00	USD 0.0079
Manila – Keelung, Taiwan	732	USD 15.00	USD 0.02
Manila – Singapore	1,308	USD 12.00	USD 0.009
Manila – Cagayan de Oro	504	PhP 503.23 – 773.52 USD 10.12 – 15.56	USD 0.02 – 0.03
Manila – Gen. Santos	723	PhP 586.07 – 1,054.54* USD 11.79 – 21.22	USD 0.016 – 0.029
Manila – Davao	829	PhP 774.57 – 1,190.56 USD 15.59 – 23.96	USD 0.018 – 0.029

Source: Philippine Shippers' Bureau for the oceangoing rates and Maritime Industry Authority for the domestic rates.
* Covers the range of freight rates for Class C to Class A commodities which are now deregulated.
n.m. = nautical mile;
cbm = cubic meter

Appendix Table 2. Value Added at Exporter Level

Gross Value Received (USD 120/kg at PhP 44/USD for 10,000 kg/month)	PhP	53,640,000
Cost of Intermediate Inputs:		
Cost of Product (PhP 4,200/kg @ 10,000 kg/month)	PhP	42,000,000
Other Intermediate Inputs:		
Sacks	PhP	2,850
Plastic cellophane	PhP	625
Plastic straw	PhP	50
Total	PhP	42,003,525
	PhP	11,636,475
Contribution to Value Added:		
Value Added by shipment from Palawan to Manila	PhP	36,000
Value Added by shipment from Manila to Hong Kong	PhP	2,700
Permits and Taxes:		
Auxiliary permit	PhP	3,000
Transhipment fee (Palawan-Manila)	PhP	2,500
Phil. Port Authority fee	PhP	120
Terminal Handling fee (Manila-HK)	PhP	3,220
Documentation fee (Manila-HK)	PhP	1,080
Value Added by direct labor (exporters' hired direct labor)	PhP	39,312
Value Added by indirect (overhead) labor, exporters' management, capital and profit.	PhP	11,548,543

Note: This table served as basis in calculating the value added per kilogram

Appendix Table 3. Value Added at Assembler/Processor Level

Value Received (PhP 4,200/kg @ 10,000 kg/month)	PhP	42,000,000
Cost of Intermediate Inputs:		
Cost of Product (PhP 3,000/kg @ 10,000 kg/month)	PhP	30,000,000
Other Intermediate Inputs:		
Sacks	PhP	2,850
Plastic cellophane	PhP	10,042
Match/salt/water (1.35/kg @ 10,000 kg)	PhP	13,500
Fuel wood (PhP 1.42/kg @ 10,000 kg)	PhP	14,200
Total	PhP	30,040,592
Value Added	PhP	11,959,408
Contribution to Value Added:		
Value Added by transport from the village to buying station (PhP 44/trip @ 1,000 trips) (i.e. 10 kg/transaction)	PhP	44,000
Value Added by assembler/processors' labor, management and capital	PhP	11,915,408

Note: This table was used as basis in calculating value added per kilogram.

Appendix Table 4. Value Added at Diver/Collector Level

Gross Value Received (PhP 3,000/kg @ 10,000 kg/month)	PhP	30,000,000
Cost of Intermediate Inputs:		
Intermediate Inputs:		
Fuel (boat) (PhP 10.4/kg collection @ 10,000 kg)	PhP	104,166
Kerosene for lamp (PhP 3.67/kg collection @ 10,000 kg dried equivalent weight)	PhP	36,666
Value Added	PhP	29,859,168
Contribution to Value Added:		
Value Added by transport from landing site to assembler/processor (nil)		
Value Added by diver/collectors' own labor and capital	PhP	29,859,168

Note: This table was used as the basis for calculating valued added per kilogram.

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