

## SUPPLY CHAIN ANALYSIS OF MANTIS SHRIMP (*Lysiosquillina Maculata*: STOMATOPODA) IN TAWI-TAWI

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### ABSTRACT

This study aimed to determine the supply chain analysis of Mantis shrimp (*Lysiosquillina maculata*: Stomatopoda) in Tawi-Tawi. Specifically, this study sought to determine the supply chain of Mantis shrimp from the fisherman to the wholesaler and to the retailer. To determine the morphometric characteristics, the total length, width and total weight of Mantis shrimp were measured. The abundance of the Mantis shrimps were determined by counting directly the number of individuals of Mantis shrimps in the three different sites. The study finds out that there's no fishermen that catch Mantis shrimp in Bongao, only in Sibuto and Sapa-Sapa. In Sibuto, all of the fishermen catch Mantis shrimp everyday and most (10%) of them catch 6-10 pieces. While most (10%) of the fishermen in Sapa-Sapa catch 0-5 pieces of Mantis shrimps every three days. Most (20%) of them sold their Mantis shrimp catch to the wholesaler with the price of 101-500 pesos per kg. The Mantis shrimps will be delivered to the wholesalers in Bongao. Most (13.33%) of the wholesalers purchased 21-30 kg and 50 kg and above of Mantis shrimp in a week. Most (23.33%) of them purchased it with the price of 1001-1500 pesos. And then they (20%) will sell it to the retailer with the price of 1001-1500 pesos. For the delivery of Mantis shrimp outside Tawi-Tawi, 16.67% said yes and the other 16.67% said no. For those who deliver outside Tawi-Tawi, wholesalers said that they deliver it to Zamboanga City. The wholesalers in Zamboanga will sell and deliver the Mantis shrimp to Manila. Then wholesaler in Manila will sell and export the Mantis shrimp to Mainland China or Hongkong. For the measurement of Mantis shrimps, based on the results of the study, it can be concluded that male Mantis shrimps in Bongao with the average length of 25.31 cm, average width of 6.31 cm and the average weight of 310.25 g were longer and heavier than the female Mantis shrimps with the average length of 23.36 cm, average width of 5.93 cm and the average weight of 193.24 g. While in Sibuto, female Mantis shrimp with the average length of 25 cm, width of 6.31 and weight of 340.89 g were longer and heavier than the male Mantis shrimps with the average length of 20.75 cm, average width of 5.08 cm and average weight of 243.33 g. In Sapa-Sapa, the male Mantis shrimps with the average length of 22.63 cm, average width of 5.75 cm and average weight of 319.75 g were longer than female with the average length of 20.21 cm, average width of 5.29 cm and the average weight of 265.00 g. In the abundance of Mantis shrimps, the results reveal that Site 3 (Sapa-Sapa) got the highest number of Mantis shrimps per week among the 3 sites, therefore, it can be concluded that Mantis shrimps were abundant in Site 3.

**KEYWORDS:** *Lysiosquillina maculata*, Mantis shrimp, Supply Chain, Fisherman, Wholesaler, Retailer.

### INTRODUCTION

Mantis shrimps are very popular due to its sweet taste meat. They are usually used as a dependable source of raw material in fishmeal, poultry feeds and fertilisers in other countries (Rajendra Prasad and Yedukondala Rao, 2015). But, in some countries such as the Philippines, people commonly eat the meat of Mantis shrimps.

Mantis shrimps belong to order Stomatopoda. They are very violent predators eating only live prey, sometimes much larger in size than themselves. The adults wait in burrows until suitable prey passes, then strike and kill

either by smashing or by spearing it using the claws. There are 485 species of mantis shrimp from 115 genera and 17 families have currently been described worldwide (WoRMs, 2013; Chesalin *et al.*, 2013). In the Philippines, twenty-one species of stomatopod crustaceans are reported from Balicasag Island and from various Philippine localities. Four superfamilies, six families and 15 genera are represented (Ahyong, 2004). The most common species found in the Philippines, especially in Tawi-Tawi is the *Lysiosquillina maculata*. This species known as the largest, the most common, and the most widely distributed species of the mantis shrimp

in the Indo-West-Pacific region. They can reach a length of 40 cm, making them the largest mantis shrimp. They can be recognized by their transverse stripes through their entire body. The color ranges from cream to dark brown with alternating tan stripes. Sexually mature females can be recognized by their visible pink ovaries that run the length of the thorax and abdomen (Caldwell, 2005; EOL, n.d.). Mantis shrimp has commercial significance in some Asian countries. They are normally captured in a traditional way by using simple tools such as rattan and fishing line.

A factor that is important to the sale of mantis shrimp is the chain of supply. A supply chain is the linked network of individuals, organizations, resources, activities and technologies involved in the manufacture and sale of a product or service (Kleab, 2017). It starts with the delivery of raw materials and ends with the delivery of the finished product to the consumer. The process involves several actors such as collector, wholesaler and retailer.

Nowadays, supply chains are increasing concern in the seafood industry because of the issues impacting the chain such as human rights violations, labor exploitations and other economic issues. With these concerns, fully traceable seafood is crucial for ensuring food safety, verifying environmental performance, and avoiding products that are at high risk of being illegally harvested or associated with human and labor rights abuses. Knowing where and how the seafood is caught will help the consumer determine whether it is sustainable, improving, or failing to improve (SFS, n.d.).

Equally important to the chain are the fishermen, for without them there will be no available Mantis shrimp in the market. The source of living of some fishermen in Philippines especially Tawi-Tawi is catching and selling Mantis shrimps commonly known as “kamun” in their dialect. Tawi-Tawi is known for its diverse marine ecosystem. It is an island province located in the southernmost of Philippines. Since it is diverse in marine ecosystem, fishing and seaweeds are one of the main sources of people’s income. About 25,000 of the provincial population are considered to be municipal fishers, and another 1,000 are employed in commercial fishing (PFO, 2001; OO, n.d.).

Due to the foregoing presentations and the fact that there is no conducted study about the supply chain of Mantis shrimps in Tawi-Tawi, the researcher decided to conduct this study. This study aimed to determine the supply chain of Mantis shrimp from the fisherman to the wholesaler and to the retailer and measure the total length and total weight of Mantis shrimp. Results from this study traces the supply chain of Mantis shrimp from the fisherman to the retailer.

## MATERIAL AND METHOD

This study involved a descriptive and quantitative analysis using survey method. Descriptive design was used to analyse the profile of the fishermen, wholesalers and retailers, management and measurement of the Mantis shrimp.

### Description of the study sites

The survey was conducted in Tawi-Tawi, Philippines. It is an Island province located in the southernmost of Philippines. The place can be easily accessed by flight or boat from Zamboanga City.

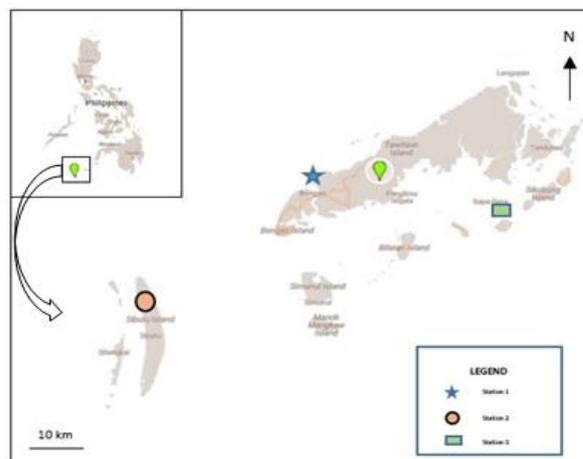


Fig 1: Map of the Philippines showing the 3 sites.

### Gathering of Data

A permit was secured from the Barangay chairman in Bongao, Sibuto and Sapa-Sapa, Tawi-Tawi. A total of 30 respondents composed of fisherman, wholesaler and retailer were interviewed. Only fishermen who catch Mantis shrimp were interviewed. The researcher personally interviewed the fisherman, wholesaler and retailer or they were provided with questionnaire to fill it up. Total length and weight of fifteen Mantis shrimps per station were measured. Total length was measured by ruler and the total weight was measured by weighing scale.



Fig 2: Dorsal view (A) and ventral view (B) of Mantis shrimp.

SN *Lysiosquillina maculata*  
 CN "Kamun"  
 EN Zebra Mantis shrimp  
 TL 19 cm  
 TW 133 g

### Statistical Analysis

Descriptive Statistics was utilized in the analysis and interpretation of the data. The descriptive statistics, particularly frequency, percent and mean were used for the demographic profile of the fishermen, wholesalers and retailers, the catching and management of Mantis shrimps, and for the measurement of the average length and weight of Mantis shrimps.

### RESULTS AND DISCUSSION

There are several interconnected and constituent attributes that influence supply chain analysis of Mantis shrimp. Some of these are the demographic profile of the fisherman, wholesaler and retailer and the management of the Mantis shrimp.

Table 1 presents the demographic profile of fisherman, wholesaler and retailer in three different sites (Bongao, Sibuto and Sapa-Sapa). It shows that there's no fishermen that catch Mantis shrimp in Bongao, only in Sibuto and Sapa-Sapa. Most (6.67%) of the fishermen in Sibuto belonged to 21-30 years and 31-40 years old and the rest (3.33%) belonged to 41-50 years old. Fishermen in Sapa-Sapa were younger than in Sibuto, most (10%) of the fishermen in Sapa-Sapa were 31-40 years old and the rest belonged to 20 years and below and 21-30 years old. All of the fishermen in Sibuto and Sapa-Sapa were male. Both sites have 3.33% single fishermen and 13.33% married fishermen. Many (6.67%) of the fishermen in Sibuto and Sapa-Sapa were elementary graduate. As to ethnicity, all of the fishermen in Sibuto

and Sapa-Sapa were Sama, it is because the two sites are dominated by Sama. For the wholesalers, 6.67% belonged to 21-30 years old and the other 6.67% belonged to 31-40 years old and the rest (3.33%) belonged to 50 years and above. In Sibuto, all (10%) of the wholesalers belonged to 21-30 years old. In Sapa-Sapa, 3.33% belonged to 31-40 years old and the other 3.33% belonged to 41-50 years old. All of the wholesalers in the three sites were male and married. Most (10%) of the wholesalers in Bongao reached college level, the rest (3.33%) reached elementary level only and college graduate. In Sibuto, most (6.67%) reached secondary level and the rest (3.33%) reached elementary level. In Sapa-Sapa, 3.33% reached elementary level and the other 3.33% reached college level. As to ethnicity most (10%) wholesalers in Bongao were Tausog and the rest (6.67%) were Sama. In Sibuto, most (6.67%) were Sama and the rest (3.33%) were Tausog. In Sapa-Sapa, 3.33% were Sama and 3.33% were Tausog. For the retailers in Bongao, most (10%) of them belonged to 21-30 years old. In Sibuto, 3.33% belonged to 20 years and below and the other 3.33% belonged to 21-30 years old. While in Sapa-Sapa, all of them belonged to 50 years and above. All of the retailers in Bongao and Sibuto were male. While in Sapa-Sapa, 3.33% were male and 3.33% were female. Most (16.67%) of retailers in Bongao were married and the rest (3.33%) were single. In Sibuto, all of the retailers were married. In Sapa-Sapa, 3.33% were married and 3.33% were single. In highest level of education, most (10%) of the retailers in Bongao reached college level and the rest (6.67% and 3.33%) were college graduate and reached elementary level only. All of the retailers in Sibuto and Sapa-Sapa said that they have not attended school. As to ethnicity, most (13.33%) of the retailer in Bongao were Tausog and the rest (6.67%) were Sama. All of the retailers in Sibuto and Sapa-Sapa were Sama.

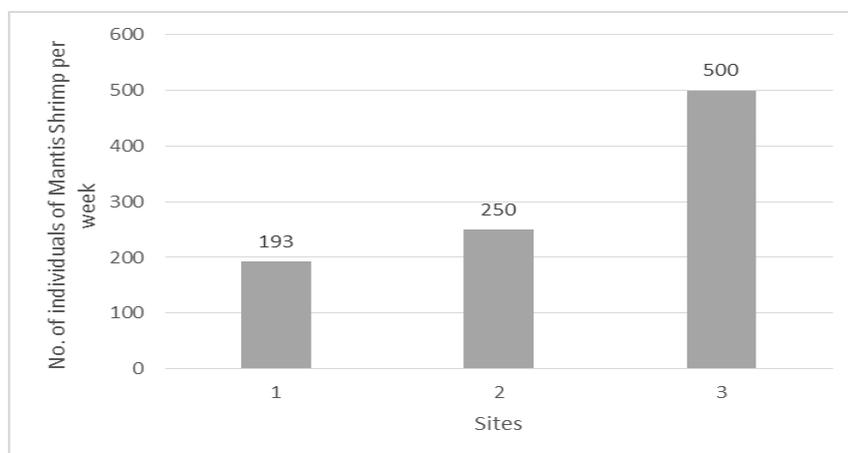
**Table 1: Demographic Profile of Fishermen, Wholesaler and Retailer.**

Demographic Profile	Bongao (% of total number) n=30	Sibuto (% of total number) n=30	Sapa-Sapa (% of total number) n=30
<b>Fisherman</b>			
<b>Age</b>			
20 years and below	.00(0)	.00(0)	3.33(1)
21-30 years	.00(0)	6.67(2)	3.33(1)
31-40 years	.00(0)	6.67(2)	10.00(3)
41-50 years	.00(0)	3.33(1)	.00(0)
50 years and above	.00(0)	.00(0)	.00(0)
<b>Gender</b>			
Female	.00(0)	.00(0)	.00(0)
Male	.00(0)	16.67(5)	16.67(5)
<b>Marital Status</b>			
Single	.00(0)	3.33(1)	3.33(1)
Married	.00(0)	13.33(4)	13.33(4)
Separated	.00(0)	0.00(0)	0.00(0)
<b>Highest level of education</b>			
None	.00(0)	3.33(1)	3.33(1)
Elementary level	.00(0)	3.33(1)	3.33(1)

Elementary Graduate	.00(0)	6.67(2)	6.67(2)
Secondary Level	.00(0)	.00(0)	3.33(1)
Secondary Graduate	.00(0)	.00(0)	.00(0)
College level	.00(0)	3.33(1)	.00(0)
College Graduate	.00(0)	.00(0)	.00(0)
<b>Ethnicity</b>			
Sama	.00(0)	16.67(5)	16.67(5)
Tausog	.00(0)	.00(0)	.00(0)
Others	.00(0)	.00(0)	.00(0)
<b>Wholesaler</b>			
<b>Age</b>			
20 years and below	.00(0)	.00(0)	.00(0)
21-30 years	6.67(2)	10.00(3)	.00(0)
31-40 years	6.67(2)	.00(0)	3.33(1)
41-50 years	.00(0)	.00(0)	3.33(1)
50 years and above	3.33(1)	.00(0)	.00(0)
<b>Gender</b>			
Female	.00(0)	.00(0)	0.00(0)
Male	16.67(5)	10.00(0)	6.67(2)
<b>Marital Status</b>			
Single	.00(0)	.00(0)	.00(0)
Married	16.67(5)	10.00(3)	6.67(2)
Separated	.00(0)	.00(0)	.00(0)
<b>Highest level of education</b>			
None	.00(0)	.00(0)	.00(0)
Elementary level	3.33(1)	3.33(1)	3.33(1)
Elementary Graduate	.00(0)	.00(0)	.00(0)
Secondary Level	.00(0)	6.67(2)	.00(0)
Secondary Graduate	.00(0)	.00(0)	.00(0)
College level	10.00(3)	.00(0)	3.33(1)
College Graduate	3.33(1)	.00(0)	
<b>Ethnicity</b>			
Sama	6.67(2)	6.67(2)	3.33(1)
Tausog	10.00(3)	3.33(1)	3.33(1)
Others	.00(0)	.00(0)	.00(0)
<b>Retailer</b>			
<b>Age</b>			
20 years and below	3.33(1)	3.33(1)	.00(0)
21-30 years	10.00(3)	3.33(1)	.00(0)
31-40 years	3.33(1)	.00(0)	.00(0)
41-50 years	.00(0)	.00(0)	.00(0)
50 years and above	3.33(1)	.00(0)	6.67(2)
<b>Gender</b>			
Female	.00(0)	.00(0)	3.33(1)
Male	20.00(6)	6.67(2)	3.33(1)
<b>Marital Status</b>			
Single	3.33(1)	.00(0)	3.33(1)
Married	16.67(5)	6.67(2)	3.33(1)
Separated	.00(0)	.00(0)	.00(0)
<b>Highest level of education</b>			
None	.00(0)	6.67(2)	6.67(2)
Elementary level	3.33(1)	.00(0)	.00(0)
Elementary Graduate	.00(0)	.00(0)	.00(0)
Secondary Level	.00(0)	.00(0)	.00(0)
Secondary Graduate	.00(0)	.00(0)	.00(0)
College level	10.00(3)	.00(0)	.00(0)

College Graduate	6.67(2)	.00(0)	.00(0)
<b>Ethnicity</b>			
Sama	6.67(2)	6.67(2)	6.67(2)
Tausog	13.33(4)	.00(0)	.00(0)
Others	.00(0)	.00(0)	.00(0)

Fig 3 presents the number of individuals of Mantis shrimps per week in 3 sites. Sapa-Sapa has the highest number of individuals of Mantis shrimps.



**Fig 3: Number of individuals of Mantis shrimps per week in 3 sites.**

Table 2 presents the Fisherman's frequency of catching and pieces of Mantis shrimp catch. It shows that in Sibuto, all of the fishermen catch Mantis shrimp everyday and most (10%) of them catch 6-10 pieces and the rest (6.67%) catch 0-5 pieces. While most (10%) of

the fishermen in Sapa-Sapa catch Mantis shrimp every three days and the rest (6.67%) catch everyday. Most of the fishermen (10%) catch 0-5 pieces and the rest (6.67%) catch 6-10 pieces of Mantis shrimp.

**Table 2: Fisherman's frequency of catching and pieces of Mantis shrimp catch in Sibuto and Sapa-Sapa.**

Frequency of catching	Sibuto (% of total number) n=30	Sapa-Sapa (% of total number) n=30
Everyday	16.67(5)	6.67(2)
Every three days	.00(0)	10.00(3)
<b>Pieces of Mantis shrimp catch</b>		
0-5 pieces	6.67(2)	10.00(3)
6-10 pieces	10.00(3)	6.67(2)

Table 3 presents the Fisherman's catching and Management of Mantis shrimp. In terms of years of experience catching the Mantis shrimp, most (20%) of the fishermen have 0-5 years of experience of catching Mantis shrimp, and the rest (13.33%) have 6-10 years of experience. In terms of kg of Mantis shrimp per catching, majority (26.67%) of the fishermen got 0-5 kg of Mantis shrimp per catching and the rest (6.67%) 6-10 kg per catching. For the price of Mantis shrimp sold to buyer, most (20%) of them sold their Mantis shrimp catch with the price of 101-500 pesos. Four (13.33%) of the fishermen sold it with the price of 501-1000 pesos. As for the observed difference in total weight per catching of Mantis shrimp 10 years ago to present, all (33.33%) of them said yes. Ten years ago many (13.33%) of the fishermen caught 0-5 kg of Mantis shrimp and 3.33% caught 16-20 kg. While 5 years ago, majority (26.67%) of the fisherman caught 0-5 kg and the rest (6.67%)

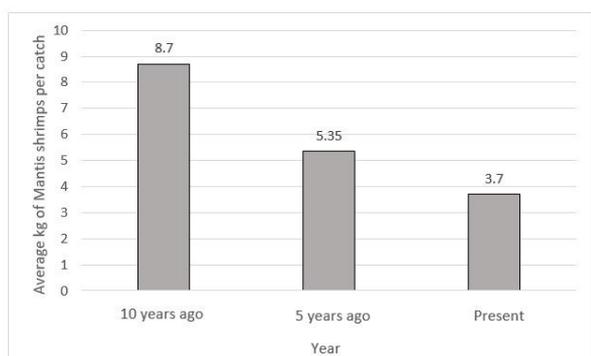
caught 11-15 kg. At the present most (26.67%) caught 0-5 kg of Mantis shrimp and the rest (6.67%) caught 6-10 kg. As for the limitation of Mantis shrimp catch, all (33.33%) of the fishermen said they don't limit their catch. For the equipment used for the catching of Mantis shrimp, all (33.33%) of them use a rattan in trapping the Mantis shrimp. All (33.33%) of the fishermen prefer to sell their catch to the wholesaler. And for the place of delivery, all (33.33%) of them deliver it to Bongao.

Table 3: Fisherman's catching and Management of Mantis shrimp.

<b>Fisherman's Catching and Management of Mantis Shrimp</b>	<b>Frequency count</b>	<b>Percentage (%)</b>
<b>Years of Catching Experience</b>		
0-5 years	6	20%
6-10 years	4	13.33%
11-15 years	0	0
15-20 years	0	0
21-25 years	0	0
<b>Kilograms of Mantis shrimp per catching</b>		
0-5 kg	8	26.67%
6-10 kg	2	6.67%
11-15 kg	0	0
16-20 kg	0	0
21-25 kg	0	0
<b>Price per kg of Mantis shrimp sold to buyer</b>		
100 pesos and below	0	0
101-500 pesos	6	20%
501-1000 pesos	4	13.33%
1001-1500 pesos	0	0
1501 pesos and above	0	0
<b>Observed difference in total weight per catching of Mantis shrimp 10 years ago to present</b>		
Yes	10	33.33%
No	0	0
<b>Weight catch of Mantis shrimp 10 years ago</b>		
0-5 kg	4	13.33%
6-10 kg	3	10%
11-15 kg	2	6.67%
16-20 kg	1	3.33%
21-25 kg	0	0
<b>Weight catch of Mantis shrimp 5 years ago</b>		
0-5 kg	8	26.67%
6-10 kg	0	0
11-15 kg	2	6.67%
16-20 kg	0	0
21-25 kg	0	0
<b>Weight catch of Mantis shrimp at present</b>		
0-5 kg	8	26.67%
6-10 kg	2	6.67%
11-15 kg	0	0
16-20 kg	0	0
21-25 kg	0	0
<b>Limitation of Mantis shrimp catch</b>		
Yes	0	0
No	10	33.33%
<b>Equipment used for catching</b>		
Trap using rattan	10	33.33%
Others	0	0
<b>Person to sell the Mantis shrimp catch</b>		

Consumer	0	0
Wholesaler	10	33.33%
Retailer	0	0
<b>Place of Delivery</b>		
Bongao	10	33.33%
Others	0	0

Figure 4 shows that there is continues reduction of the kg of Mantis shrimp per catch from 10 years ago (8.70 kg) to present (3.70 kg). All of the fishermen said that they don't limit the number of Mantis shrimps they catch, this can be considered as one of the main reasons why there's a reduction in the kg of Mantis shrimp. If there will be no policy regarding the catching, there will be a possibility that Mantis shrimps in the Philippines will be seriously at risk of extinction.



**Fig 4: Average kg of Mantis shrimps per catch 10 years ago to present.**

Table 4 presents the wholesaler's purchase and management of Mantis shrimp. It shows that most of the wholesaler (13.33%) purchased 21-30 kg and 50kg and above of Mantis shrimp in a week. The rest (3.33%) purchased 10 kg and below and 11-20 kg. As for the price per kg of purchased Mantis shrimp, most (23.33%) of them purchased it with the price of 501-1000 pesos, and 3.33% purchased it with the price of 1001-1500 pesos. When the Mantis shrimps were sold to buyer, majority (20%) of the wholesaler sold it with the price of 1001-1500 pesos. And the rest (13.33%) sold it with the price of 1501 pesos and above. For the equipment used in the maintenance of Mantis shrimp, most (23.33%) of the wholesaler used fish net and plastic bottle, 10% used fish tank with plastic bottle, water pump and oxygen. For the delivery of Mantis shrimp outside Tawi-Tawi, 16.67% said yes and the other 16.67% said no. For those who deliver outside Tawi-Tawi, wholesalers said that they deliver it to Zamboanga. Then wholesalers from Zamboanga deliver it to Manila. The 3.33% of the wholesalers said that they don't deliver it outside Tawi-Tawi. In terms of exporting the Mantis shrimp, majority (30%) of them said they don't export it and 3.33% export the Mantis shrimp. Usually they export it to China (3.33%) and Hongkong (3.33%).

**Table 4: Wholesaler's Purchase and Management of Mantis shrimp.**

Wholesaler's Purchase and Management of Mantis Shrimp	Frequency count	Percentage (%)
<b>Kilograms of Mantis shrimp purchased in a week</b>		
10 kg and below	1	3.33%
11-20 kg	1	3.33%
21-30 kg	4	13.33%
31-40 kg	0	0
50 kg and above	4	13.33%
<b>Price per kg of purchased Mantis shrimp</b>		
100 pesos and below	0	0
101-500 pesos	0	0
501-1000 pesos	7	23.33%
1001-1500 pesos	1	3.33%
1501 pesos and above	3	10%
<b>Price per kg of Mantis shrimp sold to buyer</b>		
100 pesos and below	0	0
101-500 pesos	0	0
501-1000 pesos	0	0
1001-1500 pesos	6	20%
1501 pesos and above	4	13.33%

<b>Equipment used in the maintenance of Mantis shrimp</b>		
Fish tank with plastic bottle, water pump and oxygen	3	10%
Fish Net and plastic bottle	7	23.33%
<b>Delivery of the Mantis shrimp outside Tawi-Tawi</b>		
Yes	5	16.67%
No	5	16.67%
<b>Place of delivery outside Tawi-Tawi</b>		
Zamboanga	5	16.67%
None	5	16.67%
<b>Exportation of Mantis shrimp</b>		
Yes	1	3.33%
No	9	30%
<b>Place where Mantis shrimp are exported</b>		
Hongkong	1	3.33%
China	1	3.33%
None	0	26.67%

Table 5 presents the retailer's purchased and management of Mantis shrimp. It shows that there was a tie of 5 (16.67%) from each group of retailer who bought 10 kg and below and 50 kg and above of Mantis shrimp. For the price per kg of purchased Mantis shrimp, 10% of them purchased it with the price of 101-500 pesos and 3.33% purchased it with the price of 1501 pesos and above. For the price kg of Mantis shrimp sold to consumer, there was a tie of 5 (13.33%) from each group of retailer who sold the Mantis shrimp with the price of

501-1000 pesos and 1501 pesos and above. The rest (6.67%) sold it with the price of 101-500 pesos. For the equipment used in the maintenance of Mantis shrimp most (16.67%) of them use fish tank with plastic bottle, water pump and oxygen. While 13.33% used fish net and plastic bottle and 3.33% used refrigerator. For the estimated number of customer per day, majority (30%) of the retailer have 0-5 costumes per day and 3.33% have 26 costumers and above.

**Table 5: Retailer's purchase and Management of Mantis shrimp.**

<b>Retailer's Purchase and Management of Mantis Shrimp</b>	<b>Frequency count</b>	<b>Percentage (%)</b>
<b>Kilograms of Mantis shrimp bought</b>		
10 kg and below	5	16.67%
11-20 kg	0	0
21-30 kg	0	0
31-40 kg	0	0
50 kg and above	5	16.67%
<b>Price per kg of purchased Mantis shrimp</b>		
100 pesos and below	2	6.67%
101-500 pesos	3	10%
501-1000 pesos	2	6.67%
1001-1500 pesos	2	6.67%
1501 pesos and above	1	3.33%
<b>Price per kg of Mantis shrimp sold to consumer</b>		
100 pesos and below	0	0
101-500 pesos	2	6.67%
501-1000 pesos	4	13.33%
1001-1500 pesos	0	0
1501 pesos and above	4	13.33%
<b>Equipment used in the maintenance of Mantis shrimp</b>		
Fish tank with plastic bottle, water pump and oxygen	5	16.67%
Fish Net and plastic bottle	4	13.33%

Refrigerator	1	3.33%
<b>Estimated number of costumer per day</b>		
5 persons and below	9	30%
6-15 persons	0	0
16-25 persons	0	0
26 persons and above	1	3.33%

Table 6 presents the average length, width and weight of female Mantis shrimp in 3 sites. It shows that the average length of female in Mantis shrimp in Bongao was 23.36 cm, the average width was 5.93 cm and the average weight was 193.24 g. In Sibuto, the average length of Mantis shrimp was 25 cm, the width was 6.31 and the weight was 340.89 g. While in Sapa-Sapa, the average length of female Mantis shrimp was 20.21 cm, average width 5.29 cm and the average weight was 265.00 g.

**Table 6: Average length, width and weight of female Mantis shrimp in 3 sites.**

Female	Length (cm)	Width (cm)	Weight (g)
<b>Bongao</b>			
1	21.5	6.0	145.0
2	23.0	6.5	175.0
3	25.0	6.5	249.0
4	21.0	5.0	127.0
5	23.0	5.5	195.0
6	25.0	5.5	235.0
7	25.0	6.5	226.0
<b>Mean</b>	<b>23.36</b>	<b>5.93</b>	<b>193.14</b>
<b>Sibuto</b>			
1	33.0	6.25	495.0
2	20.5	5.70	137.0
3	29.5	6.35	376.0
4	25.0	6.0	335.0
5	27.0	7.0	370.0
6	19.0	6.0	380.0
7	27.0	9.0	395.0
8	24.0	5.5	290.0
9	20.0	5.0	290.0
<b>Mean</b>	<b>25.00</b>	<b>6.31</b>	<b>340.89</b>
<b>Sapa-Sapa</b>			
1	20.5	5.5	175.0
2	27.0	6.5	365.0
3	20.5	6.0	380.0
4	28.5	6.5	385.0
5	21.0	5.5	165.0
6	24.0	7.0	385.0
7	21.0	5.5	280.0
<b>Mean</b>	<b>20.21</b>	<b>5.29</b>	<b>265.00</b>

Table 7 presents the average length, width and weight of male Mantis shrimp in 3 sites. It shows that the average length of male Mantis shrimp in Bongao was 25.31 cm, the average width was 6.31 cm and the average weight was 310.25 g. In Sibuto, the average length of male

Mantis shrimp was 20.75 cm, the average width was 5.08 cm and the average weight was 243.33 g. While in Sapa-Sapa, the average length of the male Mantis shrimp was 22.63 cm, average width was 5.75 cm and the average weight was 319.75 g.

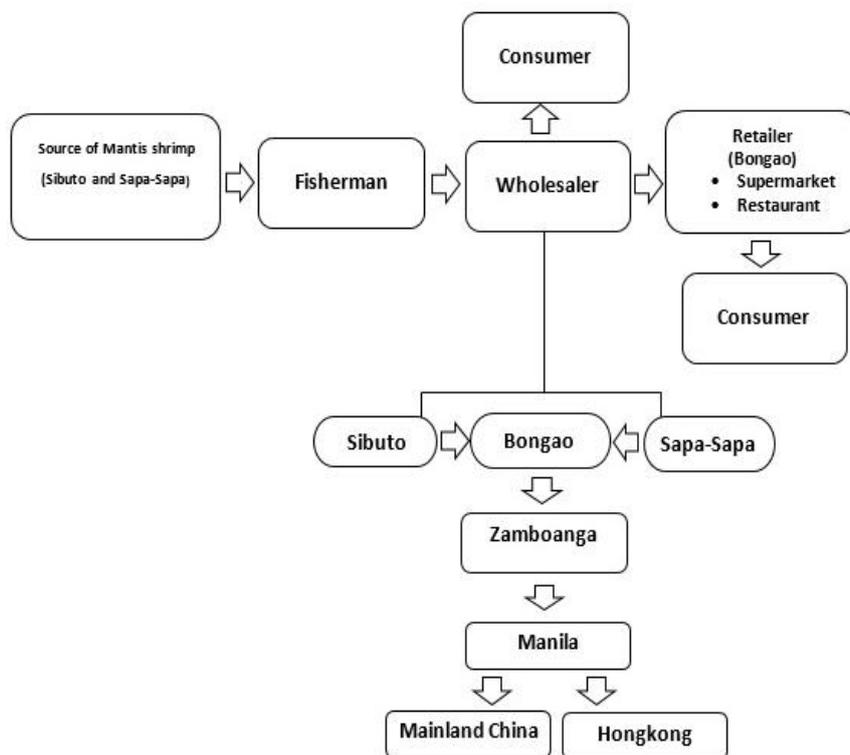
**Table 7: Average length, width and weight of male Mantis shrimp in 3 sites.**

Male	Length (cm)	Width (cm)	Weight (g)
<b>Bongao</b>			
1	27.0	7.5	376.0
2	28.5	7.0	375.0
3	21.0	5.5	135.0
4	29.0	6.5	470.0
5	28.0	7.5	471.0
6	27.0	5.5	325.0
7	19.0	5.0	133.0
8	23.0	6.0	197.0
<b>Mean</b>	<b>25.31</b>	<b>6.31</b>	<b>310.25</b>
<b>Sibuto</b>			
1	23.0	5.5	275.0
2	23.0	6.0	285.0
3	23.0	5.0	265.0
4	18.0	4.5	195.0
5	17.5	3.8	165.0
6	20.0	5.7	275.0
<b>Mean</b>	<b>20.75</b>	<b>5.08</b>	<b>243.33</b>
<b>Sapa-Sapa</b>			
1	27.0	7.0	375.0
2	28.0	7.0	375.0
3	24.0	6.0	295.0
4	23.0	5.5	290.0
5	24.5	6.0	345.0
6	19.5	5.0	295.0
7	18.0	5.0	305.0
8	17.0	4.5	278.0
<b>Mean</b>	<b>22.63</b>	<b>5.75</b>	<b>319.75</b>

There are many actors involved in the supply chain analysis such as the collector or the fisherman, wholesaler and the retailer. The supply chain of the Mantis shrimp in Tawi-Tawi is illustrated in Figure 5. It shows that most of the fishermen catch Mantis shrimps from Sibuto and Sapa-Sapa. The fishermen sold their catch to the wholesaler in Sibuto, Bongao and Sapa-Sapa. The wholesaler sold the Mantis shrimp either to the retailer or directly to the consumer. Some consumer prefer to buy Mantis shrimps from the retailer which sold

the Mantis shrimp in Supermarket or Restaurant. Wholesalers from Sibuto and Sapa-Sapa deliver the mantis shrimp to the wholesalers in Bongao. Wholesalers in Bongao deliver the Mantis shrimps in Zamboanga.

When in Zamboanga another wholesaler will buy the Mantis shrimp and deliver it to Manila where another wholesaler buy it. From Manila, the Mantis shrimp will be sold and exported to Mainland China or Hongkong.



**Fig 5: Supply chain of Mantis shrimp in Tawi-Tawi.**

## CONCLUSIONS

Based on the results of the study, it can be concluded that the fishermen get their sources of Mantis shrimps from Sibuto and Sapa-Sapa, 16.67% of the fishermen catch Mantis shrimps everyday while the other 16.67% catch every three days. Most (26.67%) of them got 0-5 kg of Mantis shrimp per catching. Most (20%) of them sold their Mantis shrimp catch to the wholesaler with the price of 101-500 pesos per kilo. The Mantis shrimps will be delivered to the wholesalers in Bongao. Most (13.33%) of the wholesalers purchased 21-30 kg and 50 kg and above of Mantis shrimp in a week. Most (23.33%) of them purchased it with the price of 1001-1500 pesos. And then they (20%) will sell it to the retailer with the price of 1001-1500 pesos. For the delivery of Mantis shrimp outside Tawi-Tawi, 16.67% said yes and the other 16.67% said no. For those who deliver outside Tawi-Tawi, wholesalers said that they deliver it to Zamboanga City. The wholesalers in Zamboanga will sell and deliver the Mantis shrimp to Manila. Then wholesaler in Manila will sell and export the Mantis shrimp to Mainland China or Hongkong. For the measurement of Mantis shrimps, based on the results of the study, it can be concluded that male Mantis shrimps in Bongao with the average length of 25.31 cm, average width of 6.31 cm and the average weight of 310.25 g were longer and heavier than the female Mantis shrimps with the average length of 23.36 cm, average

width of 5.93 cm and the average weight of 193.24 g. While in Sibuto, female Mantis shrimp with the average length of 25 cm, width of 6.31 and weight of 340.89 g were longer and heavier than the male Mantis shrimps with the average length of 20.75 cm, average width of 5.08 cm and average weight of 243.33 g. In Sapa-Sapa, the male Mantis shrimps with the average length of 22.63 cm, average width of 5.75 cm and average weight of 319.75 g were longer than female with the average length of 20.21 cm, average width of 5.29 cm and the average weight of 265.00 g. In the abundance of Mantis shrimps, the results reveal that the Site 3 (Sapa-Sapa) got the highest number of Mantis shrimps per week among the 3 sites, therefore, it can be concluded that Mantis shrimps were abundant in Site 3.

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