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The Fishery of the Mangrove Crabs, *Scylla* spp in Three Selected Areas of the Philippines

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ABSTRACT The effect of unsustainable fishing practices, on the fishery and biology of the *Scylla* species was investigated in four stations in the Philippines based on primary and secondary data. Results show that the combined catch profile revealed a decreasing trend in the last ten years. Evaluation of crabs in the landing stations show that from a total of 644 individuals measured in terms of carapace length, carapace width and body weight, size and sexual maturity, computed length-weight relationships revealed that the growth is allometric and the size of *S. serrata* is decreasing. It is important to note from the results of the survey that *S. serrata* was the most exploited since it was shown to be the majority of crabs harvested and sold because they are not only the largest among the three species but because it is popular for both the local and export market. Aquaculture, unregulated fishing practices and the empirical data generated in this study may affect the fishery and biology of the species needing appropriate management interventions especially in regulating the collections of crabs in the wild that are not mature and in reproductive age.

KEYWORDS: Carapace, length-weight, allometric, aquaculture, unregulated fishing

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INTRODUCTION

The mangrove crabs of the genus *Scylla* are among the ecologically and economically important fishery products of the Philippines (Williams and Hill, 1982; Demopoulos, et al., 2007). They are considered "ecological engineers" and keystone species in the mangrove areas such that their absence can adversely affect the ecological condition of their habitat (Jones, et al., 1994; Gillikin, et al., 2001). Economically, these crabs are among the top products for export supporting the economy of the country (Triño, et al., 1999; Williams and Primavera, 2001). Many fishermen throughout the Philippines depend on these crabs for their livelihood and sustenance (Triño and Rodriguez, 2002). Many fishermen thought this marine fishery resources were limitless, and fishing provides many benefits because it provides not only food but also employment and business opportunities.

Because of increasing demand, harvest of crabs has declined for the past several years due to overfishing. It is argued that harvesting of individuals of reproductive age have contributed to the reduction of population sustainability. This brought a lot of concerns not only to communities but the national government as well. Fisheries experts including commercial, recreational and local fishermen recognize that any form of fishing practices can have profound effects on this marine fisheries stocks and the ecosystems they inhabit. While the government's Bureau of Fisheries and Aquatic Resources (BFAR) has taken measures to build sustainable fisheries of this species, this cannot be properly addressed if not based on empirical data on the factors ensuring its sustainability.

Declining crab landings and smaller maximum sizes reported over the last two decades is argued that the dynamics of size distribution may be affected by environmental disturbances and intrinsic differences in the expected asymptotic length of the individuals (Parma and Deriso, 2011). Since size-selective exploitation directly influence the size distribution by selective removal of larger individuals otherwise known as size truncation may result to decrease in trait variability, depressing the capacity to buffer environmental change, hinders evolutionary rebound and ultimately impairs population recovery (Edeline, et al., 2009). With the rising human population in the coastal areas and high demand for the crabs for subsistence and commercial farming has led to increased pressure in the populations of the crabs (Triño, et al., 1999; Fondo, et al., 2010; Kosuge, 2001). Overfishing have affected abundance and size throughout their distribution range (Brown, 1993; Naylor and Drew, 1998; Marichamy and Rajapackiam, 2001). This study was therefore conducted on mud crabs *Scylla* spp. valued not only as source of food and income but are also valuable components of small scale coastal fisheries as well as an essential species for ecological homeostasis (Angell, 1992; Keenan, 1999).

METHODOLOGY

In the Philippines, among the major locations of the fishery of *Scylla* spp. are in the Lingayen Gulf, Roxas City and Bislig Bays thus an assessment is wanting especially investigating the effects of fishing pressure and information on the fishery profile of the crabs. The species were *Scylla serrata* (Forsskål, 1775), *S. olivacea* and *S. tranquebarica* (Fabricius, 1798) (Figure 1).

Figure 1. The three mud crab species used in the study: a. *Scylla serrata* (Forsskål, 1775), b. *Scylla tranquebarica* (Fabricius, 1798), and c. *Scylla olivacea* (Herbst, 1796).

This study determined the fishery profile and the biological information of 3 *Scylla* species in the 4 stations in 3 selected areas, namely: S1: Lingayen Gulf in Luzon area, S2: Sibuyan Sea (Roxas City) in the Visayas area, S3: Panguil Bay and S4: Bislig Bay in Mindanao area by using primary and secondary data (Fig. 2). The choice of these study areas was based on their geographic location, thriving crab trading and differences in environmental conditions (Fig. 2).

The study was conducted for 15 to 20 days in a month (from May 2014 until April 2015) by recording in the notebook provided with information on date, name of fisherman, sex of crabs and the volume caught as well as their views on the crab fishery profiles as well as the similarities and differences, strengths and weaknesses of environmental awareness and advocacies on the different crab fishery management approaches practiced by the key informants in the 4 stations in 3 selected areas in the Philippines.

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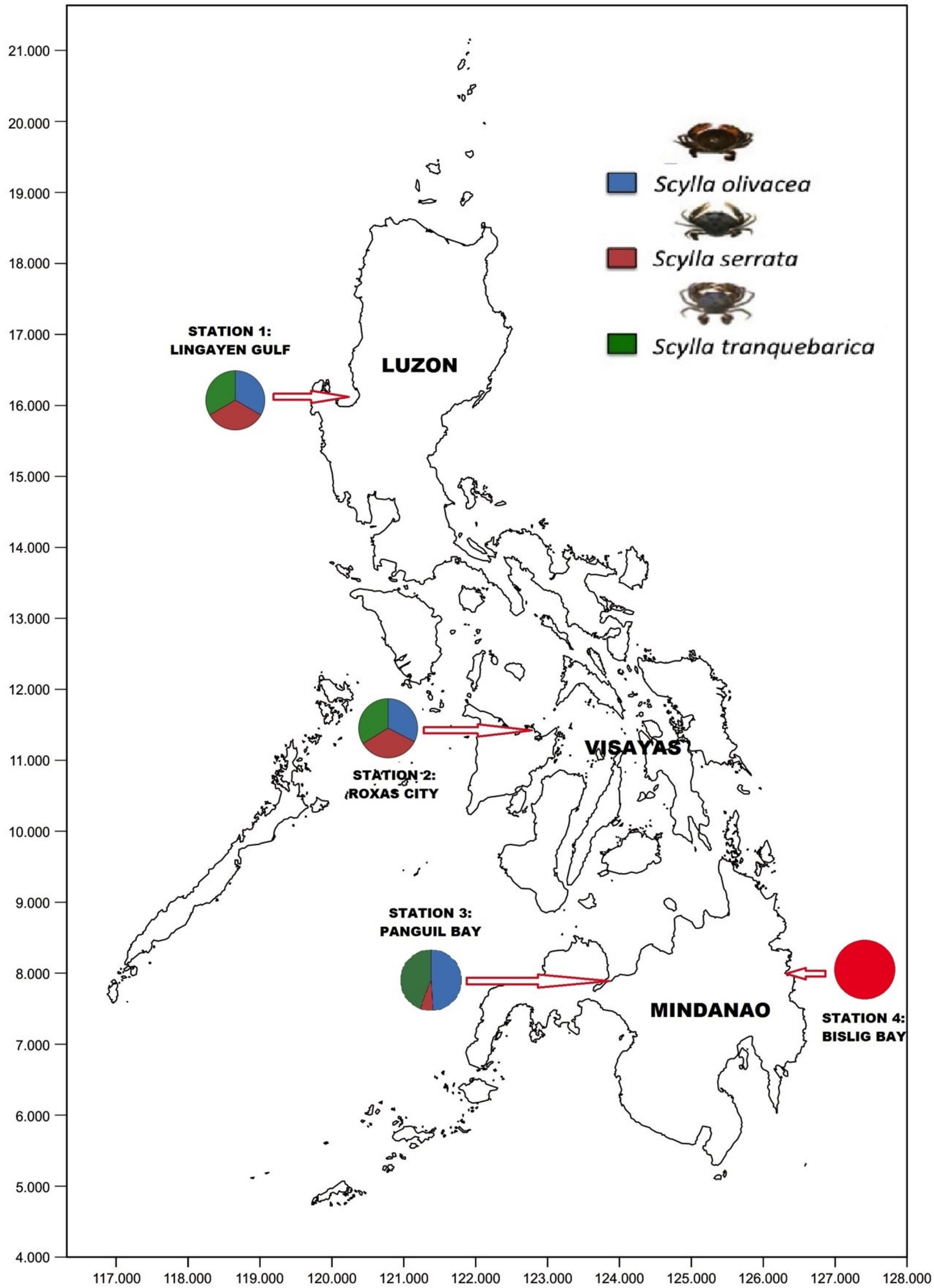

Figure 2. Location of the 4 sampling stations of the 3 study areas with photographs of the three *Scylla* species and their corresponding ratio.

Station 1: Lingayen Gulf is located in the northwestern portion of the Philippines at 16°11'36"N and 120°11'32"E. It is said to be an extension of the former South China Sea but now called West Philippine Sea considering its proximity and connection to the larger waters of the West Philippine Sea. The gulf is littered with several fish cages resulting to occasional fish kills. It continually receives pollution from agriculture, mining and mariculture activities. The Gulf is also home to the 1200 megawatt Sual Power Station, the largest coal power plant of the Philippines.

Station 2: Sibuyan Sea particularly in Roxas City which is located in Panay Island geographically positioned at 11°33'10"N and 122°44'26"E and dubbed as the "seafoods capital of the Philippines". Its major economic activities are fishing and farming as well as fresh and brackish water aquaculture. Small and medium scale industries operate in the city. These are an electronic manufacturing firm, one prawn processing plant, one crabmeat processing, bangus and prawn fry hatcheries, shellcraft business, rattan and wood furniture manufacturing, ice plants, hollow blocks manufacturing, rice mills, the cutflower and garments industries, and commercial poultry farms (Municipal Profile: Roxas City).

Station 3: Panguil Bay, situated in the northwestern part of Mindanao at 8°2'20"N 123°44'2"E which represented inland waters since it empties and interacts with the larger Iligan Bay which in turn is connected to Bohol Sea. The coastal areas of Panguil Bay is bordered with coastal communities and fishponds while the bay waters has been used for mariculture of seaweeds and continually being installed with various stationary fishing gears such as fish corral and stationary filter nets.

Station 4 which was Bislig Bay is situated in the southeastern side of the Philippines and eastern side of Mindanao, geographically positioned at 8°12'55"N and 126°22'13"E. The bay receives and exchanges waters with the Pacific Ocean. It had been the home of the defunct company PICOP Resources, Inc., which was the largest paper mill in Asia and one of the largest in the world. It started its operation in 1952 until 2008 with various solid and liquid waste pollution discharged directly into the bay without treatment (Garcia, 1976).

The fishery of mangrove crabs in the four stations in Luzon, Visayas, and Mindanao areas share the same fate of wanton human activities such as overexploitation, pollution and conflicting use of resources.

Collection of primary data

The research process (Fig. 3) and the methods (Fig. 4) outlined in the flowcharts were followed in implementing this study. It started with an entry protocol to the respective LGUs by submitting a letter and conducting a courtesy call to the mayors or barangay captains if the mayors were not available informing them of the nature of the study and to get their support and permission for secondary data collection on crabs if available. After the courtesy call, collection of samples commenced. Fifty crab samples per species were gathered from Lingayen Gulf, Roxas City, Panguil Bay and Bislig Bay. These samples were bought from the landing stations of the four areas and were brought to MSU Naawan laboratory for biological analyses. For samples coming from Lingayen Gulf, biological analyses were done in the BFAR-NIFTDC station in Bonuan, Binloc, Dagupan City while samples from Roxas City were processed at the Violeta's residence in Tolarucan, Mina, Iloilo.

Determination of the fishery profile

The fishery profile was determined by using a combination of primary and secondary data. In the absence of secondary data, actual determination of needed data was conducted at the landing stations.

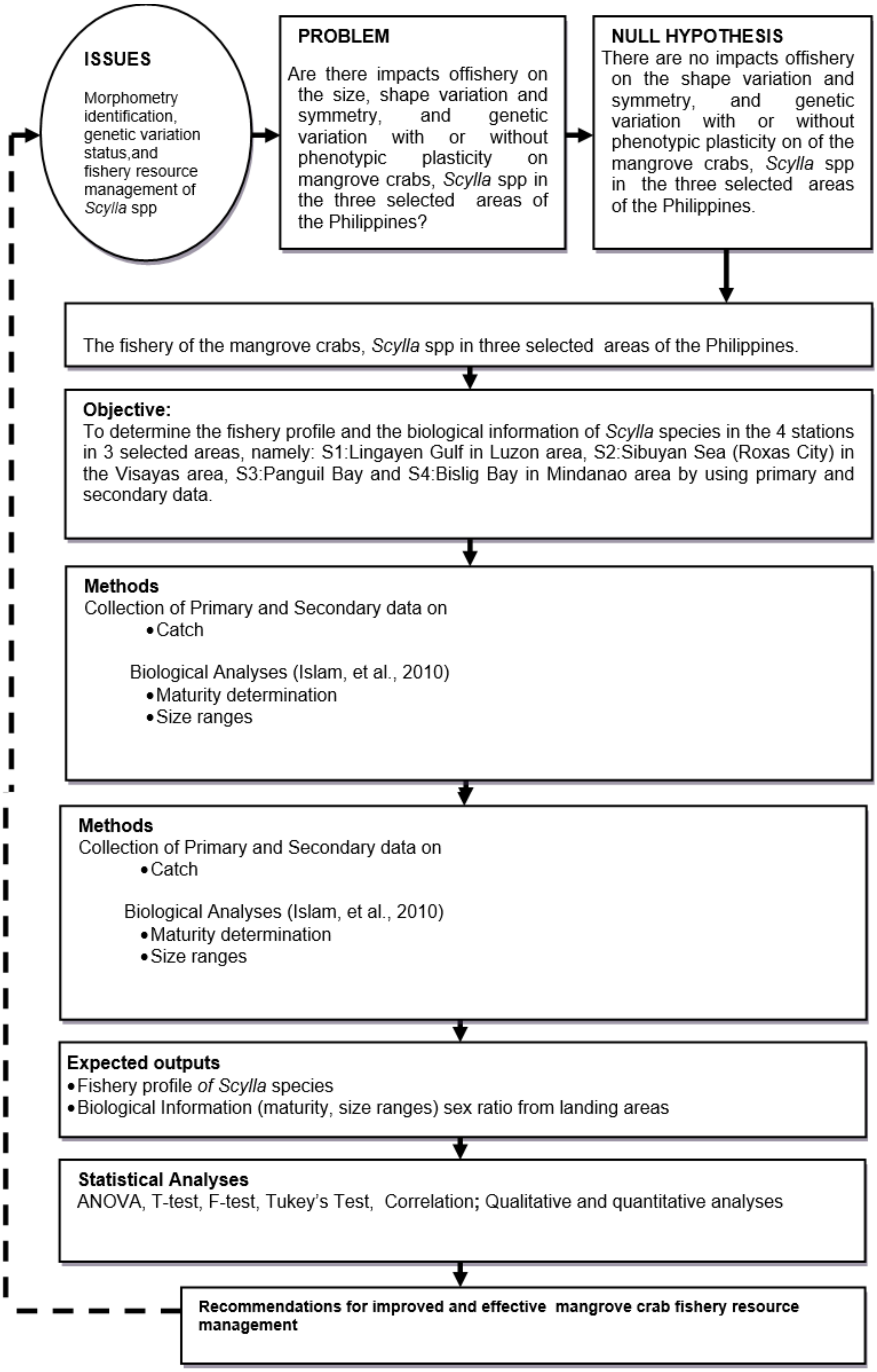

Figure 3. The research process involved in the study in relation to issues, problems, hypothesis and objectives of the study.

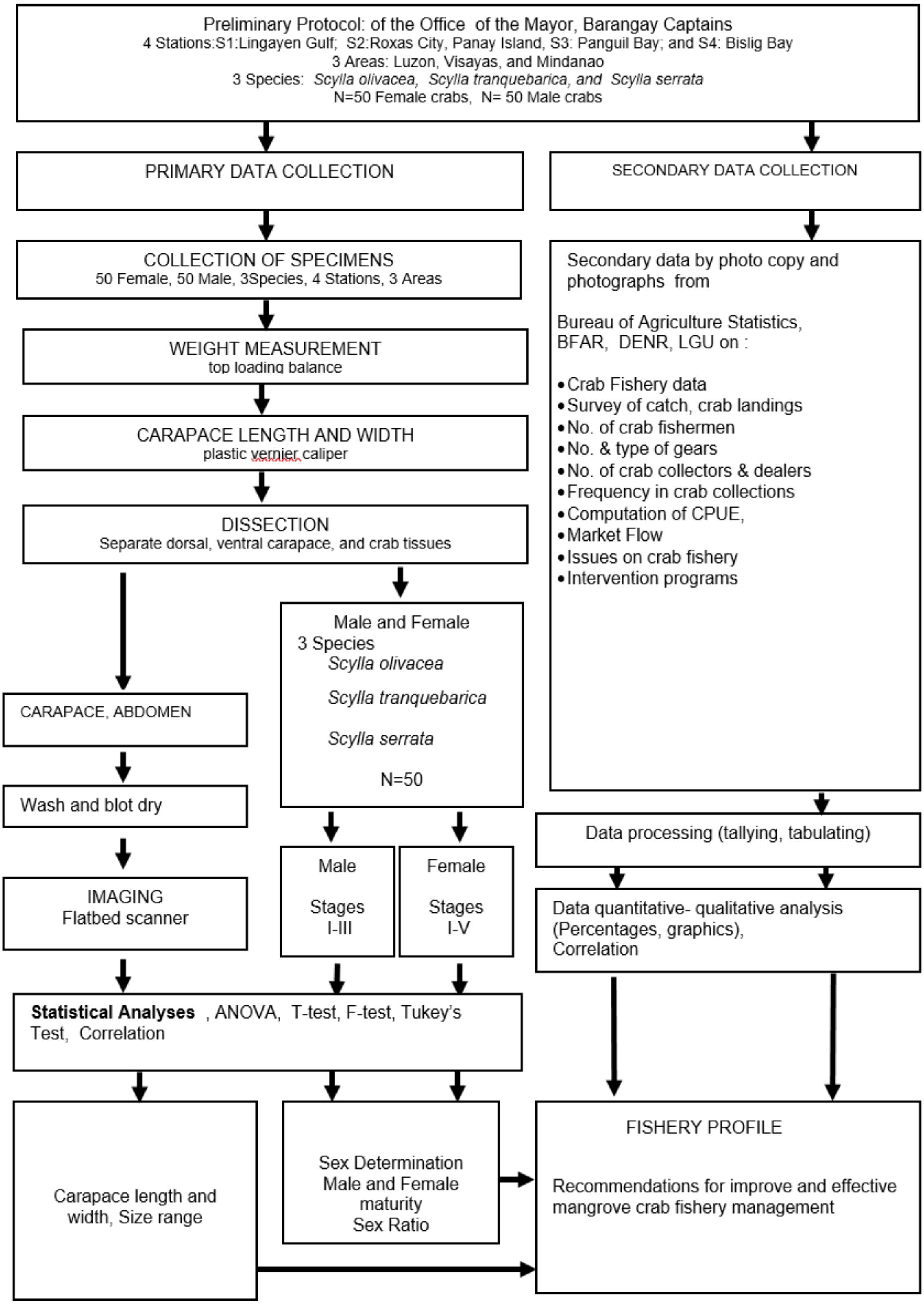

Figure 4. General flowchart of methods used in the analyses of *Scylla* spp from the 4 stations of the 3 areas in the Philippines.

Secondary data collection

Available secondary data were obtained from LGU and other line agencies like DA-BFAR, DA-BAS (Bureau of Agriculture Statistics), Philippine Statistics Authority and DENR. However, if there were no available secondary data, actual primary data collection was done like in the case of Bislig Bay.

Key informant interview

Some questions were asked directly from some LGUs, crab landing station operators and fishermen on their perspectives on the crab fishery data and market flow, issues on crab fishery, and intervention programs as well as on aspects covering crab fishery policies, operations, and conservation management, and sustainability.

The respondents' answers constituted the data regarding the assessment of crab fishery profiles in the 4 stations in 3 selected areas in the Philippines. The outcome of all these perceptions was synthesized in their implications on shape variations and genetic variations of the *Scylla* species to recommend an improved and systematic crab fishery conservation management program in the Philippines.

Biological Analysis

Males and females were separated based on the shape of the abdomen which is wider and globular in females and narrow in males (Fig. 5). In younger females, the abdomen is invariably triangular in shape. Maturity stages of males and females were determined based on the published article on *Scylla paramamosain* with detailed description (Islam, et al., 2010) (Table 1). The developing or previtellogenic ovary (stage II) form as two lines on the upper portion of digestive gland and can be easily differentiated from the gland (Fig. 6B). The early developing or primary vitellogenesis stage (stage III) is the initiation of vitellogenesis.

a **b** **c**

Figure 5. The abdominal flap of the juvenile (a), female (b) and male (c) of *Scylla serrata* (photo: RC Gonzales).

The ovary changes to yellow coloration (Fig. 6C). During the late-maturing or secondary vitellogenic (stage IV) stage, the globules develop prominently in sterno carapace and upper digestive gland (Fig. 6D). In this stage, the oocyte grows rapidly (120–200 μm) and the nucleus reachesits maximum size of 30–40 μm at this stage or at the end of primary vitellogenesis. In the mature or tertiary vitellogenesis stage (stage V), the ovary enlarges to the maximum and eventually covers the hepatopancreas and the majority of the cardiac stomach (Fig. 6E). In Thailand, females with a V-shape abdominal flaps have immature ovaries (stages I–II)**.** While females with U-shaped abdomen have 57% vitellogenic ovary (stages III–V), but the remaining 43% are classified as immature (stages I–II) (Islam, et al., 2010).

Biological information on size, sex ratio and sexual maturity are very important in describing the nature of fisheries exploitation in these areas, particularly in establishing the size ranges being caught against an optimal or regulatory size in order to prevent growth overfishing of the crabs.

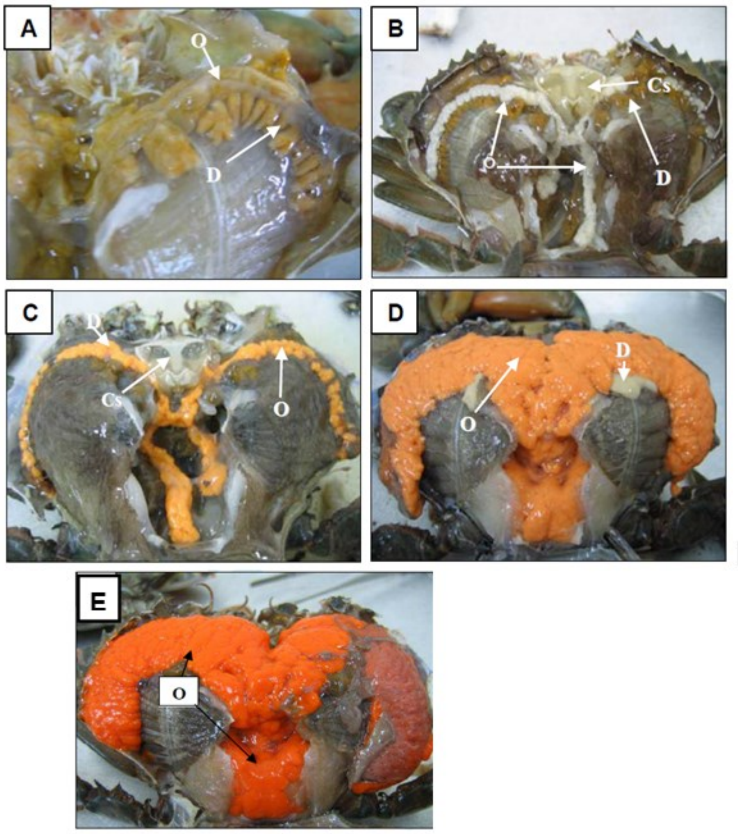

Figure 6. The ovarian maturity stages of *S. paramamosain* after Islam, et al., 2010.

The weights were measured using a 1-kg capacity Akita weighing scale made in Japan. Carapace length (CL) and width (CW) measurements were done by using a plastic vernier caliper.

Statistical analysis

ANOVA was used to determine the significance of catches between sexes. Correlation was done to determine the relationship between the carapace length and width of the crabs collected from the selected areas. The percentage, frequency and correlation were used for data analyses. The data were evaluated by using the Statistical Package for Social Science (SPSS) version 20.0 and Excel Software.

RESULT AND DISCUSSION

Fishery profile

The catch profile of crabs from Roxas City, Panguil bay and Bislig bay showed a fluctuating trend with three episodes of slight increase and low catch. When compared with other areas, the highest recorded catch was observed at Bislig Bay (Fig. 7) (Philippine Statistics Authority, 2017**)**.

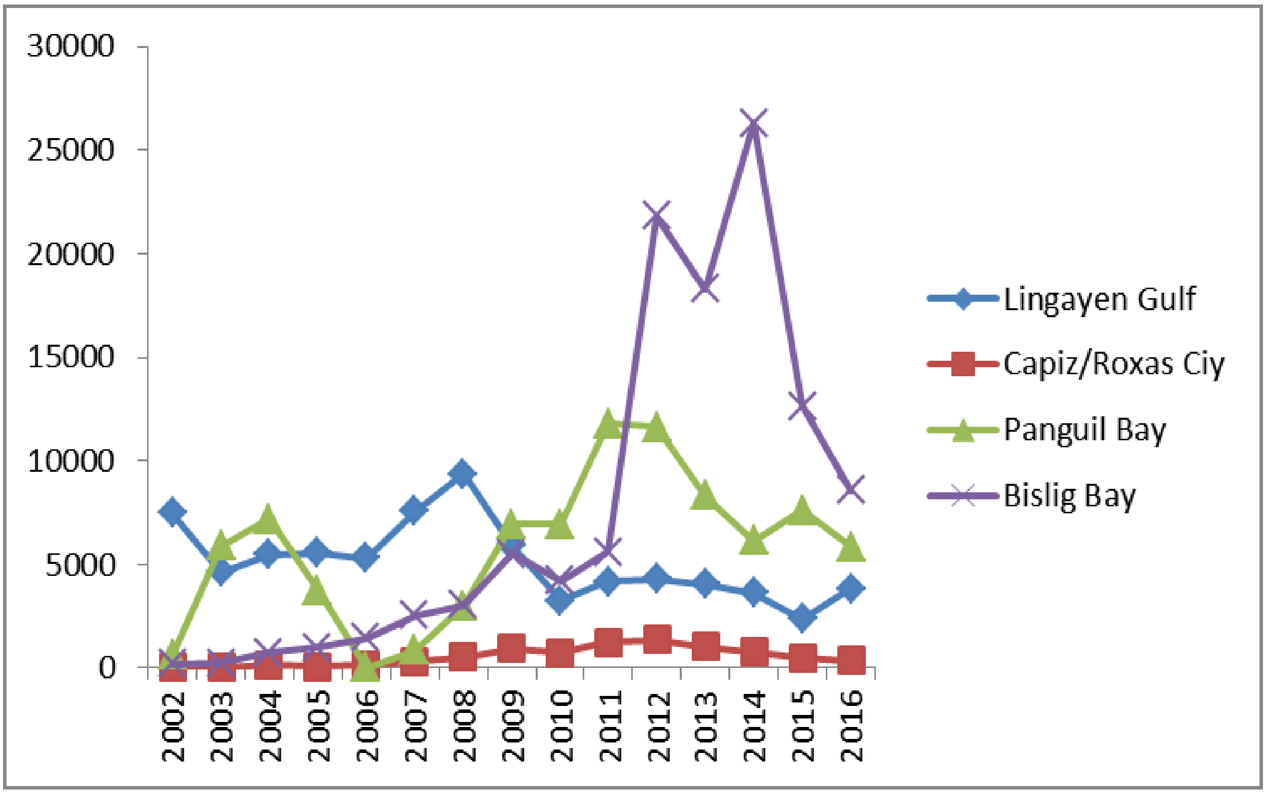

Figure 7. Catch profile of crabs in the four areas in 10 years (Source: Philippine Statistics Authority, 2017)

Biological information

i. Size and length-weight relationship

In terms of carapace length (CL), carapace width (CW) and body weight (BW), the largest sizes of crabs were that of *S. serrata* (Table 1) while *S. olivacea* were generally smaller (Table 1). Among populations, the largest samples for the 3 species were all coming from S1: Lingayen Gulf (Table 2). The smallest samples for *S. serrata* were from S4: Bislig Bay. For *S. tranquebarica* the smallest females were collected from S3: Panguil Bay while the smallest males were from S2: Sibuyan Sea, Roxas City. The smallest samples for the male and female *S. olivacea* were from S1: Lingayen Gulf.

Table 1. Size profile of the three *Scylla* species in terms of carapace length, carapace width and total weight.

Species	Carapace Length (mm)		Carapace Width (mm)		Body Weight (g)	
	Range	Mean	Range	Mean	Range	Mean
S. serrata	50-137	77	73-200	121	60-935	242
S. tranquebarica	49-91	66	69-126	97	70-455	169
S. olivacea	46-78	61	58-109	87	60-200	129

Table 2. Size profile of the three *Scylla* populations in terms of carapace length, carapace width and total weight.

Species/ Stations	Carapace Length (mm)		Mean (M/F)	Carapace Width(mm)		Mean (M/F)	Body Weight (g)		Mean (M/F)
	M	F		M	F		M	F	
S. serrata									
S1: Lingayen Gulf	73-116	81-137	96/100	103-165	115-180	140/375	230-935	135-895	545/443
S2: Sibuyan Sea, Roxas City	69-109	77-101	94/86	99-154	104-140	136/121	150-610	180-360	409/285
S3: Panguil Bay	61-64		63	94-96		95	90-140		120
S4: Bislig Bay	50-126	49-126	68/75	73-200	73-200	100/104	60-580	55-580	159/186
S. tranquebarica									
S1: Lingayen Gulf	51-91	52-91	73/73	74-126	69-119	104/104	93-455	73-295	277/180
S2: Sibuyan Sea, Roxas City	49-80	56-77	63/68	71-119	80-109	92/ 96	70-285	80-195	143/141
S3: Panguil Bay	55-72	52-70	64/60	82-108	87-107	95/ 94	110-250	90-190	167/124
S. olivacea									
S1: Lingayen Gulf	46-66	46-68	57/55	69-97	68-98	84/ 80	75-200	60-155	132/92
S2: Sibuyan Sea, Roxas City	57-69	50-78	64/66	81-97	72-109	90/ 92	100-180	60-190	145/126
S3: Panguil Bay	57-65	55-74	61/62	84-97	58-102	89/ 89	125-185	125-185	148/125

Length-weight relationship analysis revealed males were larger than females in all 3 species as indicated by higher "b" values except for the male *S. serrata* in S2: Sibuyan Sea, Roxas City (Table 3). Among the 3 species, *S. serrata* has the largest size while *S. olivacea* the smallest. A significant positive correlation between the CL and CW was observed for all the 3 species indicating an increase in the CL as the CW increases. The same relationship was also observed between the CL and BW as well as between CW and BW of the 3 species. Results also show that growth was allometric for all the species which means that the CL and BW grow at different rates.

Table 3. Length-weight parameters of the *Scylla* populations.

Sampling Stations	Species	Gender	*a*	*b*	r^2
S1: Lingayen Gulf	*S. serrata*	F	-2.7408	2.6853	0.9576
		M	-3.9066	3.3219	0.935
		FM	-3.3525	3.0236	0.9093
S4: Bislig Bay		F	-2.5396	2.562	0.9357
		M	-2.6323	2.6349	0.8339
		FM	-2.517	2.5724	0.8725
S2: Sibuyan Sea, Roxas City		F	-5.203	3.9499	0.8953
		M	-3.4724	3.0792	0.9538
	Mean *b* = 3.0371	FM	-4.3452	3.5153	0.9172
S1: Lingayen Gulf	*S. tranquebarica*	F	-2.8608	2.7215	0.9352
		M	-3.872	3.3407	0.9269
		FM	-3.1988	2.9353	0.8603
S3: Panguil Bay		F	-2.2703	2.4131	0.9243
		M	-3.7409	3.2757	0.935
		FM	-2.8791	2.774	0.8246
S2: Sibuyan Sea, Roxas City		F	-2.737	2.6543	0.9548
		M	-3.4925	3.1155	0.8591
	Mean *b* = 2.7835	FM	-2.6832	2.6412	0.8588
S1: Lingayen Gulf	*S. olivacea*	F	-2.3385	2.485	0.8704
		M	-3.257	3.0173	0.9071
		FM	-2.7048	2.6872	0.8415
S3: Panguil Bay		F	-3.4072	2.8743	0.9791
		M	-3.5477	3.1805	0.9427
		FM	-3.3313	3.019	0.8799
S2: Sibuyan Sea, Roxas City		F	-2.4981	2.5263	0.9239
		M	-3.1026	2.9244	0.8964
	Mean *b* =2.7263	FM	-2.3419	2.4728	0.772

ii. Maturity stages and size at maturity

There were varying maturity stages observed in all the sexes of the three crab species (Table 4 and 5) for all the sampling areas. Both sexes the three crab species collected in S2: Sibuyan Sea, Roxas City were observed to be dominated by crabs with matured gonads. Half of the collected male *S. serrata* from S1: Lingayen Gulf were immature. Majority (81%) of the samples from S4: Bislig Bay were also immature while majority (94%) of the crabs from S2: Sibuyan Sea, Roxas City were mature (Table 6). In the case of *S. tranquebarica*, majority were maturing in S1: Lingayen Gulf (49%), immature in S3: Panguil Bay (43%) and mature in S2: Sibuyan Sea, Roxas City (66%). For *S. olivacea*, most of the samples from S1: Lingayen Gulf and S3: Panguil Bay were maturing (46% and 55%, respectively) while the samples from S2: Sibuyan Sea, Roxas City were mostly mature (81%). Majority of the female crabs from S1: Lingayen Gulf, S4: Bislig Bay and S3: Panguil Bay belong to stages I-III which were categorized as immature while most of the female crabs from S2: Sibuyan Sea, Roxas City fell under stages IV and V which were under mature stages (Table 7).

Table 4. Maturity stages and size ranges of the male samples of the three species of *Scylla* collected from the four sampling stations.

Population	Stage I/ size range (mm)	Stage II/ size range (mm)	Stage III/ size range (mm)
S. serrata, S1: Lingayen Gulf	50% 103-123	38% 115-140	12% 135-165
S. serrata, S2: Sibuyan Sea, Roxas City	3% 99-115	3% 110-125	94% 120-154
S. serrata, S4: Bislig Bay	81% 73-95	14% 79-125	5% 115-200
S. tranquebarica, S1: Lingayen Gulf	24% 74-89	49% 79-90	27% 89-126
S. tranquebarica, S2: Sibuyan Sea, Roxas City	17% 71-85	17% 80-93	66% 90-119
S. tranquebarica, S3: Panguil Bay	43% 82-93	39% 86-99	18% 95-108
S. olivacea, S1: Lingayen Gulf	34% 69-80	46% 75-90	20% 89-97
S. olivacea, S2: Sibuyan Sea, Roxas City	0	19% 81-93	81% 88-97
S. olivacea, S3: Panguil Bay	28% 84-93	55% 86-95	17% 90-97

Table 5. Maturity stages and size ranges of the female samples of the three species of *Scylla* collected from the four sampling stations.

Population	Stage I/ size range (mm)	Stage II/ size range (mm)	Stage III/ size range (mm)	Stage IV/ size range (mm)	Stage V/ size range (mm)
S. serrata, S1: Lingayen Gulf	31% 115-126	6% 120-132	46% 125-138	11% 128-150	6% 145-180
S. serrata, S2: Sibuyan Sea, Roxas City	0	17% 104-119	20% 107-128	50% 125-133	13% 131-140
S. serrata, S4: Bislig Bay	24% 73-122	22% 92-129	40% 89-133	13% 118-146	10% 139-200
S. tranquebarica, S1: Lingayen Gulf	20% 69-79	20% 72-83	26% 75-89	16% 87-100	18% 100-119
S. tranquebarica, S2: Sibuyan Sea, Roxas City	0 80-93	13% 85-96	13% 88-100	7% 91-103	67% 98-109
S. tranquebarica, S3: Panguil Bay	32% 87-93	8% 88-96	12% 88-100	18% 90-105	30% 98-107
S. olivacea, S1: Lingayen Gulf	18% 68-75	2% 70-89	37% 75-88	8% 80-92	35% 89-98
S. olivacea, S2: Sibuyan Sea, Roxas City	0 72-83	0 80-90	10% 88-95	10% 90-101	80% 98-109
S. olivacea, S3 Panguil Bay	0	0	8% 58-83	12% 80-94	36% 90-102

Variations in the immature stages of development in both sexes in the 3 species across all populations were observed. The immature stage (Stages I and II) for male *S. serrata* ranged between 73-140 mm and from 115-165 mm for the mature stage (stage III). Size at maturity of samples from S4: Bislig Bay were the smallest (115 mm) among the 3 populations while males from S1: Lingayen Gulf have the largest size at maturity (135 mm). For *S. tranquebarica*, immature sizes ranged between 71 and 91 mm while the mature sizes ranged from 89 to 126 mm. The smallest and the largest size at maturity were all observed in S1: Lingayen Gulf (89 mm and 126 mm). The immature stages of *S. olivacea* fell within 69-95 mm while the mature stage was observed to be between 88 to 97 mm. The smallest size at maturity (88 mm) were found in S2: Sibuyan Sea, Roxas City but the largest (97 mm) could be found in all 4 sampling stations.

The immature (I-III) size of *S. serrata* female crabs ranged between 73 and 138 mm and from 118 to 200 mm for the mature (IV-V) size. The smallest size (89 mm) and largest size (200 mm) at maturity among populations were observed in S4: Bislig Bay. For S. *tranquebarica*, immature sizes ranged between 69 and 100 mm while the mature sizes ranged from 87 to 119 mm. The smallest size (87 mm) and largest size (119 mm) at maturity among populations were observed in S1: Lingayen Gulf. However, the immature sizes of *S. olivacea* were between 58 and 95 mm while the mature stages ranged from 89 to 109 mm. The smallest size at maturity was observed in S1: Lingayen Gulf while the largest was in S2: Sibuyan Sea, Roxas City.

DISCUSSION

Looking at the catch profile of the crabs based on the data obtained from the Philippine Statistics Authority (PSA, 2017) show a declining trend in a span of ten years with episodes of high and low catch in between. It is argued that this downtrend in catch might be an indication of overexploitation. Of the three species, it was shown that *S. serrata* was the most predominant species. This assessment appears to be true based on surveys conducted in the markets and landing stations in one of the sampling stations S4: Bislig Bay area where it was observed that a majority of the catch were *S. serrata* and only 0.05% of the crabs displayed in the markets were composed of *S. olivacea*. This may indicate that the PSA data of decreasing volume of catch and sizes of crabs were based primarily on *S. serrata* catch. There have been claims that areas in the Philippines facing the Pacific Ocean were dominated with *S. serrata* thus may also explain the availability of the species in the landing areas.

The downward trend can be explained also based on the results on length-weight analysis shown by the b values. The data showed an allometric growth of the 3 crab species indicating an unequal growth of the length and weight of the body. Of these, *S. serrata* is the largest and may explain as the most preferred by the fishermen and aquaculturists. The preference of collecting large sizes may have detrimental effects to the target species *S. serrata* since size truncation or selective removal of larger individuals result to decrease in trait variability thus depresses the species capacity to buffer environmental change, hinders evolutionary rebound and ultimately impairs population recovery (Edeline et al., 2009). This can also explain the fluctuating trend in crab catch in the landing areas.

While the mangrove crabs of the genus *Scylla* are among the highly exploited species in the Philippines, the exploitation of the 3 species of crabs vary depending on their location and the purpose. This study found out that among the 3 species, *S. serrata* was the largest which agreed with the findings of Carpenters and Niem (1998) that *S. tranquebarica* and *S. olivacea* were smaller than *S. serrata*. It is also the target organism for aquaculture due to its large size (maximum weight:

between 2-3 kg, FAO, 2008), its preference for estuarine habitats, peculiar taste, less aggressive behavior and higher value in the market (Cowan, 1984). Its potential for aquaculture has been harnessed over the last 10 years in Southeast Asian countries (Begum, et al., 2009; Mwaluma, 2002) including Australia. In the Philippines, *S. serrata* is highly exploited for aquaculture due to its larger size, peculiar taste and higher price in the market. Crab aquaculture started booming in the early 1990's and *S. serrata* had been cultured in ponds, in pens, bamboo and net cages (Catanaoan, 1972; DA, Region VI 1988; Kuntiyo, 1992; Samonte and Agbayani, 1992; Triño, et al., 1999; Baliao, et al., 1999). This information can also be used as basis for the episode of increased catch of crabs in certain years.

It is also important to note from the information generated from this study that since the source of seed stocks for aquaculture was and will continue to be from the wild since hatchery-produced juveniles are not yet feasible (Shelley, 2008, Begum, et al., 2009), continuous harvest of female crabs at reproductive stages will not only deplete sources of stocks but also reduces the populations in the wild. The problem is further aggravated by the harvest of immature *crabs* to meet the increasing and unmet demand in the local and international markets (Begum, et al., 2009). This unregulated collection from the wild coupled with other factors such as habitat degradation, illegal fishing practices and pollution, among others, added more pressure to the already declining crab population in the Philippines.

CONCLUSION

The fishery of the *Scylla* species investigated in four stations in the Philippines to determine the effect of unregulated crab fishing based on primary and secondary data showed that the combined catch profile revealed a decreasing trend in the last ten years. Results from the market survey indicated *S. serrata* was the most exploited being the largest and popular for both the local and export market. The decreasing marketable size of *S. serrata* found to be decreasing indicate that aquaculture, unregulated fishing practices may affect the fishery and biology of this species thus needing appropriate management interventions especially in the collections of crabs in the wild that are not mature and in reproductive age.

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