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Capture Fisheries Assessment of Commercially Important Marine Crabs in Sorsogon Bay and San Miguel Bay

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Abstract

An assessment of commercially important marine crabs in San Miguel Bay and Sorsogon Bay was carried out in key landing sites. Dataset for length-frequency analysis was taken including species ID, gear inventory, CPUE and production including market and channel of distribution. Data analysis made use of FISAT and SPSS.

Blue crab (*Portunus pelagicus*); Christian crab (*Charybdis feriata*); three-spotted crab (*Portunus sanguinolentus*) and mud crab (*Scylla serrata*) constitute the majority of the catch. Results showed that these are highly exploited with E values of E_{cur} = 0.45 and E_{cur} = 0.59 for *P. pelagicus* and *C. feriata*, respectively. The observed low and smaller size catch indicate signs of overfishing. This means that an increase in effort by gill nets, crab pots and trawlers would not result in a sustained increase in catch in either bay.

Market and distribution are characterized by competitive market with live trade getting a premium price for the species. Christian crab is the most sought species today. At present there is no effective management measure at work in the fishing grounds where the species are caught. The recommended resource management options including reduction of fishing efforts, closing the season and limits on taking berried females; all options should be explored by the LGU's to manage and save the remaining stock.

Key words: Capture fisheries assessment, marine crabs, Sorsogon Bay and San Miguel Bay

Introduction

Fishing is the largest extractive use of wildlife in the world with demand exceeding the supply. This system of resource extraction is expected to continue in the coming years as the human population increases in the next ten years. In Bicol, Sorsogon Bay (SB) and San Miguel Bay (SMB) are important fishing grounds for small pelagic, demersal fishes and shellfish. Marine crabs such as the blue swimming crab (*Portunus pelagicus*) and the Christian crab (*Charybdis feriatus*) have been abundantly harvested in the area. Live trade for high valued species including grouper, wrasses, crustaceans, and lobster are common in SMB and SB because of the booming export market which provided significant economic incentive among fishers. Unfortunately, very little work has been carried out in regard to management of wild populations. Given the unregulated resource extraction coupled with the alarming impacts of climate change, the future of these species is extremely threatened.

Considering its contribution to the economy and the livelihood and income of those who depend on its fisheries, it is imperative that research efforts towards the development of resource management be given utmost attention in order to sustain an appropriate number of parent stock to maintain populations of valued marine species. An assessment of the resources is therefore necessary to determine its present status and formulate doable management and enhancement strategies for future long-term use.

The present research work is designed to assess the status of commercially important marine crab fisheries in SB and SMB. Specifically, it seeks to do the following: determine commercially important species of marine crabs; estimate the growth, mortality parameters and exploitation rate; determine fishing gears exploiting

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the species and their catch rate; estimate the annual production and describe the marketing system. Research output derived from the local research was presented to the concerned local government unit (LGU's) and the fishers' group as input for the development of sustainable management plans for the crab fishery. Without proactive moves to manage our resources, the chance of a collapse in the wild crab population is not far from reality. Acting now to save important species is therefore an urgent need.

Materials and Methods

This paper presents the output of the collaboratively effort of Sorsogon State College-Magallanes Campus, and Camarines Norte State College-Mercedes Campus and LGU's bordering the bay.

Monthly sampling and landing surveys were carried out at major landing sites in SMB and SB. Length-frequency data, individual weight (TW), carapace height (CH) and the carapace width (CW)) measurement were taken, species ID, estimate of production, catch data, and catch per unit effort (CPUE) by gear were collected using standard stock assessment tools. Simultaneously, gear inventory and profile of fishers were also carried out. Market and channel of distribution surveys were undertaken using KI interview and documentary analysis. Data analysis made use of FISAT and SPSS.

The Study Site. SB is situated at the southern coast of Luzon Island with approximately 201 sq km bounded by longitude 123°50' and 124°0' east and 13°0' and 13°5' north characterized by a large horizontal and temporal salinity variation due to strong influence of freshwater discharged from the rivers around the bay (Villanoy C. & Ranola M.C.1995). Specific landing sites in Sorsogon include Magallanes, Casiguran and Cambulaga (Fig. 1).

SMB is one of the most productive coastal fishing grounds in Bicol (Soliman *et al.,* 1997) and is located in the eastern coast of the Philippines between Latitude 13 40' and 14 09' North and Longitude 122 59' and 123 20' East. The bay is about 250 kilometers southeast of Manila on the Pacific Coast of Luzon Island. It has an approximately surface area of 840 square kilometers (See Fig. 1). The landing sites are located in Mercedes, Cabusao, Calabanga and Tinambac.

Data analysis. The relationship of CH and CW were examined through least squares linear regression with the formula: $y = a+b*x$, while the relationship between the CW and TW to its individual weight was analyzed through power regression analysis expressed as $y = a*x^b$ where y = the dependent variable

a = is the intercept

x= is the independent variable (or covariate)

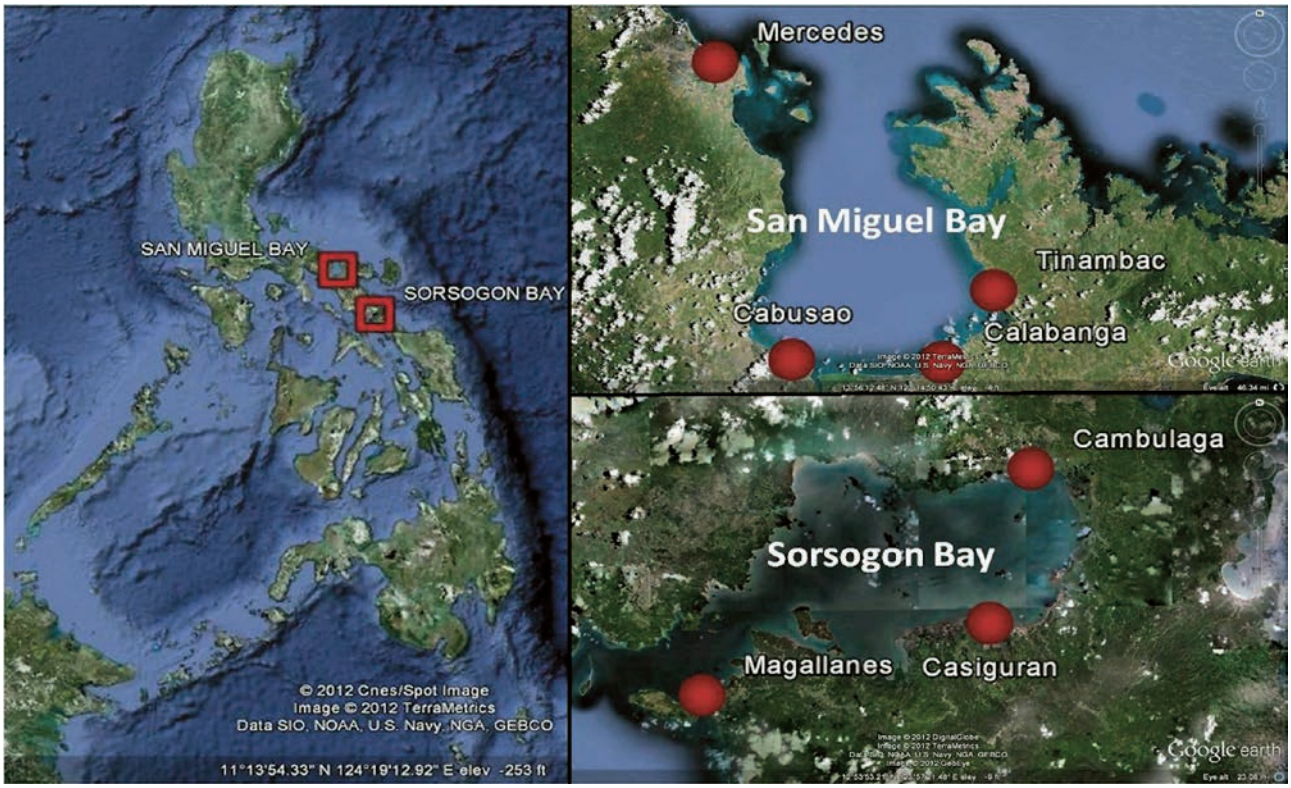

Fig. 1. Study sites in San Miguel Bay and Sorsogon Bay.

Fig. 2. Important Commercial Crabs in Sorsogon Bay and San Miguel Bay.
1. *Charybdis feriata*, 2. *Portunus pelagicus*, 3. *Scylla serrata*, and 4. *Portunus sanguinolentus*.

b = is the slope of regression coefficient

All relationships were analyzed for their normality using the Kolmogorov-Smirmov-test, also termed the KS Lilliefors test for normality. Analysis of the growth parameters (L_∞ and k) and mortality coefficients (M,F and Z) were estimated using FISAT Ver. 1.2.0 (FAO-ICLARM Stock Assessment Tools) software (Gayanilo *et al*., 1996). All other analysis were analyzed using SPSS 17.0 (SPSS Inc., Chicago, 1996)

Results and Discussion

Commercially Important Marine Crab Species

Blue crab (*Portunus pelagicus*) constitutes the majority (75-98%) of the catch in both fishing grounds with Christian crabs (*Charybdis feriatus*) comprising only 2% of the total catch and the rest comprising three-spotted swimming crabs (*Portunus sanguinolentus*) (Fig. 2). The latter are caught mainly by gill net with a mean catch of 3.5 kg. Meanwhile, Christian crab is mainly caught (80%) by crab pot 80% with mean catch rate is 9.0 kg.

Estimate of Population, Growth, Mortality and Exploitation

Population structure of *P. pelagicus and C. feriatus*. A total of 8,272 *Portunus pelagicus* were measured for length-frequency and about 721 individuals measured for length-weight relationship in SB. Mean carapace width CW (±SD) of *P. pelagicus* was 11.4±1.1 cm (combined sexes) with a range from 4.0 to 16.7 cm.

A total of 1,971 marine crabs were measured for length-frequency in SMB, and was comprised of 223 *C. feriata* and 1,748 *P. pelagicus*. The distribution of carapace width of *C. feriata* and *P. pelagicus* are 4.8 cm to 16 cm and 3.6 cm to 17 cm, respectively. In addition, mean (±SD) values for CW are 9.4 (±1.6) for *C. feriata* and 10.8 (±1.2) for *P. pelagicus*. Noticeably, berried crabs were also captured during crab fishing which can be a factor leading to overfishing (Ingles, J.A., 2004). The linear regression between carapace width (CW) and total weight (TW) for berried female and combined sexes were calculated as shown in Figs. 3 - 5.

Regression between CW and TW for berried female in Sorsogon Bay resulted in a positive linear regression with a very high correlation coefficient (r) of 0.96. The same results were obtained between CW and TW for

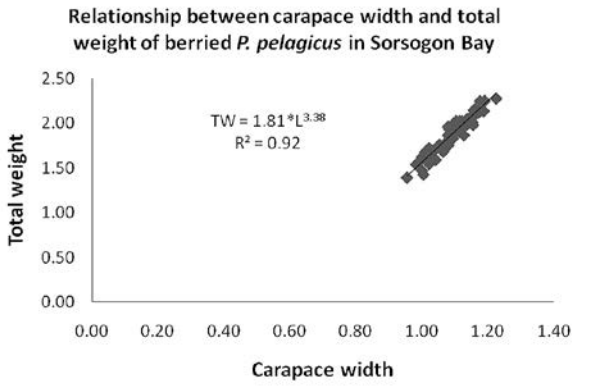

Fig. 3. Relationship between carapace width and total weight of berried *P. pelagicus* in Sorsogon Bay.
For *Charybdis feriata,* a total of 146 individuals were measured for length-frequency analysis. The mean CW (±SD) was 12.6±1.5cm and belongs to sizes ranging from 9.1 to 19.0 cm. Mean total weight (±SD) was 218.9±101.7 g. from the observed sizes ranged from a minimum of 50 to 1300g.

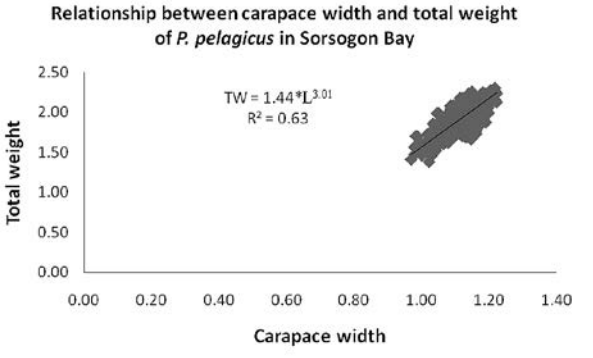

Fig. 3. Relationship between carapace width and total weight of berried *P. pelagicus* in Sorsogon Bay.

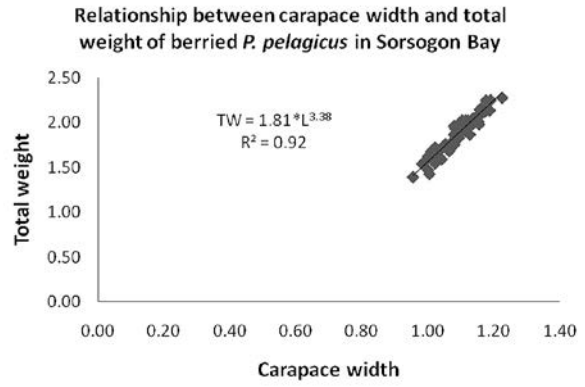

Fig. 4. Relationship between carapace width and total weight of *P. pelagicus* in Sorsogon Bay.

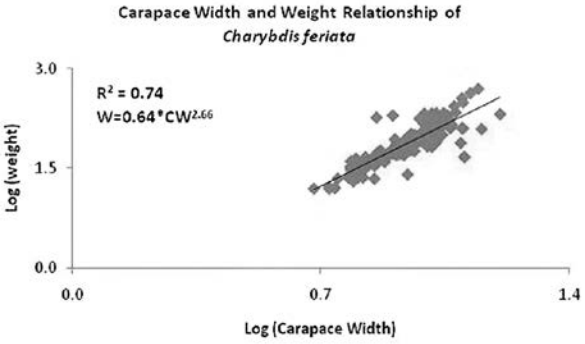

Fig. 5. Carapace Width-Weight relationship of *C. feriata* in San Miguel Bay.

combined sexes with a correlation coefficient of 0.79.

In SMB, the carapace width-weight relationship of *C. feriata* and *P. pelagicus* also had a high R^2 value which implies that the weight of the species was significantly related to the increase of its carapace width for berried individuals. All regressed parameters generated a slope equal to 3 (b=3), meaning that the weight growth was isometric. The exponent 'b' value estimated for *C. feriata* was below 3, indicating the allometric pattern of growth.

Growth parameters. Growth parameters were computed using the software FISAT (Gayanilo *et al*., 1996) to determine exploitation, mortality, L_∞, and k (see Table 1). In SB, the asymptotic carapace width (CW_∞) was 17.61 with a growth constant (k) value of 1.3 implying a faster growth for the species. Findings of the mortality estimation in SB showed a natural mortality (M) value of 2.54 and fishing mortality (F) of 2.08 per year. The current exploitation rate (E_{cur} = 0.45) is higher than the optimum exploitation rate (E_{50}) of 0.393, indicating more highly exploited stock than what it should be. Olaño *et al*. (2009) of NSAP BFAR-V also reported that exploitation rate of *P. pelagicus* in 2001-2002 was higher with values 0.69 and 0.64 for male and female, respectively.

In SMB, population parameters (Table 1) of *C. feriata* were Z=4.10 yr^{-1}, M=1.70 yr^{-1}, F=2.40 yr^{-1} and exploitation rate (E) = 0.59. While for the *P. pelagicus*, Z=4.41 yr^{-1}, M=1.82 yr^{-1}, F=2.59 yr^{-1} and exploitation rate (E) = 0.59, these high E values indicates overexploitation of the species (Gulland, 1971).

Estimate of Annual Production

Production. A total of 524.90 mt was estimated as the annual production in San Miguel Bay (Table 2). The production constitutes 3.11% of the 16,879 mt fisheries annual production in San Miguel Bay (Soliman, V.S. and Dioneda, R.R., 1997). Catches in the Philippines have been around 34,000 t in recent years and evidence has shown the abundance of swimming crabs has declined (www.fao.org).

The annual marine crab production in Sorsogon Bay is shown in Table 3. In Casiguran and Sorsogon an annual production of 713.66 mt was estimated during peak season and about 192.71 mt of *P. pelagicus* during lean season. Fishermen usually start fishing around 5:00 A.M. spending an average of 8 hours fishing per day with an estimated average income from crab fishing of Php 4,404.00.

Fishing Gears Exploiting the Species and Catch Rate

Fishing Gears and CPUE. Figure 6 presents the frequently used crab catching gears. There are 9 different fishing gears available for crab fishing in SB, the most common are crab gillnet (CGN) , crab lift net CLN) and

Table 1a. Population parameters of *P. pelagicus* in Sorsogon Bay.

Species	$CW\infty$ (cm)	K (/yr)	Z (/yr)	M (/yr)	F (/yr)	E_{cur}	E_{50}	$L_{50\ (cm)}$
P. pelagicus	17.61	1.3	4.62	2.54	2.08	0.45	0.39	10.33

Table 1b. Population parameters of *C. feriata* and *P. pelagicus* in San Miguel Bay.

Species	$L\infty$ (cm)	K (/yr)	Z (/yr)	M (/yr)	F (/yr)	E_{curr} (/yr)	L_{50} (cm)	Sampling period
Charybdis feriata	26.93	0.84	4.10	1.70	2.40	0.59	11.50	Nov.2011-Sept.2012
Portunus pelagicus	20.98	0.84	4.41	1.82	2.59	0.59	10.51	Nov.2011-Sept.2012

crab pot (CP) (Table 3). The preferred (88.04%) fishing gear across SB is CGN because it does not need bait in catching crabs; the least used is CP.

The cost of bait also represents an additional expense for crab fishers. In regard to gear efficiency, CLN had a better mean catch of 6 kg/trip/day compared to CGN with 4 kg/trip/day. However, in aggregate terms CGN has the highest aggregate total catch (*P. pelagicus*) volume estimated at 324 kg/trip/day. *C. feriata* on the other hand are mainly caught using CP with an average catch of 2-3 kg/day. Observation also showed that crab fishing in SB is year round with an average fishing days of 25 to 30 days/month (Table 4). The major crab fishing gears in SB are shown in Table 4. In SMB, the majority of the gear used includes CGN and CP. The mean catch for CGN and CP is 6.0 kg/trip and 12.5 kg/trip, respectively.

Figure 7 presents the catch composition, 94.06% of the catch in CGN is *P. pelagicus,* 0.58% *C. feriata,* 0.12% *P. sanguinolentus,* and about 5.24% by-catch species.

The catch composition of by-catch in SMB is shown in Table 5. The by-catch from CGN was consisted of 52.75 % Mantis shrimp, 25.08% tonguefish and the remaining percentage comprised other fish species, mollusks and shrimp. A greater proportion of by-catch in CP consists of Mantis shrimps (74.08%), shrimp

Table 2. Estimated annual production by gear in San Miguel Bay (in metric ton).

Area	Crab gill net	Crab pot	total
Tinambak (Sogod)	134.78	10.80	145.58
Calabanga (Sabang)	154.43	1.14	155.57
Cabusao (Castillo)	121.50	-	121.50
Mercedes (Manguisoc & Mambungalon)	-	102.24	102.24
total	410.72	114.18	524.90

Table 3. Estimated annual production by gear by sampling areas in Sorsogon Bay (in metric tons).

Area	Crab gill net	Crab pot	Crab lift net
Sorsogon City	46.02	-	10.24
Casiguran	43.40	3.60	1.85
Magallanes	63.82	-	-
Total	153.23	3.60	12.09

Table 4. Major fishing gear used in crab fishing in Sorsogon Bay.

Fishing Gear	Magallanes		Sorsogon City		Casiguran	
	F	%	F	%	F	%
Crab lift net	0	0	7	20	2	5
Crab gill net	14	100	28	80	39	91
Crab pot	0	0	0	0	2	5
Total	14	100	35	100	43	100

Fig. 6. The most common fishing gears used in crab fishing (Upper: crab gill net, lower: crab pot).

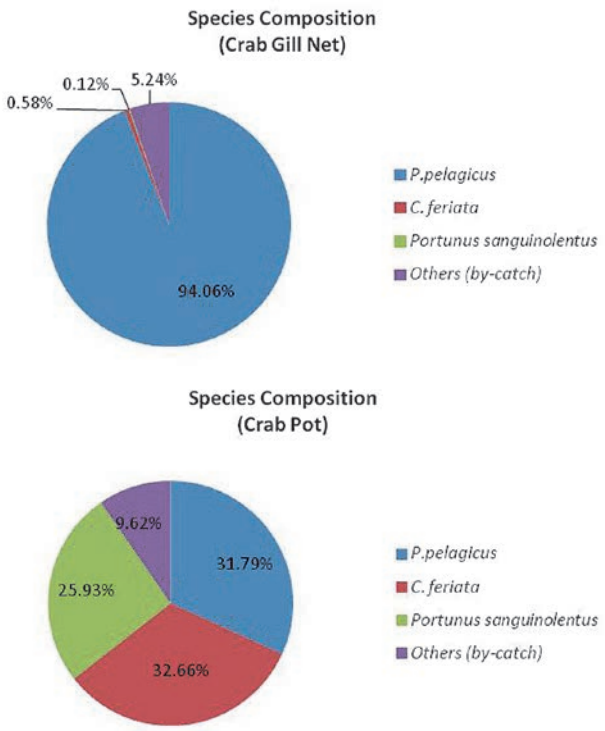

Fig. 7. Catch compositions of crab gill net crab pot in San Miguel Bay.

(14.81%) and grouper (11.11%).

In Samar and Letye, Germano and Melgo (2003) reported a mean CPUE of 2.8 kg/gear/day regardless of the month followed by crab pot with 2.67 kg/gear/pot and in the month of January the with a mean CPUE of 4.5 kg/gear/day was obtained by two types of gear which was lower than the mean CPUE recorded in the present study, implying an overexploitation of marine crabs in most fishing grounds in the country.

Marketing System

As in most fishing grounds, the marketing system in both bays is characterized by a competitive market structure as exemplified by many buyers and sellers but generally lacking in post-harvest facilities. Most of the fresh catch is sold locally at different channels of distribution. Distribution starts from fishers onto broker, bidders, buyers, retailers, dealers, wholesaler, fish vendor, processor and traders and finally goes to to the consumer. The municipality of Mercedes have the most complicated and longest market chain before reaching the consumer. From these market channels, fishers get the least benefit from the whole market system.

The common marketing practice for marine crabs is the selling from crab fishers to traders ("*factorador*") or local crab meat processors ("*beneficiador*") (Fig. 8). According to key informants, these are delivered to Manila or Cebu for domestic market or exported to China, Hongkong and Taiwan as live crabs, fresh frozen or processed crab meat. Another market player is the broker, who sells crab to the trader or street/market vendor ("*regaton*"). The "*regaton*" sells directly to the consumers in their places (Fig. 8).

Crab pot fishers usually bring 75% of their catch to "*factorador*", 15% to "*beneficiador*" and 10% to "*regaton*". On the other hand, CGN-fishers sold 90% of their catch to "*beneficiador*" and the remaining 10% to "factorador"/"*regaton*" with a price range from Php 100.00 to Php 120.00/kg ("*beneficiador*") whereas rejects (e.g. molting, small sizes, dead crabs, thin crabs, pinchers removed, etc.) are either consumed or brought to "*factorador*"/"*regaton*" and sold at Php 50.00 only. Live crabs fetch from Php 300.00 to as high as Php 2,000.00/kg depending on the size and species. Live Christian crabs caught in SMB are brought to Mercedes, Camarines Norte where they sold live at a premium price.

The "suki "patronage system is still a prevalent practice wherein customers regularly buys from the same seller which in return gives special favour to the customer. Similarly, "bulungan" or whisper bidding is also carried out in most fish landings. In most areas, the marketing system does create a special relationship between the fishers and the market players. More often, market players provide credit for fishing input or family expenses particularly during bad times in exchange for the exclusive right to purchase their catch at a lower price. In some cases, they also perform some social functions like acting as god father or principal sponsors to the fisher children's baptismal or wedding.

In terms of market structure, aside from having a competitive market, there are barriers to the fish trading business that include legal (i.e. license, permit, taxes, limited operation of brokers), financial (i.e. lack of capital, limited credit and high interest rates) and market information limited to the middlemen.

Table 5. By-catch Catch Composition using crab gill net and crab pot in San Miguel Bay.

Common Name	Family	Catch Composition (%)	
		Crab Gillnet	Crab Pot
Croaker	*Scianidae*	7.65	
Catfish	*Arridae*	0.46	
Grounper	*Serranidae*	0.15	11.11
Scad	*Carangidae*	1.68	
Trevally	*Carangidae*	2.45	
Mullet	*Mugilidae*	0.15	
Catfish	*Plotosidae*	2.45	
Sillago	*Sillaginidae*	1.99	
Toungefish	*Cynoglossidae*	25.08	
Spider conch	*Strombidae*	0.76	
Cockle	*Arcidae*	3.06	
Mantis shrimp	*Gonodactylidae*	52.75	74.08
Shrimp	*Penaeidae*	0.15	14.81
Prawn	*Penaeidae*	0.76	
Mudcrab	*Portunidae*	0.46	
	total	100	100

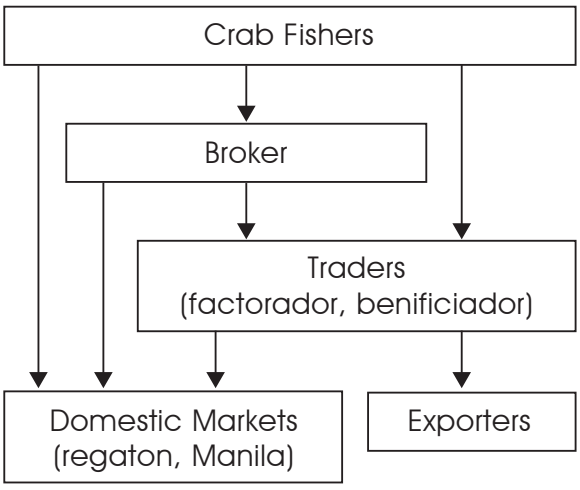

Fig. 8. Market distribution for swimming crabs in SMB and SB.

Problems and Issues

The problems besetting crab fishers in SB and SMB are quite similar with the exception of *Red Tide,* which has occurred in SB for quite a long time now. Common in these fishing grounds are the recurring problems associated with declining fishery resources, habitat destruction and siltation, overfishing, conflict among resource users, no alternative livelihood, poverty and increasing population, weak law enforcement and uncoordinated efforts of LGU's and climate change. Other complaints from fishers include bad weather or typhoons that often result in loss of fishing gears and the high cost of fuel and low prices for the catch. These threaten the resources and the lives of the people who largely dependent on this resource for their livelihood.

Careful analysis of these problems shows that some of them are actually symptoms while others are catalysts, a motor-driver and a buffer. For instance, overfishing, habitat destruction and siltation are symptoms of diminishing resources or declining fish catch problems, while education, population, poverty, the uncoordinated efforts of LGU and climate change are critical factors that may bring about change for the better. The buffer that might have prevented the problem is the availability of alternative livelihoods. Finally, the active element with predictable impacts is the availability of funds and logistics which LGU's often do not have.

Summary and Conclusions

The fisheries for marine crabs in SMB and SB is one of the major exploited resources that contributes to the employment and livelihood of fishers. Blue crab constitutes the major exploited species (98% of the total catch) and other crab species are caught in smaller quantities (i.e. Christian crab, three-spotted swimming crab, mud crab and by-catch). These species are caught predominantly using CGN, CLN and CP. Interestingly, Christian crabs, though only representing about 2% of the total catch, are becoming a high-value stock with a premium price of Php 1,200/kg in local live markets, making them the most sought after species.

Findings reveal that all the biological parameters computed using the software FISAT (Gayanilo *et al*., 1996), point to the fact that the fisheries for *P. pelagicus* and *C. feriata* stock are overexploited. Reckoning from the problems experienced by fisher's, it could be deduced that the fishing ground is indeed overfished. It should be noted that at present there are no effective management measures at work where the species are caught.

Recommendations

Considering the finding of this negative exploitation trend experienced in fishing grounds as evidenced by the high exploitation rate ($E_{cur} = 0.45$) and from the observed declining catch of crab fishers plus the sad reality of the absence of effective management measures at work in these fishing grounds, the following practical options are recommended for the concerned LGUs in SMB and SB together with the Integrated Fisheries and Aquatic Resource Management Council (IFARMC) and fishers to manage and save the remaining wild population before it is too late:

1. Reduction of fishing effort proportional to excess exploitation level. This option will reduce the fishing pressure and give time for stock replenishment.
2. Close the season during periods of peak reproductive activity for *C. feriata* particularly in December and January where higher percentages of GSI, mature, and gravid crabs were observed. This will likewise reduce fishing pressure and provide opportunity for the spawning stock to propagate and contribute to the next generation of marine crabs.
3. No taking of egg-bearing swimming crabs. Gravid crabs caught should be released immediately after catching. It should be noted that a female *C. feriata* with CW 8.3 cm to 15 cm produce about 1,513,660 to 6,357,133. Should only 25% of these eggs are allowed to spawn, hatched and grow to adult crab, some 378,415-1,589,283 will be produced for the benefit of a substantial number of fishers.
4. Egg-bearing swimming crabs should be held in an improvised spawning tank and allowed to hatch with the larvae returned to the fishing ground or Marine Protected Areas (MPA) to grow naturally.

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Letter from GSKS Alumni 3

A Step Towards Interdisciplinary Education in Environmental Studies

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Japan has always been one of the world's most fascinating countries. Besides its beautiful nature, appealing culture and colourful lifestyle that impressed most of us, I was blessed to be given the opportunity to embrace these life changing and memorable experiences in Japan especially in Kochi Prefecture. I have many fond memories of Kochi (Tosa) City which is rich in its own culture and history. Kochi University, especially the Graduate School of Kuroshio Science, has provided me the opportunity to nurture and gain new knowledge for studies in the field of environmental science.

Kuroshio Science as a New Frontier

The Graduate School of Kuroshio Science, Kochi University is a graduate school that provided an opportunity for those who are interested in pursuing their postgraduate studies in the doctoral course in the field of environmental science. The multidisciplinary nature of the graduate school provides a gateway for gaining much in-depth knowledge on the needs of cross-sectorial initiatives in solving issues regarding the environmental condition of not only the countries along the Kuroshio current but also other regions in Southeast Asia. It didn't take me much time to decide to join the Graduate School as it offers an opportunity to pursue multidisciplinary research in both natural and social sciences. Foremost, the Graduate School provides a capacity building initiative which aims at enhancing opportunities for training, education and joint research towards generating interdisciplinary knowledge and skills, for the practice of managing the environment in a sustainable manner. These are essential as a platform for the students to adopt an integrated and holistic approach in addressing environmental issues to attain sustainable development, especially in the Asian region.

Moreover, the purpose of ensuring that resources are used sustainably while striving for economic development is inevitable. In line with global needs for promotion of a safe, healthy and productive environment for present and future generations by promoting sustainable lifestyles which endured the needs for conservation of a unique and diverse natural heritage, the interdisciplinary nature of the programme offered by the Graduate School of Kuroshio Science, has provided me some critical insights in fulfilling the needs of society via enhancing the level of environmental awareness and civic consciousness among the public.

Research at Universiti Malaysia Sarawak

Since graduating from the Graduate School in 2009, I am currently attached to the Faculty of Resource Science & Technology, Universiti Malaysia Sarawak as one of their teaching staff. Among my daily duties are to attend to the teaching and learning activities of the University and at the same time, conduct scientific research for the benefit of the general research community, especially in Sarawak. Other than being involved in the academic-related responsibilities in the University, I have also been entrusted with administration duties in the Faculty. As an academician in an institute of higher learning, it is a demanding career as it involves great responsibilities to nurture and produce quality human capital for the benefit of our country.

My current research activity is on the efforts to rehabilitate the depleted tropical rainforests of Sarawak. Recent years have shown about an abrupt decrease of mature tropical rainforests in Sarawak, which has been subjected to prolonged overexploitation of forest resources for development purposes. Since such activity may lead to the reduction in the quality of the existing tropical forest in Sarawak, efforts in rehabilitating as well as restoring the tropical rainforests are essential. Adoption of reforestation activities in such areas is found to be indispensable in preventing further loss of biodiversity under tropical rainforest ecosystems. As

an option, reforestation through plantation forestry by planting indigenous species is considered to be one of the effective ways to accelerate the recovery of the original ecosystem. For the humid tropics of Sarawak, Malaysia, Dipterocarp species are the predominant tree species of the upper canopy of its rainforests, which are suitable for reforestation under artificial planting efforts due to their importance as one of the most significant climax tree species.

Along with the Forest Department, Sarawak, this forest rehabilitation project is financially supported by several agencies and organizations from Japan under the flagship of the Japan-Malaysia Association (JMA). With the participation and co-operation of various parties, our main task is to conduct ecological research in the existing forest rehabilitation areas and provide fundamental scientific information on the suitability of the current reforestation activities in restoring the tropical forests.

Future Prospectives for Kuroshio-Relaed Studies

Having graduated from the Graduate School of Kuroshio Science few years ago, I still keep in touch with the respective professors from the School, may it be regarding research collaboration participation or contribution to attend symposiums for instance the upcoming 7th International Symposium of Kuroshio Science which will be held at the University of Tanjungpura, Indonesia. Previously, I was invited to participate in the previous Kuroshio Symposium held in Kochi, Japan (2010) and Kaohsiung, Taiwan (2011). It was an excellent opportunity for me to gain and share valuable opinions and information regarding our research work and at the same time, provide platform for expanding research networks especially among researchers of the various fields of study in Asia.

Going abroad was definitely a turning point in my life, and gave me so much independence and growth coming into my young adulthood. I have many fond memories of the period during which I studied at Kochi University, especially in the Graduate School of Kuroshio Science. It was an invaluable and life-changing experience that enhanced my academic goals and inspired me to make full use of the knowledge gained for society. Other than returning back to my home country with more than pictures, souvenirs, and memories of life in Kochi; my educational experiences abroad contributed to an overall change in my academic and personal goals. The experience of being in a different culture, using a foreign language and adapting to a new environment has transpired me to develop an appreciation for differences in cultures and an interest in how these differences affect interactions among people of different backgrounds.

Studying at Kochi University has become a foundation for my academic and career goals, and has given me the drive to develop various skills and obtain new knowledge to internationalize my career in the academic world.

Note:

Dr. Soeparno, Department Secretary and Lecturer of Faculty of Agriculture, Gadjah Mada University in Yogyakarta, Indonesia, passed away on August 30, 2013. He had joined Kochi University's Graduate School of Kuroshio Science in April 2009 as a Ph.D. candidate under a scholarship sponsored by the Government of Indonesia. During his term of study in our Graduate School, he devoted himself to enhancing his knowledge in the field of fish ecology through comparative analysis between Japan and Indonesia. He obtained his Ph.D. following the completion of his excellent dissertation on "the Ecology of Juveniles of Coral Reef Fishes Using Otolith Increments" in March 2012 from Kochi University. He was popular among and respected by all of his colleagues for his patience, steadfastness and honesty. We are greatly saddened by his early departure.