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Blue swimming crab (*Portunus pelagicus*) catch and fishing effort: Perspective of crabbers in the northern Catanduanes, Philippines

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Abstract

Crab fishermen in Northern Catanduanes primarily rely on crab fishing for income. This study focused on the perspectives of crab fishermen in Northern Catanduanes regarding the catch and effort of blue swimming crab from February to May 2023. Results showed that crab fishers with an age range of 19–75 years old and an average of 12.5 years of crabbing used three fishing gears: a bottom-set gill net (BSGN), a crab pot (CP), and a crab lift net (CLN). The catch composition of BSGN in Northern Catanduanes showed that 56.89% were blue swimming crabs, with 43.11% being by-catch species including parrot fish, mullet, lobster, siganids, and others. In contrast, the catch composition of Crab Pots (CP) was 61.67% blue swimming crabs and 38.33% by-catch, including shrimp, lobster, prawns, and other fish. However, the catch composition in CLN showed a lower proportion of target catch (37.50%) compared to by-catch. The peak fishing season for most municipalities occurred between May and July, which coincides with Habagat, while the lean season varied from October to February. The catch per unit effort (CPUE) of the BSGN ranged from 0.20-0.46 kg/segment/hour, which was higher in contrast to the CPUE of CP (0.01-0.11 kg/cp/hour) and CLN (0.04-0.20 kg/liftnet/hour). An estimated annual production of BSC in Northern Catanduanes was recorded at 697.21 metric tons during the peak season and 119.47 metric tons during the lean season. Therefore, the BSC fisheries are threatened, and preventative steps are needed, including reducing fishing pressure, practicing single-ply nets with larger mesh sizes, finding alternate sources of income, and raising awareness through campaigns like IEC materials.

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Introduction

The blue swimming crab (BSC) is a commercially important species both domestically and internationally. It is locally known as “kasag” (Bicol), "alimasag" (Tagalog), and "lambay" (Bisaya).This species belonged to the Portunidae family. The texture of the carapace was rough (Kailola *et al.*, 1993). This crustacean supports the small scale fishers in livelihoods which significantly contribute to the income and sustenance of coastal communities particularly in Northern Catanduanes where blue swimming crab fishing is prominent. Given its great demand and economic value, BSC faced commercial competition from other aquatic items, such as mud crab. Approximately 77% of the Philippines' crab production was exported (Ingles 2004), primarily to Taiwan, Hong Kong, Japan, and the USA (Camacho and Aypa, 2001). The crabs were either sold live or as processed products locally.

In Bicol Region, the production was predominantly from Camarines Sur, Masbate, and Sorsogon. Although there has been an increase in production from 2010 to 2018, reaching 5210 mt in 2010 to 6105 mt in 2018, but dropped to 5524 mt in 2019 (PSA, 2020 as cited by Yap, 2020). Nieves *et al.* (2013) noted an overexploitation and declining catch rates, estimating an annual production of 524.90 metric tons in San Miguel Bay. Moreover, Ingles (2004) also highlighted fluctuating trends in crab production, with a general decline over the years. Its high demand has led to intensive fishing activities, raising concerns about overexploitation and the long-term viability of crab populations. Sustainable management practices are essential to ensure the continued availability of this resource and the livelihoods it supports.

Given the crucial contribution of BSC to coastal communities, assessing its current status in Northern Catanduanes is imperative. Furthermore, understanding fishers' perceptions and knowledge is vital for effective fisheries management (Macale and Nieves, 2019). Therefore, this study focuses on crabbers' perspectives regarding BSC catch and effort in Northern Catanduanes, Philippines.

Materials and methods

Study area

Northern Catanduanes is located in the northeastern part of the province of Catanduanes, Philippines. It comprises the four municipalities of Pandan, Bagamanoc, Viga, and Panganiban. Its rugged coastline, rolling hills, and verdant forests characterize the region. It is also home to a diverse range of marine life, including blue swimming crabs (*Portunus pelagicus*), which are the subject of the current research. Fishing is a major source of livelihood for the people of Northern Catanduanes. Blue swimming crabs are one of the most important target species or fishers in the region (Fig. 1).

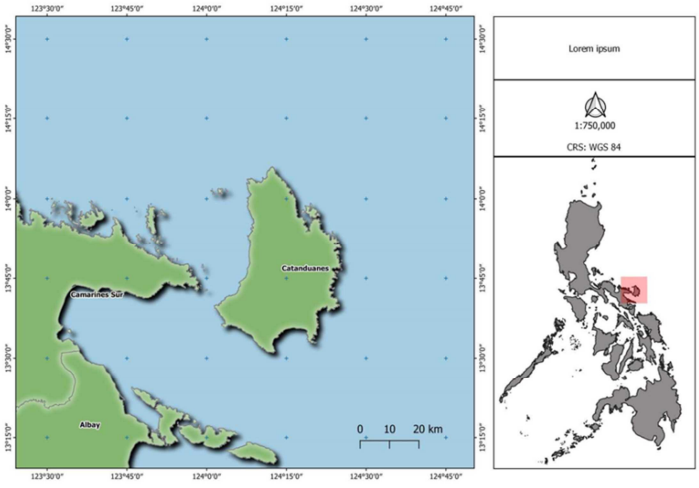

Fig. 1. Map of the study area in northern Catanduanes, covering the municipalities of Pandan, Bagamanoc, Viga, and Panganiban

Data collection

A survey questionnaire that was modified from the Philippine Blue Crab Management Plan from BFAR, (2013) was used to collect data to the 208 crab fishers of the Northern Catanduanes. An additional question about fishers profile, fishing gears used, by-catch, catch and estimated annual production were included in the questionnaire to collect more data specifically for monitoring blue crabs. The questions were translated to Bicol dialect during the interview.

Statistical

The number of fishers and fishing gears used was determined through interviews with fishers and gear inspections. The crab fishers profile, catch, and by-catch composition were analysed using descriptive statistics.

The annual production was estimated by determining the average catch per trip per gear, multiplied by the number of trips, and the number of months of operations, multiplied by the number of fishing gears operating. The annual production of each gear and the total annual blue swimming crab production of all fishing gears operating in the Northern part of Catanduanes, were computed from:

$$\text{Annual Production} = ACTG * NFTMO * NFMYO * NG$$

Where:

ACTG - average catch/trip/gear

NFTMO - number of fishing trips per month

NFMYO - number of fishing months per year of operation

NG - number of gears

On the other hand, the data for CPUE was analyzed based on the formula computation of De la Cruz *et al.* (2015) study:

Gillnets were standardized at 50 m segment[1] and an average of 12-hour soaking time.

Gillnets CPUE= (Total daily catch)/(Total no. of segments)

Mean soaking time for crab pot is 10 hours.

Crab pots CPUE= (Total daily catch (kg))/(Total no. of pots)

Mean soaking time for crab lift net is 5 hours.

Lift nets CPUE=(Total daily catch(kg))/(Total no. of lift nets)

Results and discussion

Fishers profile and fishing gears used

Crab fishers in Northern Catanduanes rely mostly their source of income from crab fishing. A total of 208 male crab fishers were interviewed in each municipality with 52 crab fishers with the age ranged of 19-75 years old and an average 12.5 years of crabbing. The crab fishing practices in Northern Catanduanes revealed that gear selection varied by municipality. The fishing gears employed in the Northern Catanduanes were Bottom Set Gill Net (BSGN), crab pot (CP) and crab lift net (CLN) (Fig. 2A-D).

Bottom set gill net (BSGN)

Crab pot (CP) made of tire wire

Crab pot (CP) made of bamboo strips

Crab lift net (CLN)

Fig. 2A-D. Fishing gears

In each Municipality, there were 44 (Viga), 43 (Viga), 34 (Panganiban), and 13 (Pandan) bottom set gill net (BSGN) users. On the other hand, crab pot (CP) and crab lift net (CLN) number in each municipality differs in each municipality as shown in Table 1. Bottom set gill nets (BSGN) were the dominant gear in all locations except Pandan, likely due to their simplicity and lack of bait requirement. This preference aligns with economic factors as BSGN construction materials are potentially cheaper and more accessible.

Table 1. Type and Number of Gear Units for Crabbing in Northern Catanduanes, Philippines, 2023

Location	Bottom set gill net	Crab pot	Crab lift net	Total
Bagamanoc	43	0	9	52
Viga	44	4	4	52
Panganiban	34	10	8	52
Pandan	13	25	14	52
Total	134	39	35	208

Moreover, educational background and training were relevant to the fishing gear preferences of the crab fishers. Among BSGN users, completion of high school was more common in Bagamanoc (80.77%), Viga (65.38%), Panganiban (48.08%), and Pandan (21.15%). Additionally, participations in fisheries agency training programs such as BSGN assembly and mud crab fattening techniques were more likely to have learned. However, there were significant differences in terms of income in crab fishing in the different locations in which Viga had the highest income at Php 13000.00 compared to Pandan with the lowest income of Php 3932.70. The income of the crab fishers per municipality differs because of the type of fishing gears used, fishing effort, location of fishing grounds and selling price of BSC. Currently, the market for BSC in Catanduanes is primarily confined to local buyers and consumers.

As a result, the crabs were only sold within the region, restricting the potential market and preventing fishermen from obtaining fair prices for their catches. The selling price of BSC in Catanduanes ranged from Php.150.00-180.00, which is lower compared to the prices in Sorsogon and San Miguel (Nieves *et al.,* 2013). The relatively small market access in Catanduanes makes it challenging to attract the attention of larger buyers.

However, Pandan crabbers had the highest income from other sources, with a mean income of Php. 12,567.00, followed by Bagamanoc, with a mean income of Php. 11,413.00. These two municipalities were not solely reliant on crab fishing but also engaged in tuna and lobster fishing, contributing to their monthly income by 68% (Bagamanoc) and 76% (Pandan). Panganiban and Viga also depended on farming activities such as copra farming and abaca farming, which augmented the monthly income by 26% and 19%, respectively.

Catch and by-catch composition

In the BSC fisheries, by catch is a significant issue. When non-target species are accidentally caught in fishing gear, it is known as bycatch. The catch composition of BSGN in Northern Catanduanes revealed that 56.89 % were the target catch, blue swimming crabs and 43. 11 % by-catch species composed parrot fish, mullets, lobsters, siganids, threadfin breams, slipmouths, sole fish, bar tail flat head fish, goat fish and etc. Given the crab fishers in Northern Catanduanes' use of 2-ply nets, which combined two net, one for BSC and the other for finfish has resulted in almost the same targets and bycatch for BSGN. The two ply technique is unintentionally harming the environment and perhaps lowering populations of other valued species.

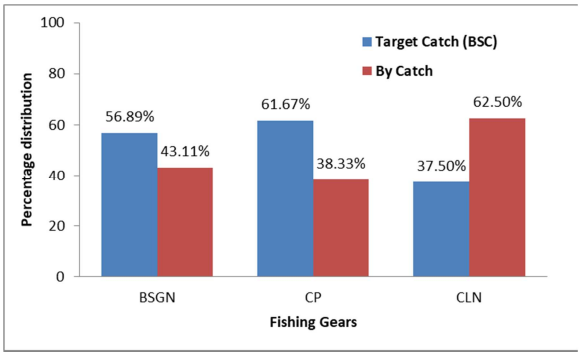

Fig. 3. Catch and by-catch composition of fishing gears used in Northern Catanduanes, 202

While, the CP gear resulted to a catch composition of 61.67% blue swimming crabs and 38.33% by-catch (shrimp, lobster, prawn and some fishes) and contradict to the percentage of catch in CLN shows lesser target catch (37.50%) than the by catch (Fig. 3).

The by-catch composition of the said fishing gears consists of a total of 18 families belonging to three (3) phyla such as Phylum Chordata, Arthropoda, and Mollusca. Thirteen (13) of the 18 families belong to Chordata, six (4) are Mollusca, and one (1) was Arthropoda. The by-catch of CP and CLN were dominated by crustaceans with 74% and 93%, respectively. Finfishes (64%) were the most common bycatch in the BSGN which belongs to Phylum Chordata.

Additionally, Table 2 provides a comprehensive list of the families of bycatch species caught using bottom set gillnets, crab pot nets, and crab lift nets in the crabbing areas of Northern Catandaunes. Among the various fishing methods, the top three bycatch species in bottom-set gillnets were the Bar three-spot swimming crab (17.89%), flying fish (12.74%), and mullet (9.39%). In contrast, the dominant bycatch composition in crab pots was penaeid shrimp (36.76%), while the crab lift net predominantly caught three-spotted swimming crabs (37.50%).

Catch effort and estimated annual production

The catch effort and production of BSC varies on seasonality. The peak and lean fishing season of BSC in Northern Catanduanes occurred during the months of March to September and October to February, respectively. Moreover, the number of crab fishing operations for peak seasons are 20-30 days (BSGN), 20-25 days (CP and CLN), respectively. While during lean season the number of days spent were for BSGN, CP and CLN were 15-20 days, 5-10 days and 5 days, respectively.

Table 2. By-catch composition of fishing gears in northern Catanduanes, 2023

Common names	Family	Catch composition (%)		
		Gillnet	Crab pot	Crab lift net
Parrot fish	*Scaridae*	6.07		
Mulllet	*Mugillidae*	9.39	5.64	
Bar tail flat head fish	*Synodontidae*	4.01		
Silver biddy	*Gerreidae*	2.12		
Siganids	*Siganidae*	7.37		
Goatfish	*Mullidae*	3.12		
Flatfishes	*Platycephalidae*	1.39		
Sole fish/ Tounge	*Pleuronectidae*	4.51		
Trevally	*Carangidae*	2.77		
Slipmouth fish	*Leiognathidae*	2.08		
Grouper	*Serranidae*	1.39	5.64	
Thread fin bream	*Nemipteridae*	6.93	14.78	7.49
Flying fish	*Exocoetidae*	12.74		
Green tiger prawn	*Penaidae*	4.00	10.87	
Octopus	*Octopidae*	1.09		
Shrimp	*Penaidae*	1.87	36.76	23.76
Lobster	Palinuridae	7.89		
Mantis shrimp	Odontodactylidae	1.12		
Mangrove crab	*Portunidae*	2.25	11.29	31.25
Three spot swimming crab	*Portunidae*	17.89	15.02	37.5
Total		100.00	100.00	100.00

Table 3. Estimated annual production by gear in Northern Catanduanes during Peak season (in metric ton)

Area	Bottom set gill net	Crab pot	Crab lift net	Total
Bagamanoc	232.2		6.48	238.68
Viga	266.24	4.16	3.83	274.23
Panganiban	76.5	11.81	6.72	95.03
Pandan	11.7	6.8	13.1	31.6
Total	586.64	22.77	30.13	639.54

Table 4. Estimated annual production by gear in Northern Catanduanes during lean season (in metric ton)

Area	Bottom set gill net	Crab pot	Crab lift net	Total
Bagamanoc	16.68		0.68	17.36
Viga	36.99	2.02	1.12	40.13
Panganiban	21.42	2.7	1.44	25.56
Pandan	3.8	12.6	6.8	23.2
Total	78.89	17.32	10.04	106.25

In addition the CPUE of the BSGN ranged from 0.20-0.46 kg/segment/hour which was higher in contrast to the CPUE of CP (0.01- 0.11 kg/cp/hour) and CLN (0.04-0.20 kg/liftnet/hour). This means that BSGN gear is generally more effective in catching blue swimming crabs during peak and lean season. This is in contrast to San Miguel bay, the mean catch for CLN and CP was 6.0 kg/trip and 12.5 kg/trip, respectively which were relatively higher to the catch per trip recorded in the present study (Nieves *et al.,* 2013). In addition, Samar and Letye, as 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 higher than the mean CPUE recorded in the present study, implying an overexploitation of marine crabs in most fishing grounds in the country.

On the other hand, Table 3 and 4 shows the estimated annual production during the peak season and lean season in Northern Catanduanes and had an estimated 639.54 metric tons and 106.25 (mt) of blue swimming crabs, respectively. Northern Catanduanes demonstrates a significant 17.93% increase in annual Blue Swimming Crab production compared to San Miguel Bay, Camarines Norte (524.90 mt). However, Sorsogon Bay maintains dominance with a superior production level of 713.66 mt, exceeding Northern Catanduanes by 11.58% (Nieves et al., 2013). But according to the data of Philippine Statistics Authority, the volume of production of BSC is 71.74% higher to the present study which is 2263.08 mt. Moreover, the Fig. 4 shows a decreasing trend of BSC production for the past ten years from 2014-2023.

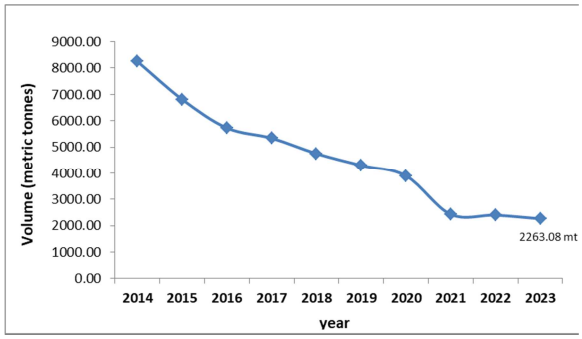

Fig. 4. Production volume of blue swimming crabs in Catanduanes from 2014 to 2023 (Source: openstat.psa.gov.ph)

Conclusion

In Northern Catanduanes, BSC Fisheries play a significant role as a source of income, particularly for high school graduates who primarily engage in crabbing. The major fishing gears used in the area include bottom set gillnets (BSGN), crab pots (CP), and crab lift nets (CLN). Among these, BSGNs are the most commonly used due to their simplicity and affordability. While CPs and CLNs are less common, they offer some selectivity in catching target species.

However, BSGNs, especially those using the "2-ply" technique, have a high by catch rate, catching many non-target species along with the target blue swimming crabs. This raises environmental concerns and potential overfishing of these unintended catches.

The study also indicates a decreasing trend on the annual production with an estimated of 639 metric tons during the peak season and 106 metric tons during the lean season due to increase fishing pressures and crab fishers dependents on crab fishing. Hence, it is recommended to practice the used of single-ply nets with larger mesh sizes. Provide alternative income sources or financial assistance to supplement their income. These will help reduce by catch and pressure on crab populations and give crab stocks a chance to recover.

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