ORIGINAL RESEARCH

Status of crabbers in northern Catanduanes, Philippines, and their perspectives on national policies and plans for the blue swimming crab

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ABSTRACT. Marine resources in the Philippines are rapidly declining due to overfishing and habitat degradation, threatening biodiversity and the livelihoods of coastal communities and small-scale fishers. Crustaceans, like the blue swimming crab (*Portunus pelagicus*), which serve as a vital source of income for small-scale fishers, are among the most affected. To combat the depletion of fishery resources, the Philippine government implemented the National Blue Swimming Crab Policies and Plans (NBSCPP). This study focused on the perspectives of crabbers in northern Catanduanes to provide insights into the implementation and impact of the NBSCPP at the community level. Data were collected through interviews with 208 crabbers using a modified survey questionnaire based on the NBSCPP framework. Results revealed that the income of crabbers and their families fell significantly below the poverty threshold, a challenge further compounded by low levels of formal education, which limited their opportunities for alternative livelihoods. Crabbers demonstrated a general awareness of conservation and management policies, particularly on closed fishing seasons and size limits, and exhibited a positive attitude toward compliance and participation in conservation initiatives. However, socio-demographic characteristics such as education and income were not significantly associated with crabbers' awareness or attitudes toward policy implementation. To enhance awareness and foster sustainable practices, the study recommended intensified information, education, and communication campaigns, stricter enforcement of regulations, and the development of alternative livelihood programs. These measures are critical to ensuring the long-term sustainability of the blue swimming crab population and supporting the livelihoods of communities in northern Catanduanes.

Key words: Socioeconomic, awareness, attitudes.

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Situación de los pescadores de cangrejos en el norte de Catanduanes, Filipinas, y sus perspectivas sobre las políticas y planes nacionales para el cangrejo azul

RESUMEN. Los recursos marinos en Filipinas están disminuyendo rápidamente debido a la sobrepesca y la degradación del hábitat, lo que amenaza la biodiversidad y los medios de vida de las comunidades costeras y los pescadores artesanales. Los crustáceos, como el cangrejo azul (*Portunus pelagicus*), que constituyen una fuente vital de ingresos para los pescadores artesanales, se encuentran entre los más afectados. Para combatir el agotamiento de los recursos pesqueros, el gobierno filipino implementó las Políticas y Planes Nacionales para el Cangrejo Azul (NBSCPP). Este estudio se centró en las perspectivas de los cangrejeros del norte de Catanduanes para comprender la implementación y el impacto de las NBSCPP a nivel comunitario. Los datos se recopilaron mediante entrevistas con 208 cangrejeros utilizando un cuestionario de encuesta modificado basado en el marco de la NBSCPP. Los resultados revelaron que los ingresos de los cangrejeros y sus familias se situaban significativamente por debajo del umbral de pobreza, un desafío agravado por los bajos niveles de educación

formal, que limitaban sus oportunidades de obtener medios de vida alternativos. Los cangrejeros demostraron un conocimiento general de las políticas de conservación y gestión, en particular sobre las temporadas de veda y los límites de tamaño, y mostraron una actitud positiva hacia el cumplimiento y la participación en iniciativas de conservación. Sin embargo, las características sociodemográficas, como la educación y los ingresos, no se asociaron significativamente con el conocimiento ni las actitudes de los cangrejeros hacia la implementación de políticas. Para fomentar la concienciación y prácticas sostenibles, el estudio recomendó intensificar las campañas de información, educación y comunicación, una aplicación más estricta de las regulaciones y el desarrollo de programas de medios de vida alternativos. Estas medidas son fundamentales para garantizar la sostenibilidad a largo plazo de la población de cangrejo azul y apoyar los medios de vida de las comunidades del norte de Catanduanes.

Palabras clave: Socioeconómico, concientización, actitudes.

INTRODUCTION

The overexploitation and degradation of marine resources have become pressing global issues, threatening biodiversity, ecosystem functions, and the livelihoods of coastal communities dependent on these resources. In the Philippines, marine fisheries face similar challenges, including declining fish stocks and habitat degradation, primarily due to overfishing, destructive fishing methods, and limited implementation of management measures (Gonzales et al. 2014a, 2014b, 2014c; Palla et al. 2015; Gonzales and Gonzales 2016; Gonzales et al. 2021; Malolos et al. 2024). These challenges have particularly affected crustaceans, such as the blue swimming crab (*Portunus pelagicus*), an economically valuable species for small-scale fisheries across the country. The blue swimming crab (BSC) is a vital resource in the Philippines. It contributes significantly to the fisheries sector, with approximately 77% of the crab production exported, indicating its importance in the global market (Ingles 2003). The BSC fisheries are predominantly small-scale, employing artisanal methods such as gleaning, bamboo traps, crab pots, crab lift nets, and bottom-set gillnets (Mesa et al. 2018). Within the Bicol Region, the species ranks third in terms of production volume, with primary production areas in Camarines Sur, Masbate, and Sorsogon (BAS 2008).

Despite its economic significance, the blue swimming crab population has experienced a worrying decline. The Philippine Statistics Authority (PSA 2020) reported a substantial drop in national production from 34,003.87 t in 2008 to 26,251.87 t in 2015. While production temporarily increased to 33,929.60 t in 2018, it fell again to 29,677.14 t in 2019. This decline has been attributed to overfishing, unsustainable fishing gears, and limited enforcement of conservation measures (BFAR 2013). To address this, the Bureau of Fisheries and Aquatic Resources (BFAR) developed the National Blue Swimming Crab Policies and Plan (NBSCPP), which aims to implement a precautionary approach for the sustainable management of BSC fisheries (BFAR 2013). Additionally, BFAR DA-DILG Joint Administrative Order no. 1, s. 2014 was introduced to regulate crab conservation efforts. However, despite these initiatives, violations of fisheries laws and unsustainable practices persist, undermining conservation efforts. Even before closed seasons for crustaceans are enforced in the Philippines, several studies have already been conducted recommending policies based on their findings. For example, Nieves et al. (2015) proposed a closed season for Christian crabs (*Charybdis feriatus*), Mesa et al. (2018) suggested a closed season for blue swimming crabs (*P. pelagicus*) in San Miguel Bay, and Jumawan et al. (2020) recommended limiting mud crab harvesting from July to October in Panguil Bay.

Fisheries management involves the stewardship of both human and fisheries resources, guided by principles of good governance to ensure effective regulation (Palla et al. 2015). Effective manage-

ment relies on a solid foundation of knowledge, including species composition, distribution, fishing gear types, fish landings, stock abundance, and the spatial and temporal patterns of species occurrences (Palla et al. 2015). A key component in enhancing the management of BSC fisheries is active community involvement. Perceptions, awareness, and attitudes of resource users, particularly crabbers, play a vital role in shaping effective conservation strategies. Understanding their perspectives provides valuable insights into the challenges they face and highlights opportunities to promote sustainable practices. The objective of the study was to bridge a critical knowledge gap by examining the perspectives of crabbers in northern Catanduanes regarding the implementation of the NBSCPP covering the compliance with these regulations for sustainable management of the BSC fishery in that region. Specifically, it aimed to (1) determine the socioeconomic profile of crabbers in the area, and (2) assess their awareness and attitudes toward these national policies and plans. Findings are expected to inform the development of localized strategies to promote sustainable management of the BSC fisheries in northern Catanduanes.

MATERIALS AND METHODS

Study sites

Northern Catanduanes, situated in the northeastern portion of the province of Catanduanes, Philippines, encompasses the municipalities of Pandan, Bagamanoc, Viga, and Panganiban (Figure 1). The region is characterized by a rugged coastline, rolling hills, and lush forests, which contribute to its

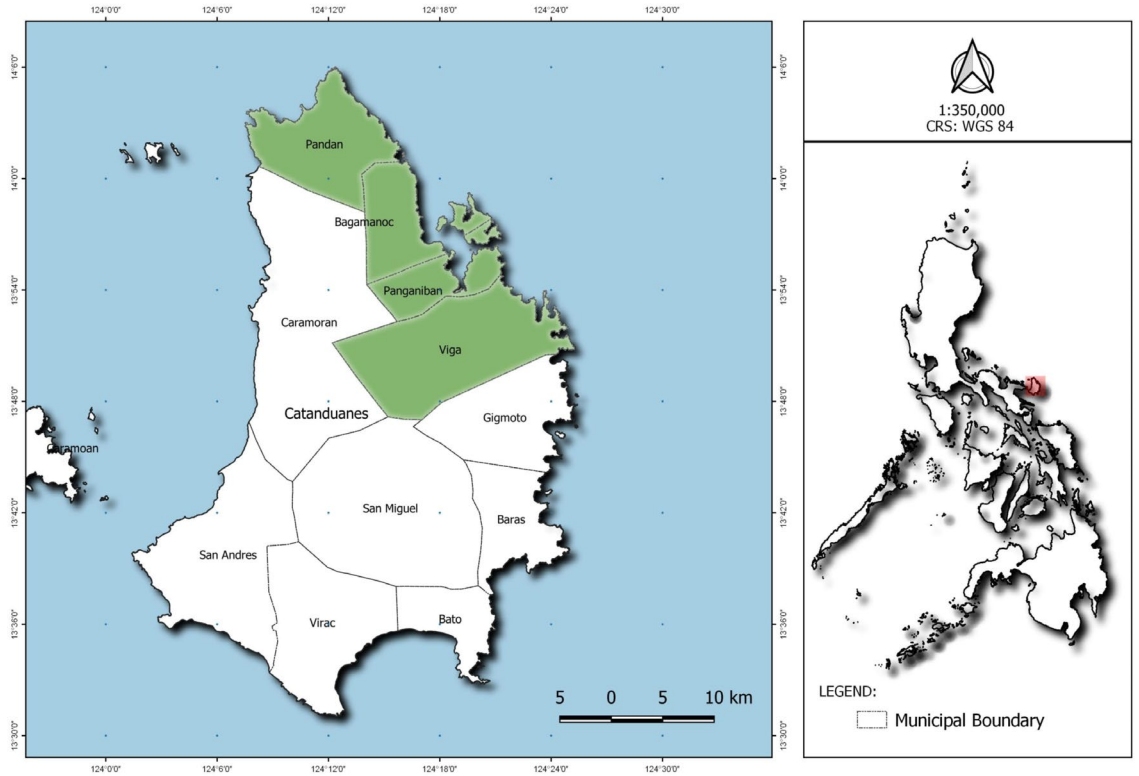

Figure 1. Study sites on the northeastern coast of Catanduanes, Philippines.

rich biodiversity. Fishing is a primary source of livelihood for communities in northern Catanduanes, with blue swimming crabs being one of the most economically significant target species. Crabbers employ various traditional and small-scale fishing methods to harvest this valuable resource, making it an ideal location for studying the socioeconomic and ecological aspects of the BSC.

Data collection

Data were collected through in-person, face-to-face interviews conducted from September to October 2024, using a modified survey questionnaire based on the NBSCPP framework. The survey instrument was divided into two main sections: (a) Socioeconomic profile, which gathered demographic and fisheries-related data, and (b) Awareness and perception of national policies and plans, which assessed crabbers' knowledge and attitudes toward regulatory measures and conservation efforts specified by the NBSCPP. To systematically evaluate awareness and attitudes, the second section of the questionnaire was structured around key regulatory and conservation components of the NBSCPP, including size regulations, gear restrictions, effort control measures, seasonal fishing closures, conservation practices, and post-harvest and trade regulations. A five-point Likert scale was employed: (1) Disagree, (2) Less Agree, (3) Quite Agree, (4) Agree, and (5) Strongly Agree, and data were processed as interval data in accordance with methodological guidance of Awang et al. (2016), enabling the computation and interpretation of mean scores across items. To ensure clarity and cultural relevance, the questionnaire was translated into the local Bicol dialect during interviews. Prior to participation, all respondents were informed of the purpose and scope of the study. Ethical procedures were strictly followed.

Data analysis

To address the research objectives, a combination of descriptive and inferential statistical methods was applied. Descriptive statistics, including frequencies, percentages, means and standard deviations were used to summarize the socioeconomic profile of crabbers in northern Catanduanes. Categorical variables such as gender, marital status, educational attainment, and fishing gear type were analyzed using frequencies and percentages, while continuous variables like age, household size, income, and fishing experience were analyzed using means and standard deviations.

To assess the crabbers' awareness and attitudes toward the NBSCPP, responses to a 5-point Likert scale were analyzed using weighted mean scores. This approach quantified the overall levels of awareness and attitudes regarding the implementation of national regulations for sustainable BSC fisheries management. Inferential statistical analyses were conducted to examine potential relationships between selected socioeconomic variables and levels of awareness and attitudes. The Pearson Product-Moment Correlation Coefficient was used to identify associations among continuous variables such as age, income, and fishing experience. Furthermore, a one-way Analysis of Variance (ANOVA) was performed to determine whether there were significant differences in awareness and attitudes based on educational attainment. These analyses provided insights into how specific socioeconomic characteristics may influence perceptions and compliance with national BSC management policies.

RESULTS AND DISCUSSION

Socioeconomic profile of crabbers

Understanding the socioeconomic profile of crabbers is essential in contextualizing their livelihoods, challenges, and dependence on crab fishing as a primary source of income. All 280 respondents in the survey were male (100%). Crab fishing was

their primary source of income. This reflects a gendered division of labor common in many fishing communities, where men predominantly perform physically demanding tasks such as operating boats, setting and retrieving crab traps, and maintaining fishing gear. According to Ariwidodo (2016), this pattern mirrors traditional gender roles in fishing villages, where men are primarily responsible for the capture phase of the fishing process and hold greater access to productive assets such as boats and gear. Women typically take on less visible but equally essential roles, such as seafood processing, marketing, and managing household finances (Ariwidodo 2016; Torell et al. 2021). This dynamic indicates that fishing remains a male-dominated sector in the Philippines, largely due to its physical demands, high risks, and prevailing cultural expectations surrounding gender roles.

Results of the socioeconomic profile of crabbers were presented separately to allow for clearer analysis and more precise interpretation of variables related to policy awareness and livelihood vulnerability. The mean age of crabbers ranged from 49.06 ± 17.73 years in Panganiban to 52.19 ± 16.47 years in Bagamanoc (Table 1). This consistency across municipalities suggests that crab fishing attracts middle-aged individuals who rely on it as a stable livelihood. Most of crabbers were older, indicating that they have greater experience and established routines guiding their fishing practices. Additionally, as Macusi et al. (2022) highlighted in various southeast Asian coastal regions, an older age demographic and a probable lack of youth engagement can hinder the transfer of traditional fishing knowledge to younger generations, impacting the cultural and economic continuity of fishing. Muddassir et al. (2019) suggested that older crabbers may be less willing to adopting advanced fishing techniques or pursue alternative jobs, potentially limiting their ability to adapt to changing environmental or economic conditions. The age of crabbers and the number of years in crab fishing have a strong

Table 1. Mean (± SD) socioeconomic profile of crabbers in northern Catanduanes, Philippines, in 2024.

Variables	Municipality	Mean ± SD
Age	Bagamanoc	$52.19^{a} \pm 16.47$
	Panganiban	$49.06^{a} \pm 17.73$
	Viga	$51.00^{a} \pm 15.22$
	Pandan	$51.62^{a} \pm 13.81$
Number of years of residency	Bagamanoc	$50.29^{a} \pm 17.88$
	Panganiban	$46.31^{a} \pm 18.07$
	Viga	$50.69^{a} \pm 15.75$
	Pandan	$48.29^{a} \pm 14.57$
Number of years in fishing	Bagamanoc	$8.13^{a} \pm 6.38$
	Panganiban	$16.35^{b} \pm 10.81$
	Viga	$18.00^{c} \pm 9.75$
	Pandan	$8.40^{a} \pm 6.70$
Monthly income (USD)	Bagamanoc	$92.95^{a} \pm 72.14$
	Panganiban	$207.96^{b} \pm 115.77$
	Viga	$229.47^{b} \pm 88.49$
	Pandan	$69.95^{a} \pm 76.41$

positive relationship ($r = 0.982$, $p < 0.001$), which implies that as age increases, the number of years spent as residents also increases. Furthermore, this relationship indicated that elder crabbers are likely to have accumulated more time fishing, which has improved their skills, knowledge of fishing practices, and understanding of environmental factors that influence crab populations. Moreover, the number of years of residency showed no significant differences among the municipalities, highlighting the long-standing presence and integration of these crabbers within their communities. The number of years spent fishing exhibited significant differences, with crabbers in Panganiban and Viga recording a significantly higher number of years in fishing compared to Bagamanoc and Pandan, which have similar values (8 years).

Monthly income varied significantly among municipalities, with Panganiban and Viga reporting higher mean incomes of USD 224.91 and USD 229.47, respectively (Table 1). Despite these figures, many families remain below the Philippine Statistics Authority's poverty line of USD 243.53 per month for a family of five (PSA 2023). This indicates that a significant proportion of crabbers and their families struggle to meet basic needs such as food, housing, and healthcare. According to the same source, fisherfolk continue to have the highest poverty rates among the basic sectors in 2021, with 30.6% poverty incidence. Based on the PSA report, there was a significant increase in the poverty incidence from 2018 to 2021 in most basic sectors, with fisherfolks experiencing the largest increase of 4.4%. Bagaipo and Napiere (2024) found that 58.9% of fisherfolks in a similar coastal community earned between USD 17.55 and USD 87.75 monthly, emphasizing the financial hardships faced by fishing households. These challenges highlight the economic vulnerability of crabbers in northern Catanduanes, which calls for targeted interventions to improve their standard of living. Results emphasize the urgent need for poverty alleviation programs, sustainable fisheries management, and the provision of alternative livelihoods to reduce overdependence on fishing. Addressing these socioeconomic challenges is critical to achieving long-term sustainability for both crabbers and the marine resources they rely on.

The educational attainment of crabbers has a significant impact on their income and quality of life (Table 2). Most crabbers are high school graduates, which limits their opportunities for higher-paying jobs. Employers often prefer college graduates over those with only a high school diploma, resulting in reduced career prospects for many crabbers. This is also affirmed by Espinas et al. (2024), who stated that the lack of formal education beyond high school severely limits alternative employment opportunities. This low income is also reflected in the type of housing materials used by the crabbers. The majority live in houses made of light materials, except in Viga, where 40.38% of houses are semi-concrete, and 44.23% are concrete. Light material houses are typically made with inexpensive, local available materials like bamboo and thatch, which may not offer durable shelter. The better housing conditions in Viga may be linked to additional sources of income beyond fishing, such as rice farming, Manila hemp farming, operating variety stores, village officials and others benefit from children who are already employed in stable jobs contributing to household income stability.

Crabbers' awareness towards the NBSCPP

In this study, awareness refers to the level of consciousness of crabbers regarding the implementation of policies and plans related to the BSC conservation. Results revealed that crabbers were aware of key regulations, such as the minimum carapace width (CW), limits on the number of crabbers allowed to operate in a given area, restrictions on fishing gear and depth, closed fishing season, and the requirement for monthly records (Table 3). High awareness of policies such as the closed season (AP7) and size limits (AP1) indicated the likelihood of compliance with these conservation measures. The mean value of 3.82 ± 0.82 suggests

Table 2. Percentage distribution of the educational attainment, housing materials, and boat ownership in northern Catanduanes municipalities.

Variables	Bagamanoc		Panganiban		Viga		Pandan	
	F	%	F	%	F	%	F	%
Educational attainment								
College graduate	0	0.00	2	3.85	4	7.69	0	0.00
College undergraduate	16	30.77	1	1.92	0	7.69	0	0.00
High school graduate	17	32.69	49	94.23	17	7.69	18	34.62
High school undergraduate	0	0.00	0	0.00	0	7.69	12	23.08
Elementary graduate	17	32.69	0	0.00	21	7.69	16	30.77
Elementary undergraduate	2	3.85	0	0.00	10	7.69	6	11.54
House materials								
Light material	34	65.38	31	59.62	8	15.38	40	76.92
Semi-concrete	12	23.08	15	28.85	21	40.38	8	15.38
Concrete	6	11.54	6	11.54	23	44.23	4	7.69
Boat ownership								
Yes	30	57.69	50	96.15	51	98.08	43	82.69
No	22	42.31	2	3.85	1	1.92	9	17.31
Total	52	100	52	100	52	100	52	100

that crabbers were educated about the minimum carapace width of 10.2 cm required for catching, collecting, and trading BSC. This awareness significantly impacts the population dynamics of the BSC, particularly by protecting juvenile crabs. Awareness of this regulation limits the harvest of immature crabs and aids in the effective management of crab stocks, which is crucial for preventing population collapses. Furthermore, studies have highlighted overexploitation rates of BSC in various regions, such as western Visayas at 0.68 (Mesa et al. 2018), San Miguel Bay at 0.60 (Nieves et al. 2015), and Asid Gulf at 0.79 (Bonaos et al. 2022). Exploitation rates exceeding 0.5 are considered indicative of overfishing. The high fishing pressures observed in these areas threaten the long-term sustainability of BSC fisheries. By raising awareness among crabbers, the risk of stock collapse can be reduced and better managed, contributing to the sustainable use of the resource.

Crabbers are aware of a limitation on the number of registered crabbers authorized to operate in specific areas inside Philippine waters (3.63 ± 1.12). Educating crabbers will help to regulate the number of registered crabbers, prevent overfishing and promote sustainable harvesting practices. Limiting entry into the fishery helps maintain a balance between fishing activities and the health of crab populations, which are vulnerable to overfishing. Crabbers have also expressed their awareness of regulations limiting the number of traps per vessel. These regulations aim to reduce fishing pressure on crab populations, allowing for better recovery rates and healthier ecosystems. This balance is essential

Table 3. Crabbers' awareness towards policy and plan implementations in northern Catanduanes. N = 208.

Awarness towards policy and plans	Mean ± SD	Interpretation	Qualitative description
AP1.The minimum carapace width of BSC allowed for catching, collecting, and trading is 10.2 cm	3.41 ± 0.82	Aware	Familiar with the policy or plan, showing a general understanding and likely adherence
AP2. The minimum mesh size for crab entangling nets (single layer only) is 11 cm, and for crab lift nets is 3 cm stretch mesh	3.38 ± 0.81	Neutral	Moderately informed about the policy or plan, with limited or unclear understanding and inconsistent adherence
AP3. Crab pots/traps must have a minimum hole diameter of 5 cm	2.81 ± 1.49	Neutral	Moderately informed about the policy or plan, with limited or unclear understanding and inconsistent adherence
AP4. There are limits on the number of registered crabbers allowed to operate in any areas in Philippine waters	3.63 ± 1.12	Aware	Familiar with the policy or plan, showing a general understanding and likely adherence
AP5. There is a limit on the number of crab pots/traps allowed per boat	4.05 ± 1.00	Aware	Familiar with the policy or plan, showing a general understanding and likely adherence
AP6.There is a limit on the length/depth and number of nets a fisher can own and operate	3.41 ± 0.99	Aware	Familiar with the policy or plan, showing a general understanding and likely adherence
AP7. A specific closed fishing season for BSC is implemented by municipality	3.45 ± 1.09	Aware	Familiar with the policy or plan, showing a general understanding and likely adherence
AP8. The establishment of holding cages for berried crabs is required	3.25 ± 1.20	Neutral	Moderately informed about the policy or plan, with limited or unclear understanding and inconsistent adherence
AP9. Monthly records must be kept by all BSC processors and those engaged in buying, selling, and processing	4.01 ± 1.16	Aware	Familiar with the policy or plan, showing a general understanding and likely adherence
AP10. Crab buyers, traders, and processors must secure an auxiliary invoice and Local Transport Permit (LTP) before shipping/transporting BSCs from buying stations and crab meat processors to processing plants	3.70 ± 1.04	Aware	Familiar with the policy or plan, showing a general understanding and likely adherence

for maintaining both economic activities in fisheries and ongoing conservation efforts.

The closed fishing season is an essential management tool designed to protect crabs during their breeding periods. Crabbers in northern Catanduanes have demonstrated awareness of the implementation of the closed season (3.4 5 ± 1.09), as mandated by the BFAR DA-DILG Joint Administrative Order No. 01/2014, which allows BSC populations to reproduce and replenish. Baco and Baco (2022) indicated that crabbers who understand the importance of closed seasons in promoting stock recovery are more likely to comply with these regulations. Studies have shown that the effective enforcement of closed fishing seasons resulted in healthier crab stocks and higher recruitment rates, ultimately benefiting both the ecosystem and local fisheries (Al-Beak et al. 2023; Zamroni et al. 2023; Arofah et al. 2024). However, moderate awareness indicates limited or inconsistent adherence to certain regulations. For example, a lack of awareness regarding pot/trap regulations (AP3) may result in practices that harm juvenile crabs and berried females, threatening resource sustainability. Such practices could reduce the number of juvenile crabs entering the reproductive stock, ultimately affecting the long-term viability of the fishery (Ramakrishnan et al. 2023). Similarly, inadequate understanding of holding cages requirements (AP8) could undermine efforts to protect reproductive stocks, thereby weakening conservation initiatives.

Policies requiring permits and record-keeping (AP9, AP10) are critical for ensuring traceability and legal compliance in trade. However, limited understanding among some stakeholders may result in unregulated practices, which could adversely impact income stability and market dynamics. Moderate awareness of specific regulations, such as mesh size requirements and holding cages, underscores the need for targeted education and stricter enforcement. Awareness campaigns focusing on compliance's ecological and economic benefits could play a significant role in enhancing adherence and promoting sustainable practices.

Crabbers' attitudes towards the NBSCPP

In this study, attitude toward policy implementation refers to how individuals or groups perceive, feel about, and respond to policy enforcement. It reflects their willingness to comply with rules and regulations and their overall perspective on measures implemented. The highest mean score of 4.52 ± 0.85 highlights the crabbers' strong compliance with the necessary permits and documentation, such as auxiliary invoices and Local Transport Permits (LTP) when transporting BSCs (Table 4). This compliance is essential for effective monitoring of crab fishing activities and trade. By tracking the volume and sources of crabs entering the market, resource management and conservation efforts are significantly supported. Additionally, adherence to documentation requirements enables crabbers to access formal markets, which often demand proof of legal sourcing. This opens up opportunities for higher income and contributes to stabilizing the supply chain. Encouragingly, this strong agreement around legal compliance also suggests a high level of trust in regulatory processes and a willingness among crabbers to participate in formalized fisheries management. This could serve as a foundation for enhancing traceability systems and improving governance across the supply chain. Furthermore, crabbers strongly agree on their willingness to comply with the closed fishing season for BSCs in their municipality, as outlined in the RA 10654/1998 of the Philippine Fisheries Code. A closed fishing season, which prohibits certain fishing activities in designated areas of Philippine waters, is crucial for resource sustainability. The strong agreement among crabbers indicates their understanding of the importance of this regulation. However, the closed season can negatively impact the economic well-being of communities who rely solely on these resources, as they may face temporary losses of income or livelihood during this time. To mitigate these challenges, the implementation of alternative livelihood programs is essential. Notably,

Table 4. Crabbers' attitudes towards policy and plans implementations in Northern Catanduanes. N = 208.

Attitude towards policy and plans	Mean ± SD	Interpretation	Qualitative description
ATP1. I will always ensure that the BSCs I catch meet the minimum carapace width requirement of 10.2 cm	3.56 ± 0.84	Agree	Fisherfolk generally agree to adhere to size regulations, but stronger compliance may require additional awareness efforts
ATP 2. I will use crab nets with the appropriate mesh size as specified in the regulations	3.64 ± 0.88	Agree	Indicates agreement to use regulated mesh sizes, with moderate variability in responses
ATP3. I will adhere to the limits on the number of crab pots/traps I can use per boat	3.95 ± 1.20	Agree	There is general agreement, but the higher standard deviation suggests a wider range of compliance levels
ATP 4. I will return the berried crabs to the sea to ensure their reproduction	3.86 ± 1.08	Agree	Agreement to return berried crabs, but variability indicates room for improvement in practice
ATP5. I will comply with the closed fishing season for BSCs in my municipality	3.97 ± 0.93	Agree	Strong agreement to follow with closed season regulations, indicating better awareness or enforcement in this area
ATP 6. I will be willing to adopt alternative livelihood strategies during periods of low crab abundance	3.81 ± 0.95	Strongly agree	Strong agreement reflects openness to diversification, which could reduce pressure on crab populations during lean seasons
ATP7. I will support the establishment of holding cages for berried crabs and ensure their proper maintenance	3.97 ± 0.93	Agree	Agreement to support holding cages, though slightly variable responses indicate that resource availability may influence practices
ATP8. I will keep accurate monthly records of my crab fishing activities as required	4.15 ± 0.96	Agree	High agreement shows a willingness to track activities, which can aid in the effective management of crab stocks
ATP9. I will comply with all necessary permits and documentation, such as the auxiliary invoice and Local Transport Permit (LTP), when transporting BSCs	4.52 ± 0.85	Strongly agree	Strongest agreement among all statements, reflecting high awareness or perceived importance of legal compliance
ATP 10. I will actively participate in information, education, and communication campaigns to raise awareness about BSC conservation	4.38 ± 0.86	Strongly agree	Reflects a high willingness to engage in community-level conservation efforts and advocacy

crabbers in northern Catanduanes have expressed a willingness to adopt alternative livelihood strategies during periods of low crab abundance (3.81 ± 0.95) (Table 4). While this aligns well with national policy goals, putting such strategies into practice may require training, funding, and local government support. Without these, livelihood diversification may remain a hopeful intention rather than a sustainable solution.

Additionally, the willingness of crabbers to participate in conservation campaigns (4.38 ± 0.86) shows their openness to community involvement and advocacy efforts (Table 4). Campaigns highlighting the benefits of BSC conservation management can further reinforce their positive attitude. Similarly, their readiness to explore alternative livelihoods reflects an understanding of the need for economic diversification during periods of low crab abundance. This approach can reduce fishing pressure on crab stocks, particularly during lean seasons, and contribute to resource sustainability. Support from government agencies and NGOs through training and resources could enhance the viability of these alternative livelihoods. Crabbers in northern Catanduanes generally exhibit a positive attitude toward implementing policies and regulations for BSC conservation. This finding aligns with earlier studies from Braga et al. (2018), Musiello-Fernandes et al. (2021) and Gerasmio (2024), who also reported moderate conservation attitudes in certain communities. With the right support and ongoing education, these attitudes can be further strengthened to promote sustainable practices and safeguard the long-term health of crab populations. Conversely, the lowest mean score of 3.56 ± 0.84 indicates a general agreement to adhere to size regulations, although stronger compliance may require additional awareness efforts (Table 4). The lower score suggests that some crabbers may not fully understand the ecological importance of these size limits. Awareness campaigns that emphasize the connection between compliance and long-term benefits, such as sustainable harvests and higher yields, could help improve adherence. Economic pressures may also compel some crabbers to catch undersized crabs, prioritizing immediate income over long-term sustainability. This highlights a potential mismatch between policy assumptions and on-the-ground realities, where enforcement and livelihood constraints affect crabbers' ability to comply fully. Addressing this gap requires not only better education but also support mechanisms that make sustainable practices economically viable. Interestingly, there was stronger agreement when it came to rules that are likely more visible or easier to follow. For example, the idea of respecting a closed fishing season received the highest level of support. This may be because crabbers see the direct benefits of letting crab populations recover or because local enforcement has been more consistent in this area. The same is true for returning berried crabs to the sea and supporting the use of holding cages. Crabbers seem to understand the importance of protecting crab reproduction, but the mixed responses also suggest that not everyone has the means to do so, perhaps due to a lack of facilities, equipment, or community-level support. Overall, responses from crabbers show promising alignment with the goals of national conservation policies. Their willingness to participate in conservation campaigns, follow documentation protocols, and explore alternative livelihoods signals a strong potential for co-management approaches. However, successful implementation depends on how well policies are adapted to local conditions and how effectively crabbers are supported through education, infrastructure, and incentives.

Crabbers' socioeconomic attributes relationship to their awareness and attitudes toward the NBSCPP implementation

Socioeconomic attributes were correlated with crabbers' awareness and attitudes towards the BSC policy and plan implementation using Pearson's r (Table 5). Results showed that none of the socio-

Table 5. Awareness and socioeconomic profile correlations among crabbers in northern Catanduanes. Ho: null hypothesis.

Variables	Pearson's r	Correlation	*p*	Decision
Age	0.04	Weak positive	0.53	Accept Ho
Numbers of years in residency	0.00	Weak positive	0.99	Accept Ho
Numbers of years in fishing	-0.07	Weak negative	0.30	Accept Ho
Education attainment	-0.08	Weak negative	0.24	Accept Ho
Monthly income	-0.04	Weak negative	0.59	Accept Ho
Types of housing materials	-0.02	Weak negative	0.80	Accept Ho
Boat ownership	0.06	Weak positive	0.41	Accept Ho

economic variables studied had a significant correlation with awareness. Therefore, we accepted the null hypothesis (Ho) for these variables, indicating no significant relationship with awareness toward BSC policy and plan implementation.

The primary socioeconomic consideration in fisheries policy is the livelihoods of those directly involved in fishing and related industries. Policies imposing restrictions on fishing activities, such as quotas, seasonal closures, or gear limitations, can significantly impact the income and employment of fishers, processors, and vendors (Cappai et al. 2018). The lack of statistical significance with awareness of BSC policies could be related to their economic needs. Economic pressures may cause fishers to prioritize immediate livelihood needs over compliance, creating a disconnect between awareness and attitudes. Even if fishers are aware of policies, their socioeconomic status might influence their ability to comply rather than their knowledge (Dar et al. 2024; Nakamura 2024).

Findings showed that the age has no significant relationship with crabbers' awareness of policies and regulations. This is consistent with observations of Aishi et al. (2020), who explained that younger individuals entering the fishing industry often become discouraged early on, as they do not see immediate financial gains. On the other hand, elder fishers who have been in the industry for years may feel disillusioned due to the lack of noticeable improvements in the sector, which over time leads them to view the occupation as less profitable and fulfilling. This growing dissatisfaction can negatively influence their overall attitude toward fishing. Similarly, Shireesha et al. (2016) reported that marital status also plays a role in shaping fishers' attitudes. For many who are the sole breadwinners of their families, the financial pressure of meeting basic household needs while relying solely on fishing can be overwhelming. Because fishing revenue is often insufficient to support a family, some fishers are forced to seek alternative, albeit lower-paying, jobs. As a result, they participate in fishing less frequently, potentially contributing to a weaker connection with policy awareness and implementation.

Findings also indicated that awareness of the BSC policy and its implementation are not influenced by socioeconomic factors (Table 5). Therefore, efforts should prioritize strengthening information, education, and communication (IEC) campaigns to raise awareness of BSC conservation. Crabbers in northern Catanduanes have expressed strong willingness to participate in such initiatives. The IEC programs play a vital role in encouraging crabbers to adopt sustainable crabbing practices. These efforts address harmful techniques that contribute to the decline of crab stocks by promoting cost-effective and non-destructive methods that enhance productivity while conserving marine

resources (De la Cruz et al. 2018). By educating crabbers on regulatory measures and the ecological consequences of their activities, IEC campaigns foster greater compliance with conservation policies. Moreover, these programs also seek to improve the socioeconomic well-being of crabbers by sharing knowledge on sustainable aquaculture technologies. While socioeconomic factors such as age, education, and income are commonly associated with environmental awareness, they do not fully capture the complex set of influences that shape crabbers' attitudes toward conservation. Other factors, particularly fishing experience and community involvement, may have a more direct impact. For instance, a study conducted in Polillo Island, Quezon, found that crabbers with longer fishing experience exhibited greater awareness and more positive attitudes toward the conservation of parrotfish, highlighting the role of lived experience in shaping conservation behavior (Tolentino and Mancenido 2024).

In the case of crabbers in northern Catanduanes, analysis revealed no significant correlation between attitudes toward the BSC policy and socioeconomic variables such as age, number of years in residency, monthly income, types of housing materials, and boat ownership ($p > 0.05$) (Table 6). However, significant correlations were observed for years in fishing and educational attainment ($p < 0.05$). Notably, years in fishing showed a negative correlation ($r = -0.21$, $p = 0.00$), suggesting that longer involvement in fishing may be associated with less favorable attitudes toward the BSC policy and plan implementations. This finding contrasts with previous research by Ngodigha and Abowei (2015), who indicated that fishing experience positively influenced attitudes toward conservation initiatives. Conversely, educational attainment demonstrated a positive correlation ($r = 0.26$, $p = 0.00$), indicating that higher education levels were associated with more favorable views toward the BSC policy. Crabbers with a deeper understanding of the marine environment are more likely to comply with fisheries legislation and recognize the environment's crucial role in sustaining fishery resources (Braga et al. 2018). Furthermore, the success of awareness campaigns and the accessibility of information are critical. Even educated or economically stable crabbers may not prioritize conservation if they lack exposure to relevant, context-specific information or if conservation practices are not perceived as immediately beneficial. As Miyata et al. (2017) found in their study in Northern Panay, some crabbers, despite being aware of declining fish stocks, were reluctant to adopt management measures, believing that fish populations would recover naturally without intervention. In summary, socioeconomic characteristics alone cannot fully explain conservation attitudes among crabbers. Factors such as fishing

Table 6. Attitudes and socioeconomic profile correlations among crabbers in northern Catanduanes. Ho: null hypothesis.

Variables	Pearson's r	Correlation	*p*	Decision
Age	0.103	Weak positive	0.14	Accept Ho
Numbers of years in residency	0.04	Weak positive	0.52	Accept Ho
Numbers of years in fishing	-0.21	Weak negative	0.00	Reject Ho
Education attainment	0.26	Weak positive	0.00	Reject Ho
Monthly income	-0.12	Weak negative	0.09	Accept Ho
Types of housing materials	-0.12	weak negative	0.08	Accept Ho
Boat ownership	-0.11	Weak negative	0.13	Accept Ho

experience, cultural and community ties, and the perceived relevance of conservation messaging are equally, if not more, important in influencing their environmental behaviors. Overall, crabbers´ attitude towards the NBSCPP implementation in northern Catanduanes were generally positive (3.82 ± 0.43).

CONCLUSIONS

Northern Catanduanes crabbers depend deeply on the blue swimming crab fishery, not only for both income and daily survival. Many are particularly vulnerable due to their difficult realities, low income, limited education, and few job alternatives. Despite these challenges, they demonstrate a strong awareness of key conservation rules, such as closed fishing seasons and proper documentation, and they typically support efforts to protect crab populations. However, other rules are less understood or harder to follow without additional support, particularly those involving gear restrictions and crab handling. It is interesting to note that while education and years of fishing experience shaped their attitudes, age and income did not seem to influence on their awareness. These findings remind us that sustainable fisheries are about people, not just regulations. By investing in education, enforcement, and livelihood support, we can help crabbers not only follow the law but also prosper alongside thriving marine ecosystems.

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Author contributions

Recie Bonaos: conceptualization; methodology; investigation; formal analysis; writing-original draft; writing-review and editing; supervision; project administration. Maria Mojena Gonzales-Plasus: data curation; visualization; investigation; writing-review and editing.

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