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Diversity and Catch per Unit Effort of Marine Fishes Caught by Various Fishing Gears in Cabugao, Ilocos Sur

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ABSTRACT

Fishery resources play a vital role in ensuring food security and nutrition while contributing to economic growth through fish production and trade. This study aimed to determine the diversity of marine fishes caught by various fishing gears in Cabugao, Ilocos Sur. A quantitative research design was utilized, providing numerical data on the diversity, abundance, and catch per unit effort of marine fishes. Data gathering was conducted in the five coastal barangays of Cabugao, Ilocos Sur, from January to March 2025. Mean, ANOVA, and Games-Howell tests were employed to determine the average abundance, test for significant differences in CPUE, and compare fishing gears, respectively. Simple handlines, bottom-set longlines, gillnets, and pamo gillnets are commonly used fishing gears. The various fishing gears caught a total of 60 species. Pamo gill net yielded the highest abundance (279,497), while the bottom-set longline was the lowest (541). Species diversity was low in bottom-set longlines (2.24) and gillnets (2.33), while very low in simple handlines (1.04) and pamo gillnets (.58). The low species diversity across gears suggests potential ecological pressure influenced by seasonality, fishing intensity, and gear selectivity. The Catch Per Unit Effort (CPUE) of the various fishing gears significantly differed. These findings provide baseline, gear-specific data that can inform municipal fisheries management and sustainable gear regulation in Cabugao, Ilocos Sur. The study recommends guiding fisherfolk on the sustainable use of fishing gear, conducting continuous monitoring to track changes in fish diversity, regulating fishing to reduce ecological impact, and developing sustainable fishing strategies.

Keywords: *Catch per unit effort, species richness, abundance, evenness*

INTRODUCTION

Marine ecosystems sustain human livelihoods and biodiversity, making them among the planet's most productive habitats. For a long time, sustainable marine resources have supplied vital goods for trade, food production, and revenue generation. Globally, especially in coastal and island areas, fisheries are vital for meeting nutritional demands and supporting economic growth. According to the

Food and Agriculture Organization (FAO), fish provided approximately 3.3 billion people with roughly 20% of their average per capita protein intake in 2017, accounting for around 17% of animal protein consumed worldwide. In 2016, an estimated 39 million individuals were engaged in the primary sector of capture fisheries (Zhang et al., 2021). These contributions support the objectives of the United Nations Sustainable Development Goals (SDGs)—notably SDGs 2 (Zero Hunger) and 8 (Decent Work and Economic Growth) —which promote food security and nutrition and sustainable livelihoods, respectively.

Fishing gear is one of the most essential components of marine production. Its design and use determine both the volume and composition of the catch, directly influencing ecological balance and fishing productivity. For sustainable fisheries management, a gear's selectivity—its ability to target particular species, sizes, or life stages while minimizing bycatch—is crucial (Bhanja et al., 2024). However, in many areas, overfishing and habitat destruction have been exacerbated by the widespread adoption of unsustainable techniques and inappropriate fishing gear. SDG 14 (Life Below Water), which emphasizes the need to preserve and sustainably exploit oceans and marine resources, is strongly aligned with these concerns.

Fishing gear categorized as lines represents the most basic equipment used for fishing, consisting of lines, hooks, and bait. Meanwhile, the nets category is the second-most prevalent category (Baleta et al., 2017). In addition, it was previously reported that hook-and-line fishing gear targets different species and is highly selective, targeting carnivorous, pelagic, demersal, and bottom-dwelling species (Balisco et al., 2019). In another study cited, wrasse *Stethojulis* spp., *Coryphaena hippurus*, and *Istiompax* indica were the primary fish species observed in the hook-and-line category (Obar et al., 2021). On the contrary, fishing gears such as gillnets and beach seines under the net category were most likely used to target small pelagic species, such as scads, anchovies, and mackerels, within the municipal waters (15 km from the shoreline) (Balisco et al., 2019).

The Philippines is fortunate to have a rich and diverse marine ecosystem, teeming with various marine creatures, all thriving in its warm tropical waters (Ilac et al.). Even though the Philippines has degraded some of its coral reefs, it still sustains high marine biodiversity (Mendoza et al.). Fisheries have always been a vital component of the Philippine economy and food chain. In 2020, the nation produced over 1.76 million metric tons of fish, placing it 13th in the world for marine capture production (Tahiluddin & Sarri, 2022). However, despite this accomplishment, damaging fishing practices have resulted, especially in coral reef locations, due to the population's rapid development and growing economic pressures. These methods have undermined small-scale fishing and jeopardized the viability of regional marine resources since the 1980s. To ensure that fisheries remain both productive and ecologically sound, it is crucial to understand how different fishing gears affect fish diversity and capture composition.

Several researchers have studied the relationship between fish diversity and fishing gear types to inform sustainable management. According to Romero et al. (2023), examining the species makeup and quantity of fish captured using different fishing methods provides important information on the biological state of aquatic systems. Fish abundance and diversity are biological markers of invasive species, habitat degradation, and climate-related stressors. Shester and Micheli (2011) added that a range of gear types, such as drift gillnets, set gillnets, and traps, are used in small-scale fisheries, each of which has unique ecological consequences. It is possible to determine the relative effectiveness of these gears and their effects on the ecosystem, such as bycatch or habitat disturbance, by evaluating how they interact within the same community.

In the study by Balisco et al. (2019) on the municipal waters of Simbana, Puerto Princesa City, and Rasa Island in Palawan, sixteen types of fishing gear were identified and categorized into nets, lines, barriers, traps, and hand instruments. The maturity of the captured species was linked to reefs, demonstrating the intimate relationship between fishing methods and original areas. In a research, Romero et al. (2023) found that Lake Danao, Ormoc City, had relatively low fish variety, a condition linked to delimited fishing areas, seasonal volatility, and declining fish populations. They stressed the importance of continuing biodiversity monitoring with both conventional methods and more contemporary approaches, such as environmental DNA analysis, to inform conservation plans.

Even with these studies' insightful findings, little is known about the use of fishing gear and the variety of fish in northern coastal regions such as Ilocos Sur. Specifically, not much is known about the fish capture composition in the municipality of Cabugao and the gears most frequently used. The absence of local data restricts the ability of fishery managers and communities to assess fishing efficiency, minimize bycatch, and develop sustainable practices (Muallil, Cleland, & Aliño, 2013; Salayo et al., 2008). As McClanahan and Mangi (2004) suggested, studying gear types in relation to fish selectivity and capture efficiency is critical for developing effective fisheries management strategies. According to Tzanatos, Somarakis, Tserpes, and Koutsikopoulos (2008), communities can increase productivity while minimizing ecological harm by selecting effective and selective gears.

Despite national fisheries assessments, there is a lack of localized, gear-specific studies on fish diversity and catch efficiency in northern Philippine coastal municipalities such as Cabugao, Ilocos Sur. This absence of local data limits evidence-based decision-making for municipal fisheries management.

In the coastal barangays of Cabugao, Ilocos Sur, this study was conducted to identify the most popular fishing gear and to evaluate the variety of marine fish captured with different gears. Understanding how different fishing gears influence species diversity and catch efficiency is critical for balancing local livelihood needs with marine conservation. The findings are intended to support evidence-based policymaking by providing baseline data to define the local fishing system. This research advances the nation's efforts to meet the Sustainable Development Goals, especially those related to maintaining food security, fostering sustainable economic growth, and protecting marine biodiversity, by integrating ecological knowledge with regional fishing methods.

Objectives of the Study

This study aimed to determine the diversity of marine fishes caught by various fishing gears in the five coastal barangays of Cabugao, Ilocos Sur, namely, Brgy. Namruangan, Brgy. Daclapan, Brgy. Sabang, Brgy. Salomague, and Brgy. Dardarat. Specifically, this study aimed to (1) Identify the fishing gears commonly used in the coastal barangays of Cabugao, Ilocos Sur; (2) determine the species composition of marine fishes caught by each fishing gear (3) assess the abundance and diversity of fish species associated with each gear type, and (4) determine and compare the Catch Per Unit Effort (CPUE) of the different fishing gears.

METHODOLOGY

Research Design. This study used a quantitative descriptive-comparative design to provide numerical data on the diversity, abundance, and catch per unit effort of marine fishes caught with various fishing gears in Cabugao, Ilocos Sur, and to examine patterns and differences among fishing gears without establishing causal relationships.

Study sites. The study sites were located in the five coastal barangays of Cabugao, Ilocos Sur, namely: Barangay Namruangan, Barangay Daclapan, Barangay Sabang, Barangay Salomague, and Barangay Dardarat (Figure 2), where local fisherfolk used to sustain themselves from these coastal fishing grounds. The site was chosen as the research locale due to its accessibility and the significance of fishing activities to the livelihoods of local communities using different fishing gear.

Data Gathering Procedures.

The procedures employed in this study were derived from the work of Balisco et al. (2019) and Baleta et al. (2017), specifically on the identification and classification of fishing gears. The study was conducted weekly from January to March 2025, totaling 8 weeks.

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Figure 2
Study sites. *A) Map of the Philippines showing Ilocos Sur. B) Map of Ilocos Sur, showing Cabugao. C) Map of the five coastal barangays in Cabugao*

1. Sources of Data. Data gathering was conducted along the seashore of the coastal barangays in collaboration with local fisherfolk. Sampling was based on the population of active motorized boats engaged in fishing specifically for marine fish species using various fishing gears. The participants were purposefully chosen local fisherfolk residing within the five coastal barangays. Seven (7) fishermen were selected from each study site for a total of thirty-five (35) fishermen. The sample size of thirty-five (35) fisherfolk was considered adequate to capture gear-use variability across the five coastal barangays. Participants were provided with informed consent forms and asked to answer questions about the raw data needed for the study.

2. Identification of fishing gears. The selection of fishing gear was based on the prevalence of gear types used at the study sites. The gears used in each barangay were identified with the help of the local fisherfolk, who provided the local names and variations of their fishing gear and lures (particularly for the hook-and-line category). Local names were then translated into English for easy identification. Afterward, the fishing gears were categorized as either active or passive, and further classified by type - nets or hook-and-line- based on the Field Guidebook on Philippine Fishing Gears (Monteclaro et al., 2017). The number of fishing gears used by fisherfolk per motorized boat was also recorded.

3. Fish Identification. The fish species were initially identified by fisherfolk using their local names. Verification was carried out using the Manual Field Guide to Coastal Fishes of Palawan (Gonzales, 2013) and the FishBase database (https://www.fishbase.se/Country/CountryChecklist.php?what=list&trpp=50&c_c

ode=608&csub_code=&cpresence=present&sortby=alpha&ext_pic=on&vhabitat=saltwater), which served as the basis of the fish species taxonomic accuracy. The taxonomic identification of each fish species caught was based on its morphological characteristics.

4. Species Composition. The total weight and number of fish per species caught by fisherfolk were recorded on the datasheet in kilograms (kg). Separate catches were distinguished on the data sheet by numbering each species caught (*ex., 1. Durado*). For each fish species caught, three representative samples were collected corresponding to large, medium, and small sizes. The catch was subsequently sorted into individual fish, and the following data were recorded for each specimen. Fish were identified at the species level, and those that could not be precisely identified were classified at the genus level. Additionally, the total length of the three fish samples per species was measured from the snout to the tip of the caudal fin using a roll meter for larger fish and a vernier caliper for smaller fish. The weight of the three fish samples (large, medium, and small) for each species was also measured using a digital scale and recorded in grams (g).

5. Abundance and Diversity. The abundance of fish was determined by calculating the total number of individuals of each species caught with various fishing gears. Species diversity and evenness were assessed using the Shannon-Wiener Index, as presented:

$$H' = -\sum_{n-1}^{n}(pi * lnpi)$$

where in;

H' = Shannon-Weiner Diversity Index
pi = proportion of the total represented by species
n = represents the total number of species (or different categories) in the community or sample.

The results of the diversity index and evenness were interpreted using the guidelines of Fernando (1998), as cited by Baliton et al. (2020).

Table 1
Criteria for Species Diversity

Condition Index	*H'* Values
Very High	3.50 and above
High	3.00 -3.49
Moderate	2.50 – 2.99
Low	2.0 – 2.49
Very low	1.99 and below

Legend: H' (Shannon-Weiner Diversity Index)

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6. Catch Per Unit Effort. The abundance of fish species was calculated as the percentage of fish caught by each gear, by all gears combined, and for each sampling site. Differences in Catch Per Unit Effort (CPUE) and species diversity among sites and gear types were analyzed using Analysis of Variance (ANOVA). The CPUE for each gear type was computed using the following equation from (Rahman et al., 2024):

$$\textbf{(CPUE)} = \frac{\text{Total catch (kg.)}}{\text{Fishing effort of gear used (hr)}}$$

where in;

Total catch (kg) = total weight of fish caught in kilograms
Fishing effort = the hours spent fishing

RESULTS AND DISCUSSIONS

This chapter presents, analyzes, and interprets the data gathered in the study. Tabular and textual forms were used to present the data.

1. The Different Fishing Gears Commonly Used in the Study Sites of Cabugao, Ilocos Sur.

Table 2 presents the English and local names of the fishing gears commonly used by fisherfolk at the study sites in Cabugao, Ilocos Sur. A check (✓) mark indicates the presence of a particular fishing gear, while a dash (-) denotes absence.

Table 2
The Different Fishing Gears Commonly Used in the Study Sites in Cabugao, Ilocos Sur

STUDY SITES	FISHING GEARS				TOTAL
	Active Simple hand lines (Baniit)	Bottom-set longline (Kitang)	Passive Gill net (Sigay)	Pamo gill net (Daklis)	
Brgy. Namruangan	✓	-	-	✓	2
Brgy. Daclapan	✓	-	-	-	1
Brgy. Sabang	✓	✓	-	✓	3
Brgy. Salomague	✓	-	✓	-	2
Brgy. Dardarat	✓	✓	✓	-	3
Total	5	2	2	2	

Table 2 revealed that four (4)types of fishing gears were commonly used across the five study sites in Cabugao, Ilocos Sur. In Brgy. Namruangan, two fishing gears were used: the Simple handline (Baniit) and the Pamo gillnet (Daklis). Similarly, Brgy. Daclapan had the fewest fishing gear types, with only one: the Simple handline (Baniit). In Brgy. In Sabang, three types of fishing gear were used: the Simple handline (Baniit), the Bottom-set longline (Kitang), and the Pamo gillnet (Daklis). Meanwhile, Brgy. Salomague also used two common fishing gears: the Simple handline (Baniit) and the Gill net (Sigay). Lastly, Barangay Dardarat utilized three fishing gears: the Simple handline (Baniit), the Bottom-set longline (Kitang), and the Gill net (Sigay).

Fisherfolk in Brgy. Sabang and Brgy. Dardarat recorded the highest number of fishing gears operated throughout the fishing trips. It was also observed that the choice of fishing gear used by fisherfolk during each trip varied with the desired gear type, fishing location, and target fish species across the five coastal sites. On the contrary, it was noted that fisherfolk in Brgy. Daclapan used only simple hand lines (baniit), primarily targeting species such as Coryphaena hippurus, Istiompax indica, Elagatis bipinnulata, Katsuwonus pelamis, and Thunnus obesus, which explains the fewest gear types used in the area.

Furthermore, the fishing gears documented in the study were classified as either active or passive. Active gears are those that move to pursue or capture target species and are often used in combination with other fishing techniques, while passive gears remain stationary, allowing target species to approach them through various methods such as setting and attracting (Balisco et al., 2019).

Results also revealed that active gears were present in all coastal barangays, while passive gears such as bottom-set longlines were found only in Brgy. Sabang and Brgy. Dardarat. Meanwhile, Gill nets were used in Brgy. Salomague and Brgy. Dardarat, whereas Pamo gill nets were observed in Brgy. Namruangan and Brgy. Sabang.

The variation in gear use across barangays reflects differences in target species, fishing grounds, and local fishing practices.

2. The Composition of Fish Species Caught by the Different Fishing Gears in Cabugao, Ilocos Sur

Table 3 presents the taxonomic classification of the fish species, specifying their respective Order, Family, Species (scientific name), along with their English and local names. The fish species presented were caught using various fishing gears across the five study sites in Cabugao, Ilocos Sur.

The order of these fish was classified into seventeen (17) and thirty-one (31) families. A total of sixty (60) fish were identified as shown in Table 3.

The identification of sixty (60) fish species across all gear types highlights the biological richness of Cabugao’s coastal waters, despite indications of low diversity within individual gear categories.

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Volume 34, Issue 1, January - December 2025

Table 3

The Taxonomic Classification of Fish Species Caught by Various Fishing Gears in Five Study Sites

ORDER	FAMILY	SCIENTIFIC NAME	ENGLISH NAME	LOCAL NAME
Acanthuriformes	Acanthuridae	*Acanthurus lineatus*	Lined surgeonfish	Raga - raga
Acanthuriformes	Acanthuridae	*Acanthurus nigrofuscus*	Brown surgeonfish	Barbangisit
Acanthuriformes	Chaetodontidae	*Forcipiger flavissimus*	Forcepsfish	Cadis
Acanthuriformes	Leiognathidae	*Leiognathus equula*	Common ponyfish	Sap - sap
Acanthuriformes	Siganidae	*Siganus guttatus*	Orange spotted spinefoot	Malaga
Acanthuriformes	Siganidae	*Siganus punctatus*	Goldspotted spinefoot	Malaga
Acanthuriformes	Siganidae	*Siganus virgatus*	Barhead spinefoot	Balangatan
Acropomatiformes	Pempheridae	*Pempheris adusta*	Dusky sweeper	Samsampin
Anguilliformes	Congridae	*Ariosoma scheelei*	Tropical conger	Bulungan / Payo - igat
Anguilliformes	Muraenidae	*Uropterygius micropterus*	Tidepool snake moray	Siksikkil
Aulopiformes	Synodontidae	*Saurida wanieso*	Wanieso lizardfish	Dimmalag
Beloniformes	Belonidae	*Ablennes hians*	Flat needlefish	Layalay
Beloniformes	Exocoetidae	*Cheilopogon unicolor*	Limpid-wing flyingfish	Burador
Carangaria	Sphyraenidae	*Sphyraena forsteri*	Forster's barracuda	Babayo
Carangiformes	Carangidae	*Caranx ignobilis*	Giant trevally	Talakitok
Carangiformes	Carangidae	*Caranx sexfasciatus*	Bigeye trevally	Talakitok
Carangiformes	Carangidae	*Decapterus kurroides*	Redtail scad	Burot
Carangiformes	Carangidae	*Megalaspis cordyla*	Torpedo scad	Sikkaran
Carangiformes	Carangidae	*Selar crumenophthalmus*	Bigeye scad	Mataan
Carangiformes	Carangidae	*Selaroides leptolepis*	Yellowstripe scad	Bittoko
Carangiformes	Carangidae	*Seriola dumerili*	Greater amberjack	Gulisan
Carangiformes	Carangidae	*Turrum coeruleopinnatum*	Coastal trevally	Talakitok
Carangiformes	Coryphaenidae	*Coryphaena hippurus*	Common dolphinfish	Durado
Carangiformes	Istiophoridae	*Istiompax indica*	Black marlin	Susay
Clupeiformes	Engraulidae	*Encrasicholina punctifer*	Buccaneer anchovy	Monamon
Clupeiformes	Engraulidae	*Stolephorus heterolobus*	Shorthead anchovy	Monamon
Eupercaria	Labridae	*Cheilinus fasciatus*	Red-breasted wrasse	Mannilag
Eupercaria	Labridae	*Cheilio inermis*	Cigar wrasse	Immalibot
Eupercaria	Labridae	*Stethojulis trilineata*	Three-lined rainbowfish	Mulmol
Eupercaria	Labridae	*Thalassoma hardwicke*	Sixbar wrasse	Mulmol
Eupercaria	Lethrinidae	*Lethrinus lentjan*	Pink ear emperor	Bugsi
Eupercaria	Lethrinidae	*Monotaxis grandoculis*	Humpnose big-eye bream	Baseng

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Eupercaria	Lutjanidae	*Lutjanus fulviflamma*	Dory snapper	Maya – maya
Eupercaria	Lutjanidae	*Lutjanus fulvus*	Blacktail snapper	Bugsi; Sapingan
Eupercaria	Lutjanidae	*Lutjanus gibbus*	Humpback red snapper	Maya – maya
Eupercaria	Lutjanidae	*Lutjanus madras*	Indian snapper	Kambayan
Eupercaria	Lutjanidae	*Pristipomoides typus*	Sharptooth jobfish	Siksikan
Eupercaria	Nemipteridae	*Nemipterus furcosus*	Fork-tailed threadfin bream	Bisugo
Eupercaria	Nemipteridae	*Nemipterus thosaporni*	Palefin threadfin bream	Sarimulyiti
Eupercaria	Priacanthidae	*Priacanthus blochii*	Paeony bulleye	Mulagat
Eupercaria	Scaridae	*Leptoscarus vaigiensis*	Marbled parrotfish	Bugok
Eupercaria	Scaridae	*Scarus altipinnis*	Filament-finned parrotfish	Lunawan
Holocentriformes	Holocentridae	*Sargocentron puntctatissimum*	Speckled squirrelfish	Baratiktik
Kurtiformes	Apogonidae	*Ostorhinchus nigrofasciatus*	Blackstripe cardinal bass	Bagsang
Mulliformes	Mullidae	*Upeneus moluccensis*	Goldband goatfish	Balaki
Ovalentaria	Pomacentridae	*Abudefduf vaigiensis*	Indo-pacific sergeant	Mannakudog
Ovalentaria	Pomacentridae	*Pomacentrus moluccensis*	Lemon damsel	Ar-aro
Perciformes	Carangidae	*Elagatis bipinnulata*	Rainbow runner	Salmon
Perciformes	Epinephelidae	*Cephalopholis urodeta*	Darkfin hind	Grouper
Perciformes	Epinephelidae	*Ephinephelus areolatus*	Areolate grouper	Kurapo/ Lapu-lapu
Perciformes	Epinephelidae	*Epinephelus coioides*	Orange-spotted grouper	Kurapo/ Lapu-lapu
Perciformes	Epinephelidae	*Epinephelus quoyanus*	Longfin group	Kurapo/ Lapu-lapu
Perciformes	Lethrinidae	*Lethrinus atkinsoni*	Pacific yellowtail emperor	Silap
Perciformes	Pinguipedidae	*Parapercis cylindrica*	Cylindrical sandperch	Immaso-aso
Scombriformes	Gempylidae	*Gempylus serpens*	Snake mackerel	Payo - Iglesia
Scombriformes	Scombridae	*Katsuwonus pelamis*	Skipjack tuna	Buslugan
Scombriformes	Scombridae	*Thunnus obesus*	Bigeye tuna	Yellowfin
Siluriformes	Plotosidae	*Plotosus lineatus*	Striped eel catfish	Canduli
Tetraodontiformes	Balistidae	*Canthidermis sufflamen*	Ocean triggerfish	Ampapakol
Tetraodontiformes	Balistidae	*Rhinecanthus verrucosus*	Blackbelly triggerfish	Ampapakol

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Volume 34, Issue 1, January - December 2025

Table 4
Fish Species Caught by the Different Fishing Gears in Cabugao, Ilocos Sur

FISH SPECIES	Fishing Gears			
	Simple Handline	Bottom-Set Longline	Gill Net	Pamo Gill Net
1. *Acanthurus lineatus*	-	-	✓	-
2. *Acanthurus nigrofuscus*	-	-	✓	-
3. *Forcipiger flavissimus*	-	-	✓	-
4. *Leiognathus equula*	-	-	✓	✓
5. *Siganus guttatus*	-	-	✓	-
6. *Siganus punctatus*	-	-	✓	-
7. *Siganus virgatus*	-	-	✓	-
8. *Pempheris adusta*	-	-	✓	-
9. *Ariosoma scheelei*	✓	✓	✓	-
10. *Uropterygius micropterus*	-	✓	-	-
11. *Saurida wanieso*	-	✓	-	-
12. *Ablennes hians*	✓	-	-	-
13. *Cheilopogon unicolor*	✓	✓	-	-
14. *Sphyraena forsteri*	✓	✓	-	-
15. *Caranx ignobilis*	-	✓	-	-
16. *Caranx sexfasciatus*	✓	✓	-	-
17. *Decapterus kurroides*	-	✓	-	-
18. *Megalaspis cordyla*	-	✓	-	-
19. *Selar crumenophthalmus*	✓	-	-	-
20. *Selaroides leptolepis*	-	-	✓	-
21. *Seriola dumerili*	✓	✓	-	-
22. *Turrum coeruleopinnatum*	✓	✓	-	-
23. *Coryphaena hippurus*	✓	-	-	-
24. *Istiompax indica*	✓	-	-	-
25. *Encrasicholina punctifer*	-	-	-	✓
26 *Stolephorus heterolobus*	-	-	-	✓
27. *Cheilinus fasciatus*	-	-	✓	-
28 *Cheilio inermis*	-	-	✓	-
29. *Stethojulis trilineata*	-	-	✓	-
30. *Thalassoma hardwicke*	-	-	✓	-
31. *Lethrinus lentjan*	-	✓	✓	-
32. *Monotaxis grandoculis*	-	-	✓	-
33. *Lutjanus fulviflamma*	✓	✓	-	-
34. *Lutjanus fulvus*	-	✓	✓	-
35. *Lutjanus gibbus*	✓	✓	-	-
36 *Lutjanus madras*	-	✓	-	-
37. *Pristipomoides typus*	✓	✓	-	-
38. *Nemipterus furcosus*	-	✓	-	-
39. *Nemipterus thosaporni*	-	✓	-	-
40. *Priacanthus blochii*	-	✓	-	-
41. *Leptoscarus vaigiensis*	-	-	✓	-
42. *Scarus altipinnis*	-	-	✓	-
43. *Sargocentron punctatissimum*	-	-	✓	-
44. *Ostorhinchus nigrofasciatus*	-	-	✓	-
45. *Upeneus moluccensis*	-	-	✓	-
46. *Abudefduf vaigiensis*	-	-	✓	-
47. *Pomacentrus moluccensis*	-	-	✓	-

FISH SPECIES	Fishing Gears			
	Simple Handline	Bottom-Set Longline	Gill Net	Pamo Gill Net
48. *Elagatis bipinnulata*	✓	-	-	-
49. *Cephalopholis urodeta*	-	-	✓	-
50. *Ephinephelus areolatus*	-	✓	-	-
51 *Epinephelus coioides*	✓	✓	-	-
52. *Epinephelus quoyanus*	-	-	✓	-
53. *Lethrinus atkinsoni*	-	✓	-	-
54. *Parapercis cylindrica*	-	-	✓	-
55. *Gempylus serpens*	✓	-	-	-
56. *Katsuwonus pelamis*	✓	-	-	-
57. *Thunnus obesus*	✓	-	-	-
58. *Plotosus lineatus*	-	-	✓	-
59. *Canthidermis sufflamen*	✓	-	-	-
60. *Rhinecanthus verrucosus*	-	-	✓	-

The fish species caught by the different fishing gears in Cabugao, Ilocos Sur, are presented in Table 4. A check mark (✓) indicates that the fish species was caught using that specific fishing gear, while a dash (-) denotes absence.

As shown in the table, the gill net caught the highest fish species (29), followed by the bottom-set longline (23), and the simple handline (19), while the pamo gill net caught the lowest (3).

A Gill net is a passive gear, meaning it catches a diverse range of fish species, including small and medium-sized ones, as they swim into the net. Due to its low selectivity, a gillnet catches a wide variety of species regardless of their size or commercial value. The pamo gillnet, however, even if classified as passive gear, was used only to catch specific fish species, particularly Leiognathus equula, Encrasicholina punctifer, and Stolephorus heterolobus, resulting in the lowest catch of fish species among the fishing gears.

3. Abundance and Diversity of Fish Species Caught by the Different Fishing Gears in Cabugao, Ilocos Sur

Table 5 presents the abundance and diversity of the fish species caught by the commonly used fishing gear across the five coastal barangays using Shannon's index to determine the mean value of fish species among the four gear types utilized by fisherfolk and the distribution of individuals across various species within a community.

Among the gear types fisherfolk utilize are the simple handline, bottom-set longline, gillnet, and pamo gillnet. It was revealed that the highest abundance of fish species was recorded in the pamo gillnet, with 279,497 fish caught in total, followed

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by the gillnet with 1,699 fish, and the Simple handline with 1,610 fish. Meanwhile, the bottom-set longline had the fewest captures, with 541 fish.

The exceptionally high abundance recorded for the pamo gill net is attributed to its targeted capture of schooling, small-sized species, rather than to broad species representation. Meanwhile, overall low diversity and evenness values indicate dominance by a few species per gear type, suggesting selective fishing patterns and possible ecological pressure.

Moreover, the species richness refers to the number of fish caught per gear type. As mentioned above, simple handline caught twenty (20) fish species, twenty-three (23) fish species caught by bottom-set long line, twenty-nine (29) species captured by gill net, and three (3) fish species captured by pamo gill net.

Table 5

Abundance and Diversity of Fish Species Caught by the Different Fishing Gears in Cabugao, Ilocos Sur

FISH SPECIES	Fishing Gears			
	Simple Handline	Bottom-Set Longline	Gill Net	Pamo Gill Net
1. *Acanthurus lineatus*			22	
2. *Acanthurus nigrofuscus*			28	
3. *Forcipiger flavissimus*			2	
4. *Leiognathus equula*			342	129
5. *Siganus guttatus*			29	
6. *Siganus punctatus*			2	
7. *Siganus virgatus*			12	
8. *Pempheris adusta*			16	
9. *Ariosoma scheelei*	1	7	14	
10. *Uropterygius micropterus*		16		
11. *Saurida wanieso*		1		
12. *Ablennes hians*	1			
13. *Cheilopogon unicolor*	3	10		
14. *Sphyraena forsteri*	1	2		
15. *Caranx ignobilis*		12		
16. *Caranx sexfasciatus*	48	18		
17. *Decapterus kurroides*		4		
18. *Megalaspis cordyla*		1		
19. *Selar crumenophthalmus*	5			
20. *Selaroides leptolepis*			72	
21. *Seriola dumerili*	1	2		
22. *Turrum coeruleopinnatum*	2	7		
23. *Coryphaena hippurus*	392			
24. *Istiompax indica*	18			
25. *Encrasicholina punctifer*				206400
26 *Stolephorus heterolobus*				72968
27. *Cheilinus fasciatus*			88	
28 *Cheilio inermis*			4	
29. *Stethojulis trilineata*			15	
30. *Thalassoma hardwicke*			22	
31. *Lethrinus lentjan*		8	10	

FISH SPECIES	Fishing Gears			
	Simple Handline	Bottom-Set Longline	Gill Net	Pamo Gill Net
32. *Monotaxis grandoculis*			1	
33. *Lutjanus fulviflamma*	4	21		
34. *Lutjanus fulvus*	4	17	7	
35. *Lutjanus gibbus*	5	11		
36 *Lutjanus madras*		13		
37. *Pristipomoides typus*	5	54		
38. *Nemipterus furcosus*		126		
39. *Nemipterus thosaporni*		177		
40. *Priacanthus blochii*		4		
41. *Leptoscarus vaigiensis*			99	
42. *Scarus altipinnis*			3	
43. *Sargocentron punctatissimum*			38	
44. *Ostorhinchus nigrofasciatus*			365	
45. *Upeneus moluccensis*			252	
46. *Abudefduf vaigiensis*			15	
47. *Pomacentrus moluccensis*			178	
48. *Elagatis bipinnulata*	15			
49. *Cephalopholis urodeta*			3	
50. *Ephinephelus areolatus*		3		
51 *Epinephelus coioides*	4	17		
52. *Epinephelus quoyanus*			13	
53. *Lethrinus atkinsoni*		10		
54. *Parapercis cylindrica*			8	
55. *Gempylus serpens*	1			
56. *Katsuwonus pelamis*	699			
57. *Thunnus obesus*	398			
58. *Plotosus lineatus*			35	
59. *Canthidermis sufflamen*	3			
60. *Rhinecanthus verrucosus*			4	
Abundance	1,610	541	1,699	279,497
Species richness	20	23	29	3
Shannon's index (*H'*)	1.04	2.24	2.33	0.58
Shannon evenness (E_{Sh})	0.23	0.47	0.43	0.33
Interpretation	Very low	Low	Low	Very low

The highest the number of captured fish species among the fishing gears was recorded in the gill net, which acquired 29 fish species, while the lowest was obtained by the pamo gill net, with only three (3) fish species.

According to the study by Ahmed and Hambrey (2005), several factors, such as the choice of fishing locations, net sizes, the number of hooks, lures, and baits, water turbidity, wind, waves, and rainfall, affected differences in fish catches. Additionally, factors and Catch Per Unit Effort (CPUE) influenced differences in fish catches, which showed significant differences in fish species between months.

In terms of species diversity, the bottom-set longline and gillnet yielded values of 2.24 and 2.33, respectively, indicating low species diversity. Meanwhile, the Simple Handline and Pamo Gill Net yielded values of 1.04 and 0.58, respectively, indicating very low species diversity. It was observed that the gillnet and the bottom-set longline were rated low in diversity, while the simple handline and the pamo gillnet were rated very low in diversity. It might be attributed to seasonal factors influencing the variety of fish species, with peak diversity noted during the pre-monsoon season. It is likely exacerbated by human-induced and environmental pressures, as well as the repercussions of overfishing with illegal fishing gear, as stated in previous studies (Aziz et al., 2021).

Furthermore, the evenness of fish species across gears ranged from 0.23 to 0.47, indicating low evenness.

4. CPUE of the Different Fishing Gears in Cabugao, Ilocos Sur, and their Significant Difference

Table 6 shows the CPUE of the different gear types in Cabugao, Ilocos Sur.

Table 6

CPUE of the Different Fishing Gears in Cabugao, Ilocos Sur

	CATCH PER UNIT EFFORT (CPUE)				
	SIMPLE HANDLINE	BOTTOM-SET LONG LINE	GILL NET	PAMO GILL NET	TOTAL CPUE PER SPECIES
TOTAL CPUE PER GEAR	**392.05**	**32.05**	**11.05**	**56.90**	**435.46**

As shown in the table, the highest CPUE was recorded in simple hand-line (392.05), followed by pamo gill net (56.90), bottom set long line (32.05), and gill net (11.05).

The result might be attributed to the type of gear used to catch their species. Simple handline is an active type of gear, which allows fishers to select and target larger and heavier species. In contrast, the gillnet is a passive gear that relies on fish to encounter it and typically captures smaller, lighter species, resulting in a lower CPUE.

Table 7 shows a significant difference between CPUE and Gear Type in Cabugao, Ilocos Sur, as determined by Welch's ANOVA.

Table 7

Welch's ANOVA Showing Significant Difference in CPUE vs Gear Type in Cabugao, Ilocos Sur

Source of Variation	F Statistics	df1	df1	p value	Decision
Between Groups	22.336	3.000	9.2052	0.0001476 ***	Reject Ho
Note: p<0.05**, p<0.01***					

As shown in Table 7, the F-statistic (22.336) is quite large, indicating substantial differences between group means. The degrees of freedom for the test between groups (df1) = 3, within groups (df2) = 9.2052 (approx., due to Welch correction). Results revealed that p<0.01 indicates that gear type was highly statistically significant to Cath per Unit Effort (CPUE), so the decision was to reject the null hypothesis. It provides strong evidence that at least one gear type yields a significantly different CPUE from the others in Cabugao, Ilocos Sur.
Table 8 shows that bottom-set Longline and Simple Handline show significant differences from Gill Net, suggesting they yield noticeably different CPUEs. Pamo Gill Net does not differ significantly from any of the other gear types. Simple Handline differs significantly from Gill Net, but not from Pamo Gill Net. Catch per unit effort (CPUE) varied substantially across the gear types, with particularly marked differences between Gill Nets and Simple Handlines. It suggests that gear selection had a meaningful influence on regional fishing performance.

Table 8

Pairwise Comparisons of Gear Type Using Games-Howell Test in Cabugao, Ilocos Sur

Comparison	p-value	Decision
Bottom-Set Longline vs Gill Net	0.0124*	Reject Ho
Bottom-Set Longline vs Pamo Gill Net	0.4131	Do not Reject Ho
Bottom-Set Longline vs Simple Handline	0.0038*	Reject Ho
Gill Net vs Pamo Gill Net	0.1313	Do not Reject Ho
Gill Net vs Simple Handline	0.000068*	Reject Ho
Pamo Gill Net vs Simple Handline	0.9210	Do not Reject Ho

**significant at the 0.05 level.*

These results indicate that fishing gear type significantly influences catch efficiency, underscoring the importance of gear regulation in managing fishing pressure and resource sustainability.

CONCLUSIONS

Simple handline, bottom-set longline, gillnet, and pamo gillnet were the commonly used fishing gears in Cabugao, Ilocos Sur. The different fishing gears caught sixty (60) fish species in Cabugao, Ilocos Sur. The highest abundance was recorded with a pamo gillnet, while the bottom-set longline had the lowest. Bottom-set longline and gill net were low in species diversity, while simple handlines and pamo gill nets have very low species diversity. The Catch Per Unit Effort (CPUE) among the different fishing gears in Cabugao, Ilocos Sur, differs significantly. The findings demonstrate that fishing gear selectivity plays a critical role in shaping fish diversity, abundance, and catch efficiency in Cabugao, Ilocos Sur. Low diversity values across gear types suggest the need for precautionary management to prevent further biodiversity decline.

RECOMMENDATIONS

Based on the findings and conclusions, it is recommended that municipal fisheries managers guide fisherfolk on the sustainable and selective use of fishing gears. Regular biodiversity monitoring should be conducted to track changes in species composition and abundance. Local regulations may be strengthened to reduce ecological pressure from inefficient or non-selective gears. Lastly, evidence-based fishing strategies should be developed to balance livelihood sustainability and marine resource conservation in Cabugao, Ilocos Sur.

ETHICAL STATEMENT

This study was reviewed and approved by the Ethics Committee of the University of Northern Philippines under ERC Number 2025-021. The ethical principle of informed consent was observed, including consent to the interview, assessment, and data collection. The researchers secured informed consent from the Municipality Mayor to conduct the data gathering procedures. Photographs and information gathered were used solely for this study and not for personal interest. Participants who voluntarily joined the study were given an informed consent form that showed no participants were coerced or harmed during their participation. Researchers ensured that all information shared by participants was kept strictly confidential and secure, that the information remained anonymous, and that participants' privacy was protected.

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REFERENCES

Ahmed, K. K. U., & Hambrey, J. B. (2005). Studies on the fish catch efficiency of different types of fishing gear in Kaptai Reservoir, Bangladesh. *Lakes and Reservoirs: Science, Policy and Management for Sustainable Use, 10*(4), 221–234. https://doi.org/10.1111/j.1440-1770.2005.00280.x

Aziz, M. S. B., Hasan, N. A., Mondol, M. M. R., Alam, M. M., & Haque, M. M. (2021). Decline in fish species diversity due to climatic and anthropogenic factors in Hakaluki Haor, an ecologically critical wetland in northeast Bangladesh. *Heliyon, 7*(1), e05861. https://doi.org/10.1016/j.heliyon.2020.e05861

Baleta, F. N., Beltijar, J. G., & Bolanos, J. M. (2017). *Design, fabrication, and operation of fishing gears used along the coastal areas of Isabela, Philippines*. https://www.researchgate.net/publication/315614911

Balisco, R. A. T., Tahajudjin, C. J. D., & Vigonte, A. C. M. (2019). *Fishing gears and their common catch in two coastal areas of Palawan, Philippines: Implications to fisheries management*. https://www.researchgate.net/publication/332497134

Baliton, R. S., Landicho, L. D., Cabahug, R. E. D., Paelmo, R. F., Laruan, K. A., Rodriguez, R. S., Visco, R. G., & Castillo, A. K. A. (2020). Ecological services of agroforestry systems in selected upland farming communities in the Philippines. *Biodiversitas: Journal of Biological Diversity, 21*(2), 707–717. https://doi.org/10.13057/biodiv/d210237

Bhanja, A., Payra, P., & Mandal, B. (2024). A study on the selectivity of different fishing gear. *Indian Journal of Pure and Applied Biosciences, 12*(2), 8–19. https://doi.org/10.18782/2582-2845.9072

Fernando, E. S. (1998). *Forest formations and flora in the Philippines*. https://www.scirp.org/reference/referencespapers?referenceid=2859343

Food and Agriculture Organization of the United Nations. (2020). *The state of world fisheries and aquaculture 2020*. https://doi.org/10.4060/ca9229en

Gonzales, B. J. (2013). *Field guide to coastal fishes of Palawan*. https://www.researchgate.net/publication/279618811

Ilac, A. G., Foronda, J. M. S., Ayop, A. N., Europa-Morales, A., & Ruadap, M. E. V. (2024). Exploring growth of *Gracilaria* sp. using the raft culture method. *Ilmu Kelautan: Indonesian Journal of Marine Sciences, 29*(4), 557–566. https://doi.org/10.14710/ik.ijms.29.4.557-566

McClanahan, T. R., & Mangi, S. C. (2004). Gear-based management of a tropical artisanal fishery based on species selectivity and capture size. *Fisheries Management and Ecology, 11*(1), 51–60. https://doi.org/10.1111/j.1365-

2400.2004.00358.x

Mendoza, J. A., Verzosa, A. L. R., & Ayop, A. N. (2023). Evaluation of coral reef health status in the fish sanctuary of San Esteban, Ilocos Sur. *The Vector: International Journal of Emerging Science, Technology and Management, 32*(1). https://doi.org/10.69566/ijestm.v32i1.302

Monteclaro, H. A. K., & I. S. (2017). *Field guidebook on Philippine fishing gears*. https://www.researchgate.net/publication/342199436

Muallil, R. N., Cleland, D., & Aliño, P. M. (2013). Socioeconomic factors associated with fishing pressure in small-scale fisheries along the West Philippine Sea. *Ocean & Coastal Management, 82*, 27–33. https://doi.org/10.1016/j.ocecoaman.2013.04.013

Obar, E. A., Nobleza-Payne, M. M., Montecarlo, H., & Babaran, R. P. (2021). Characterization of the handline fishery in Batanes Province, Philippines. *Philippine Journal of Natural Sciences*. https://pjns.upv.edu.ph/characterization-of-the-handline-fishery-in-batanes-province-philippines/

Rahman, B. M. S., Rahman, M. K., Ali, A., Lima, R. A., Mia, M. L., & Mahmud, Y. (2024). Catch composition, catch per unit effort (CPUE), and species selectivity of fishing gears on multi-species Kaptai Lake in Bangladesh. *Heliyon, 10*(10), e31173. https://doi.org/10.1016/j.heliyon.2024.e31173

Romero, J. B., de la Cruz, J. O., Gerona-Daga, M. E. B., Tabornal, R. U., Dañal, R. M. S., & Neis, L. M. V. (2023). Diversity, abundance, and local use of fishes in Lake Danao, Ormoc City, Philippines. *Philippine Journal of Fisheries, 30*(2), 277–288. https://doi.org/10.31398/tpjf/30.2.2023-0009

Salayo, N. D., Garces, L. R., Pido, M. D., et al. (2008). Managing small-scale fisheries in Southeast Asia: Bridging the gap between local and national levels. *Marine Policy, 32*(4), 512–522. https://doi.org/10.1016/j.marpol.2007.09.003

Shester, G. G., & Micheli, F. (2011). Conservation challenges for small-scale fisheries: Bycatch and habitat impacts of traps and gillnets. *Biological Conservation, 144*(5), 1673–1681. https://doi.org/10.1016/j.biocon.2011.02.023

Tahiluddin, A. B., & Sarri, J. H. (2022). An overview of destructive fishing in the Philippines. *Acta Natura et Scientia, 3*(2), 116–125. https://doi.org/10.29329/actanatsci.2022.352.04

Tzanatos, E., Somarakis, S., Tserpes, G., & Koutsikopoulos, C. (2008). Catch length analysis, relation to minimum landing sizes, and implications for the management of small-scale fisheries. *Fisheries Research, 93*(1–2), 125–134. https://doi.org/10.1016/j.fishres.2008.03.003

Zhang, L., Zou, K., & Chang, Y.-C. (2021). Global fisheries management and community interest. *Sustainability, 13*(15), 8586. https://doi.org/10.3390/su13158586