Egyptian Journal of Aquatic Biology & Fisheries
Zoology Department, Faculty of Science,
Ain Shams University, Cairo, Egypt.
ISSN 1110 – 6131
Vol. 29(4): 2451 – 2472 (2025)
www.ejabf.journals.ekb.eg

Catch Composition of Bottom Set Gillnet in Caba, La Union, Philippines

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ARTICLE INFO

Article History:
Received: May 30, 2025
Accepted: Aug. 1, 2025
Online: Aug. 20, 2025

Keywords:
Catch per unit effort,
Diversity index,
Relative abundance,
Species composition

ABSTRACT

This study aimed to identify the species composition, assess the relative abundance, determine the catch per unit effort and the diversity index of the species caught by the bottom set gillnet in Caba, La Union, Philippines. Descriptive method of research was used in the study. Data were gathered through field research and collection of samples and analyzed using percentages and presented in tables and graphs. Results revealed that 43 species belonging to 10 orders and 23 families were identified from the total of 1,324 individuals collected. *Gazza minuta* is the most abundant species in the area with 30.89% of the total sample population. The highest catch per unit effort was recorded in October 2024 with 0.0100 (kg/hr/unit of gear) and lowest in March 2025 with 0.0055 (kg/hr/unit of gear), with an average of 0.0076 (kg/hr/unit of gear) which means low value. Diversity index was 2.63 indicating that species in the area are moderately diverse. These results emphasizes the efficiency and gear selectivity of bottom set gillnet in relation to species abundance and diversity in the area, which also influence the catch of the fisherfolk.

INTRODUCTION

The world's population has been more than tripled since the mid-twentieth century. In mid-November 2022, the world human population surpassed eight **(**8**)** billion, up from an estimated 2.5 billion in 1950, with one billion added since 2010 and two billion since 1998. The world's population is predicted to grow by about two **(**2**)** billion people during the next 30 years from eight billion current population to 9.7 billion in 2050 and may peak at roughly 10.4 billion in the mid-2080s **(United Nations, 2023)**. In line with population growth, the demand for fish continues to increase as well as the consumption of animal protein associated with urbanization. The fisheries sector provides the basis for the livelihood and nutrition of billions of people and constitutes a significant source of foreign exchange for countless developing economies **(Finegold, 2009)**. Global fish consumption increased from 121 million tons in 2008 to 140 million tons in 2013, representing an annual growth rate of 2.9 percent and a total of 19 million tons.

Approximately 40 percent of the 19-million-ton increase is attributed to population growth from 6.7 billion to 7.1 billion **(**1.2 percent annual growth**)**, with the other 60 percent due to an increase in per capita fish consumption from 18kg to almost 20kg **(**1.7 percent annual growth**)**. Although there is a clear correlation between population and demand, it is also associated to sustainable development goal number 14, "Life below water," where fisheries play a vital role in satisfying global demand despite the availability of fisheries resources **(Cai & Leung, 2017)**.

Notably, the production of capture fisheries worldwide has hardly changed since the late 1980s **(Food and Agriculture Organization, 2024)**. Following that, the fisheries production in the Philippines increased gradually in 2019 and 2020 before declining in 2021 and 2022, when it was 2.08 million MT in 2020 and 1.99 million MT in 2022 **(Bureau of Fisheries and Aquatic Resources, 2022)**. Similarly, in Region I marine municipal fisheries production in 2022 was 23,770.63 MT, while the total fisheries production in 2023 dropped 1.8% from 4.34 to 4.26 million metric tons, with declines across the commercial, marine municipal, and inland municipal fisheries subsectors, including a 4.9% drop in commercial fisheries and a 7.3% decrease in marine municipal fisheries **(BFAR, 2023)**. While in the province of La Union, the dominant catch of marine municipal fisheries in 2023 encompassed the threadfin bream *"bisugo"*, yellowfin tuna *"bariles"*, slipmouth *"sapsap"*, blue crab *"alimasag"*, and skipjack *"gulyasan"* **(Philippine Statistics Authority, 2023)**.

La Union is a province located in the Ilocos Region on the western coast of Luzon in the Philippines. It has a land area of 1,499.28 square kilometers or 578.88 square miles. The province of La Union is composed of 19 municipalities and one city. Caba, like the other municipalities in the province of La Union, is a fourth-class municipality comprising of 17 barangays. It covers 46.31 square kilometers **(**17.88 square miles**)** and accounts for 3.09 percent of La Union's total area **(PhilAtlas, 2024)**.

In capture fisheries, different fishing gears were used by the fishermen throughout the world **(FAO, 2024)**. A gillnet which is the dominant fishing gear in Caba, La Union **(National Oceanic and Atmospheric Administration, 2021)**, has also specific types which include the set gillnet **(**also referred as bottom set gillnet**)**, drift gillnet, encircling gillnet, and fixed gillnet **(He *et al*., 2021)**.

Set gillnets **(**also known as bottom set gillnets**)** are form of passive gear that captures fish that swim into them and it is often mounted on the bottom. In deep water, especially when there are currents, bigger weights are employed to bring the net down quickly, especially when the net has to reach a precise location. According to the International Standard Statistical Classification of Fishing Gear **(**ISSCFG**)**, the standard abbreviation of set gillnet is GNS-07.1 **(FAO, 2024)**.

Bottom set gillnet was used particularly in the municipality of Caba and it is operated with the use of motorized boat, usually a complement of two persons, and is the the most dominated fishing gear used by the fisherfolks in the municipality. However, as years passed by, it was observed that fisherfolks' catch from the area is experiencing a decline by which the livelihood was affected **(Picana & Cavinta, 2024)**. Aside from bottom set gillnet, fish corral, ring net, troll line, push net, and baby trawl were used in the municipality **(Thia-Eng & McManus, 1998)**.

Bottom dwelling species such as the rabbitfish, emperor, flatfish, parrotfish, Indian mackerel, and the big-eyed scad are the target of the bottom set gillnet **(Balisco *et al.*, 2019)**. While in the study of **Ameworwor (2020)**, the catch of bottom set gillnet comprised of bony fishes, elasmobranchs, cephalopods, echinoderms and cnidarians. Additionally, based on the study of **Mohamad *et al.* (2022)**, the common species caught by the bottom set gillnet are the rabbitfish **(***Siganus* spp.**)**, sweetlips **(***Plectorhinchus* spp., *Diagramma* spp.**)**, goatfish **(***Mulloidichthys* spp., *Parupeneus* spp.**)**, and the common silverbiddy **(***Gerres oyena***)**.

The operators of bottom set gillnet **(***sigay***)** set the fishing gear to let it capture aquatic species. When set, it serves as a wall intercepting school of fish, only needs periodic attention, and are usually 100-300 meter long and 50 meshes deep. This gear is simple in design, easy to construct and operate **(Balisco *et al.*, 2019)**.

The study generally aimed to assess the catch composition of bottom set gillnet in Caba, La Union, Philippines. Specifically, it focused on identifying the species composition, assessing the relative abundance of the species, determining the catch per unit effort **(**CPUE**)** of the bottom set gillnet, applying the diversity index of species caught by the bottom set gillnet.

MATERIALS AND METHODS

Research design

Descriptive research method was used to describe the species composition, relative abundance, and diversity of fish caught using bottom set gillnet in the municipal waters of Caba, La Union, Philippines. Data were gathered through field research and collection of samples.

Study area

Fig. (1) shows the geographical locations of the study along the coast of Barangay Santiago Sur, Santiago Norte, San Carlos and Wenceslao, Caba, La Union, which covers the eight specific locations where fisherfolk operates bottom set gillnet. It is characterized by having sandy-muddy grayish sediment, seagrass beds and coral patches. Caba municipal waters extend up to 15 kilometers from the shore, covering about 1,500 hectares of marine area. The water depth ranges from 5 meters near the shore to about 50 meters at the outer limit **(National Mapping and Resource Information Authority, 2022)**.

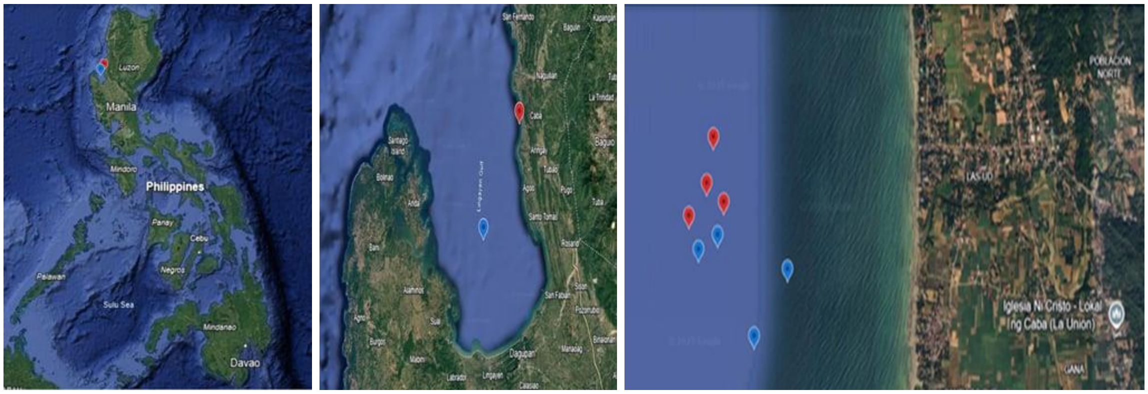

Fig. 1. Location of the Study. **(**A**)** Map of the Philippines; **(**B**)** Lingayen Gulf; **(**C**)** Caba, La Union **(**pinned coordinates of sites fished during sampling**) (Google Earth Pro, 2025)**

Sampling methods

Samples were collected bimonthly for six-month duration at fifteen **(**15**)** days interval from October 2024 to March 2025. Random samples were obtained by filling a 12-liter bucket with catch from the first haul of randomly selected bottom-set gillnet operators. Sampling was done using the materials such as: one piece of styrofoam board to hold the sample for documentation; mechanical weighing scale **(**60kg**)** to weigh the total catch in kilograms and digital weighing scale **(**1- 5kg**)** to weigh the samples. In terms of measuring the total length and standard length, ruler board and tape measure were used. Vernier caliper was also used for morphometric measurement. Pins were used during the documentation and identification by pinning the fins of the subsample on the styrofoam board. Styrofoam box was used as a storage for the samples during transportation from the sampling site to the laboratory. The samples were sorted according to physical characteristics and transported to DMMMSU-SLUC Capture Fisheries Laboratory. Sample and subsamples were weighed before getting the morphological and morphometric measurement, including meristic features for further identification of the species.

Sampling gear

The study used a bottom set gillnet **(**locally known as *sigay***)** made of monofilament polyamide with a number 8 mesh size, measuring 100 meters long and 2.5 meters deep with an International Standard Statistical Classification of Fishing Gear **(**ISSCFG**)** Code of GNS 07.1. A total of 24 units per operator were set for one hour using a motorized boat up to 3 GT with 16 horsepower, having the dimensions ranging from 5 to 10 meters of length, 0.5 to 2.5 meters of width, and up to 1 meter of height.

Fig. 2. Sampling gear and boat used: **(**A**)** Bottom set gillnet **(**B**)** Motorized boat

Data gathered

Species composition

The catch composition of bottom set gillnet were taxonomically identified according to order, family, genus and species. In identifying the samples, primary **(**interview on the fisherfolk and actual sampling**)** and secondary data **(**fish base, published journals and articles**)** were used. The dominant species caught were determined based on the species contribution by weight to the total harvest during the duration of the study. All species were arranged through percentage ranking from highest to lowest contribution to the total catch.

Relative abundance

The relative abundance used by **Achacoso *et al*. (2016)** was adapted and used in this study. Relative abundance expressed as **(***RA***)** is the proportional representation of a species in a community or sample of a community. The relative abundance **(***RA***)** of each species is expressed as:

$$RA = ni \,/\, \mathrm{N} \times 100$$

Where; *ni* is the number of individuals of the same species, and N is the total number of individuals for all species.

Catch per unit effort

Catch per unit effort **(**CPUE**)** was expressed in the number of species caught in kilograms **(**kg**)** by an amount of effort, and the CPUE was calculated using the formula of **Gökçe *et al*. (2016).**

$$\mathrm{CPUE} = \mathrm{C/T}$$

where:

C = Catch amount in weight **(**kg**)** of species

T = Soaking duration **(**hours per number of unit**)**

Diversity index

The formula of Shannon Diversity (Weiner) Index was used in the computation of species diversity, **Bobbit (2021)**.

Shannon Diversity (Weiner) Index (H) = - ∑ pi * ln (pi)

where:

H = Shannon Diversity (Weiner) Index

∑ = sum

ln = Natural logarithm

Pi = proportion of the entire community made up of a particular species.

Analysis of data

The data of catch composition, relative abundance, CPUE and diversity index for the bottom set gillnet that was gathered from the sampling were calculated using the formula used in the studies of **Achacoso *et al*. (2016)**, **Gökçe *et al*. (2016)** and **Bobbit (2021)** and encoded and analyzed descriptively using percentages and presented in tables and graphs.

RESULTS AND DISCUSSION

Species composition

Table (1) presents the species composition caught by bottom set gillnet. The collected samples were composed of ten (10) orders, 23 families, and 43 genus and species.

Table 1. Species composition of bottom set gillnet in Caba, La Union, Philippines (October 2024 – March 2025).

Order	Family	Genus and Species	Total no. of individuals
Acanthuriformes	Leiognathidae	*Aurigequula fasciata*	12
		Eubleekeria splendens	36
		Gazza achlamys	65
		Gazza minuta	409
		Leiognathus equula	150
Aulopiformes	Synodontidae	*Saurida tumbil*	31
Carangiformes	Carangidae	*Atule mate*	30
		Caranx ignobilis	5
		Carangoides armatus	9
		Megalaspis cordyla	3
		Scyris indica	1
		Selar boops	27
		Selaroides leptolepis	12
		Scomberoides tala	1
		Scomberoides tol	7
	Lactariidae	*Lactarius lactarius*	15
Clupeiformes	Chirocentridae	*Chirocentrus dorab*	3

	Dorosomatidae	*Sardinella lemuru*	1
	Engraulidae	*Stolephorus indicus*	18
Decapoda	Portunidae	*Portunus sanguinolentus*	6
Meniformes	Menidae	*Mene maculate*	4
Mugiliformes	Mugilidae	*Mugil sp.*	9
Perciformes	Gerreidae	*Gerres macracanthus*	113
	Haemulidae	*Pomadasys maculatus*	18
	Lutjanidae	*Lutjanus lutjanus*	1
		Lutjanus malabricus	1
		Lutjanus rivulatus	2
	Mullidae	*Upeneus sulphureus*	75
	Nemipteridae	*Nemipterus japonicus*	10
		Nemipterus peronii	1
		Nemipterus virgatus	13
	Polynemidae	*Eleutheronema tetradactylum*	5
		Polydactylus plebeius	1
	Sillaginidae	*Sillago sihama*	5
	Sphyraenidae	*Sphyraena obtusata*	57
		Sphyraena putnamae	7
	Terapontidae	*Terapon jarbua*	2
Pleuronectiformes	Cynoglossidae	*Cynoglossus abbreviatus*	2
	Psettodidae	*Psettodes erumei*	2
Scombriformes	Scombridae	*Rastrelliger brachysoma*	9
		Rastrelliger kanagurta	33
		Scomberomorus commerson	3
	Trichiuridae	*Trichiurus lepturus*	110
10 Order	23 Families	43 Species	1324

There were 1,324 individuals and 43 species identified belonging to ten **(**10**)** orders collected from bottom set gillnet during the sampling period. Among these identified families, the Carangidae has the highest genus and species identified throughout the sampling period, followed by Leiognathidae. Identifying fish species accurately and efficiently is crucial for ecological research and sustainable fisheries management **(Rishi *et al*., 2024).**

Furthermore, Carangidae is one of the most popular fish in the Philippine market, with many species regularly ranking among the top species **(Philippine Statistics Authority, 2017**, as cited in **Nepumuceno *et al*. (2023)**. It comprises with various species and characteristics that include the jacks, trevallies **(**crevalles**)**, amberjacks, pompanos, scads, kingfish, pilotfish, and rainbow runners, whereas majority of these species form schools except for the genus *Alectis* which has a solitary species **(Nepumuceno *et al*., 2023)**.

In the study of **Ramos *et al*. (2018)** in Tayabas Bay, it revealed that family Carangidae obtained the highest number of species with 21 identified species compared to other families of Serranidae, Scombridae, Mullidae, Nemipteridae, and Lutjanidae which include jacks, trevallies, scads, hardtail, pomfrets and quuenfishes.

Considering the ecological advantages of crustacean larvae and other meroplankton as preferred food of carangids may have contributed to the high abundance of carangids in an area **(Hermes & Guarin, 2003**, as cited in **Nepomuceno *et al*., 2023)**.

Table (2) shows the total weight in kilogram **(**kg**)** by rank of collected species in Caba, La Union from October 2024 to March 2025.

Table 2. Total weight in kilogram **(**kg**)** of collected species by rank **(**October 2024 – March 2025**)**

Species	Total Weight %	Rank
Trichiurus lepturus	30.82	1
Gazza minuta	11.77	2
Saurida tumbil	7.87	3
Sphyraena obtusata	5.49	4
Leiognathus equula	5.18	5
Gerres macracanthus	4.13	6
Rastrelliger kanagurta	3.69	7
Atule mate	3.26	8
Selar boops	2.92	9
Sphyraena putnamae	2.92	9
Lactarius lactarius	2.52	10
Upeneus sulphureus	2.01	11
Scomberomorus commerson	1.48	12
Eleutheronema tetradactylum	1.39	13
Chirocentrus dorab	1.33	14
Gazza achlamys	1.24	15
Pomadasys maculatus	1.20	16
Nemipterus virgatus	1.17	17
Rastrelliger brachysoma	1.00	18
Carangoides armatus	1.00	18
Eubleekeria splendens	0.82	19
Nemipterus japonicus	0.81	20
Scomberoides tol	0.77	21
Mugil sp.	0.66	22
Scyris indica	0.65	23
Selaroides leptolepis	0.58	24
Portunus sanguinolentus	0.53	25
Mene maculate	0.38	26
Caranx ignobilis	0.32	27
Sillago sihama	0.30	28
Megalaspis cordyla	0.24	29
Stolephorus indicus	0.24	29
Aurigequula fasciata	0.23	30
Psettodes erumei	0.19	31
Scomberoides tala	0.18	32

Polydactylus plebeius	0.16	33
Lutjanus malabricus	0.11	34
Cynoglossus abbreviatus	0.11	34
Lutjanus lutjanus	0.09	35
Lutjanus rivulatus	0.09	35
Terapon jarbua	0.07	36
Nemipterus peronii	0.05	37
Sardinella lemuru	0.02	38
Total	**100.0**	**-**

Trichiurus lepturus has the highest contribution and ranked first with 32.82 percent, followed by *Gazza minuta* ranked second with 11.77 percent, *Saurida tumbil* ranked third with 7.87 percent, *Sphyraena obtusata* ranked fourth with 5.49 percent, and *Leiognathus equula* ranked fifth with 5.18 percent.

The *Sardinella lemuru* has the least contribution in terms of kilogram in percentage which may be due to the change in reproductive biological performance and fishing activities decreasing its abundance **(Ramos & Roque, 2023)**. This pelagic species also has the least contribution in terms of relative abundance by volume of catch having 0.01 percent that was recorded in the study of **Gaerlan *et al*. (2018)** in the Lingayen Gulf.

Although the bottom set gillnet does not target mainly pelagic species, it would be still included in the catch due to their movement from surface down close to the bottom during daytime making them susceptible to bottom set gillnet according to **Nieland (1982)** as cited in the study of **Gaerlan *et al*. (2018)** in Lingayen Gulf.

In the study of **Villarao *et al*. (2024)** in Babuyan Channel, the species *Trichiurus lepturus* is primarily caught by fishing gears such as bottom set gillnet, multiple handline, drift filter net, beach seine, simple handline, ring net, surface set gillnet, and drift gillnet. This species also exhibits seasonal migration patterns influenced by moonsonal changes. The higher catch volumes in October to February suggests that the species aggregates in the area during these months making it more susceptible to capture.

In the duration of the study, a decline was detected in the volume of catch from October 2024 to January 2025 due to the strong waves and fishing gears with more debris and mud attached. According to **Padios *et al.* (2017)**, possible explanations include weather disturbances and changes in monsoons which also correlates to the frequent creation of typhoons in the region that strongly affects the volume, density, and quantity of the catch. In addition, the size of ocean waves significantly affects fishing operations, as well as the prospects and dangers for fisherfolk who depend significantly on marine resources **(Maltby *et al*., 2021**, as cited in **Rahim & Hastuti, 2023)**. Strong winds, rising sea surface temperatures, and tidal wave frequency and severity had an impact on fishing activities **(Rahim & Hastuti, 2023)**.

Table (3) shows the occurrence of species in every sampling month from October 2024 to March 2025. Of the total 43 identified species, 30 species were recorded in the month of October, followed by November with 21 species, December with 22 species, January with 9 species, February with 12 species, and March with 14 species.

Table 3. Occurrence of species in each sampling month **(**October 2024 – March 2025**)**.

Species	October	November	December	January	February	March
Atule mate	+	+	-	-	-	-
Aurigequula fasciata	+	-	-	-	-	-
Caranx ignobilis	+	+	+	-	-	-
Chirocentrus dorab	+	-	-	+	-	-
Carangoides armatus	+	+	+	-	-	-
Cynoglossus abbreviatus	+	-	-	-	-	-
Eleutheronema tetradactylum	-	-	+	-	-	-
Eubleekeria splendens	+	+	+	+	+	+
Gazza achlamys	-	-	+	-	+	+
Gazza minuta	+	+	+	+	+	+
Gerres macracanthus	+	+	+	-	+	-
Lactarius lactarius	+	+	-	-	-	+
Leiognathus equula	+	-	-	+	-	+
Lutjanus lutjanus	-	-	+	-	-	-
Lutjanus malabricus	-	-	+	-	-	-
Lutjanus rivulatus	+	-	-	-	-	-
Megalaspis cordyla	+	+	-	-	-	-
Mene maculata	-	+	-	+	-	-
Mugil sp.	+	-	-	-	-	-
Nemipterus japonicus	-	-	+	+	+	+
Nemipterus peronii	-	-	-	-	+	-
Nemipterus virgatus	+	-	+	-	-	-
Polydactylus plebeius	-	-	-	-	-	+
Pomadasys maculatus	+	-	-	-	-	+
Portunus sanguinolentus	+	-	-	-	-	-
Psettodes erumei	+	+	-	-	-	-
Rastrelliger brachysoma	+	-	+	-	-	-
Rastrelliger kanagurta	+	+	+	-	-	+
Sardinella lemuru	+	-	-	-	-	-
Saurida tumbil	+	+	+	-	+	-
Scomberoides tala	-	+	-	-	-	-
Scomberoides tol	-	-	-	-	+	-
Scomberomorus commerson	+	+	-	-	-	-
Scyris indica	-	+	-	-	-	-
Selar boops	+	+	+	-	-	+
Selaroides leptolepis	-	+	+	+	-	-
Sillago sihama	+	-	-	-	-	-
Sphyraena obtusata	-	-	+	-	+	+
Sphyraena putnamae	+	+	+	+	-	-
Stolephorus indicus	+	+	+	-	+	+
Terapon jarbua	+	-	+	-	-	-

Trichiurus lepturus	+	+	+	+	+	+
Upeneus sulphureus	+	+	+	-	+	+
	30	**21**	**22**	**9**	**12**	**14**

Note: Positive sign **(+)** denotes presence of the species while negative sign **(-)** means absence.

The species *Gazza minuta, Trichiurus lepturus* and *Eubleekeria splendens* were present in all sampling months from October 2024 to March 2025, which were also the most abundant species identified in terms of volume. A total of 13 species appeared only once within the duration of the study namely; *Aurigequula fasciata*, *Cynoglossus abbreviatus, Eleutheronema tetradactylum, Lutjanus lutjanus, Lutjanus malabricus, Lutjanus rivulatus, Mugil* sp., *Nemipterus peronii*, *Polydactylus, plebeius, Portonus sanguinolentus, Sardinella lemuru, Scomberoides tala, Scomberoides tol, Scyris indica* and *Sillago sihama.*

The kind and size of fish captured by a gillnet are mostly determined by its mesh size. Fish size, hanging ratio, and rope thickness also affect gillnet selectivity. Because of their high size selectivity, reduced fuel consumption, and direct benthic effects only during gear retrieval, gillnets can be an environmentally beneficial choice **(He, 2006)**. However, discarded, lost, or abandoned gillnets can remain in marine ecosystems for years, posing a threat to the sustainability of gillnet fisheries due to their continued entanglement of marine species **(**ghost fishing**)** and contribution to both macroplastic and microplastic pollution **(Savina *et al*., 2024)**.

According to **Puspasari *et al*. (2018)**, the primary environmental factors that influence the fish's habitat are temperature, salinity, chlorophyll-a **(**the availability of food source**)**, and thermocline depth, which will affect the swimming area. More specifically, the value of CPUE of pelagic fish is influenced by temperature and chlorophyll-a, or only partially by chlorophyll-a.

Monsoon variability affects fishing production and the relationship is evident when fishing results decline in response to high wind speeds. In contrast, the amount of fish caught increases when the wind speed is low **(Kunarso *et al*., 2018)**. However, it is important to familiarize the fishing season pattern in gathering information about the presence of fish in certain areas **(Imron *et al*., 2022)**.

The presence of *Gazza minuta, Eubleekeria splendens, Trichiurus lepturus* in all sampling months may be due to the selectivity of the fishing gear as mentioned in the study of **Ramos *et al*. (2018)** in Tayabas Bay that these species targets by various fishing gears such as bottom set gill net and hook and line. Availability of food on certain fishing fishing grounds also contributed to the variations of species **(Villarao *et al*., 2024)**.

Relative abundance

Table (4) presents the abundance of the identified species collected in the area during the study period.

Table 4. Relative abundance of species caught by bottom set gillnet in Caba, La Union, Philippines **(**October 2024 – March 2025**)**

Species	Relative Abundance **(**%**)**
Gazza minuta	30.89
Leiognathus equula	11.33
Gerres macracanthus	8.53
Trichiurus lepturus	8.31
Upeneus sulphureus	5.66
Gazza achlamys	4.91
Sphyraena obtusata	4.31
Eubleekeria splendens	2.72
Rastrelliger kanagurta	2.49
Saurida tumbil	2.34
Atule mate	2.27
Selar boops	2.04
Pomadasys maculatus	1.36
Stolephorus indicus	1.36
Lactarius lactarius	1.13
Nemipterus virgatus	0.98
Aurigequula fasciata	0.91
Selaroides leptolepis	0.91
Nemipterus japonicus	0.76
Carangoides armatus	0.68
Mugil sp.	0.68
Rastrelliger brachysoma	0.68
Scomberoides tol	0.53
Sphyraena putnamae	0.53
Portunus sanguinolentus	0.45
Caranx ignobilis	0.38
Eleutheronema tetradactylum	0.38
Sillago sihama	0.38
Mene maculate	0.30
Chirocentrus dorab	0.23
Megalaspis cordyla	0.23
Scomberomorus commerson	0.23
Cynoglossus abbreviatus	0.15
Lutjanus rivulatus	0.15
Psettodes erumei	0.15
Terapon jarbua	0.15
Lutjanus lutjanus	0.08
Lutjanus malabricus	0.08
Nemipterus peronii	0.08
Polydactylus plebeius	0.08
Sardinella lemuru	0.08
Scomberoides tala	0.08
Scyris indica	0.08
Total	**100.00**

In terms of species abundance, *Gazza minuta* was the most abundant species contributing almost one-third of the total abundance having 30.89 percent, followed by *Leiognathus equula* with 11.33 percent, *Gerres macracanthus* with 8.53 percent, *Trichiurus lepturus* with 8.31 percent, *Upeneus sulphureus* with 5.66 percent and others contributed 35.28 percent namely; *Gazza achlamys, Sphyraena obtusata, Eubleekeria splendens, Rastrelliger kanagurta, Saurida tumbil, Atule mate, Selar boops, Pomadasys maculatus, Stolephorus indicus, Lactarius lactarius, Nemipterus virgatus, Aurigequula fasciata,Selaroides leptolepis,Nemipterus japonicas,Carangoides armatus, Mugil* sp., *Rastrelliger brachysoma, Scomberoides tol, Sphyraena putnamae, Portunus sanguinolentus, Caranx ignobilis, Eleutheronema tetradactylum, Sillago sihama, Mene maculate, Chirocentrus dorab, Megalaspis cordyla, Scomberomorus commerson, Cynoglosus abbreviatus, Lutjanus rivulatus, Psettodes erumei, Terapon jarbua, Lutjanus lutjanus, Lutjanus malabricus, Nemipterus peronii, Polydactylus plebeius, Sardinella lemuru, Scomberoides tala,* and *Scyris indica.*

Gazza minuta, a small benthopelagic fish, thrives in shallow, soft-bottom environments and is known for forming dense schools, contributing to its high relative abundance throughout the sampling **(Francisco *et al*., 2018)**.

Seasonal variations particularly monsoon-driven changes affect spawning, feeding, and migration, contributing to temporal shifts in species dominance and abundance **(Vivekanandan *et al*., 2010)**. Species dominance and distribution are determined by habitat, which includes among other things, plankton populations, upwelling system, temperature, salinity, current direction, and production seasonality **(FAO, 2021)**.

However, according to **Hong *et al*. (2023)**, it has demonstrated that climate variability significantly affects the distribution and quantity of fish stocks. Both fishing pressure and environmental impacts have often attributed for changes in the population and distribution of most significant commercial fish species.

Fig. (3) presents the relative abundance of fish families caught by bottom-set gillnets in Caba, La Union, Philippines.

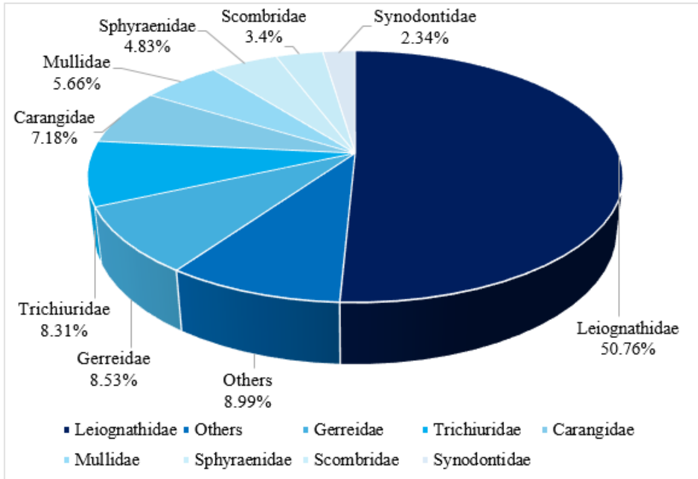

Fig. 3. Relative abundance of fish family caught by bottom set gillnet in Caba, La Union, Philippines **(**October 2024 – March 2025**)**

Leiognathidae was the most abundant family consisting of 50.76 percent of the total number of individuals collected, followed by Gerridae with 8.53 percent, Trichiuridae with 8.31 percent, Carangidae **(**7.18 percent**)**, Mullidae **(**5,66 percent**)**, Sphyraenidae **(**4.83 percent**)**, Scombridae, **(**3.4 percent**)**, Synodontidae **(**2.34 percent**)**, and others have a total of 8.99 percent which comprised of the following families: Nemipteridae, Engraulidae, Haemulidae, Lactariidae, Mugilidae, Portunidae, Polynemidae, Sillaganidae, Menidae, Lutjanidae, Chirocentridae, Terapontidae, Cynoglossidae, Psettodidae, and Dorosomatidae.

Family Leiognathidae comprises five species including *Aurigequula fasciata*, *Eubleekeria splendens*, *Gazza achlamys*, *Gazza minuta*, and *Leiognathus equula*. Portunidae with the species of *Portonus sanguinolentus* was the only crustaecean collected throughout the study.

Leiognathidae is also known as silverbellies or slip mouths throughout the world. Beach seines, gill nets, bottom trawls, and other artisanal gears are frequently used to catch this species. Some of the catch may consist of those found in congested schools **(Chandrani & Wattevidanage, 2016)**.

Species from Leiognathidae have small, compressed silvery bodies and dramatically protruding jaws that are found on soft bottoms in coastal marine and estuary seas in the Indo-West Pacific's tropical waters **(Bray, 2025)**.

In the study of **Francisco *et al.* (2018)** in Leyte Gulf, abundant species caught from the area also has similarities to this study, including the species that belongs to the Leiognathidae family, followed by Carangidae, Nemipteride, Scombridae, Gerreidae, Engraulidae, Mullidae, Synodontidae, Clupeidae, and Portunidae. In addition, Carangidae and Leiognathidae were the most abundant with four species recorded from both families, followed by Lutjanidae and Muguilidae in the study of **Quindo *et al*. (2019)** in Bayawan River, Negros Oriental.

Catch Per Unit Effort

Table (5) presents the catch per unit effort of bottom set gillnet in Caba, La Union throughout the six- month study.

Table 5. Catch per unit effort of bottom set gillnet in Caba, La Union, Philippines (October 2024 – March 2025)

Month	Total weight (kg)	Soaking duration (hr)	Panel	CPUE (kg/hr/panel)
October	15.32	8	192	0.0100
November	14	8	192	0.0091
December	13.3	8	192	0.0087
January	9	8	192	0.0059
February	9.6	8	192	0.0063
March	8.5	8	192	0.0055
AVERAGE	**11.62**	**8**	**192**	**0.0076**

The month of October obtained the highest CPUE with 0.0100 kilogram per hour per panel, followed by November (0.0091), December (0.0087), January (0.0059), February (0.0063), and March (0.0055). It shows a declining trend in CPUE from October 2024 to March 2025, having the month of October as the highest CPUE attained and March as the lowest CPUE. It can also be observed that the CPUE for the month of February (0.0063 kg/hr/panel) has a slight recovery compared to January (0.0059). An average CPUE of 0.0076 was obtained throughout the study. However, the soaking duration of eight (8) hours and unit of gear remained constant (192).

Species behavioral and physiological movements in response to environmental factors such as temperature, oxygen levels, food availability, and predation risk may influence catchability, which in turn may influence the seasonal variation in catch rate **(Villegas-Rios, 2014)**. The diel activity influences the dynamics of catches and is impacted by feeding and habitat choice of the species in certain areas **(Tawari *et al*., 2025)**.

Furthermore, the relationship between CPUE and real stock abundance may not necessarily be linear. While the fish population is declining, CPUE may occasionally stay the same or even rise. In spite of general population declines, this can happen when fish congregate in dense schools, which makes them easier to capture **(Maunder *et al*., 2006)**.

Species diversity

Table (6) presents the diversity index of species caught by bottom set gillnet in Caba, La Union from October 2024 to March 2025.

Table 6. Diversity index of species caught by bottom set gillnet in Caba, La Union, Philippines **(**October 2024 – March 2025**)**

Species	Frequency	Shannon-Weinner
Gazza minuta	409	0.36288
Leiognathus equula	150	0.24673
Gerres macracanthus	113	0.21004
Trichiurus lepturus	110	0.20670
Upeneus sulphureus	75	0.16263
Gazza achlamys	65	0.14797
Sphyraena obtusata	57	0.13541
Eubleekeria splendens	36	0.09802
Rastrelliger kanagurta	33	0.09202
Saurida tumbil	31	0.08791
Atule mate	30	0.08581
Selar boops	27	0.07938
Pomadasys maculatus	18	0.05843
Stolephorus indicus	18	0.05843
Lactarius lactarius	15	0.05076
Nemipterus virgatus	13	0.04540
Aurigequula fasciata	12	0.04263
Selaroides leptolepis	12	0.04263
Nemipterus japonicus	10	0.03690
Carangoides armatus	9	0.03393
Mugil sp.	9	0.03393
Rastrelliger brachysoma	9	0.03393
Scomberoides tol	7	0.02772
Sphyraena putnamae	7	0.02772
Portunus sanguinolentus	6	0.02446
Caranx ignobilis	5	0.02107
Eleutheronema tetradactylum	5	0.02107
Sillago sihama	5	0.02107
Mene maculata	4	0.01753
Chirocentrus dorab	3	0.01380
Megalaspis cordyla	3	0.01380
Scomberomorus commerson	3	0.01380
Cynoglossus abbreviatus	2	0.00981
Lutjanus rivulatus	2	0.00981
Psettodes erumei	2	0.00981
Terapon jarbua	2	0.00981
Lutjanus lutjanus	1	0.00543
Lutjanus malabricus	1	0.00543
Nemipterus peronii	1	0.00543
Polydactylus plebeius	1	0.00543
Sardinella lemuru	1	0.00543
Scomberoides tala	1	0.00543
Scyris indica	1	0.00543
Total	**1324**	**2.63173**

The number of species and the total number of individual species may be the cause of species diversity. It was observed that *Gazza minuta*, followed by *Leiognathus equula* are the most abundant species that lead to moderately high diversity indices.

In this study, an H’ value of 2.63 was obtained using the Shannon-Weiner Diversity Index. Whereas this value would be considered indicative that the municipal waters in Caba, La Union has moderate species diversity, wherein diversity values of 2.00-2.49 are categorized as low, 2.50- 2.99 as moderate, 3.00-3.49 as high, and >3.50 as very high diversity **(Reyes *et al*., 2019)**.

Spatial variations may be a reflection in habitat quality, which is influenced by a number of physical and biological factors, including bathymetry, currents, wave exposure, temperature, salinity, turbity, food availability and bottom substrates, thus contributes to diversity of certain species **(Hinz *et al*., 2006; Sorensen & Pedersen, 2021)**. High freshwater discharge during the rainy season can also alter the ecosystem, causing seasonal variations in nutrient loadings, salinity, and temperature. The abundance of nutrients in marine environments encourages the growth of planktonic organisms, which are a major source of food, which can have a domino effect on many fish species. Besides, biodiversity may alter when species with particular habitat preferences tend to migrate **(Nhat *et al*., 2024)**.

CONCLUSION

Forty-three (43) species belonging to ten (10) orders and twenty-three (23) families were identified. The most abundant species was *Gazza minuta* with 30.89 percent, followed by *Leiognathus equula* with 11.33 percent, *Gerres macracanthus* with 8.53 percent, *Upeneus sulphureus* with 5.66 percent and other species contributed 35.28 percent during the study.

The Shannon-Wiener diversity index obtained in the study was 2.63 which suggests that species are moderately diverse in the area.

The catch per unit effort varied across months peaking at 0.0100 **(**kg/hr/panel**)** in the month of October, and the lowest catch per unit effort was observed in the month of March with 0.0055 **(**kg/hr/panel**)**, reflecting seasonal fluctuations that may be influenced by environmental conditions, migration patterns, or reproductive cycles.

The dominance of *Gazza minuta* and fluctuations in CPUE underscores the necessity for adaptive strategies that consider seasonal patterns in species abundance. However, certain limitations including potential seasonal bias due to the limited sampling period and gear selectivity that may influence representation toward certain species. To enhance the understanding on local fisheries, future research should focus on continuous monitoring to determine year-round variations, assess the socio-economic implications of catch composition on local livelihoods, and examine ecological relationships between species distribution and habitats like coral reefs, seagrass beds and substrates. These efforts would contribute to a more integrated and sustainable approach to fisheries resource management in Caba, La Union.

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