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Ichthyofaunal Community in Dibut River Baler, Aurora

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ABSTRACT
The Dibut River in Baler, Aurora, runs along Luzon's eastern coast, located between the Pacific Ocean and the Sierra Madre Mountain range, and it serves important functions for the local ecosystem, such as agricultural irrigation, biodiversity support, and sustaining the livelihoods of nearby communities. Despite its significance, no studies have been conducted on the river's ichthyofaunal composition. This study determined the river's ichthyofaunal composition and assessed the quantity of catch in terms of weight of fish species by lunar phases. The study collected 1,265 fish representing 22 species from 17 families using gill nets. The five major fish species comprise 85.63% of total catch biomass and are composed of the following species; *Planiliza macrolepsis* with 64.60%, *Mesoprites cancellatus* with 7.31%, *Gerres erythrourus* with 6.29 %, *Hypoatherina temminck*i with 4.03 % and *Eubleekeria splendens* with 3.40 %, respectively. Due to the limitations of this study, further studies related to species identification through DNA barcoding, growth by sexes, and other important growth parameters of different species are recommended for better management of the Dibut River.

INTRODUCTION

The Philippines' inland waters, which include rivers, lakes, and waterfalls, are recognized to contain an extremely diversified biotic diversity **(Vedra *et al.*, 2013)**. Aurora Province, situated in Central Luzon, is known for its rich biodiversity, including marine and freshwater species **(Santos *et al.*, 2017)**. It serves vital functions for the local ecosystem, including agricultural irrigation, biodiversity support, and sustaining the livelihoods of nearby communities **(Department of Environment and Natural Resources, 2018)**. Baler, the center of commerce in Aurora, is found along Luzon's eastern coast and is a third-class municipality. Nestled between the Pacific Ocean and the Sierra Madre Mountain range, its municipal hub is approximately 15°46' North, 121°34' East on Luzon Island **(PhilAtlast, 2024)**.

Baler consists of two major rivers: the Aguang River and the Dibut River. The Dibut River, the second largest river in Baler, Aurora, is an important freshwater system that supports a variety of fish species. The river plays an important role in the community by providing fish sources, and it provides habitat for diverse aquatic organisms, including fish populations. However, habitat degradation, pollution, and climate change threaten these ecosystems, necessitating continuous monitoring and assessment. Moreover, declining water quality due to industrial and agricultural runoff further impacts fish populations and ecosystem stability **(Vörösmarty *et al*., 2010)**.

Understanding the ichthyofaunal community structure in rivers is essential for conservation efforts and sustainable management of aquatic resources. Therefore, this study aimed to assess the fish species in the Dibut River, Baler, Aurora.

MATERIALS AND METHODS

Study area

The study was conducted from October 2023 to March 2024 in the river of Dibut, Baler Aurora, at three specific coordinates: Station 1 (15° 45' 18.43" N and 121° 34' 26" E) is the lower stream of the river where the freshwater and saltwater meets, Station 2 (15° 44' 55" N and 121° 33' 39" E) is between the upper and lower stream of the river, and Station 3 (15° 44' 56" N and 121° 33' 11" E) is the upper stream of the river.

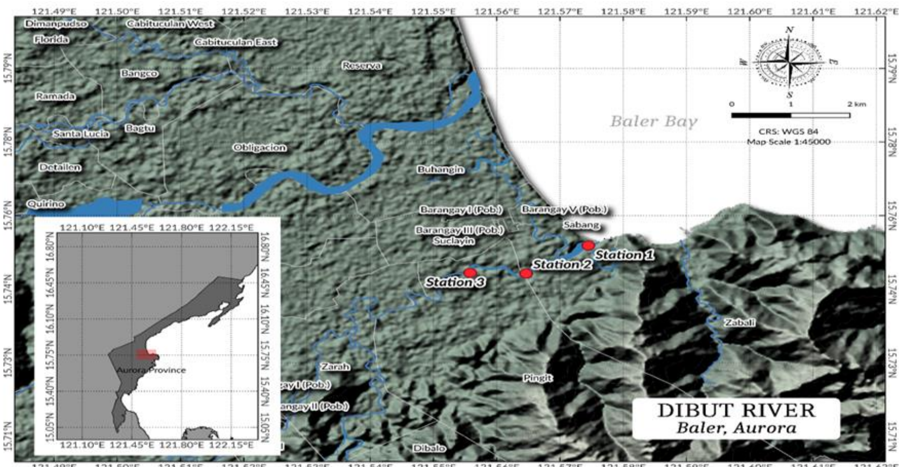

Fig. 1. Site and location of the area

Fish collection

Sampling was carried out monthly, using a gill net measuring 100 x 1m with a mesh size of 14. Data collection occurred simultaneously in all three sampling locations. The gill net were set around 6:00 am and harvested at 6 pm in conjunction with the lunar phases (full moon, new moon, last quarter and first quarter).

Fish identification

Identification of the specimens was made using internet materials and other local identification guides. FishBase, IUCN, was used to confirm the scientific names.

Water quality parameters

Water parameters were measured at every station using various water quality kits, including a refractometer (ATAGO) and DO meter (DO9100), Secchi disk, and pH meter (REEOPEE). These methods were utilized to evaluate multiple parameters such as salinity, dissolved oxygen levels, water transparency, and pH.

Data analysis

To evaluate the similarity and variety of sample sets, the Jaccard index, also known as the Jaccard similarity coefficient, was used. It is calculated by dividing the intersection of two sets by the size of their union. If no elements are common, the Jaccard coefficient equals 0.

It can be stated mathematically as follows:

J =(A U B)/(A Ω B)

Where:

The two sets under comparison are represented by (A) and (B).

The size of the intersection (elements shared by both sets) is shown by (|A \cap B|).

The union's size (all distinct elements in both sets) is represented by (|A \cup B|).

If there are no elements in common between sets (A) and (B) at their intersection, then (J (A, B) = 0).

RESULTS and DISCUSSION

Species composition

A total of 1,265 fish individuals, representing 23 species from 17 families, were collected from three stations along the Dibut River in Baler, Aurora. At Station 1, 13 species were recorded, belonging to the families Atherinidae, Ambassidae, Gerreidae, Kuhliidae, Leiognatidae, Lutjanidae, Mugilidae, Serranidae, Siganidae, Sillaginidae, and Terapontidae. Station 2 recorded 12 species from the families Atherinidae, Ambassidae, Apogonidae, Butidae, Gerreidae, Kuhliidae, Leiognatidae, Lutjanidae, Mugilidae, and Terapontidae. At Station 3, 14 species were observed, including those from the families Ambassidae, Anguillidae, Apogonidae, Butidae, Cichlidae, Gerreidae, Leiognatidae, Lutjanidae, Mugilidae, Osphronemidae, and Scorpaenidae. Species from the families Ambassidae, Gerreidae, Leiognatidae, Lutjanidae, and Mugilidae were found at all three stations, indicating their tolerance to a wide range of salinity conditions. The Jaccard similarity index values showed low similarity between the stations: 0.36 between Station 1 and Station 2, 0.31 between Station 2 and Station 3, and 0.22 between Station 1 and

Station 3. These values, as shown in Table (1), suggest a generally low level of species similarity across the stations.

Table 1. Jacckard similarity index: Species composition caught by gillnet at stations 1-3 of Dibut River from October 2023 to March 2024

Family Name	Scientific Name	Station 1	Station 2	Station 3
Atherinidae	*Hypoatherina temminckii*	+	+	-
Ambassidae	*Ambassis vachellii*	+	+	+
Anguillidae	*Anguilla marmorata*	-	-	+
	Anguilla bicolor	-	-	+
Apogonidae	*Yarica hyalosoma*	-	+	+
Butidae	*Oxyeleotris marmorata*	-	-	+
	Butis butis	-	+	+
Cichlidae	*Oreochromis niloticus*	-	-	+
Gerreidae	*Gerres macracanthus*	+	+	+
	Gerres erythrourus	+	+	+
Kuhliidae	*Kuhlia marginata*	+	+	-
Leiognatidae	*Eubleekeria splendens*	+	+	+
Lutjanidae	*Lutjanus argentimaculatus*	-	+	-
	Lutjanus russellii	+	+	+
Mugilidae	*Planiliza macrolepis*	+	+	+
Osphronemidae	*Trichopodus trichopterus*	-	-	+
Scorpaenidae	*Neovespicula depressifrons*	-	-	+
Serranidae	*Epinephelus fuscoguttatus*	+	-	-
	Cephalopholis argus	+	-	-
Siganidae	*Siganus guttatus*	+	-	-
Sillaginidae	*Sillago sihama*	+	-	-
Terapontidae	*Mesoprites cancellatus*	+	+	-
	Total	13	12	14

Note: positive (+) sign means present in the catch; negative (-) sign means absent in the catch.

Relative biomass

The biomass data obtained from fish caught using gillnets in three locations in the Dibut River, Baler Aurora, between October 2023 to March 2024, offers valuable insights into the varying weights of different species present in the ecosystem. There is evident diversity in biomass among the species, reflecting their varied ecological roles and population dynamics. Certain species exhibit substantial biomass across stations and moon phases. The researchers caught a significant amount of *Oreochromis niloticus*, totaling between 84 and 854 grams, which makes up a notable proportion of their catch. Similarly, *Planiliza macrolepis* demonstrates considerable biomass, totaling between 1350 grams to an impressive 23058 grams. These findings highlight the ecological importance and abundance of these species within the Dibut River ecosystem. Conversely, some species show lower biomass values or are absent from specific stations or moon phases. Species like *Epinephelus fuscoguttatus*, *Cephalopholis argus*, and *Siganus guttatus* exhibit minimal biomass values or are not captured during the study period, suggesting potentially lower abundance or specific habitat preferences within the Dibut River. Additionally, the fluctuations in biomass across moon phases suggest possible impacts of lunar cycles on fish behavior, migration patterns, or feeding activities. Species such as *Hypoatherina temminckii* and *Gerres erythrourus* display significant variations in biomass across different moon phases, indicating potential behavioral patterns or spawning activities linked to lunar cycles.

Table 2. Biomass (g) of species caught by gillnet across 3 stations by moonphase in Dibut River Baler Aurora from October 2023 to March 2024

Family Name	Scientific Name	LQ (g)	NM (g)	FQ (g)	FM (g)
Atherinidae	*Hypoatherina temminckii*	453	992	658	182
Ambassidae	*Ambassis vachellii*	294	285	179	99
Anguillidae	*Anguilla marmorata*	-	86	-	-
	Anguilla bicolor	-	286	-	-
Apogonidae	*Yarica hyalosoma*	82	34	27	-
Butidae	*Oxyeleotris marmorata*	286	178	235	128
	Butis butis	147	37	-	-
Cichlidae	*Oreochromis niloticus*	854	179	-	84
Gerreidae	*Gerres macracanthus*	282	956	202	162
	Gerres erythrourus	208	1981	1135	242
Kuhliidae	*Kuhlia marginata*	-	272	24	-
Leiognatidae	*Eubleekeria splendens*	287	796	739	105
Lutjanidae	*Lutjanus argentimaculatus*	250	50	-	-
	Lutjanus russellii	124	657	111	93
Mugilidae	*Planiliza macrolepis*	9140	1350	23058	3076
Osphronemidae	*Trichopodus trichopterus*	285	54	126	8
Serranidae	*Epinephelus fuscoguttatus*	250	-	-	-
	Cephalopholis argus	52	-	300	-
Scorpaenidae	*Neovespicula depressifrons*	24	-	-	-
Siganidae	*Siganus guttatus*	250	-	-	-
Sillaginidae	*Sillago sihama*	65	45	-	-
Terapontidae	*Mesopristes cancellatus*	1605	1005	1259	276

(Note: LQ stands for Last Quarter; NM stands for New Moon; FQ stands for First Quarter; FM stands for Full Moon)

1. Water quality parameters

Water is crucial for life and human needs, ranking second only to air. Scientific research on water quality involves monitoring its physical, chemical, and biological attributes. Monitoring helps in decision-making about water demand, extraction, land utilization, and contamination. It also aids in creating policies and evaluating management efforts, enabling the use of data to improve water quality.

1.1 Water turbidity

Optical turbidity measurement may make water appear hazy, muddy, or different colors. Suspended particles and dissolved colored pigment make water opaque, cloudy, or muddy. Turbidity measures evaluate suspended particles and water clarity, making them a standard water quality indicator.

Turbidity levels in the Dibut River in Baler, Aurora, were monitored from October to March. On average, Station 1 recorded turbidity measurements of 69.46cm at 6:00 AM, 65.67cm at 12:00 noon, and 74.63cm at 6:00 PM. Station 2 showed average turbidity readings of 66.00cm at 6:00 AM, 57.92cm at 12:00 noon, and 65.83cm at 6:00 PM. Station 3 exhibited the lowest turbidity levels, with average measurements of 62.08 cm at 6:00 AM, 58.33cm at 12:00 noon, and 68.33cm at 6:00 PM. The highest turbidity was recorded at Station 1 during a full moon, reaching 99.17cm at 6:00 PM, while the lowest turbidity was observed at Station 3 during the first quarter moon, measuring 38.67cm at 6:00 PM. Turbidity is influenced by the scattering of light caused by suspended particles in the water column **(Myre *et al.*, 2006)**.

1.2 Water depth

Water depth measurements in the Dibut River at each station in Baler, Aurora, were recorded from October to March. At Station 1, the average water depth was 196.4cm at 6:00 AM, 156.8cm at 12:00 noon, and 201.2cm at 6:00 PM. Station 2 recorded average depths of 179.5cm at 6:00 AM, 151.1cm at 12:00 noon, and 188.7cm at 6:00 PM. In contrast, Station 3 had slightly lower average depths, measuring 154.6cm at 6:00 AM, 118.5cm at 12:00 noon, and 146.2cm at 6:00 PM. The highest water depth during the study period was observed at Station 1 during a new moon, reaching 263.3cm at 6:00 PM. The lowest depth was recorded at Station 3 during a full moon at 12:00 noon, measuring only 77.0cm. Tidal fluctuations significantly influenced water depth at all stations, with the most pronounced changes occurring at Station 1, particularly during new moon and full moon phases. The study observed that fortnightly variations in subtidal water levels were primarily driven by the interaction between the river and tidal forces. Contributions from diurnal, semidiurnal, and quarterdiurnal tidal interactions to subtidal friction were found to be comparatively minor **(Buschman *et al*., 2009)**.

1.3 Water salinity

Salinity values in the Dibut River at each station in Baler, Aurora, were measured from October to March. Station 1 exhibited the highest salinity among the three, with average readings of 7.96ppt at 6:00 AM, 7.92ppt at 12:00 noon, and 18.04ppt at 6:00 PM. Species known to tolerate and thrive in high salinity levels at this station include *Hypoatherina temminckii*, *Ambassis vachellii*, *Gerres macracanthus*, *Gerres erythrourus*, *Kuhlia marginata*, *Eubleekeria splendens*, *Lutjanus russellii*, *Planiliza macrolepis*, *Epinephelus fuscoguttatus*, *Cephalopholis argus*, *Siganus guttatus*, *Sillago sihama*, and *Mesopristes cancellatus*. Station 2 recorded intermediate salinity levels, with averages of 1.73ppt at 6:00 AM, 1.85ppt at 12:00 noon, and 2.44ppt at 6:00 PM. Species adapted to these salinity levels during the new moon phase include *Hypoatherina temminckii*, *Ambassis vachellii*, *Yarica hyalosoma*, *Butis butis*, *Gerres macracanthus*, *Gerres* *erythrourus*, *Eubleekeria splendens*, *Lutjanus argentimaculatus*, *Lutjanus russellii*, *Planiliza macrolepis*, and *Mesopristes cancellatus*. In contrast, Station 3 recorded the lowest salinity, averaging 0ppt throughout the study period. Species observed thriving at this freshwater level include *Ambassis vachellii*, *Anguilla marmorata*, *Anguilla bicolor*, *Yarica hyalosoma*, *Oxyeleotris marmorata*, *Butis butis*, *Oreochromis niloticus*, *Gerres macracanthus*, *Gerres erythrourus*, *Eubleekeria splendens*, *Lutjanus russellii*, *Planiliza macrolepis*, *Trichopodus trichopterus*, and *Neovespicula depressifrons*. The variation in salinity levels across stations is influenced by gravitational circulation resulting from the interaction between upstream freshwater inflow and downstream seawater intrusion. This density-driven dynamic leads to stratification, with river discharge playing a dominant role in controlling salinity patterns in river-dominated estuarine systems **(Valle-Levinson & Wilson, 1994; Wong, 1995; Monismith *et al*., 2002)**.

1.4 Water temperature

The water temperature variations in the Dibut River at different stations in Baler, Aurora, from October to March show that station 1 had the highest average temperatures, reaching 26.75°C at 6 am, 28.30°C at 12 noon, and 29.56°C at 6 pm. Stations 2 and 3 also exhibited similar trends, with average temperatures of 26.69, 28.82, and 28.27°C at station 2, and 26.12, 27.94, and 27.72°C at station 3, respectively, during the corresponding time slots. Towards the last quarter of the period, station 1 recorded the highest average temperature of 30.18°C at 6 pm, while station 3 had the lowest average temperature of 26.00°C at 6 am. The data indicate that water temperature samples collected at all stations ranged from 26°C to 30°C, which falls within the criteria for Class AA water quality as defined by the Environmental Management Bureau (EMB) Water Quality Guidelines for Primary Parameters. Class AA represents the highest standard and is suitable for drinking after disinfection. In comparison, Class A water requires full treatment—including filtration, sedimentation, and disinfection—before being used as a drinking source, while Class B water is deemed suitable for recreational activities such as swimming or bathing in designated areas. According to EMB guidelines, if the recorded water temperature exceeds or falls below the recommended range, the natural background temperature should be used as a reference. Any deviation must not exceed a 10% increase to prevent risks to human health and the environment **(DENR, 2016)**.

1.5 Water pH

According to the findings, Station 1 exhibited the highest average pH values, with measurements of 7.18 at 6:00 AM, 7.19 at 12:00 noon, and 7.42 at 6:00 PM. Stations 2 and 3 recorded slightly lower averages: Station 2 had pH values of 7.05 at 6:00 AM, 7.07 at 12:00 noon, and 7.16 at 6:00 PM, while Station 3 registered 6.97 at 6:00 AM, 7.03 at 12:00 noon, and 7.08 at 6:00 PM. The highest pH value was observed during the new moon phase at Station 1 at 6:00 PM, reaching 7.64. Conversely, the lowest pH value was recorded at Station 1 at 6:00 AM during the first quarter moon phase, measuring 6.84. These pH values fall within the EMB-recommended range of 6.5 to 8.5, classifying the water under Class AA quality—suitable for drinking after disinfection. For comparison, Class A water requires full treatment before being used as a potable source, while Class B water is suitable for recreational activities **(DENR, 2016)**.

Dissolved oxygen (DO)

Dissolved oxygen is essential for aquatic life, supporting biogeochemical cycles, respiratory metabolism, and overall water quality **(Bahadori *et al.*, 2010)**. Based on the collected data, Station 2 exhibited the highest average DO concentrations, with values of 4.00mg/ L at 6:00 AM, 4.86mg/ L at 12:00 noon, and 4.49mg/ L at 6:00 PM. Station 1 followed closely, with DO levels of 3.92mg/ L at 6:00 AM, 4.86mg/ L at 12:00 noon, and 4.23mg/ L at 6:00 PM. Station 3 recorded the lowest averages, measuring 3.71mg/ L at 6:00 AM, 4.70mg/ L at 12:00 noon, and 4.38mg/ L at 6:00 PM. Lunar phases also influenced DO levels, with the highest concentrations observed at Station 1 during the first quarter (5.32mg/ L at 12:00 noon) and full moon phases (4.65mg/ L at 12:00 noon). The lowest DO level was recorded during the new moon phase at 6:00 AM, measuring 3.65mg/ L. All measured DO concentrations were above 2mg/ L, meeting the minimum standard for Class D (propagation of wildlife and fisheries) and Class SD (industrial cooling, controlled waste disposal, and aesthetics) according to the EMB Water Quality Guidelines for Primary Parameters **(DENR, 2016)**.

CONCLUSION

A total of 1,265 fish individuals, representing 23 species from 17 families, were collected across the three stations of the Dibut River in Baler, Aurora. Five dominant fish species accounted for 85.63% of the total catch biomass. These included *Planiliza macrolepis* (64.60%), *Mesopristes cancellatus* (7.31%), *Gerres erythrourus* (6.29%), *Hypoatherina temminckii* (4.03%), and *Eubleekeria splendens* (3.40%). Given the limitations of the current study, further research is recommended—particularly in areas such as species identification through DNA barcoding, analysis of growth patterns by sex, and investigation of other critical growth factors—to support more effective management and conservation of fish populations in the Dibut River.

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