

# **RESEARCH PAPER**

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# Current fish fauna in Mandulog River, Iligan City, Lanao Del Norte, Philippines

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# Abstract

This paper provides the current fish species richness, composition, distribution, and conservation status in the Mandulog River, Iligan City, Philippines, highlighting its ecological significance and the impact of anthropogenic activities. A total of Fourteen species from 13 families were recorded, consisting of- 12 native and two introduced species from three sampling sites (upstream, midstream, and downstream). Native species dominated the fish assemblage, with *Fibramia thermalis* (44.22%) and *Planiliza subviridis* (18.03%) being the most abundant. This study confirmed the first record of *Barbodes tumba*, a threatened endemic species confined to upstream areas, reflecting their vulnerability to habitat disturbance. Conservation assessments of the 12 native revealed that ten species (85.7%) are classified as "Least Concern", one as "Endangered" and another one species as "Data Deficient". This study also documented two invasive alien species, *Oreochromis niloticus* and *Clarias batrachus*. The recent findings underscore significant threats to the Mandulog River's biodiversity, including pollution, quarry mining, sedimentation, and invasive alien species. Recommendations emphasize conservation strategies targeting habitat restoration, invasive alien species management, and community-driven biodiversity monitoring to sustain the river's ecological health and align with global conservation goals.

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### Introduction

Freshwater ecosystems, such as rivers, play a vital role in maintaining biodiversity and providing ecosystem services to human and natural systems. They are essential habitats for various aquatic species, including fish that contribute to the ecological balance, support livelihoods, and serve as indicators of environmental health (Jamandre, 2023). Among these, rivers in the Philippines, including the Mandulog River in Iligan City, stand out due to their rich ichthyofauna, comprising native and endemic species. However, these ecosystems face mounting challenges from human-induced disturbances such as overfishing, pollution, and invasive alien species environmental degradation (Guerrero, 2023).

The Mandulog River traverses urban and rural areas and supports diverse freshwater fish species. This river system, previously studied by Sempio *et al.* (2013), Vedra *et al.* (2013), and Tampus *et al.* (2015), has been a focal point for understanding the impacts of human activities such as quarrying, urbanization, unregulated fishing activities and landscape alterations on freshwater biodiversity. Quarrying activities, sedimentation, and pollution from surrounding communities significantly threaten aquatic habitats, as Buot *et al.* (2014) and (Vedra and Ocampo, 2016) highlighted. These threats have led to declines in native and endemic fish populations, echoing trends observed in similar freshwater systems across the Philippines (Gonzalez *et al.*, 2023; Macalisang *et al.*, 2023; Guerrero, 2023).

Past research efforts across Philippine rivers emphasieze the need to understand fish species composition and abundance, particularly as many species remain threatened or poorly documented (IUCN, 2019). Thus, this study aims to build on existing knowledge by providing the current of fish species composition, abundance, distribution, and conservation status in the Mandulog River. This work addresses critical gaps in understanding the river's current ecological state, focusing on its biodiversity's sustainability. The study align with global conservation priorities under the United Nations Sustainable Development Goals (SDGs), particularly SDG 6.6, which emphasizes the protection and restoration of water-related ecosystems, SDG 15.1, which focuses on the conservation, restoration and sustainable use of freshwater ecosystems and their services, SDG 15.5, which seeks to protect habitats, halt biodiversity loss and safeguard species from extinction, and SDG 15.8 which aims for prevention, reduction, control, and eradication of invasive alien species (UN SDG 2024).

#### Materials and methods

#### Study area and sampling sites

Three sampling sites were established along the Mandulog River, Iligan City, Lanao Del Norte, Philippines (Fig. 1). The Mandulog River is a 50-km waterway north of Iligan City in Lanao del Norte, with tributaries coming as far as Lanao del Sur. The upstream areas of the river are mainly undeveloped as they course through mountainous and hilly terrain, whereas the downstream portions are developed lowland areas (Sempio *et al.*, 2013). These sites included the upstream portion in Barangay Digkilaan (SS1), the midstream portion in Barangay Upper Hinaplanon (SS2), and the downstream portion in Bayug Island (SS3) as shown in Fig. 2.

The upstream portion (SS1), situated at coordinates o8°14'38" N and 124°19'12" E, featured a landscape predominantly of rocks, sand, and gravel. The vegetation cover consisted mainly of grasses and some riparian tree species along the riverbanks. The area had no nearby residences, but quarrying activities were observed.

The midstream portion (SS2), located at coordinates o8°15'32" N and 124°16'37" E, was characterized by a mixture of rocky terrain, sand, gravel, and silt. This area, near households, exhibited turbid water due to sand and gravel extraction from quarrying activities. The region featured vegetation cover comprising grasses and riparian tree species.

The downstream portion (SS33) of Mandulog River on Bayug Island is positioned at coordinates 08°15'11" N and 124°15'21" E. No nearby households were observed in the area, but small-scale quarrying activities were noted.

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Fig. 1. Map showing the Mandulog River, Iligan City, Lanao Del Norte, Philippine



Sampling site 3 (SS3)

# Sampling site 1 (SS1)Sampling site 2 (SS2)Fig. 2. Sampling sites of Mandulog River (SS1, SS2 and SS3)

### Data collection

Fish species were collected from three designated sampling stations, using hand-held gillnets ( $4m \times 5m$ , 3.5mm mesh size) and cast nets ( $3m \times 3m$ , 50mm mesh size) sourced from local fishermen. The collection process was carried out by hired fishermen twice a week from August to October 2023, with sampling times set for mornings and afternoons between 9:00 A.M. and 3:00 P.M.

Each fish species was identified using identification tools, such as Quick ID tools and Identification Keys of FishBase (Froese and Pauly, 2023), taxonomic faunal revisions and books, and verified by fish experts. Detailed data were recorded for every species collected, including total count, relative abundance, and occurrence (categorized as native, endemic, or introduced). Conservation status was obtained from the International Union for Conservation of Nature Red List of Threatened Species (IUCN, 2024).

## Data analysis

The relative abundance of each species was calculated using the formula described by Achacoso *et al.* (2016) as follows:

 $Pi = \frac{ni}{N} x \ 100$ 

Where, Pi is the relative abundance  $n_i$  is the number of individuals of the same species, N is the total number of individuals for all species.

# **Results and discussion**

Fish species composition and richness in Mandulog river

The current freshwater fish species observed in the Mandulog River, Iligan City, Lanao Del Norte, Philippines, with data for each species' occurrence, conservation status and relative abundance, is presented in Table 1 and Distribution of Fishes from three sampling sites in Mandulog River in Table 2.

This study documented 14 fish species representing 13 families, revealing a decline of species richness compared to the previous study by Tampus *et al.*, 2015 in Mandulog River. The observed decline in species richness may be attributed to pollution, habitat modification, and sedimentation, particularly in downstream areas where human activities are most intense. The current fish fauna primarily comprises 12 native species (85.7%) and two introduced species (14.3%). Notably, this study reports the first record of the endemic species, Barbodes tumba (Cyprinidae) in Mandulog River where it was mostly observed in upstream sections characterized lower anthropogenic disturbances. by The introduced species were Clarias batrachus and Oreochromis niloticus, both classified as invasive alien species that threaten native biodiversity due to resource competition and potential habitat displacement according to the Global Invasive Species Database (2024). This highlights the vulnerability of endemic fish to invasive alien species in Mandulog River.

Family	Species	Common name	Occurrence	Conservation	n Relative
-	-			status	abundance (%)
Apogonidae	Fibramia thermalis	Half-barred	Native	LC	44.22
Ciablidae	(Cuvier, 1829)	Vila Tilania	Introduced	IC	1.00
Cicilidae	(Linnaeus, 1758)	Nile Thapia	mtroduced	LC	1.02
Clariidae	Clarias batrachus	Walking catfish	Introduced	LC	0.68
Cyprinidae	Barbodes tumba (Herre 1024)	Tumba	Endemic	EN	4.08
Eleotridae	Belobranchus belobranchus (Valenciennes, 1837)	Throat-spine gudgeon	Native	LC	5.44
Gobiidae	Awaous melanocephalus (Bleeker, 1849)	Largesnout goby	Native	LC	5.10
	Glossogobius giuris (Hamilton, 1822)	Tank goby	Native	LC	2.38
Mugilidae	Planiliza subviridis (Valenciennes, 1836)	Greenback mullet	Native	LC	18.03
Muraenidae	Strophidon sathete (Hamilton, 1822)	Slender giant morav	Native	LC	0.34
Ophichthidae	Pisodonophis boro (Hamilton, 1822)	Rice-paddy eel	Native	LC	0.34
Rhyacichthyida	e <i>Rhyacichthys aspro</i> (Valenciennes, 1837)	Loach goby	Native	DD	6.12
Sillaginidae	Sillago sihama (Fabricius, 1775)	Silver sillago	Native	LC	5.44
Syngnathidae	(Bleeker, 1854)	Short-tailed	Native	LC	5.10
Terapontidae	Mesopristes cancellatus (Cuvier, 1829)	Tapiroid grunter	Native	LC	1.70

Table 1. Species composition, abundance and conservation status of fishes in Mandulog river, Iligan city

Note: Conservation Status: LC- Least Concern; DD- Data Deficient; EN- Endangered

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Family	Species	Occurrence	Digkilaan U	oper Hinaplanon	Bayug Island
	-F		(upstream)	(Midstream)	(Downstream)
Apogonidae	Fibramia thermalis	Native	_	-	+
	(Cuvier, 1829)				
Cichlidae	Oreochromis niloticus	Introduced	+	-	-
	(Linnaeus, 1758)				
Clariidae	Clarias batrachus	Introduced	+	+	-
	(Linnaeus, 1758)				
Cyprinidae	Barbodes tumba (Herre, 1924)	Endemic	+	+	-
Eleotridae	Belobranchus belobranchus	Native	+	+	-
	(Valenciennes, 1837)				
Gobiidae	Awaous melanocephalus	Native	+	+	+
	(Bleeker, 1849)				
	Glossogobius giuris	Native	+	+	-
	(Hamilton, 1822)				
Mugilidae	Planiliza subviridis	Native	+	+	+
	(Valenciennes, 1836)				
Muraenidae	Strophidon sathete	Native	-	-	+
	(Hamilton, 1822)				
Ophichthidae	Pisodonophis boro	Native	-	-	+
	(Hamilton, 1822)				
Rhyacichthyidae	Rhyacichthys aspro	Native	+	-	-
	(Valenciennes, 1837)				
Sillaginidae	Sillago sihama	Native	-	-	+
	(Fabricius, 1775)				
Syngnathidae	Microphis brachyurus	Native	-	-	+
	(Bleeker, 1854)				
Terapontidae	Mesopristes cancellatus	Native	-	-	+
	(Cuvier, 1829)				

Table 2	Distribution	of fishes from	n three samn	ling sites in	n Mandulog i	river Iligan	city Philippines
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Note: (+) Present, (-) Absent

A total of 294 individual fishes were collected during the three-month sampling period, with Bayug Island yielding the highest abundance at 214 individuals, while Upper Hinaplanon recorded the lowest with only 17 individuals. Bayug Island, located at the delta of the Mandulog River, functions as a vital nursery and feeding ground for fish and other aquatic organisms, characterized by exceptional productivity (Herell *et al.*, 2009; Tampus *et al.*, 2015).

# Relative abundance and distribution patterns

Native species dominated the assemblage, with *Fibramia thermalis* (44.22%) and *Planiliza subviridis* (18.03%) being the most abundant. These findings align with similar studies in Romblon and Bukidnon, where native species exhibited high adaptability to dynamic riverine environments (Lubos *et al.*, 2020; Macalisang *et al.*, 2023).

The species composition at each site suggests specific habitat suitability and ecological pressures unique to each zone. The high abundance of estuarine-adapted species downstream may point to salinity changes or anthropogenic alterations in water flow. These findings emphasize the ecological transitions in the Mandulog River, highlighting the importance of continued monitoring and adaptive management strategies.

#### Conservation status assessment

Ten native species were categorized as "Least Concern" (LC) by IUCN (2024), one native as Data Deficient (DD) and one endemic as Endangered as shown Table 1. The occurrence of one "Data Deficient" species, Rhyacichthys aspro, necessitates further ecological studies to evaluate their population health and habitat preferences (Iqbal et al., 2023). The presence of threatened endemic species, Barbodes tumba, highlights the vulnerability of endemic fish to habitat alterations and supports earlier observations (Alima and Patricio, 2010 and Guerrero, 2023) on the need to prioritize endemic species conservation in regional river systems.

# Conclusion

The Mandulog River is home to diverse freshwater fish, with 85.70% native species and 14.30% introduced species. Fourteen species belonging to 13 families were recorded. *Fibramia thermalis* (Apogonidae) and *Planiliza subviridis* (Mugillidae) are the most abundant native fish with relative abundance of 44.22% and 18.03%, respectively. This study reports the first record of the endemic *Barbodes tumba* (Cyprinidae) in the upstream of Mandulog River. The biodiversity of Mandulog River is threatened by the two invasive alien species, namely *Oreochromis niloticus* and *Clarias batrachus*. Human-induced disturbances threaten the river's ecological integrity.

#### Recommendations

Strengthen conservation of native and endemic species

Enhance habitat conservation for species, the threatened endemic species, like *Barbodes tumba* by prioritizing the protection of critical habitats in upstream and midstream zones where native species are likely adapted to unique ecological niches. Conservation strategies should include pollution control, minimizing habitat disruptions, and safeguarding areas where vulnerable species are most at risk.

# Community-based monitoring and environmental education

Engage local communities, including fisherfolk and youth groups, in biodiversity monitoring initiatives to raise awareness and build community stewardship. Educational programs focused on the impacts of invasive species, habitat preservation, and sustainable fishing practices can foster a culture of conservation and enhance compliance with local regulations.

# Riparian and aquatic habitat restoration

Undertake habitat restoration efforts to enhance riparian vegetation and improve water quality, particularly in heavily impacted downstream areas. Restoration measures, such as sediment control, pollution reduction, and riparian planting, can strengthen aquatic ecosystem resilience and provide essential shelter and food sources for native fish populations.

# Invasive alien species management strategies

Develop management plans to reduce, control, and eradicate the invasive species, namely, *Clarias batrachus* and *Oreochromis niloticus*, which may pose significant risks to native biodiversity. Communitydriven initiatives, such as incentivizing the harvest of invasive species, could reduce their impact and lessen competition with native fish for resources.

#### Expand research on data-deficient species

Conduct further research to evaluate the population dynamics, reproductive cycles, and ecological roles of data-deficient species like *Rhyacichthys aspro*. Understanding this species' specific habitat requirements and vulnerabilities can support more targeted conservation efforts and ensure they are incorporated into future management plans.

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