




SHORT COMMUNICATION

Fish Species Composition and Distribution from 2015 to 2019 in the Ibulao River, Ifugao, Cordillera, Philippines

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ABSTRACT

The composition, diversity, and distribution of fish species in the Ibulao River were surveyed from January to December 2015-2019. The samples for fish species identification were collected from the landed catch of three landing centers in the Ibulao River, namely: Lamut, Kiangan, and Lagawe in the Province of Ifugao, Philippines. The sampling of stocks was conducted using the National Stock Assessment Program (NSAP) methodology. A total of 18 fish species from 11 families were recorded. The river supports four endemic species, two native species, 11 introduced species, and one species for further identification. The status of one goby species will be determined upon identification at the species level. In 2015 and 2016, the most dominant catch in the Ibulao River was *Cyprinus carpio* (common carp), but from 2017 to 2019, the most dominant catch was *Oreochromis niloticus* (Nile tilapia). These two introduced fish species constituted the top 2 fish species in the Ibulao River from 2015 to 2019. The native fish species, which are the migratory fish *Anguilla marmorata* (giant mottled eel) and the *Awaous melanocephalus* (largesnout goby), are found in all the landing centers but with an observed declining catch. This information will serve as a basis for formulating protection and conservation policies for the fish species and their habitat in the Ibulao River.

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Freshwater ecosystems are among the most diverse in the world per unit habitat (Kopf et al. 2015), and their biodiversity comprises a significant resource contributing in terms of economic, cultural, aesthetic, scientific, and educational (Dudgeon et al. 2006). The Cordillera's inland waters consist of freshwater lakes, swamps, reservoirs, rivers, ponds, and small impoundments. One of the river systems in the Cordillera is the Ibulao River, which originates in the mountains of Ifugao and drains into the Magat Dam covering parts of Ifugao and Isabela.

The Ibulao River is a major river tributary of the Magat Dam. It contributes to the dam's water budget and aquatic biodiversity. Riverine ecosystems also provide breeding grounds of many lacustrine fish species and act as sources of fish and other edible

aquatic life to the local communities (Mwangi et al. 2012).

Freshwater fishes play crucial roles in their ecosystems (Albert and Reis 2011; Loh et al. 2014; Toussaint et al. 2016; van der Sleen and Albert 2018), yet limited studies are focusing on small riverine fisheries due to the perception that fisheries of small rivers are not economically viable although fish in these rivers may grow up to large sizes (Mwangi et al. 2012). Furthermore, despite various fisheries opportunities, the freshwater ecosystems, including its flora and fauna, are under increasing threats from both natural and man-made environmental stressors, including poor agricultural activities, clearance of riparian vegetation, nutrient enrichment, climate change (Mwangi et al. 2012), intensive aquaculture, and introduction of non-native species (Papa and Briones 2017).

In the Cordillera, little is known about the diversity and status of endemic freshwater fishes, which are equally valuable as bioindicators of ecosystem health and an integral part of our country's natural heritage (Fermin et al. 2014), and there are many unique freshwater fish species with unknown status (Garcia et al. 2018). As the stock assessment studies continue in the Cordillera, species identification, diversity, and distribution are some problems being encountered. Therefore, the need for assessment studies of riverine ecosystems in the region cannot be overemphasized. This study focused on the species composition and distribution of the freshwater fish species in the Ibulao River in Ifugao, Cordillera.

The study concentrated on three municipalities that the Ibulao River traverses: Lagawe, Kiangan, and Lamut. These areas served as landing centers, where data collection was conducted. The study followed the methodology of the National Stock Assessment Program (NSAP).

Fish samples were collected from 2015 to 2019 using a variety of fishing gears such as fish nets, fish traps, and electro-fishing devices in the three landing centers. These areas are located in the middle of the Ibulao River in Ifugao. The data collected were analyzed using standard taxonomic keys based on morphometric characters.

The fishes in the Ibulao River were identified through morpho-meristic characterization and deoxyribonucleic acid (DNA) fingerprinting.

Fisherfolk collected samples in the identified landing centers and preserved them for identification. Samples were preserved in 95% ethanol and sent to the Genetic Fingerprinting Laboratory (GFL) of the National Fisheries Research and Development Institute (NFRDI) for DNA identification.

Eighteen finfishes that belong to 12 families were collected and identified in the Ibulao River. Eleven of them are introduced species which comprise 61.11% of all the fishes recorded in the Ibulao River. In addition, this river supports four endemic and two native fish species. The endemic species constitute 22.22%, while the native species constitute 11.11% of all the fishes recorded in the Ibulao River. A list of the fish and invertebrate species identified in the Ibulao River is presented in Table 1.

From 2015 to 2019, the number of fish species caught in the municipalities covered by the study presented different numbers. There are 17 species recorded in Lamut, 19 in Lagawe, and 16 in Kiangan. An observed steady number was recorded in Lagawe, which has the highest number of species. Species caught, however, changed from year to year. In Kiangan and Lamut, the number of species caught varies each year, with the fewest at six species recorded in Kiangan in 2016. In 2019, there was no monitoring conducted in the Kiangan area; hence, the zero catch. However, this does not mean that there was no catch in the municipality in 2019, but it was only because of the reduction of NSAP enumerators caused by the reduced budget.

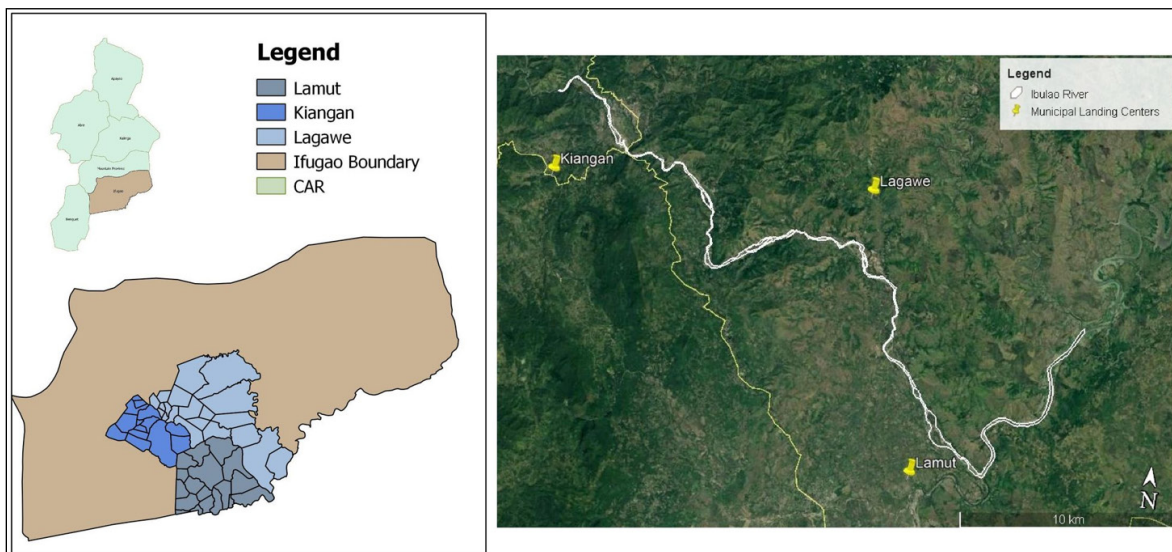


Figure 1. Map of the landing centers covered by the study

Table 1. List of the freshwater finfishes and invertebrates recorded in the Ibulao River from 2015 to 2019

Status	Local Name	Common Name	Scientific Name/Label
Freshwater FinFishes			
Native	Igat	giant mottled eel	<i>Anguilla marmorata</i>
Native	Bunog	large snout goby	<i>Awaous melanocephalus</i>
For further ID	Bunog	goby	BFARCAR_Bunog02_154
Introduced	Gurami	gourami	BFARCAR_Gourami_041
Introduced	Karpa	carp	<i>Carracius carracius</i>
Introduced	Kiwet	ricefield eel	BFARCAR_Kiwet_009
Endemic	Kurilao	catfish	<i>Plicofollis magatensis</i>
Introduced	Silap	silver barb	BFARCAR_Silap_019
Introduced	Dalag	mudfish	<i>Channa striata</i>
Introduced	Paltat/Hito	catfish	<i>Clarias batrachus</i>
Introduced	Paltat/Hito	African catfish	<i>Clarias gariepinus</i>
Introduced	Karpa	common carp	<i>Cyprinus carpio</i>
Introduced	Tamtampi	mosquito fish	<i>Gambusia affinis</i>
Endemic to Luzon	Ayungin	silver therapon	<i>Leiopotherapon plumbeus</i>
Endemic to Philippines	Susay	halfbeak	<i>Nomorhamphus sp.</i>
Introduced	Tilapia	tilapia	<i>Oreochromis niloticus</i>
Introduced	Bunog	goby	<i>Rhinogobius giurinus</i>
Endemic	Susay	halfbeak	<i>Zenarchopterus philippinus</i>

In 2015 and 2016, the most dominant catch in the Ibulao River was *Cyprinus carpio* (common carp), but from 2017 to 2019, the most dominant catch was the *Oreochromis niloticus* (Nile tilapia). These two introduced fish species constituted the top two fish species in the Ibulao River from 2015 to 2019. The native fish species, which are the migratory fish *Anguilla marmorata* (giant mottled eel) and the *Awaous melanocephalus* (large snout goby), are found in all the landing centers but with an observed declining catch. The giant mottled eel is a catadromous fish species that grows in freshwater areas and spawns in saltwater. The declining catch of the eel may be

attributed to the obstructions to the fish's migration pattern, which can be found in the lower tributaries of the river, specifically the Magat Dam. These barriers prevent the fish from migrating to the sea to spawn and going back to the freshwater areas to grow. One endemic species, the *Nomorhamphus sp.* (halfbeak), locally called "susay" or "siriw," is found only in one area in Lagawe. This species was caught in 2016, 2018, and 2019. The catch of the species is minimal, with 7.35 kg in total.

The municipality of Lamut contributed the most catch from 2015 to 2019, with a total catch of 4.004 MT. The municipality of Lagawe contributed

Table 2. Number of fish species recorded per year in the three landing centers included in the study

Landing Center	Number of Fish Species Recorded					Total Numbers of Species
	2015	2016	2017	2018	2019	
Kiangan	10	6	8	13		16
Lagawe	14	14	12	14	14	19
Ifugao	14	15	11	8	8	17

2.80 MT, while Kiangnan contributed 0.79 MT. In Lamut and Lagawe, the most dominant catches are the introduced fish species Nile tilapia and common carp. In Lamut, Nile tilapia contributed 1.94 MT (25.52%), while Common carp contributed 1.40 MT (18.22%) of the total catch in the Ibulao River. In Lagawe, Nile tilapia contributed 0.88 MT while common carp contributed 0.62 MT. These are the dominant species in these two areas from 2015 to 2019. In Kiangnan, the most dominant species were the common carp and *Rhinogobius giurinus* (barcheek goby), a species of goby. However, the high catch of the goby is attributed to the fishing gear used: electrofishing devices. Electrofishing devices can stun fishes within a certain radius depending on their voltage, water flow, and the fish species' tolerance. The *Rhinogobius giurinus*, which usually clings to rocks in riverbeds, are usual victims of electrofishing activities. The different species caught per municipality are presented in Table 3.

The Ibulao River's aquatic diversity is dominated by the introduced fish species in the area. Endemic and native fish species in the aquatic ecosystem represent only 28.57% of all the recorded species in the area, while the introduced fish species are 52.38%, which is more than half. Further assessments of the upper and lower streams of the Ibulao River would give a better perspective on the species composition, diversity, and distribution in its whole stretch.

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Table 3. Fish species recorded per year in the three landing centers included in the study

Fish Species/ Label	2015			2016			2017			2018			2019	
	Kiangnan	Lagawe	Lamut	Kiangnan	Lagawe	Lamut	Kiangnan	Lagawe	Lamut	Kiangnan	Lagawe	Lamut	Lagawe	Lamut
<i>Anguilla marmorata</i>		X			X	X		X	X	X	X	X	X	X
<i>Awaous melanocephalus</i>	X	X	X	X	X	X			X					X
BFARCAR_Bunog02_154			X			X	X	X	X	X	X	X	X	X
BFARCAR_Gourami_041						X								
<i>Carrasius carrasius</i>						X						X		
BFARCAR_Kiwet_009	X	X	X		X	X	X			X	X		X	
<i>Plicofollis magatensis</i>		X	X											
BFARCAR_Silap_019			X			X		X	X		X	X	X	X
<i>Channa striata</i>	X	X	X		X	X	X	X	X	X	X	X	X	
<i>Clarias batrachus</i>	X	X	X											
<i>Clarias gariepinus</i>		X	X		X	X		X	X	X	X	X	X	X
<i>Cyprinus carpio</i>	X	X	X	X	X	X	X	X	X	X	X	X	X	X
<i>Gambusia affinis</i>	X	X	X		X	X		X		X	X		X	

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AUTHOR CONTRIBUTIONS

Tauli MP: Conceptualization, Methodology, Formal Analysis, Investigation, Resources, Writing - Original Draft, Writing - Review and Editing. **Garcia MPC:** Conceptualization, Methodology, Formal Analysis, Writing-Review and Editing, Funding Acquisition, Supervision. **Podeque JR:** Investigation, Resources. **Signey LL:** Writing-Review and Editing, Project Administration, Supervision, Funding Acquisition. **Sarmiento K:** Methodology, Formal Analysis. **Santos MD:** Methodology, Formal Analysis, Resources.

CONFLICTS OF INTEREST

To the best of our knowledge, no conflict of interest exists.

ETHICS STATEMENT

The researchers followed all institutional and national guidelines for the care and use of laboratory animals.

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