

Ichthyofauna of Fakfak, Papua – Indonesia

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Abstract. Fakfak and Kumawa Mountains are located in Bomberay Peninsula, Papua, a poorly known ichthyological record and was recommended by Conservation International for field inventory. This research was conducted from 6-15 February 2021 to document freshwater fish diversity in northern and eastern Fakfak toward Bomberay District. The fish was collected from creeks, streams, and rivers. The fish collection was done once in each location, mainly using a seine net, while a gill net was used in a few sites along Ubadari River. It was done for four hours, netting in one to three locations each day. Fish abundance was described based on *common* (C), *occasionally* (O), dan *rare* (R) scales. Freshwater fish data were descriptively identified. Twenty-two native New Guinean species belonging to 19 genera and 14 families were collected during the survey. There was no specific family dominant in the fish community. All fish recorded have widespread distribution, yet only one species has restricted distribution in the Vogelkop and Bomberay Peninsulas. One rainbowfish species was observed but not properly identified. This results as initial data of the fish community of Bomberay Peninsula, especially of Fakfak. Further research is needed to reveal the fish community from another part of the peninsula.

1 Introduction

New Guinea has around 400 freshwater fish species, whereas 34 species have been shared to Australia because both areas had been connected in the past [1]. About 250 freshwater fish species are distributed in Papua [2] in three of seven sub-provinces freshwater fish zoogeographic of New Guinea. The sub-provinces partly or whole areas in Papua include sub-province Northern New Guinea, Southern New Guinea, Vogelkop Peninsula, and Western Islands [1].

After 1999, two biodiverse rapid assessments, known as RAP, were held in Papua, which recorded several new species from various taxa, including freshwater fish [3, 4]. In 1998 and 1999, freshwater fish surveys were held in Raja Ampat Island and Bird's Head [5, 6]. These expeditions show that fish diversity and endemism were high in the area, such as Wapoga River systems and Raja Ampat, mainly on rainbowfish (Melanotaeniidae). The rainbowfish is an endemic family to New Guinea and Australia [7], and Papua is known to have high diversity compared to Papua New Guinea and Australia.

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The sub-provinces of the Bird's Head Region are divided into two peninsulas as Vogelkop and Bomberay Peninsulas. The Vogelkop Peninsula is isolated by a narrow mountain isthmus, while Bomberay Peninsula lies north and south of the intervening Bintuni Bay. Ichthyofauna of the Vogelkop Peninsula is considered a poorly unknown area, but it shows a definite affinity with the Great Southern Province [8]. [9] confirmed that the peninsulas, including Vogelkop Lowland, Vogelkop Highland, Vogelkop Anticlines, Fakfak, and Kumawa Mountains, have high diversity and endemism of freshwater biota based on fish (Melanotaenia, Mogurnda, Allomogurnda, and Hephaestus). These areas also support the high number of species of crayfishes and aquatic insects. Based on these findings, during the Irian Jaya Biological Conservation Priority Setting Workshop [2], the area was proposed as a priority area for biodiversity research.

[9] provided analysis on the richness and endemism of freshwater biota of New Guinea, but there was no information on endemism and richness of Order Perciformes from Fakfak and Kumawa Mountains, as well as from the "neck area" of Bird's Head Region, due to lack field surveys in the areas. It is hoped this survey can provide information to fill the gap. The survey is the first freshwater fish survey in the area.

2 Materials and methods

The research was conducted in 14 rivers, streams, and creeks in Ubadari, Kayuni, Kaburbur, Patimburak, Rangkedak, northern Fakfak, and in Kinam and Waremu in eastern Fakfak, between 6-15 February 2021 (Figure 1, Table 1).

Fish samples were primarily collected using 3-meter length, 1.23 meters high, and less than 0.5 inches mesh size seine net for active technic. Two people handle the net at each end of the net and form "U" shape while two to three people were chasing fish toward the net or net be dragged to a specific part of streams, creeks, or tributaries with dense submerged plants or tree roots. Passive technic using gill net was applied in water with more than 1.5-meter depth. The gill net with 2-, 3- and 4-inches mesh size, 25 meters length, and 2-meter heigh were set in a certain part of river or stream and leave it. Fish samples were collected after two or three hours, and fish identification follows [8] and [10].

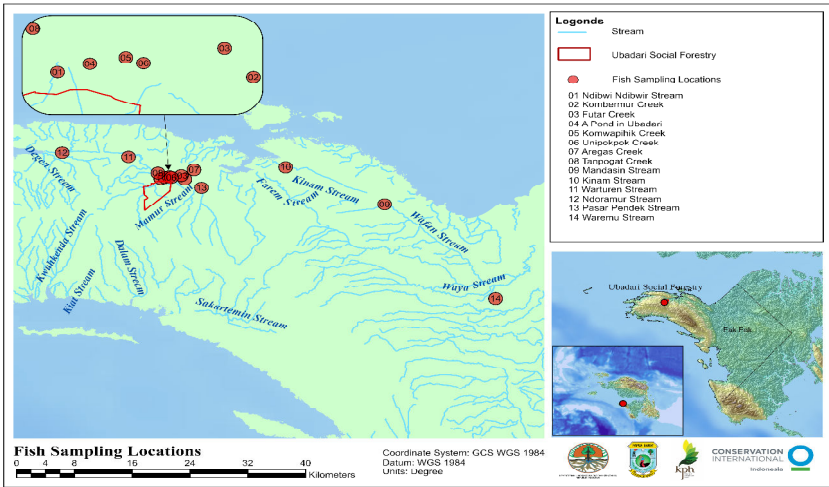


Fig. 1. Fish sampling locations in northern and eastern Fakfak, Bomberay Peninsula, Papua, Indonesia (red dot). Most of the locations were located near ocean or less than 20 km.

Fish collections were done four hours per day in one to three locations each day. Freshwater fish diversity was descriptively analyzed by describing the distribution and zoogeographic of the fish in New Guinea. Fish abundance was described based on *common* (C), *occasionally* (O), and *rare* (R) scales [4] (Table 2). Fish diversity was grouped based on its distribution area (Table 3) and its family (Table 2).

Table 1. Sampling locations and their distance to sea and elevation in northern and eastern Fakfak, Papua, Indonesia.

Site No.	Location	Distance of the sea (km)	Lat&Long	Elevation (m asl)
1	Ndibwi Ndibwir Stream	7.4	02° 44'31.4" S, 132° 20'54.6" E	10
2	Kombemur Creek	6.4	02° 44'35.0" S, 132° 22'41.3" E	17
3	Futar Creek	6	02° 43'54.4" S, 132° 22'6.2" E	58
4	A pond in Ubadari	6.8	02° 44'25.9" S, 132° 2'12.2" E	5
5	Komwapihik Creek	6.5	02° 44'21.9" S, 132° 2'31.8" E	1
6	Unipokpok Creek	6.5	02° 44'25.6" S, 132° 2'41.4" E	8
7	Aregas Creek	3.4	02° 43'46.3" S, 132° 23'22.6" E	11
8	Tanpogat Creek	3.6	02° 44'2.8" S, 132° 20'41.2" E	10
9	Mandasin Stream	4.5	02° 46'55" S, 132° 37'35.8" E	0
10	Kinam Stream	2	02° 43'33.5" S, 132° 30'13.1" E	36
11	Warturen Stream	5.3	02° 43'33.5" S, 132° 30'13.1" E	156
12	Ndoramur Stream	5	02° 42'11.1" S, 132° 13'32.8" E	117
13	Pasar Pendek Stream	4.4	02° 45'22" S, 132° 23'56.1" E	18
14	Waremu Stream	13.8	02° 55'30.5" S, 132° 45'51.7" E	6

2 Results

Twenty-two native New Guinean species belong to 19 genera, and 14 families were documented during the survey. The fish community comprises native fish of New Guinea, including one endemic species to the Vogelkop and Bomberay Peninsulas, *Hephaestus lineatus*, and one unidentified rainbowfish species (*Melanotaenia* sp.). These fish are distributed in rivers, streams, and creeks of northern and eastern Fakfak, Papua. Introduced species were not recorded in the area during the survey (Table 2).

There is no dominance family in this study area, each family was represented by single species, except for Gobiidae and Eleotridae, which represented by five and three species, respectively (Fig. 2).

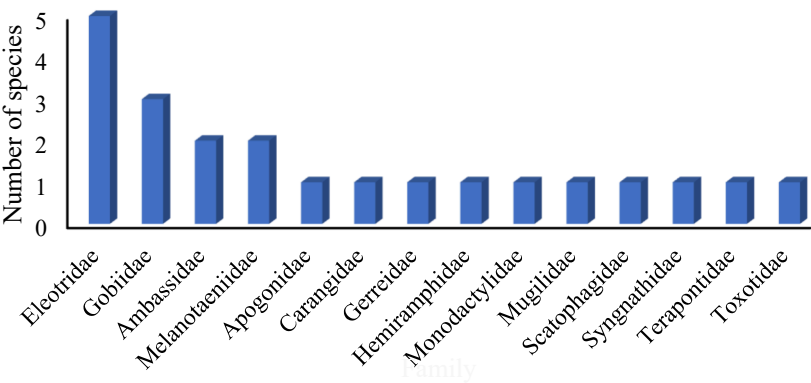


Fig. 2. Fakfak fish species composition in each family, Papua, Indonesia

Freshwater fish abundance was grouped based on scales, including common, occasionally, and rare. Mostly, each species was observed in a single location, except *Yarica hyalosoma* (Mangrove cardinalfish), *Scatophagus argus* (Spotted scat), and *Ambassis agrammus* (Sailfin Glassfish), which were observed in more than one site. Many species are considered rare, but some species were observed *occasionally*, while one species of rainbowfish was common in some sites (Table 2).

Table 2. The freshwater fish community in Fakfak, Papua, Indonesia.

N o.	Family	Species	Common Name	Site													
				1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Ambassidae	<i>A. agrammus</i>	Sailfin Glassfish	O			O									O	
2		<i>A. interruptus</i>	Long-spinned glass perchlet							O							
3	Apogonidae	<i>Y. hyalosoma</i>	Mangrove cardinal fish		R		R	R	O							R	
4	Carangidae	<i>C. sexfasciatus</i>	Bigeye Trevally					R									
5	Eleotridae	<i>H. compressa</i>	Empire Gudgeon	O							O						
6		<i>O. fimbriata</i>	Fimbriate Gudgeon	O								R				O	
7		<i>G. hoedti</i>	False Snakehead Gudgeon	R							R						
8		<i>G. margaritacea</i>	Snakehead Gudgeon	R													
9		<i>B. gyrinoides</i>	Greenback Gauvina								R						
10	Gerreide	<i>G. filamentosus</i>	Threadfin Silver Body					R									
11	Gobiidae	<i>Glossogobius</i> sp.2	Dwarf Goby	C													
12		<i>S. atratus</i>	Black stiphodon											R		R	
13		<i>S. psilosinionus</i>	Barcheek Goby	R							R						
14	Hemiramphidae	<i>Z. novaeguineae</i>	Fly River Garfish	O					R								O
15	Melanotaeniidae	<i>M. goldiei</i>	Goldie River Rainbowfish														C
16		<i>Melanotaenia</i> sp.										C	O				
17	Monodactylidae	<i>M. argenteus</i>	Silver Moony			R										R	
18	Mugilidae	<i>P. subviridis</i>	Greenback Mullet							R							
19	Scatophagidae	<i>S. argus</i>	Spotted scat		R			R		O							
20	Syngnathidae	<i>M. brachyurus</i>	Short-Tailed Pipefish													R	
21	Terapontidae	<i>H.lineatus</i>	Lined Grunter									R					
22	Toxotidae	<i>T. chatareus</i>	Seven-spot Archerfish	O													

Remarks : [4]:
R = rare, 3 or fewer individuals per site
O = occasionally, 5 – 30 per site
C = common, many per site, often more than 100

3 Discussion

River, streams, and creeks in Ubadari Village, Kokas area in northern and eastern Fakfak heading toward Bomberay District is mainly located inside the forest, slow to fast-flowing over boulders, rocks, and gravel bottom and located nearby sea (less than 20 km). The nearest location to the sea is Kinam Stream (2 km). Although there was no dominance of families, Gobiidae and Eleotridae had more species than other families during the survey. Some streams and creeks were flowing to the brackish Ubadari River, and through the mangrove

forest. Therefore, some species recorded in this survey were marine species, such as *Caranx sexfasciatus*, *Gerres filamentosus*, *Monodactylus argenteus*, *Planiliza subviridis*, *Scathopagus argus*, *Toxotes chatareus*. Marine species and gobioid species (Gobiidae and Eleotridae) have also been discovered in the steep-gradient coastal stream habitat along coastal Cycloop, Jayapura, and streams creeks in Raja Ampat and Vogelkop Peninsula [4–6].

Many species were observed only in a single location during this survey, and the most common species are *Yarica hyalosoma*, *Scatophagus argus*, *Ambassis agrammus*, and *Oxyeleotris fimbriata*. These species have been recorded in some locations and are widespread throughout New Guinea [6, 8, 10, 11], except *Hephaestus lineatus*, which is endemic to Vogelkop and Bomberay Peninsulas.

From 11 species (52%) distributed in Indo-West Pacific, six species (28.6%) were distributed to South New Guinea, where *Ambassis agrammus*, *Hypseleotris compressa*, *Glossogobius* sp.2 were also distributed in Northern Australia. *Stenogobius psilosinious* (Barcheck Goby) and *Zenarchopterus novaeguinea* (Fly River Garfish) are restricted to Southern New Guinea. *Melanotaenia goldiei* (Goldiei River Rainbowfish) has also been distributed to the Aru Islands (Table 3). As part of the freshwater fish zoogeographic of New Guinea, Aru Islands were connected to Vogelkop Peninsula and Central New Guinea in the past [8].

Oxyeleotris fimbriata (Fimbriate Gudgeon) is one of few New Guinea's species distributed on both sides, Southern and Northern New Guinea, and in Bird's Head and Northern Australia. *Giurus hoedti* (False Snakehead Gudgeon) is distributed in both sides of New Guinea, Bird's Head and Maluku. However, it has only occurred along the coast of New Guinea [10]. *Giuris hoedti* is a synonym of *Giuris margaritacea* [11]. *Ambassis interrupta* (Long-spinned glass perchlet) distributed to Indo-Australia [10] (Table 3).

Many recent studies of Kumawa Mountain and Vogelkop Anticlines ichthyofauna have described several new species [12, 13]. At least 4 of the 14 rainbowfish species reported are new species [14]; about 26 species of Gobiidae and Eleotridae. One blind fish living in a cave habitat is new species [15]. Expedition in 2014 has resulted in 1005 DNA vertebrate barcodes, including nine orders representing 17 families and 29 genera of fishes. The diversity of vertebrates of the Bird's Head is severely underestimated [16]. Previous studies [17–22] discovered new rainbowfish species in the area. These studies provided valuable information to our understanding of the diversity and endemism of freshwater in the Vogelkop areas and provided important information to [9]. Up to date, there is very limited information on freshwater fish available for Fakfak and surrounding areas, except rainbowfish collection done by [17] in Kokas area, about 3 km of Ubadari Village. He documented a new rainbowfish species, *Melanotaenia kokasensis*. Its distribution remains unknown and probably endemic to this area. This survey observed similar species, an unidentified rainbowfish, *Melanotaenia* sp., distributed near the Kokas area where *M. kokasensis* was discovered. Further research is necessary to confirm its species.

Table 3. Zoogeographic affinities Fakfak fish.

No	Zoogeographic affinities	Number of species (% fauna) (N= 21)
1	Indo-West Pacific	11 (52.4%)
2	South of New Guinea and Northern Australia	3 (14.3%)
3	South New Guinea	2 (9.5%)
4	Vogelkop and Bomberai Peninsulas	1 (4.8%)
5	Indo-Australia	1 (4.8%)
6	New Guinea and Northern Australia	1 (4.8%)
7	New Guinea and Maluku	1 (4.8%)
8	Southern New Guinea and Aru Island	1 (4.8%)

Source : [8, 10, 3, 4, 11]

Endemic species to Vogelkop and Bomberay Peninsulas species, *Hephaestus lineatus* (Lined Grunter) was observed rare and restricted in a location in the Mandasin Stream. The stream and its tributaries and other streams and creeks in the area could be the species' distribution area. Furthermore, unidentified rainbowfish species, *Melanotaenia* sp., was also observed in the same area, making this stream important for conservation.

Further research is needed to delineate the distribution area of *Hephaestus lineatus* in Fakfak and recollected the *Melanotaenia* sp. to confirm its species status. Fortunately, no introduced species were observed in this survey in the areas. However, it was reported an introduced species, *Oreochromis mossambicus*, of Bomberay River, 63 km of Ubadari Village [23]. Introduced species could spread quickly to other natural water and streams and threaten native species [24–26], where one of them is Lake Sentani.

4 Conclusion

Twenty-two native New Guinean species belong to 19 genera, and 14 families were recorded in Ubadari and surrounding villages, Fakfak. The fish species are mostly reported as widespread New Guinean species, except one species endemic to Vogelkop and Bomberay species, *Hephaestus lineatus*, and one unidentified rainbowfish, *Melanotaenia* sp. During this survey, no record of introduced species in the area. Further research is needed to add the distribution area of the endemic species and collect more specimens of the rainbowfish to confirm its species status.

5 Acknowledgments

The survey would not have been possible without generous financial support from Conservation International. Special thanks to the Dean of Mathematics and Natural Sciences Faculty of UNCEN for research permission. I also thank the Ubadari Village leader and the community, who help me do the fish collection.

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