

IDENTIFICATION OF FRESHWATER GOBY SPECIES FROM THE BIAK AND KOYOAN RIVERS, LUWUK BANGGAI, CENTRAL SULAWESI

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ABSTRACT

Sulawesi is an island famous for its biodiversity, including many endemic species. In particular, Sulawesi has the highest number of gobies in the world, including species with potential as food and/or ornamental fishes. The exploration of freshwater ichthyofauna is important in the context of Indonesian and global biodiversity. This research aimed to identify gobies found in the Luwuk Banggai area of Central Sulawesi, as a contribution to the exploration of Indonesian ichthyofaunal biodiversity. Gobies were sampled from January to March 2019 in the Biak and Koyoan Rivers. The sampled fish were measured and identified based on morphological characteristics. A total of 52 specimens were collected, and identified as belonging to 17 species within two families, the Gobiidae and Eleotridae. Gobies from the Koyoan River comprised 32 specimens from 8 species, while 20 specimens belonging to species were found in the Biak River. Only two species were found in both rivers: *Stiphodon semoni* and *Sicyopterus lagocephalus*. These results augment the body of knowledge regarding the presence and distribution of gobies in Indonesia.

Key words: biodiversity, Gobiidae, Eleotridae, Luwuk Banggai.

INTRODUCTION

Indonesia is a tropical country blessed with highly diverse flora and fauna, including ichthyofauna (Lamoureux *et al.*, 2006; Hoffman *et al.*, 2010; Hubert *et al.*, 2015). As an archipelagic nation spread across three time zones and bisected by the equator, the freshwater ichthyofauna of Indonesia is concentrated in several of the larger islands, with a high mean species density of 0.6 species per 1000 km² (Hubert *et al.*, 2015). To put this in perspective, two renowned biodiversity hotspots, Brazil and the Democratic Republic of the Congo, have freshwater ichthyofaunal densities of 0.37 and 0.48 species per 1000 km², respectively (Hubert *et al.*, 2015). The Indonesian Island of Sulawesi is particularly rich in endemic freshwater fishes. Kottelat (1990) lists 62 species of freshwater fishes found in Sulawesi, of which 52 are endemic to the island.

The gobies are a group of fishes with considerable, albeit often underestimated, potential as fisheries resources. In addition to their role as often locally important food fishes, many gobies also have potential as ornamental fishes, due to their attractive shapes and colouration. The City of Luwuk, capital of the Luwuk Banggai District in Central Sulawesi, is known as the watery city, because of the many rivers flowing into the sea all along the coast. Each of these rivers has its

own ichthyofauna, including gobies. The aim of this research was to find and identify gobies living in the rivers of the Luwuk Banggai region of Central Sulawesi as a contribution towards the inventory of fish species richness and diversity in Indonesia.

MATERIALS AND METHODS

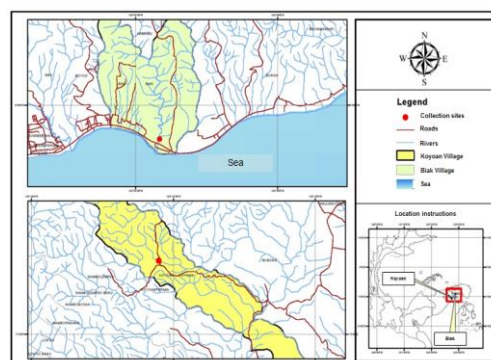


Figure 1. Goby collection sites in Luwuk Banggai, Central Sulawesi, Indonesia. The red dots indicate the collection sites on the Biak River in Biak Village (Desa Biak, above) and Koyoan River in Koyoan Village (Desa Koyoan, below).

This research was carried out between January and March 2019 in the Luwuk Banggai region of Central

Sulawesi. The sampling sites were in the Koyoan and Biak Rivers (Figure 1).

Specimens were collected using a scoop net. Each specimen was photographed (digital camera), euthanised and preserved in 70% alcohol. The specimens were identified to the lowest possible taxonomic level (species or genus) based on references including Carpenter and Niem (2001), Keith *et al.*, (2015) and FishBase, the global database of fishes (Froese and Pauly, 2019).

Table 1. Number and species of the goby specimens collected from the Biak and Koyoan Rivers

Site	Species	Number of Specimens	Total
Biak River	<i>Sicyopterus lagocephalus</i>	1	20
	<i>Sicyopterus longifilis</i>	1	
	<i>Stiphodon semoni</i>	10	
	<i>Awaous</i> sp.	1	
	<i>Schismatogobius</i> sp.	1	
	<i>Stenogobius</i> spp.	2	
	<i>Belobranchus belobranchus</i>	1	
	<i>Eleotris fusca</i>	1	
	<i>Eleotris</i> sp1	1	
	<i>Eleotris</i> sp2.	1	
Koyoan River	<i>Sicyopterus</i> sp.	2	32
	<i>Sicyopterus lagocephalus</i>	1	
	<i>Sicyopus zosterophorus</i>	12	
	<i>Sicyopus</i> sp.	1	
	<i>Sicyopus discordipinnis</i>	1	
	<i>Stiphodon semoni</i>	8	
	<i>Lentipes mekonggaensis</i>	6	
<i>Lentipes</i> sp.	1		

RESULTS AND DISCUSSION

The goby specimens found at the two study sites (Table 1) show that ten species from 7 genera (*Sicyopterus*, *Stiphodon*, *Schismatogobius*, *Awaous*, *Stenogobius*, *Eleotris*, and *Belobranchus*) were found in the Biak River. In the Koyoan River, eight species were found, belonging to four genera (*Sicyopterus*, *Sicyopus*, *Stiphodon*, and *Lentipes*). At each research site, gobies were present in all riverine habitats along each of the two rivers.

Species belonging to the Eleotridae family (*B. branchus*, *E. fusca*, *Eleotris* sp1, and *Eleotris* sp2.) were only found in the Biak River (Figure 2). This was likely related to the habitat types present, in particular the presence of muddy bottomed areas, a feature known as a favoured habitat criteria for the Eleotridae, in particular the members of this family commonly found in Indonesia. This habitat preference is described in

Hubert *et al.* (2015) who found members of the Eleotridae in all the fresh water bodies they sampled in Indonesia.

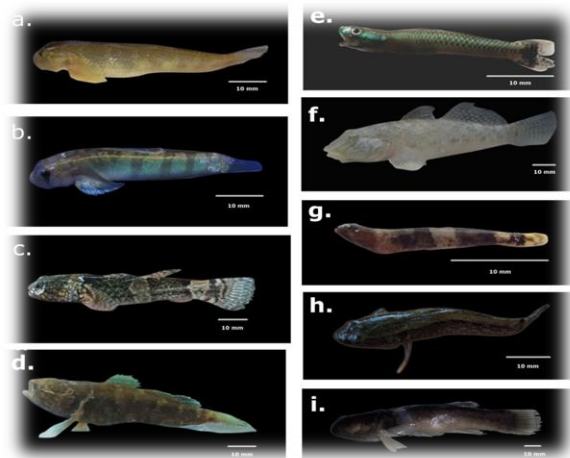


Figure 2. Goby species found in the Biak River: a. *Sicyopterus lagocephalus*; b. *S. longifilis*; c. *Belobranchus belobranchus*; d. *Eleotris* sp1.; e. *Stiphodon semoni*; f. *Awaous* sp.; g. *Schismatogobius* sp.; h. *E. fusca*; i. *Eleotris* sp2.

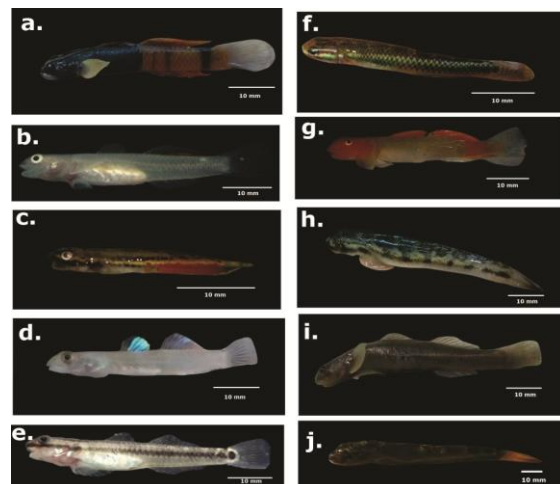


Figure 3. Goby species found in the Koyoan River: a. *Sicyopus zosterophorus* (male); b. *S. zosterophorus* (female); c. *S. discordipinnis*; d. *Sicyopus* sp.; e. *Stiphodon semoni* (male); f. *S. semoni* (female); g. *Lentipes mekonggaensis*; h. *Sicyopterus* sp.; i. *Lentipes* sp. (female); j. *Sicyopterus lagocephalus*.

All the species found in the Koyoan River (Figure 3) belong to the subfamily Sicydiinae. The Koyoan River is one of several rivers in the Luwuk Banggai area with waterfalls and rapids (Figure 4). Such features are known to be a habitat characteristic preferred by members of the subfamily Sicydiinae. According to Keith *et al.* (2003), during the upstream (amphidromous) migration of goby postlarvae, the majority of postlarvae stop and settle when they come to areas with waterfalls or rapids, which can provide them with ideal habitat. After adult gobies spawn in the river, the currents carry the embryos towards the sea where the larvae will undergo a planktonic larval phase. Once they reach the postlarval phase, the young gobies

will migrate back towards rivers and streams to grow, mature, and spawn (McDowall, 2007; Keith *et al.*, 2008).

Gobies of the subfamily Sicydiinae have a special adaptation, in the form of modified ventral fins, to enable them to climb up waterfalls. Their ventral fins are fused to form a sucker which enables them to attach themselves to rocks or other hard substrate. They use both their mouths and this sucker to climb upstream, making their way against strong, fast-flowing currents. Keith *et al.* (2003) report that the combination of these modified ventral fins and strong, well-developed pectoral fins can even enable goby species in the Sicydiinae subfamily to climb cliffs with fast-flowing waterfalls cascading down them. This ability enables members of the Sicydiinae subfamily to inhabit the upstream areas of watercourses, where they can be found in hilly or mountainous areas more than 100 m above sea level (Keith *et al.*, 2015). According to Ebner *et al.* (2011), the Sicydiinae subfamily is a group of gobies with a high species diversity in the tropical Indo-Pacific region.



Figure 4. The goby collection sites: a. Koyoan River; b. Biak River; c. Goby collection

The genus *Schismatogobius* comprises 24 known species worldwide (www.fishbase.org), 8 of which are found in Indonesia, with reported distributions in Sumatra, Java, Bali, Lombok, Ambon, and Sulawesi (Keith *et al.*, 2017; Nurjirana *et al.*, 2019). The species *L. mekonggaensis* found in the Koyoan River is a recently described species which was first found in 2014 in the Mekongga Mountains of Southeast Sulawesi Tenggara and has only been reported previously from that location (Keith *et al.*, 2014). The species *S. discordipinnis* was originally found and described from Papua New Guinea by Watson (1995), and has since been reported from several other sites including Irian Jaya (Keith *et al.*, 2015), Australia (Ebner *et al.*, 2011), and the Solomon Islands (Boseto *et al.*, 2007; Polhemus *et al.*, 2008).

Out of the 17 species found in this study, only two species, *S. semoni* and *S. Lagocephalus*, were found in

both the study sites. Keith *et al.* (2015) reports both *S. semoni* and *S. lagocephalus* as species which are widely distributed across Indonesia and even more widely within the Indo-Pacific region. In general, these gobies are relatively adaptable, which is one reason why they can be found in almost all aquatic habitat types in Indonesia, albeit with varying levels of abundance.

CONCLUSION

The results of this study show that the 52 goby specimens collected from the Biak River and Koyoan River in Luwuk Banggai, Central Sulawesi, Indonesia belong to 17 species. Research to explore the species diversity of freshwater fishes, in particular gobies, contributes to the body of knowledge on the species richness of Indonesian ichthyofauna. Such research has the potential to find new species as well as improving knowledge regarding the distribution of known species (new records).

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