The Fishery Potential of Freshwater Gobies in Mandulog River, Northern Mindanao, Philippines

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ABSTRACT

Freshwater gobies, particularly fry and some adult species, have been used as an alternative fishery resource. Mandulog River in Iligan City, northern Mindanao, Philippines, is one of the areas known for goby-fry fishery. This study described the potentials of the goby population in Mandulog River in terms of its fishery aspects. Households along the Mandulog River were the respondents of the survey.

Results show that most of the freshwater gobies were caught as alternative food while goby-fry were sold in the market. Goby fishing was done five times a year using nets and traps. The maximum catch per fishing session was one to three kilograms and sold at more or less PHP 10 (Philippine Peso) (USD 0.23) per kilogram. Monthly income from goby fishing was from PHP 100 to PHP 200 (USD 2.35 to USD 4.71) only. Goby species such as Sicyopterus lagocephalus*,* Oxyeleotris lineolata*,* Awaous melanocephalus*,* A. ocellaris*,* Giuris margaritacea*, and* Rhyacichthys aspro *were the preferred prey species. Findings suggest that goby fishing was not a major source of livelihood as fishers were not earning much from it.*

However, as a bycatch, the goby population is under threat, with their economic and ecological benefits not utilized. Destructive fishing methods such as cyanide fishing, electric fishing, and use of fine mesh nets might also adversely affect the goby population, despite being non-target species. Therefore, protection of target species from overexploitation would also benefit the goby species.

Keywords: freshwater gobies, fishery, abundance, Mandulog River
JEL classification: L13, F21, C72

INTRODUCTION

The Philippines' vast fishery resources could be attributed to its archipelagic nature, providing a lot of available habitats and food sources for different fish specie. However, rampant overfishing and widespread destructive fishing methods led to the enactment of the Fisheries Code of the Philippines or Republic Act No. 8550 in 1998 to regulate the indiscriminate use of fishery resources. Aside from this, the fishery sector is threatened by alarming rates of habitat destruction and fragmentation, increasing population growth, loss of species, uncontrolled pollution levels, and introduction of invasive exotic species in national and local scales. Threats of a changing climatic pattern characterized by erratic rainfall patterns, increased temperature, occurrence of strong typhoons, and prolonged occurrence of drought can also exacerbate the loss of Philippine fishery resources, threatening the ability of present and future generations to provide for their basic needs.

In Mindanao, goby-fry fishery was first documented and studied by Manacop (1953). Since then, however, scientific studies on gobies were undertaken to identify issues pertaining to seasonality, community involvement, and marketing. Mandulog River in Iligan City, Lanao del Norte, Mindanao is one of the areas known to have goby-fry fishery. Freshwater fishery is possible based on previous accounts of high fish population diversity, with no less than 2,117 species of gobies aside from other freshwater species. Moreover, 330 freshwater fish species are endemic to the Philippines, of which, 48 genera and 127 species are gobies (Herre 1927). However, only a few studies on gobies (Corpuz 2011; Mahilum et al. 2013; Vedra and Ocampo 2012, 2013) have been conducted in the Philippines, with recent studies focusing on inland waters of southern Luzon (UPLB Limnological Research Station 2011). Previous studies on gobies were about its life history (Manacop 1953), including its fishery, biology, ecology, and implications for conservation and management (Blanco 1956; Herre 1927; Manacop 1953; Montilla 1931). This study attempts to address the lack of studies on gobies, specifically on adult goby fishery. Findings may be used for further studies related to other goby fisheries in the Philippines.

Meanwhile, gobies have been extensively studied in other countries. Several studies on their early life history, recruitment dynamics, and fisheries (Bell and Brown 1995; Bell, Pepin, and Brown 1995; Bell 1997); and biology and genetics (Ego 1956; Fitzsimons and Nishimoto 1990; Fitzsimons, Zink, and Nishimoto 1990; Kinzie 1993; Nishimoto and Fitzsimons 1986; Radtke, Kinzie, and Folsom 1988) were conducted in Dominica, West Indies, and Hawaii, respectively. In Asia, several goby studies were also conducted, particularly those belonging to the genus *Rhinogobius* (Gill 1859), a common benthic fish fauna, not only in Taiwan and the Ryukyus Islands and mainland Japan (Akihito, Hayashi, and Yoshino 1984; Akihito et al. 1993; Chen 1994; Chen and Shao 1996), but also in continental Southeast Asia, from China to Thailand (Chen and Miller 1998; Chen, Kottelat, and Miller 1999).

MATERIALS AND METHODS

Courtesy calls and reconnaissance surveys were done with village councils, the city government, and some residents to explain the objectives of the research and obtain permission for the conduct of the study in the area. These were also done to ensure the community's support and cooperation in obtaining information.

Personal interviews using questionnaires were conducted among household heads or any member of the family aged 20 years or older on topics concerning the goby fishery—its volume

and frequency of harvest, and methods used in fishing. The number of respondents from upstream, midstream, and downstream areas of Mandulog River system was 89, 91, and 93, respectively. The number of respondents per household, assumed as one fishing unit, was determined using Slovin's (1960) formula, as cited in Pagoso and Montaño (1998) and Sevilla et al. (1997).

RESULTS AND DISCUSSION

Majority of the freshwater gobies were caught for household consumption, particularly as alternative food sources for 100 percent and 97.80 percent of upstream and midstream households, respectively (Figure 1). Only 2.2 percent of freshwater gobies (i.e., *Rhyacichthys aspro,* locally known as *dalapakan*) caught in midstream areas of the river were sold in the market. Goby fishing is prevalent in these areas because fresh marine fish are not readily available. In contrast, among households located downstream, goby-fry, locally known as *hipon* (*Sicyopterus lagocephalus* postlarvae, also known as *anga*) were primarily sold in the market (60.21%), although some were also used for household consumption (39.79%), particularly the *iswil* species.

Goby-fry fishery provided additional income. However, households located midstream were not able to take advantage of this as goby-fry existing midstream are almost in their juvenile stage, for which there is no available market. The market for goby-fry prefers them in their postlarvae stage, when they are very small (8–15 millimeters). They can be found at river mouths when goby species (*S. lagocephalus)* are in their postlarval migration. Relatedly, the challenge lies in determining the appropriate goby species that were used as sources of goby-fry fishery as 10 goby species have been identified in the Mandulog River. Fishermen identified their source of fry as *S. lagocephalus*. Meanwhile, the midstream and upstream households were interested and engaged in catching adult gobies, particularly *R. aspro*.

On the other hand, nets, traps, and hook and line were the fishing gear used in catching adult gobies (Figure 2). Nets were primarily used in goby fishing midstream (35.58%) and downstream (61.53%) since nets were also intended for other freshwater fish. Traps were mostly used by upstream fishers (60.67%) since these are also used to catch shrimp and crab. Meanwhile, hook and line (33.33%) was used particularly downstream (33.33%) since it was intended to catch marine fish that migrate at the river mouth. Findings show that fishing gear used to catch gobies were also used for other aquatic fauna such as shrimp, crab, and other fish species. This may imply that gobies are caught as bycatch rather than as target fish (e.g., siganids and mullet).

In terms of frequency, respondents in downstream areas reported fishing every month (40.86%) because most of them were fishers while those living upstream (24.73%) and midstream (77.52%) reported fishing five times a year (Figure 3). Fishing downstream was done not only for gobies but also for other freshwater fish which have high commercial value such as *Mesopristes cancellatus* (locally known as *pigok*). Goby-fry fishing starts in early November and peaks in February and late May. Spawning of gobies was observed at the onset of the rainy season, from October to November, and hence the returning postlarvae used for goby-fry are available during these months. That residents living midstream and upstream catch fish only five times a year may mean that goby fishing was merely an alternative means of livelihood, solely done for food and, to some extent, for additional income apart from the usual occupation of the residents.

The maximum catch per fishing session ranged from less than 1 kilogram (kg) to 3

Figure 1. Usage of fish caught per study site

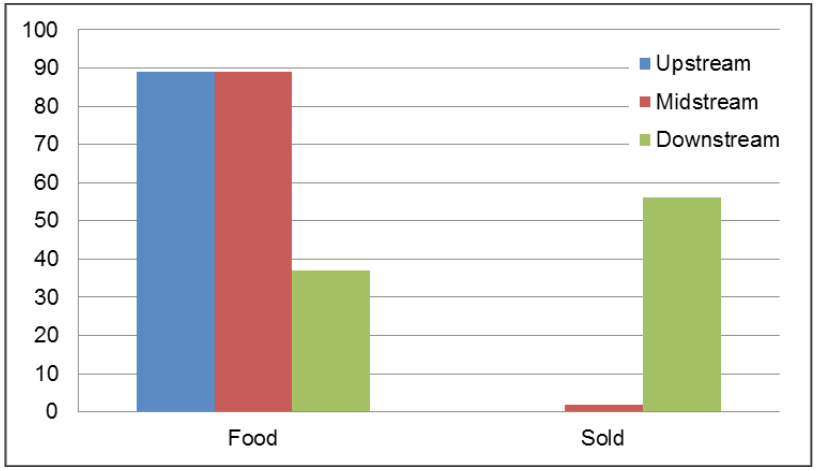


Figure 2. Fishing gear used per study site

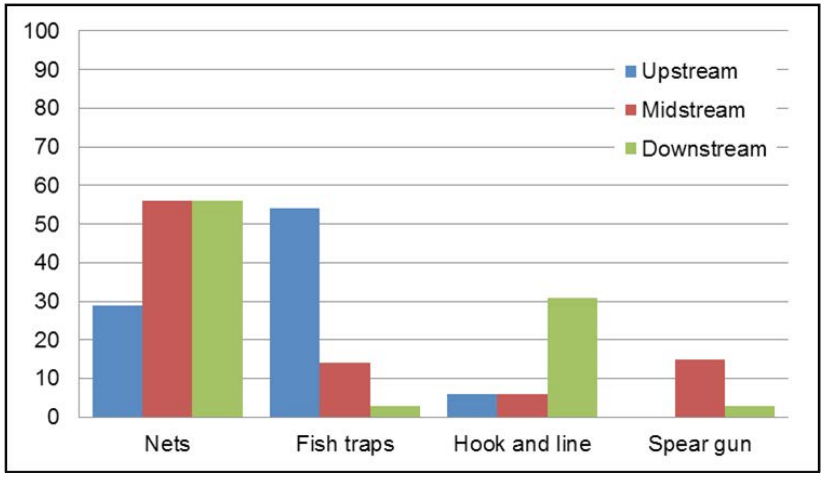


Figure 3. Frequency of fishing per study site

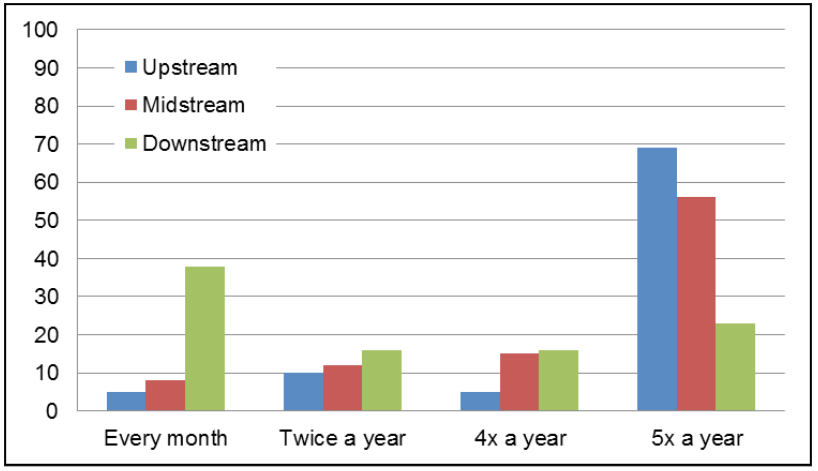
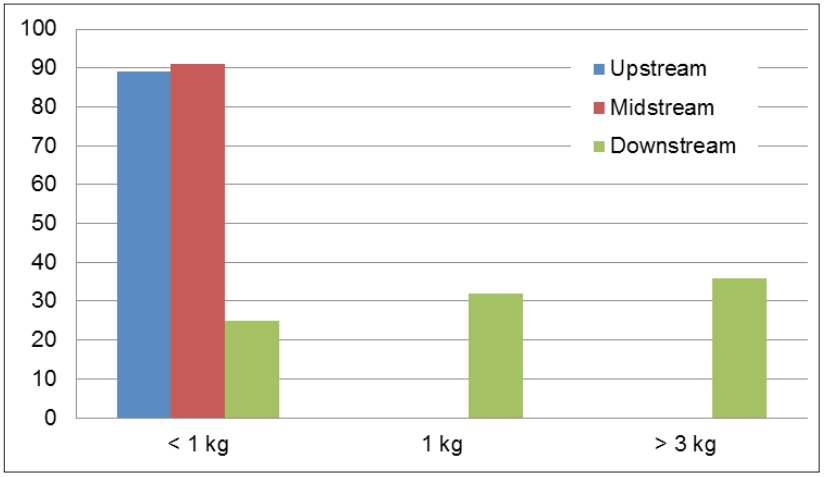


Figure 4. Estimated catch volume per fishing session per study site



kg (Figure 4). Most respondents upstream (61.53%) and midstream (77.52%) reported a maximum catch of 1 kg. Only respondents living downstream reported a maximum catch of 1 kg (26.88%) and 3 kg (38.71%). That respondents living downstream are full-time fishers while the rest are part-time fishers may explain the differences in maximum catch among respondents.

Averaging across upstream, midstream, and downstream households, the gobies caught were sold at PHP 10 (USD 0.23) per kg (44%), less than PHP 10 per kg (7.33%), and more than PHP 30 (USD 0.70) per kg (16.67%) (Figure 5). Each *S. lagocephalus* adult was sold at PHP 1 (USD 0.02) a piece, usually at the upstream site. Relatively higher prices of gobies (i.e., more than PHP 30 [USD 0.70] per kg) in midstream and downstream areas, were attributed to *R. aspro* and *S. lagocephalus*, which were sold at PHP 120 (USD 2.82) per kg.

Mean monthly income from goby fishing among the three areas was from less than PHP 100 (39%) up to PHP 200 (USD 4.71) (52%), wherein, lowest income was observed among midstream households while highest income was recorded among upstream households (Figure 6). Households located downstream reported similar monthly incomes, with 48.38 percent earning less than PHP 100 (USD 2.35) and 84.26 percent earning PHP 100 to PHP 200. The fishers did not solely rely on goby fishing as their means of livelihood, as goby-fry are seasonal and the river isaccess.

Gobies are also prey species for high-value fish. The favored goby species used as prey were anga (*S. lagocephalus),* both fry and adults (47.33%); iswil (*Awaous melanocephalus* and *A. ocellaris*) at 15 percent; *bunak* (*Oxyeleotris lineolata*) at 19.33 percent; *panghal* (*Giuris margaritacea*) at 8 percent; and dalapakan (*R. aspro*) at 1.33% (Figure 7 and Figure 8).

Data seem to suggest that goby fishing is not a main source of livelihood in the area as fishers were not earning much from it. Despite this, goby species have been under threat because of bycatch as non-target fish species; goby species are incidentally captured and discarded, and consequently, their economic and ecological benefits are underutilized. Similarly, destructive fishing methods like cyanide fishing, electric fishing, and use of fine mesh nets might also adversely affect the goby population. As such, protection of target species from overexploitation would also benefit the goby species.

CONCLUSION AND RECOMMENDATIONS

Data on goby fishery are promising to communities along the Mandulog River, particularly among fishers. Goby species like the *S. lagocephalus* (anga)*,* species from genus *Awaou* (iswil)*, O. lineolata* (bunak)*, G. margaritacea* (panghal)*,* and *R. aspro* (dalapakan) might provide additional income when properly marketed. *Glossogobius giuris* (locally known as *subok*/*kadurog*) is a goby species that has a good potential for fishery in the Mandulog River because it is relatively bigger compared to the other goby species. Future studies can focus on its natural productivity, marketability, and aquaculture potential; findings of which must be disseminated to fishers so they could tap the potential of this goby species in providing additional income. Data on the available goby-fry and adults in the river and fisheries experts might provide more information on the potential of sustainable goby fisheries in Iligan City and nearby places in Mindanao. To maintain the goby population, fishing activities in the Mandulog Rives must be regulated, including the prohibition of destructive fishing methods as well as regulation of pollution sources, which is important in protecting the growth and development of returning postlarvae gobies.

Figure 5. Monthly income derived from goby fishing

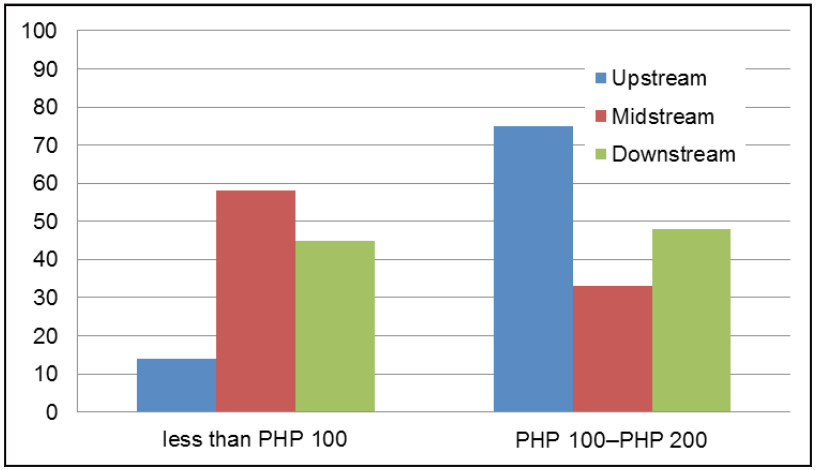


Figure 6. Possible price of goby caught

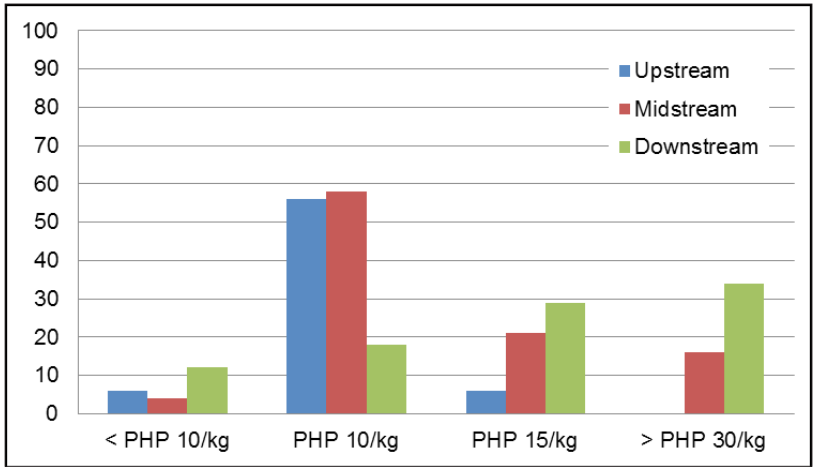


Figure 7. Species of gobies captured per fishing per type of gear

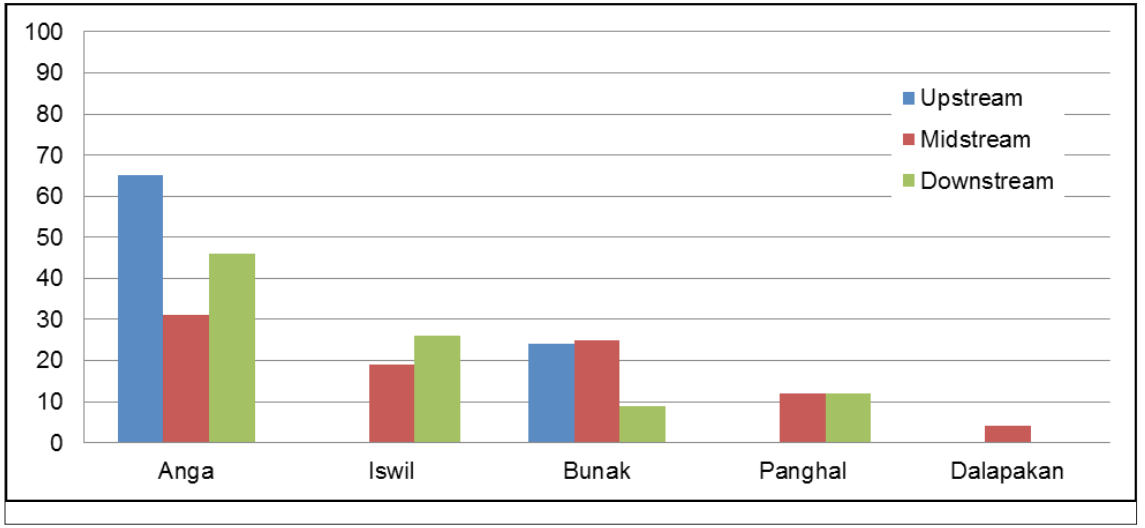
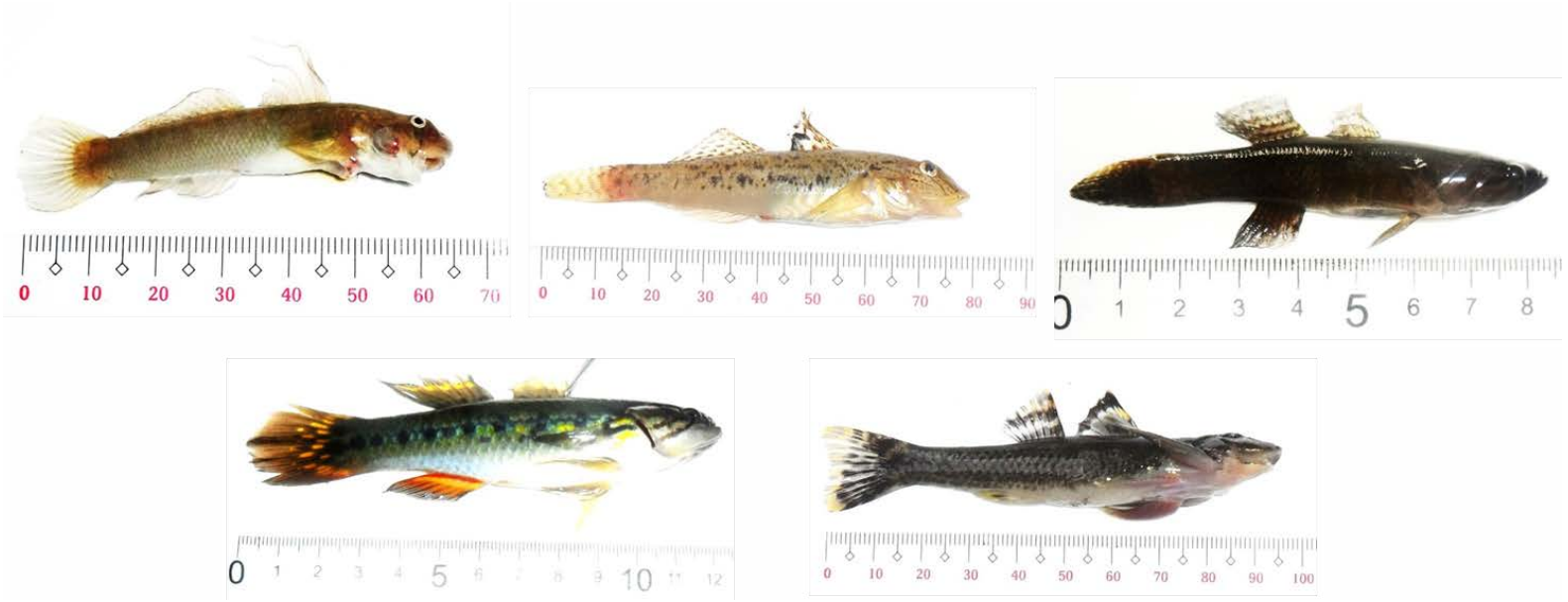


Figure 8. Goby species caught by households living in the upstream, midstream and downstream parts of Mandulog River, Iligan City, Lanao del Norte, Philippines. From top to bottom, left to right: *Sicyopterus lagocephalus, Awaous ocellaris, Oxyeleotris lineolata, Giuris margaritacea, and Rhyacichthys aspro*



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