freshwater fish of gegas dam lake

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WORD COUNT 3692
TIME SUBMITTED 05-NOV-2021 04:53PM
PAPER ID 78494540

Eco. Env. & Cons. 27 (1) : 2021; pp. (216-221)
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ISSN 0971–765X

Freshwater fishes of Gegas Dam, South Sumatra Indonesia: composition and diversity

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(Received 5 July, 2020; accepted 11 August, 2020)

ABSTRACT

Fish studies can be essential information about the health of aquatic ecosystems as well as a basis for policy making management of fish resources. Study of fishes in the Gegas Dam has never been reported. This study aims to determine the diversity of fish in the Gegas Dam. Data collection was conducted during rainy season in March 2020 at the Gegas Dam, Musi Rawas Regency, South Sumatra. Fish samples were caught with fish bait, cast net, gill net, and hexagonal fish trap. The fish obtained are tabulated based on species, genus and family. Data analysis included the index of Shannon diversity, Pielou's evenness index and Simpson dominance index. Total fishes collected during the study were 414 individuals. The composition of the fish consists of 25 species representing 19 genera, and 12 families. *Desmopuntius gemellus* is the species most caught during the study. The results of diversity index analysis were 3.01, evenness index was 0.93 and dominance index was 0.05. Diversity in the Gegas Dam is of medium category with high species evenness and no species dominate.

Key words : *Biodiversity, Ecology, Ecosystems, Fish, Population*

Introduction

Dam construction is a plays role in human development to control river flow and is used to generate electricity, and irrigation (Agostinho *et al.*, 2008; Jellyman & Harding, 2012). The dam threat to biodiversity is due to changing functional characteristics of biological communities, ecosystem processes and creating new ecosystems (Baxter, 1977; Cardinale *et al.*, 2012; Oliveira *et al.*, 2018). Dams change anthropogenic, including water pollution, overfishing, lake reclamation for agricultural land (Hu *et al.*, 2015). Dam can also cause problems for fish i.e diversity, migration delay, non-native species (Agostinho *et al.*, 2008; Azami *et al.*, 2012; Cheng *et al.*, 2015; Jawad, 2003; Marschall *et al.*, 2011; Sá-Oliveira *et al.*, 2015).

Fish studies in South Sumatra has been widely carried out in rivers such as the Kelingi River (Samitra and Rozi, 2018a), Lakitan River (Samitra and Rozi, 2019b), Musi River (Prianto and Nurdawaty, 2013; Prianto and Suryanti, 2010, and Iqbal *et al.*, 2018) and the Banyuasin River (Prianto and Aprianti, 2012). The study focused on the river,

even though a complete study including the dam needs to be done. Fish studies can be essential information about the health of aquatic ecosystems and become the basis for policy making management of fish resources and conservation of an aquatic area (Hasan *et al*., 2015; Mute, 2017; Sukmono *et al*., 2013). In addition, the fish study of dam is helpful in problems like pollution control, the construction and renovation of dams and lakes, fish and aquatic life (Theurkar *et al*., 2013). This study aims to determine the diversity of fish in the Gegas Dam.

Materials and Methods

The field study was carried out in March 2020 at the Gegas Dam, Musi Rawas, South Sumatra, with coordinates 3°14'57.9"S 103°08'10.2" E (Figure 1). Fish sample were collected through fishing efforts using fish bait, cast net, gill nets, hexagonal fish trap and also help from the local Fisherman. Sampling is done at the selected point by purposive sampling based on potential spots of fish. Captured fish were identified refers to Kottelat *et al*. (1993); Iqbal (2011); Iqbal *et al*. (2018) and Sukmono and Margaretha (2017).

Fig. 1. Location of the Gegas Dam, Musi Rawas, South Sumatra

Fish data are tabulated by species and family. Data analysis includes species composition, Shannon diversity index, Pielou's evenness index and Simpson dominance index (Guo *et al*., 2018; Hossain *et al*., 2017; Samitra and Rozi, 2019b).

Results

Fish compostion

A total of 414 fish sample were caught during research. The fish composition consists of 25 species representing 19 genera, and 12 families (Table 1). Three families [Cyprinidae (n= 237 specimens, 9 species), Clariidae (n= 23 specimens, 3 species) and Osphronemidae (n=29 specimens, 3 species)] are the most species-rich families. The most common species found in Gegas Dam *Desmopuntius gemellus* (8.45%), while the least commonly found was *Pangio kuhlii* and *Chitala lopis* (0.24%) (Table 1).

Table 1. Fish Composistion in Gegas Dam

Families	Species Abundance Relative (%)	
Anabantidae	*Anabas testudineus*	3.14
Aplocheilidae	*Aplocheilus panchax*	6.52
Bagridae	*Mystus nigriceps*	3.38
Channidae	*Channa striata*	2.66
	Channa micropeltes	3.14
Clariidae	*Clarias leiacanthus*	2.66
	Clarias nieuhofii	2.17
	Clarias gariepinus	0.72
Cobitidae	*Pangio kuhlii*	0.24
Cyprinidae	*Hampala macrolepidota*	6.28
	Puntigrus tetrazona	6.76
	Cyclocheilichthys apogon	5.07
	Osteochilus vittatus	3.86
	Rasbora trilineata	6.28
	Labiobarbus leptocheilus	6.28
	Desmopuntius gemellus	8.45
	Rasbora nematotaenia	7.49
	Rasbora cephalotaenia	6.76
Helostomatidae	*Helostoma temminckii*	5.56
Nandidae	*Nandus nebulosus*	1.21
Notopteridae	*Chitala lopis*	0.24
Osphronemidae	*Osphronemus goramy*	1.21
	Trichopodus trichopterus	3.62
	Trichopodus pectoralis	2.17
Pristolepididae	*Pristolepis fasciata*	4.11

Ecological index

The results of the data analysis in the field revealed that the diversity of fish in the Gegas Dam was 3.01 with the medium category, while the evenness index was 0.93 with the evenly distributed category and the index of dominance was 0.05 with the low category (Table 2). Environmental parameter data

(Table 3) shows that water temperature is 27.5, visibility is 93.45 cm, pH is 6.87, and DO is 40 mg.L^{-1}. Based on these data it can be said that the environmental parameters in the Gegas Dam are still within the tolerance limits for fish growth and development.

Table 2. Index of Diversity, Evenness and Dominance in Gegas Dam

Index	Value
Diversity (H')	3.01
Evenness (E)	0.93
Dominance (C)	0.05

Table 3. Data on Environmental Parameters at Gegas Dam

Parameter	Average
Water Temperature (!)	27.5
Visibility (cm)	93.45
pH	6.87
DO (mg/L)	42.3

Discussion

The fish most common in Gegas Dam are different from the results of research in Lakitan Dam (*Barbonymus gonionotus*) and Perjaya Weir (*Mystacoleucus marginatus*) (Nizar *et al*., 2014; Samitra and Rozi, 2018b) in Gegas Dam the most caught fish is *Desmopuntius gemellus*. This can affect the habitat in Dam Gegas suitable for the growth of *Desmopuntius gemellus*, habitat because it gives importance to the success of fish (Thomas *et al*, 2003).The difference in species in each water due to differences in habitat characteristics, food composition as well as chemical and physical factors (Daga *et al*., 2012; Tobes *et al*., 2016).

Fish *Chitala Lopis* and *Pangio kuhlii* the fewest fish found in the Gegas Dam. Some studies explain that the population of belida fish (*Chitala* sp) this has decreased due to human activities that are not environmentally friendly, changes in environmental conditions (Nugroho *et al*., 2019; Wibowo *et al*., 2010). *Chitala* sp is much in demand by the community so that fishermen over fishing even though this fish has a low fecundity, so it can cause these fish to become scarce (Wibowo *et al*., 2010). The Government of Indonesia in 2018 has determined that all types of belida fish in Indonesia are protected (Indonesian Government, 2018)

We found *Pangio kuhlii* in puddles that arise after rain around the Gegas Dam. Though these fish live in forest canals and peat waters (Froese and Pauly, 2019), so the possibility of these fish carried by the current when it rains. This fish can be used as ornamental fish and has been traded in the domestic and export markets (Fahmi *et al*., 2015).

The Cyprinidae family is the fish family most commonly found in the Gegas Dam, this is the same as several other studies such as in the Lakitan Dam, Musi Rawas, South Sumatra (Samitra and Rozi, 2019a, 2018b), Perjaya Weir, Komering River in South Sumatra (Nizar *et al*., 2014) and Kelingi River, South Sumatra (Samitra and Rozi, 2018a) and the Luk Ulo River, Kebumen (Wahyuni and Zakaria, 2018). Cyprinidae is the largest family in the World except in Australia, Madagascar, New Zealand, and South America (although in some places it has been introduced) (Esmaeili *et al*., 2010). They are easily adaptable, most commonly found in tropical waters and generally plays an important role in supporting human life (Kottelat and Whitten, 1996; Samitra and Rozi, 2019b; Thai *et al*., 2007).

We refer to Froese & Pauly (2019) for species distribution and habitat. The native species were found as many as 24 species and non-native species as many as 1 species of fish. We did not find endemic fish in South Sumatra, but found the endemic fish of Sumatra, namely *Desmopuntius gemellus*. The non-native species found was *Clarias gariepinus,* this fish from Africa and was cultivated for consumption fish (Froese and Pauly, 2019; Muhammad and Andriyanto, 2013). We interview community around dam, that the Government of Musi Rawas Regency has ever released (introduced) fish such as *Clarias gariepinus, Pangasius sp,* and *Oreochromis niloticus*. The non-native species carried out by the government might aim fortaken restocking, this activity needs to beinto consideration because many studies have shown the non-native species can reduce native fish (Britton and Orsi, 2012; Latini and Jr, 2004; Nuryanto *et al*., 2015; Umar and Sulaiman, 2013). The non-native species very dangerous for native fishes of the Gegas Dam, because it can be a competitor of native fish in obtaining habitat and food, predation, ecological changes (Gallardo *et al*., 2016; Grabowska *et al*., 2020; Ribeiro and Leunda, 2012). In fact, native fish can be cultivated for consumption and ornamental fish. *Osphronemus goramy, Hampala macrolepidota, Helostoma temminckii,*

Pristolepis fasciata and *Chitala lopis* for consumption. *Pangio Kuhlii* andfish of the genus Rasbora can be cultivated into ornamental fish.

The diversity of fish in the Gegas Dam is of medium category, with evenly distributed species and low dominance. Fish diversity in the Gegas Dam is lower than in the Perjaya Dam (Nizar *et al*., 2014), and higher than the diversity of fish in the Simpur Dam (Gustomi *et al*., 2013). Diversity index depends on variation in the number of individuals of each species (Hossain *et al*., 2013; Sitompul *et al*., 2017). The greater the number of fish species and the variation in the number of individuals of each species, the greater the diversity of fish in an aquatic ecosystem (Grenouillet, *et al*, 2002; Sriwidodo *et al*., 2013).

The category diversity is showing the diversity of fish in the Gegas Dam in good condition because it is supported by a stable ecosystem and there is no disturbance. The dominance of fish in the Gegas Dam can be said to be relatively nonexistent as the dominance index value reaches almost 0. The absence of high dominance in the Gegas Dam signifies competition for balanced food and habitat as well as a balance between predators and prey (Zulfikri *et al*., 2016; Sinclair *et al*, 2006). The government has banned the use of electrofishing and poison, helping to maintain the diversity of fish in dams. Data on environmental parameters in the Gegas Dam still (Table 3) support fish life, where the optimum temperature is 20-30 !, pH 6-9, DO> 4 mg.L^{-1} (Wahyuni and Zakaria, 2018).

Conclusion

Diversity in the Gegas Dam is of medium category with high species evenness and no species dominate.

Acknowledgements

This research was funded by the Indonesian Ministry of Education and Culture. We would like to thank the Lubuklinggau Kehati Team for helping us gather data.

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