

Relationship Between The Presence of Fish Floating Cages and Wild Fish in The PLTA Koto Panjang Dam

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ABSTRACT

Floating caged fish aquaculture activities in the Koto Panjang dam has positive economical impact, but its ecological impact is almost unknown. To understand the relationship between the cage and wild fish population in the surrounding area, a study has been conducted. There were 5 sampling sites, namely Station 1, 2, 3 (around the cage), 4 (in the dam, no cage) and 5 (in the Kampar River). Fish was sampled 3 times, once/ month, January to May 2013. The fish caught were counted and identified. Results shown the number and types of fish presence in each station is different. The number of fish present around the cage was higher than that of the fish in the area that has no cage. In station 1, 2 and 3, the number of fish ranged from 106 to 201, while that of the Station 4 and 5 was 53 to 348. Around the cage, there was a dominant species, *Puntius schwanenfeldii*, while in the area that has no cage, there was no dominant species. This fact indicates that the presence of wild fish around the cage may be due to the presence of feed remain spilled from the cage as the feed odor may play as an attractant to the fish. Moreover, the cage structure may play as a shelter for the fish. Based on data obtained, it can be concluded that there is a relationship between the presence of the cage and the presence of wild fish in the vicinity area.

Keywords: Fish floating cages, *Puntius schwanenfeldii*, PLTA Koto Panjang Dam, wild fish

INTRODUCTION

The Koto Panjang Dam is located in the Riau Province, Sumatra Island, Indonesia. This dam has been built within 1992-1997 and there were 3 rivers, the Kampar and Kapur rivers (in the Riau Province), and the Mahat River (in the West Sumatera Province) that have been blocked to create the dam. Nowadays, many people conduct caged fish culture activities in the dam and several types of fish such as *Cyprinus carpio*, *Pangasius hypophthalmus* and Nile tilapia (*Oreochromis niloticus*) are cultured.

Fish culture activities in the Koto Panjang positively affect the economic level of the people living around the dam. Many people work in the fish culture sectors and they get benefit as caged cultured fish has relatively high economical value. However, these activities also ecologically affect the dam as debris originated from the fish culture activities may play as an organic source that fertilize the water.

An intensive fish culture technique is applied in the caged fish culture in the Koto Panjang dam. The fishes are caged in relatively high density and they are fed on fish feed pellets that rich in protein and fat. There is no special time to feed the fish, but the feed is given many times/ day, start at 07.00 am to 07.00 pm. The farmer threw the feed to the cage frequently and they stop feeding when the fish are not eager to get the feed anymore. By applying this feeding technique, high amount of feed may be spilled out from the cage and it may affects the quality of the water as well as attracting wild fish to come.

As the fish feed is rich in protein and fat, the feed spilled out from the cage may be detected by wild fish inhabit the vicinity area. The aroma of the feed may play as an attractant for wild fish. Sumiarsih and Windarti (2009) stated that the remain of fish feed pellets are present in the stomach of several fish species that are captured around the cage. This fact suggests that the fish living around the cage may be able to use the spilled feed as their main food. Valle *et al* (2006) also stated that the presence of fish caged culture positively affect the number of species and population of fish around the cage. To understand the impact of caged fish aquaculture on the population and the number of fish species present around the cage, this study has been conducted. Information obtained from this study may be useful for designing the water quality management model in the Koto Panjang DAM.



MATERIALS AND METHODS

This study has been conducted in the Koto Panjang Dam, January to May 2013. Fish samples are analyzed in the Aquatic Ecology and Terpadu Laboratories, Fishery and Marine Science Faculty, Riau University, Pekanbaru.

Fish samples are captured from 5 stations, namely:

1. Station 1, in the dam, close to water gate, Pulau Gadang Village, 1,266 cages present
2. Station II, in the dam, around the 1st bridge, Tanjung Alai Village, 236 cages present
3. Station III, in the dam, around the 2nd bridge, Batu Bersurat Village, 80 cages present
4. Station IV, in the dam, Pongkai Istiqomah Village, no cage present.
5. Station V, in the Kampar River, the inlet of the Koto Panjang Dam, no cage present.

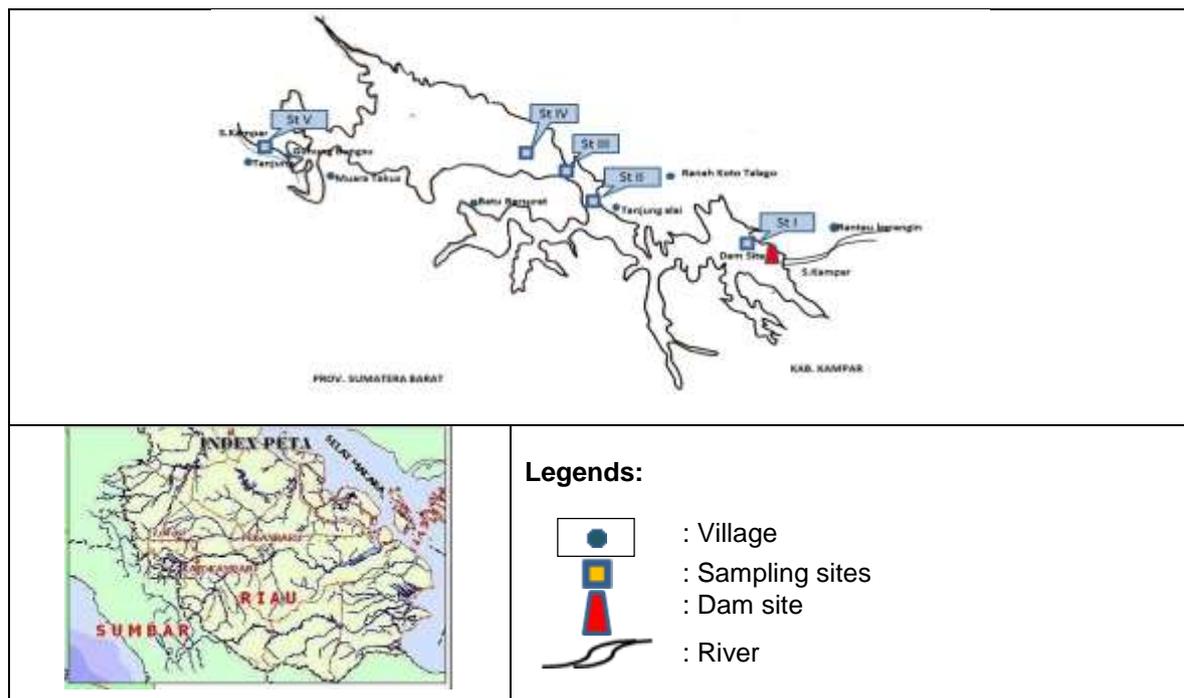


Figure 1. Sampling sites

Fish samplings were conducted at 3 times. In each sampling and fishes are caught using gill net that are set in each sampling site. The nets are lifted once/ hour for 24 hour period and the fish present are collected. The sampled fishes were counted and then identified based on Saanin (1984) dan Kottelat (1993). As well as the fish, water quality in each sampling site is also studied. The water quality parameters measured are as follow: temperature; brightness; turbidity; depth; pH; DO₂; free CO₂; NO₃-N; PO₄- P; NH₃ and plankton density.

RESULTS AND DISCUSSION

In the area around the fish cage in the Koto Panjang Dam, many species present. There are 24 fish species that are belonged to 12 families are captured. The fish consisted of endemic and non-endemic species fish (Table 1).

There are 3 species of non-endemic fishes present, namely common carp (*Cyprinus carpio*), goramy (*Ospronemos gouramy*) and nile tilapia (*Oreochromis niloticus*). These fishes are not originated from the dam, but it is predicted that they are escape from the cage and become wild as they are living in the free area around the cages. Among the endemic species, most of them are cyprinids. There are 16 species of cyprinids present and the dominant species is *Puntius schwanenfeldii* (its local name is "kapiék").

Table 1. Species and number of fish present in each sampling area.

No	Local name	Families	Scientific name	Fish number/ sampling site				
				I	II	III	IV	V
1	Baung	Bagridae	<i>Macrones nemurus</i>	-	6	4	6	-
2	Ingir-ingir	Bagridae	<i>Macrones nigriceps</i>	-	-	4	1	-
3	Bujuk	Channidae	<i>Channa lucius</i>	3	-	-	-	-
4	Toman	Channidae	<i>Ophiocephalus melanosoma</i>	-	1	5	-	-
5	Gabus	Channidae	<i>Channa sp</i>	-	-	-	4	-
6	Nila	Cichlidae	<i>Oreochromis niloticus</i>	2	5	29	2	-
7	Barau	Cyprinidae	<i>Hampala bimaculata</i>	12	5	13	8	-
8	Kapiek	Cyprinidae	<i>Puntius schwanenfeldii</i>	104	51	83	44	23
9	Motan	Cyprinidae	<i>Tynnichthys vaillanti</i>	1	2	-	-	4
10	Pantau	Cyprinidae	<i>Rasbora vaillanti</i>	1	3	4	2	-
11	Sepimping	Cyprinidae	<i>Chela oxygastroides</i>	1	-	-	-	-
12	Tabin Galan	Cyprinidae	<i>Puntius bramoides</i>	1	-	5	-	-
13	Paweh	Cyprinidae	<i>Osteochillus hasselti</i>	-	3	3	48	1
14	Sipaku	Cyprinidae	<i>Cyclocheilichthys apogon</i>	-	-	4	80	-
15	Pulau Buja	Cyprinidae	<i>Osteochillus kahajenensis</i>	-	-	2	100	3
16	Mansai	Cyprinidae	<i>Cyclocheilichthys heteronema</i>	-	-	-	10	7
17	Mali	Cyprinidae	<i>Labiobarbus festivus</i>	-	-	-	10	2
18	Mas	Cyprinidae	<i>Cyprinus carpio</i>	1	1	-	-	-
19	Motan	Cyprinidae	<i>Thynnichthys vaillanti</i>	1	2	-	-	4
20	Lelan	Cyprinidae	<i>Osteochilus pleurotaenia</i>	-	-	-	12	1
21	Selimang	Cyprinidae	<i>Crossocheilus sp</i>	-	-	-	-	1
22	Seluang	Cyprinidae	<i>Rasbora sp</i>	-	-	-	-	1
23	Sunau	Cyprinidae	<i>Puntius binotatus</i>	-	-	-	-	1
24	Tambakan	Helostomatidae	<i>Helostoma temminckii</i>	-	2	-	2	-
25	Tilan	Mastacembelidae	<i>Mastacembelus unicolor</i>	-	-	-	-	2
26	Belida	Notopteridae	<i>Notopterus chilata</i>	1	-	3	-	-
27	Sepat	Osphronemidae	<i>Trichogaster trichopterus</i>	-	-	4	-	-
28	Gurami	Osphronemidae	<i>Osphronemus goramy</i>	13	17	-	-	2
29	Katung	Pristolepididae	<i>Pristolepis grotii</i>	60	7	17	12	1
30	Buntal	Tetraodontidae	<i>Tetraodon leiurus</i>	-	1	1	1	-
31	Julung-julung	Belonidae	<i>Strongylura strongylura</i>	-	-	-	6	-
Total				201	106	181	348	53

Based on data presented in Table 1, it is predicted that there is a relationship between the presence of caged fish culture activities and the number of wild present around the cage. In Station 1, 2 and 3, there are 4 species present, namely *C. lucius*, *H. bimaculata*, *P. schwanenfeldii*, *N. chilata* and *P. grotii*. On the other hand, other species are present in the area that has no cage. This fact indicate that the aquaculture activities may attract certain species only.

The presence of wild fish around the cages may be caused by several reason. As the farmer feed the caged fish frequently and plenty of food remain spilled to the area around the cage, the aroma of the food is distributed to the water. Wild fish living in the vicinity area may be able to detect the source of food and they attracted to come to the area around the cage. Valle *et al.* (2007) and Fernandez-Jover *et al.* (2008) stated that the fish feed spilled from the cage attract the wild fish to come over the cage. In this case, fish feed serve as an attractant that cause the wild tated that the presence of wild fish around the od of wild fish captured around the cage is the



remain of fish feed pellets. Fish feed pellets spilled from the cage is able to support the life of *Clarias batracus* fingerling (Windarti and Sumiarsih, 2009).

Among the wild fish present around the cage, there are fish that do not feeding on pellets, instead they feed on algae (*P. grootii*) and carnivorous fish (*M. nemurus*, *M. nigriceps*, *C. lucius*, *O. melanosoma* and *Channa sp.*). These fishes do not directly consume the spilled feed, but they are opportunist fish that find out their food in the area that is affected by the presence of the aquaculture activities. As there are plenty of organic materials originated from spilled feed and fish feces around the cage, the water in that area become fertile. Phytoplankton and aquatic plant, including algae may grow well. *P. grootii* may feed on algae that grow out in the net, while the carnivorous fish hunt small fish that feed on plankton or debris around the cage.

Beside the feeding related activities, the presence of wild fish around the cage may be related to defence activity of the fish. The cage structure may serve as a hiding place for the fish. Fernandez-Jover *et al.* (2008) stated that wild fish is interested to cage structure and use it for hiding from predator. In the Koto Panjang Dam, small fish are present around the cage. The presence of this fish around the cage may not be caused by feeding activities only, but also hiding from predators.

Data obtained in this research shown that the number of fish present in each sampling site is different. The highest number of fish present in the Station 1, while the lowest is in the Station 5, where there is no cage present. Eventhough there is high number of fish present in the Station 1, its Diversity Index (1.337), however, is lower than that of the Station 2, 3, 4 and 5 (Table 3 and Figure 2). This fact indicates that types of fish in the Station 1 is less various than that of other stations. Shanon-Wiener in Odum (1971) stated that Diversity Index value that is ranged from 1.337 to 2.966, indicates that the fish distribution is medium. In the Station 1, however, the Dominance Index (2.693) is higher than that of the other stations. This fact indicates that there is a dominant species. In the Koto Panjang Dam, the dominance species is *Puntius schwanenfeldii*. The presence of this dominant species may a sign that in the Station 1, there is an ecological related problem (Stilling, P, 1996). This problem may be related to the rich of organic materials originated from uneaten fish feed spilled from the cage and fish feces. *P. schwanenfeldii* is able to consume the spilled feed directly and they able to use the cage structure to hide from predators. Because of this ability, this fish become adapt well with the environment and they grow well in that area., Valle *et al* stated that in the Mediteranian sea, there is a dominant fish species occur around the caged fish aquaculture. The dominant fish species are belonged to Sparidae and Carangidae (98 %). It is predicted that the dominant fish getting around the cage as they attract by fish feed pellet present in area around the cage.

In the area that has no cage (Station 4 and 5, Table 3), the diversity indices are relatively high (2.965 and 2.759 respectively), but the dominance indices is low. This fact indicate that the type of fish is various and there is no dominant species. On the other words, these environment are ecologically balance.

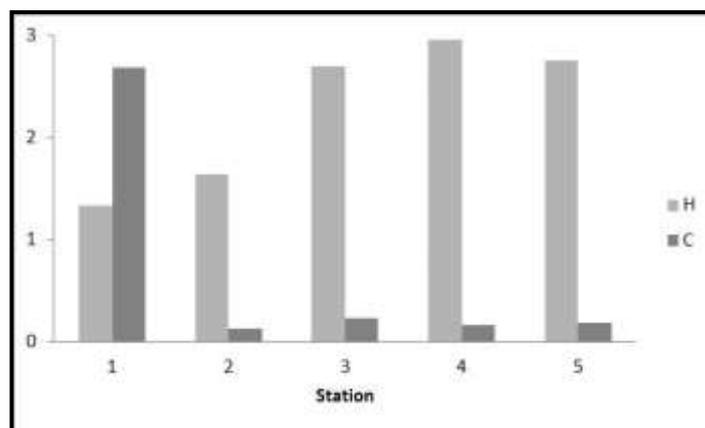


Figure 2. Diversity and Dominance Indices of wild fish in the Koto Panjang Dam

Table 2. Diversity and Dominance Indices values of wild fish in the Koto Panjang Dam

Station	Diversity Index (H')	Dominance Index (C)
I	1.337	2.693
II	1.639	0.136
III	2.700	0.241
IV	2.966	0.172
V	2.759	0.189

Results of water quality parameters indicate that the water quality in all sampling sites in the Koto Panjang Dam is relatively good (Table 3). The water temperature ranged from 26.8 – 31.3°C, Brightness 62.5 – 127 cm, turbidity 4 – 40 NTU, pH 6, DO 4.7 – 7 mg/l and free CO₂ 8.1 – 12 mg/l. These parameter values indicate that the water condition is good and suitable to support the life of aquatic organisms in that area. However, the Phosphate, Nitrate and NH₃ concentration (0.0802 – 0.2602 mg/L ; 0.1477 – 0.2602 mg/l and NH₃ 0.1544 – 0.2402 mg/l respectively) is relatively high, and indicate the organic material originated from the cage is affect the water quality in general.

Tabel 3. Water quality parameters

No	Parameters	St I	St II	St III	St IV	St V	Standard
1	Temperature (°C)	31.1	31.3	30.9	30.8	26.8	-
2	Brightness (cm)	103.8	125	127	72.8	62.5	-
3	Turbidity (NTU)	5	4	5	7	40	50
4	pH	6	6	6	6	6	6-9
5	DO (mg/l)	7.0	6.0	5.4	4.6	4.7	4
6	Free CO ₂ (mg/l)	12	10.5	9.6	9.1	8.1	-
7	Nitrate(mg/l)	0.1404	0.1127	0.0802	0.1107	0.1134	10
8	Phospate (mg/l)	0.2602	0.2169	0.2604	0.1477	0.1704	0.2
9	NH ₃ (mg/l)	0.2090	0.2402	0.1477	0.1634	0.1544	0.02

CONCLUSION

Based on data obtained in this research, it can be concluded that the presence of fish caged aquaculture affects the types and number fish present around the cage and the dominant fish species present around the cage is *Puntius schwanefeldii*. The presence of organic materials originated from aquaculture activities affect the water quality in general, especially increasing the amount of Nitrate, Phosphate and NH₃ in the water.

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