

Structure of fish communities in area of buoyant fish attractor in Lake Maninjau

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ABSTRACT

Lake Maninjau is one of the natural lakes located in Sumatra, Indonesia. One of the native fish of economic value as a consumption fish on Lake Maninjau is *Rasbora* spp. The current condition of bada fish fisheries tends to decline. This condition is estimated due to quite intensive fishing and a decrease in the lake's environmental conditions. Therefore, it is necessary to carry out an effort to conserve bada fish by using Bouyant Fish Attractor (BFA) to increase the bada fish population in Lake Maninjau so that it can be sustainable and utilized by the community. The study was conducted from April to October 2018. Data collection is carried out inside the BFA and outside the BFA. BFA was installed as many as three in the littoral zone of the lake with a depth of about 1 meter and about 15 meters from the shoreline of the lake. Fish are caught using gill nets with seven mesh sizes, surface trap and bottom trap. In this observation the data included the number and composition, catch trends, to find out the length weight relationship and the condition factor, the dominant native fish species is *Rasbora* spp. the results of the observation found 12 species of fish consist of five native fish species and seven species of fish introduced. Dominant native fish is *Rasbora* spp. and dominant introduction fish is *Oreochromis niloticus*. The dominant native fish catch trend is *Rasbora* spp. and the highest is found in July both inside the BFA and outside the BFA were 135 and 98 fish, respectively. The dominant introduction fish catch trend is *O. niloticus* which is highest in July both inside the BFA and outside the BFA were 19 and 58 fish, respectively. Based on the length-weight relationship, the growth of *Rasbora* spp. is allometric negative. The condition factor value of *Rasbora* spp. for male and female range between 0.68-0.71. From these results it can be concluded that BFA technology has succeeded in attracting fish populations, especially native fish species, because the availability of new food nets as a food source, shelter from predators.

Key words: Fish community, Bouyant Fish Attractor, *Rasbora* spp., and Lake Maninjau

Introduction

Lake Maninjau is located in Sumatra. Lake Maninjau has a multi-functional role, include being used for capture fisheries, aquaculture, tourism, hydroelectric power (HP), navigation, clean water sources, and social and cultural activities. Some studies suggest that extreme geographical differences can affect the composition of fish communities

in these waters (Carmona *et al.*, 1999; Pyron and Lauer, 2004). In Lake Maninjau found 16 species of fish including native species namely bada (*Rasbora* spp.) (Sulastris *et al.*, 2016). Bada is the dominant fish with high economic value. Bada fishing is one of the main jobs for fishermen around the lake. At present the catch of bada continues to decline (Dina *et al.* 2019). The decline of native fish caused by water quality degradation (Sulastris *et al.*, 2016), beside of

intensive fishing activities (Lukman, 2017).

The BFA technique has been used for 40 years as a fish collector. The results of this study show that BFA can change the behaviour of fish in protection from predators so that the survival rate of prey fish is increased (Sinopoli *et al.*, 2015). The use of BFA in Indonesia has been started since 1976 under different names by region. With BFA the number of fish catches increases (Boy and Smith, 1984). To restore fish populations in Lake Maninjau, habitat recovery is needed includes developing artificial habitats. Bouyant Fish Attractor (BFA) is an artificial habitat that has been developed at the Research Center for Limnology, Indonesian Institute of Sciences (LIPI) (Nofdianto, 2019).

The purpose of this study is to increase the community and population of native fish that use Bouyant Fish attractors (BFA) as feeding ground. It is hoped that it will attract populations of lake native fish to come and use it either as a food provider or as a shelter from predators.

Materials and Methods

Study site

Bouyant Fish Attractors (BFA) were installed in the littoral zone of lake in the Sungai Batang Village area from April to October 2018. Three units of BFA were installed at a depth of 2 meters and a distance of about 15 meters from the shoreline of the lake. Observation of fish communities was carried out at two locations, namely inside the BFA and outside the BFA as a control (Fig. 1).



Fig. 1. The position of inside the BFA and outside the BFA (300 m). (Source: Tjandra edit by Endra, 2018)

Sample collection

Fish sampling is done every month using gillnet fishing gear (mesh size: 5/8; ¾; 1; 1.5; 2.0; 2.5; 3.0 inches), three units of trap equipment (surface trap and bottom trap). The research method used is descriptive quantitative approach. The installation of fishing gear is carried out for 16 hours from 04.00 pm to 8.00 am. Fish samples in the field are preserved with 4-10% formalin labeled containing location data and sampling time. The fish caught were measured in total length using a fish gauge (ruler or calipers) with an accuracy of 0.1 cm and body weight using a scale with a precision of 0.1 g. The number of fish is calculated according to the type of fish obtained. Sample analysis was performed at the Research Center for Limnology, Indonesian Institute of Sciences (LIPI) Cibinong laboratory. In this observation the data included the number and composition, catch trends, to find out the length-weight relationship and the condition factor, the dominant native fish species is *Rasbora* spp.

Data analysis

Fish growth patterns were determined using a length-weight relationship equation, $W = aL^b$ (Pauly, 1984). If $b = 3$, then the growth pattern is isometric (length increase is proportional to weight gain). If $b \neq 3$ then the growth pattern is allometric (length increase is not proportional to weight gain). If $b > 3$, then the growth pattern is a positive allometric where weight gain is more dominant than the increase in length, whereas if $b < 3$, then the growth pattern is negative allometric where length is more dominant than weight gain (Effendie, 2002). Fish conditions and plaque are expressed in numbers calculated according to the formula proposed by Effendie (1979), namely $Kt = 10^5 W/L^3$, where Kt is body condition factors, W is average weight of fish (g), L is average length of fish (mm), 10^5 is the value is set so that the price of Kt approaches one.

Results and Discussion

Composition of fish species

The number of native fish species in inside the BFA from April to October 2018 is five species, namely *Rasbora* spp., *Hampala macrolepidota*, *Osteochillus vittatus*, *Barbodes* sp., *Tor* spp. Six introduction fish species namely *Oreochromis niloticus*, *Amphilopus* sp., *Oxyeleotris marmorata*, *Chana* sp., *Pangasius* sp., and

Anabas sp. (Fig. 2). The number of native fish species outside the BFA from April to October are four species, namely *Rasbora* spp., *Puntius* sp., *Osteochillus* sp. and *Barbodes* sp., and four introduction species namely *O. niloticus*, *Amphilopus* sp, *O. marmorata*, and *Clarias* sp., (Fig. 2). Dominant native species is bada fish (*Rasbora* spp.) and dominant introduction species is tilapia (*O. niloticus*). Krebs (1985) and Lagler *et al.* (1977) stated that the determinants of fish distribution were fish behavior in choosing habitat, stratification of temperature and dissolved oxygen, and availability of natural food.

Rasbora spp are found in the stations inside and outside the BFA, but more often found in inside the BFA. This accordance with the statement of Sinopoli (2015). This indicates that the BFA acts as a place to collect fish. The fish that collect around the BFA is determined by the type of BFA used and the location of its placement at the bottom or in the middle of the waters (Wan Rosdi *et al.*, 2018).

Research conducted by Nasution and Haryani (2014) in Sentani that a high abundance of fish, namely Red Rainbow (*Glossolepis incisus*) was found in stations with predominantly species of neli aquatic plants (*Ceratophyllum demersum*) and in conditions of water quality and environment that support growth of fish in Lake Sentani. There is also a very close relationship between the abundance of Rainbow Selebensis (*Telmatherina celebensis*) and the presence of aquatic plants in Lake Towuti (Nasution *et al.*, 2007). Aquatic plants here function as a gathering place for fish.

The dominant fish catch trend

The dominant native fish catch trend is *Rasbora* spp. and the highest is found in July both inside the BFA and outside the BFA were 135 and 98 fish, respectively. The dominant introduction fish catch trend is *O. niloticus* which is highest in July both inside the

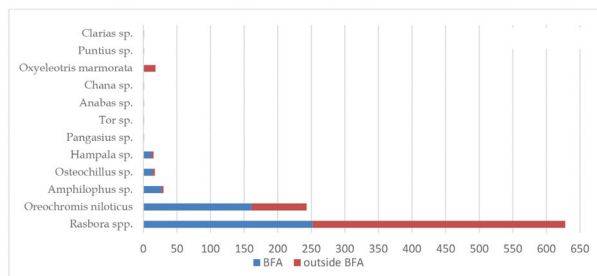


Fig. 2. Fish Species Composition in Bouyant Fish Attractor (BFA) and Outside the BFA

BFA and outside the BFA were 19 and 58 fish, respectively (Fig. 3). The number of *Rasbora* spp. inside the BFA, it began to increase in May and reached its highest number in June.

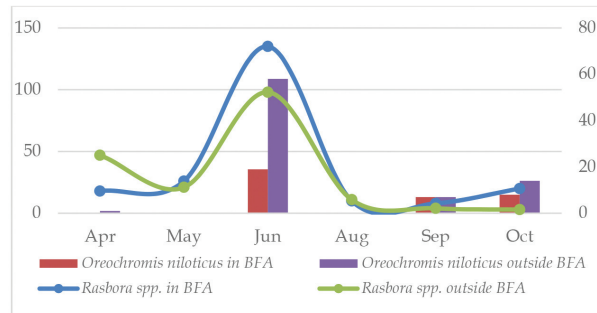


Fig. 3. Dominant fish catch trend in Lake Maninjau from April to October

Length-weight Relationship and Condition Factor

Generally, the length of male and female *Rasbora* spp. inside the BFA are 6.2 -11.7 cm and 6.0-11.6 cm respectively, while the weight measures are 1.78 g - 12.4 g and 1.6 g -9.8 g, respectively. Likewise, the lengths of male and female *Rasbora* spp. from outside the BFA are 6.5 cm -9.7 cm and 6.6-12.5 cm respectively, while the weight measures are 1.85 g - 6.11 g, and 1.80-16.4 g, respectively

Length-weight relationship models of male and female *Rasbora* spp. in inside BFA are $W = 0.0099L^{2.8154}$ and $W = 0.0073L^{2.9659}$, while in outside BFA are $W = 0.0069L^{2.9859}$ and $W = 0.0033L^{3.3386}$. T-test ($\alpha=0.05$) results in the regression coefficient value (b) shows the value of b for native fish species *Rasbora* spp. generally is negative allometric ($b < 3$). The exponent values of b for length and weight in inside the BFA for males are 2.815 and females are 2.966 and in outside the BFA for males are 2.986 and females are 3.339. This means that the growth of *Rasbora* spp. weight is not balanced with long growth. Weight gain is not as fast as the length increase (Table 1). Merta (1993) states that because the environment often changes and the fish's condition changes, the length-weight relationship will slightly deviate from the cubic law ($b \neq 3$).

The condition factor is an indicator to see the influence of the environment on the physical condition of fish which is formulated in the bodyweight function compared to the body length of the fish. Theoretically, the condition factor value is directly proportional to the bodyweight of the fish. Variations in the value of condition factors depend on

Table 1. Length-weight relationship and condition factor of *Rasbora* spp.

	Inside BFA		Outside BFA	
	Male	Female	Male	Female
W	3.033 ± 1.92	6.075 ± 1.92	2.826 ± 0.74	5.779 ± 2.67
L	7.516 ± 1.08	9.506 ± 1.08	7.449 ± 0.51	9.100 ± 1.28
a	0.010	0.007	0.007	0.003
b	2.815	2.966	2.986	3.339
R ²	0.797	0.897	0.681	0.929
W'	2.989 ± 1.77	6.016 ± 1.77	2.812 ± 0.62	5.652 ± 2.52
Formula	W = 0.0099L ^{2.8154}	W = 0.0073L ^{2.9659}	W = 0.0069L ^{2.9859}	W = 0.0033L ^{3.3386}
K	0.689 ± 0.08	0.683 ± 0.08	0.674 ± 0.09	0.712 ± 0.10
Kr	1.009 ± 0.12	1.010 ± 0.12	1.005 ± 0.13	1.024 ± 0.14

food availability, age, sex, and gonad maturity (Effendie, 1979). The condition factor value of *Rasbora* spp. for male and female inside the BFA were 0.69 and 0.68 respectively, while those outside the BFA were 0.67 and 0.71, respectively (Table 1). The condition factor values in *Rasbora* spp. almost the same both inside and outside the BFA. The value of fish condition factor at the same peak can be interpreted as the readiness of the fish reproduction, because the increase in the condition factor in the same size fish group (same length and weight relative) is directly proportional to the increase in gonad size. An increase in the condition factor (which reflects an increase in gonad weight) is an indication of an increase in reproductive activity, so it is assumed that the peak of the condition factor curve is the peak of spawning activity or spawning season. In this research that *Rasbora* spp. caught using gillnet fishing gear inside the BFA and outside the BFA are generally at the level of gonad maturity stage (GMS) III and IV.

Conclusion

Found 12 species of fish consisting of five native fish species and seven species of fish introduced. Dominant native fish is *Rasbora* spp. and dominant introduced fish is *Oreochromis niloticus*. Based on the length-weight relationship, the growth of *Rasbora* spp. is allometric negative. The condition factor value of *Rasbora* spp. for male and female range between 0.68-0.71. The BFA technology has succeeded in attracting fish populations gathered because of the availability of new food webs as a food source.

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