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Management of the Manggabai Fishes *(Glossogobius giuris)* in the Inland Aquatics Gorontalo Province, Indonesia

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ABSTRACT
The inland open aquatics of Indonesia are the second largest in Asia after China. Tank goby is one of the freshwater fish that can be found in Lake Limboto, but is not endemic to Limboto Lake or Sulawesi Island. The purpose of this research is to find out the distribution, biological aspects and management of tank goby in Gorontalo Province. This observation was carried out in August - October 2018 at the Gorontalo Province. Sampling uses the census method. The observation shows that the manggabai fish has a length range of 3.5 cm - 18 cm and weighs in the range of 4 gr - 31 gr. Sex ratio in an unbalanced state and has a negative allometric growth pattern that shows long growth faster than its weight growth. The gonad maturity level of male manggabai fish is dominated by TKG II and III, and female is dominated by TKG III and IV. Length of first mature is 9.08 cm and the lenght of first capture is 12.42 cm. The lenght of first capture in small size will threaten its sustainability. Its fecundity ranges from 206,850 - 738,871 egg. Manggabai fish are carnivorous, where the main food is crustaceas. The fishing gear used bunggo and used motorcycle tires. Manggabai fish is only distributed in Limboto Lake and Buladu River. At present there is no specific management to preserve manggabai fish in Gorontalo Province

KEYWORDS: *Inland Aquatics, Limboto Lake, Glossogobius giuris, Biological Aspects, Management*

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I. BACKGROUND

One of the aquatic resources that stores large potential to land is Public Aquatics Resources (PUD). Inland public aquatic resources store economic potential large enough to be utilized, this makes the general aquatic area of the land has undergone intensive (Ramadan *et al*., 2008). The general aquatics are the surface or landmasses that are periodically enclosed in aquatics mass and are naturally and/or artificial, either freshwater, brackish, or common Seawater (Chaidir, 2010). The general aquatics of Indonesia's mainland are the second widest in Asia after China (Retnowati *et al*., 2017) with the total potential of fishery production reaching 3,035 million tons/year (Noordiningroom *et al.*, 2012).

Manggabai fish (*glossogobius giuris*) is not a fish endemic to Lake Limboto or endemic to Sulawesi Island (Suryandi and Krismono, 2011), but fish Manggabai is an important economical fish for the people of Gorontalo especially the community around the lake Limboto. Nowadays, the existence of the fish has decreased rapidly due to continuous arrest and environmental conditions change. This consideration is the basis of assessment of the management of the Manggbai fish in PUD Gorontalo province.

Information on the biological aspects of fish mangrove and consider some aspects of the organization is expected to provide alternative fish management Manggabai in order to realize the utilization of sustainably and continuous fish. The observed aspects of biology include long-weight relationships, genital ratio, the maturity level of the gonads, the first time ripe gonads, the first long caught, the eating habits, and the fekundity. With the fishery aspect includes the capture equipment and the arrest fleet. The purpose of this observation is to know the spread of fish in the PUD Province of Gorontalo, the aspect of biology and the management of the fish Manggabai. It is hoped that this observation can be considered as consideration for sustainable and continuous use of maggabai fish.

II. METHODOLOGY

This research has been conducted in August to October 2018, in the general aquatics of the mainland of Gorontalo province which includes rivers and lakes. In general, fishermen catch the mangalted fish with the turbular traf capture tool. So at each sampling, the fish taken are the fish caught by the turbular traf fishermen.
The method of study used is the census method by conducting monitoring or observation on all fish caught. Each fish sample is measured in length in centimeters (cm) and body weight in grams (gr). Fish length is

measured from the front end of the mouth to the base of the tail. The length measurement is not up to the tail end because the tail is very prone to loss or broken. Gender determination is performed visually or morphologically with a difference of 4 levels of the maturity gonads refers to (Suryandi and Krismono, 2011), as presented in Table 1.

Determination of the genital ratio showing the comparison of the number of females and males in a population calculated from all the fish collected. The analysis was conducted on 146 individual fish Manggabai. To test the difference of genital ratio, then used *the Chi-square* test with the following equation (Octavian *et al.* , 2016) :

$$X^2 = \left[\frac{\Sigma(f_0 - f_n)^2}{f_n}\right]$$

Where the X^2 is a *Chi-square value*, f_0 is an acquired or observed frequency and f_n is the expected frequency. Analysis of the long-lasting relationship of fish Manggabai, analysed with the Tesch equation (1968) *in the* Suryanof and Krismono (2011):

$$W = aL^b$$

Where W is the weight of fish (gram) and L is the length of fish (cm), where a is the interceps and B is slope. The coefficient value ' B ' of the regression result can provide information on the growth pattern of a fish type. When the value B = 3 is said to be a type of fish with isometric growth patterns, while B > 3 shows positive allometric and negative allometric for B < 3. It is then tested through *T-Test* in real-life 95% or á = 0.05 to ensure if the acquired value differs significantly from 3 (Octavian *et al.* , 2016).

The calculation of the fecundity is done using the Gravimetric method by weighing the gonads or eggs. The way to get eggs is to take a female fish egg by lifting all the gonadnya from the stomach of the fish and weighed. Then the gonads were taken partly to be weighed using the electric scales, then the egg grain was calculated. The fecundity of fish is determined by the equation (Harianti, 2013):

$$F = {}_x Fs\frac{Bg}{Bs}$$

Where F is the sum of all eggs and Fs is the number of eggs in some gonads (grain) while Bg is the weight of a small portion of the gonads.

The habit of eating fish is evaluated using the index*of preponderance*is a combination of two methods, namely the frequency method of incidence and volumetric method. The similarities are as follows (Suryandi and Krismono, 2014):

$$IP\ (\%) = [(Vi*Oi/U(Vi*O)]*100\%$$

Where IP is the largest index (*index of preponderance*) and Vi is the percentage of the food volume of the I-type fish while Oi is the frequency percentage of the food occurrence of the-I type. Restrictions on the main feed grouping for fish when the value of the Preponderan index (IP) is greater than 25%, feed complement 5% < IP < 25% and additional feed when IP < 5% Nikolsky (1963) *in the* Ekawati *et al*. (2010).

The first size is captured by creating a graph of the relationship between the fish length (x-axis) with the amount of fish (Y-axis) so that the curve is obtained. The *length value at first capture* is that the length at 50% is first captured can be calculated using formulas (Prihatiningsih and Hartati, 2012):

$$L_C = \frac{1}{1+\exp(aL+b)}$$

Where L_C is a fish with a length of l that is caught divided by fish with a length of l that escapes from the capture device while A & B is a parameter of curves (a < 0 and b > 0), so that the length at the time of 50% caught (L_C) is equal to-a/b.

The first-time size of gonads ripe (*Lm*) is determined by the method of a Karber Spearman. Where fish that have TKG III and IV are considered as fish that have been ripe gonads (Octavian *et al.* , 2016) . The determination of LM follows the formula as follows:

$$M = x_k + -\frac{x}{2}(x_{i=1}^{n}\sum p)$$

A long range of first-time ripe gonads is obtained from an antilogue m (M) value with a confidence interval of 95% or á = 0.05:

$$\text{antilog m} = m \pm 1{,}96 \sqrt{\text{var}(m)}$$

Where M is the long log of fish on the maturity of the first gonads, XK is the middle class long log of the last grade the fish has ripe gonads, X is a long-term log in the middle value and pi is the proportion of ripe fish gonads in the long class to-I and M is an anti-log of 95 m.

III. RESULTS AND DISCUSSION

Relationship Length Weight

The mangrove spread is found in two observation locations namely Lake Limboto and Sungai Buladu. The number of individuals found in a total of 146 tails (Table 2).

No	Location	Number of sampling dates Tail		
		Males	**Female**	**Number (tail)**
1	Limboto Lake	93	43	136
2	Buladu River	6	4	10
	Total	99	47	146

Tabel 1. Number of Sampling Fish Manggabai

The results of the analysis of the long and heavy relationship of 146 individuals with 99 males and 47 female tails show that the growth of the mangrove fish followed the equation W = 0, 1517$L^{1.7661}$ (R^2 = 0.6557). The equation of heavy length Manggabai Fish follows the equation W = 0, 0229$L^{2.5027}$ (R^2= 0.7447). The equation of the heavy length fish of the females follows the equation W = 0, 6471$l^{1.1666}$ (R^2= 0.437) (Figure 1).

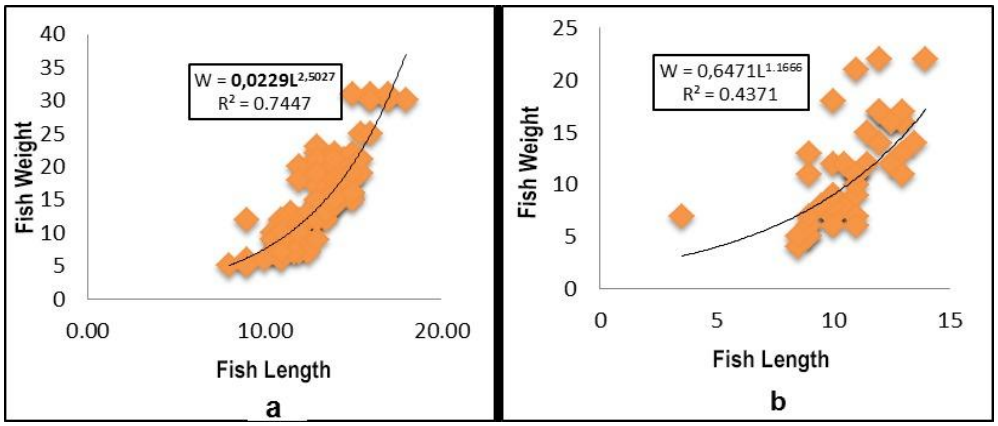

Figure 1. Long-lasting relationship of fish Manggabai (*Glossogobius giuris*)
(a) Male; (b) Females

After the T-test with a confidence level of 95% (á = 0.05), a pattern of male and female fish growth is negative allometric, which means a longer increase in length than the weight increase. The nature of this growth is different from the results of the same fish- type Research in northern Central Java (Damora and Ernawati, 2017) whose growth shows positive allometric patterns. Long relationship has a significant role in the management of fisheries resources and also useful to compare the history of life and the morphological aspects of population inhabiting various regions (Karna and Panda, 2012).

Genital Ratio and The Maturity Level of Gonad

The number of females measured during the observation is 47 and the male fish are 99 tails, so the genital ratio of the Manggabai is 1:2.1. Based on the *Chi-square* test with a free degree (db) = 1 and a 95% confidence level, the genital ratio of male and female fish is in unbalanced conditions (Table 3). For the preservation of the population to remain awake, the genital ratio is at a balanced state or more females

(Kembaren and Ernawati, 2011). Genital ratio of fish can be influenced by the social life of fish is the nature group. The group trait is relates to food availability and the presence of predators (Siby *et al*., 2009).

Sample	F_0	f_h	$f_0 - f_h$	$(f_0 - f_h)^2$	$(fo-fh)^2/fh$	$(f_0 - f_h)^2/f_h$	$\omega 2_{table}$
Female	47	73	-26	676	9.2603	18.5205	**3.84**
Males	99	73	26	676	9.2603		

Table 2. Nisbah fish Manggabai (*Glossogobius giuris*)

In general, the maturity of fish gonads is dominated by TKG III (33%), while TKG with the smallest percentage is on TKG IV (18%). This shows the fish caught mostly in the already ripe state of the gonads. The composition of the maturity of the gonads on the male Manggabai shows the percentage of TKG I by 13.6%, TKG II by 17.1%, TKG III by 32.9% and TKG IV by 36.4%. Thus most of the male manggabai was on stadia already ripe gonads. The composition of the maturity of the gonads on the female mangy fish shows the percentage of TKG I by 18%, TKG II amounted to 31.2%, TKG III amounted to 19.7% and TKG IV by 25.7%. It shows that the female manggabai that was caught in the condition had ripe gonads.

By monitoring the progress of TKG based on time, it can be known fish size time clusters (Sulistiono *et al*., 2011). The change in the TKG value has a relationship to the egg development stage. With to Paerkembangan TKG based on time, it can be known fish size time clusters (Sulistiono *et al*., 2011).

Long First Time Mature Gonad and Long First Caught

The size and age of the first time ripe gonads for each fish species may vary, this is due to differences such as temperature, food, hormone, sex , and aquatic conditions (Agustina *et al*, 2015). Usually the female fish are more rapidly reaching maturity compared to the males (Rahardjo and Simanjuntak, 2007). When the first size of the ripe gonads (L_m). A fish is smaller than the average caught size (L_C), it can indicate that the fish is safe to be arrested and is a small possibility of *recruitment overfishing*. This is because ripe fish gonads has not been caught and has a chance to spawn (Rochmatin *et al*., 2014). The size of the fish is first caught or the *Length of first captured* (L_C) is influenced by the fishing device used. The greater the value of L_C. Indicates the more selective a fishing device (Masuswo *et al*., 2016).

If the first long time ripe gonads (L_m) is connected to the first time caught (L_C) then it can be known status of its population. Based on the results of the observation, was obtained the first long caught (L_C) The male manggabai of 12.60 cm and a female fish of 10.93 cm. The first time ripe gonads (L_m) fish Manggabai Male is 12.69 cm and the fish manggabai females amounting to 7.79 cm. In other words, the length of the first caught fish manggabai less than the length of the first time ripe Gonadnya ($L_c < L_m$). Then it can be estimated that the manggabai fish caught in PUD Gorontalo province has not been spawns but has been caught, it can threaten the sustainability of the fish Manggabai.

Fecundity

Fecundities is the number of cooked eggs before being released at the time the fish will be spawns. Where the number of eggs found in fish ovaries is called individual fecundity, absolute fecundity or total fecundity. In ovaries there are usually two kinds of sizes, large and small (Apriyadi and Abidin, 2016). The results of the fecundity calculation of five individuals are obtained as follows: Fish with a range of weight gonads 3.20 gram has a fecundity of 738,871 grains, fish with a weight of 2.87 gram gonads have a fecundity of 720,611 grains, fish with a weight of gonads 3.33 Gram has a fecundity of 206,850 grains, fish with a heavy gonads 3.55 gram has a fecundity of 216,179 and fish with heavy gonads 3.95 Gram has a fecundity of 241.117 grains.

This fecundity Data is useful for understanding the biology and population dynamics of fish and Evaluating Fish Fishing (Hamid *et al*., 2015). The fekundiats are often associated with lengths as they are relatively small in comparison to heavy snores (Prihatiningsih and Hartati, 2012). The connection between the heavy fish length with the fecundity is an important alometeric function which is useful for the estimating of the fecundity of one population and estimate the production capacity of eggs as a result of the growth of eggs (Said, 2007). Fekunditas has relationships with the availability of food, fish stocks, maturity levels and environmental factors (Qambrani *et al*., 2015). In addition the factor of sampling time can also affect the fecundity (Roy, Hossain, Rahman, Salam, & Ali, 2014).

Eating Habits

The study of fish eating habits has a significant role in ecological studies related to the utilization of food resources in the environment. And the study of eating habits became more important after the inclusion of foreign fish or introduction (Sentosa and Satria, 2016). Based on the observation of eating habits, the crustaceans were found as the most common food composition of 79.41%. The types of food found are crustaceans, moss, and insects. This has something in common with the observation of the Manggabai fish at Lake Limboto in 2010. The kind of food found in the fish at Limboto Lake is shrimp, fish, insects with snails, shellfish, clams, and litter (Krismono and Kartamihardja, 2010). Meanwhile the habit of eating fish glossogobius giuris in Bangladesh also shows that the type of food found is fish, insects, crustaceans, algae and zooplankton (Hossain *et al*., 2016). So fish Manggabai is carnivorous fish.

Capture Equipment and Capture Fleet

A capture tool that is commonly used to capture a manged fish is a type of passive capture device that is using a bamboo or a piece called a Bunggo (turbular traf) by a local community with a length of ± 30-100 cm, both sides are pierced That serves as the entrance of the fish Manggabai. How to capture the mangrove by using the turbular traf by putting bamboo to the base of the lake. In addition to using bamboo as a fishing device, traditional fishermen in Lake Limboto also use an outer motor tire as a capture device. The upper part of the tyre is covered so that there are two holes that become the place of the fish then tire.

Figure 2. Fish Fishing Equipment

In the belt with rope to connect with other tires rope then tied on the stick that is plugged in as a sign of arrest location. This strap serves to facilitate the fishermen in lifting tires from the aquatic base so that fishermen do not need to dive. (Figure 2).

The whaling is done in one departure in a day or done in a few times a day. Usually fishermen give a pause of several days to carry out the arrest activities for more fish trapped in the bamboo and tires that have laid the base of the lake aquatic.

The type of fishing fleet commonly used by fishermen is a boat without motor and motor boat (ketinting machine) (Figure 3). The size of the boat is small and still relatively traditional with one to two persons. Usually fishermen only do the fishing activity itself without another member.

Figure 3. Mangabai Fishing Boat

Quality Aquatic Habitat of Fish

Based on the results of the observation of aquatic quality in the fish habitat Manggabai found that the aquatic condition of the mangrove fish habitat is still at a tolerable limit, conditions of the aquatic parameters at the observation site can be seen in Table 3.

No	Location	Parameter				
		Temperature (°c)	pH	Brightness (cm)	Water depth (m)	DO (mg/l)
1	Buladu River	29 - 30	7 - 8	65 - 75	2	3 – 4,2
2	Limboto Lake	29 - 31	6 - 7	43 - 50	1,5 - 2	2,6 – 3,8
	Quality standard standards (PP No 82 Th 2001) (class II)	28 - 32	6 - 9	200	-	3

Table 3. Aquatic quality parameters of Manggabai fish Habitat

The temperature in both locations ranges from 29-31 °c, the value is still within the limits of tolerance and is eligible for fish life. For the results of pH parameter measurements in each location does not indicate a value exceeding the standard threshold required for freshwater fish growth as it remains in the range of 6 – 8. A very low PH value will cause toxic to aquatic organisms due to the solubility of the metals in the aquatic increases, and when the ph value is too high can cause the concentration of ammonia in the aquatic to increase so that It will be toxic to aquatic organisms (Tatangindatu *et al*., 2013). Based on the results of measurements in the field obtained the highest brightness value of 43-75 cm. According TO PP No. 82 year 2001 (CLASS II) The range of brightness values obtained from all locations does not meet the criteria for cultivation activities. The low in location 1 is caused by sampling location on the upstream of the river which is also the estuary of Lake Limboto so it is still influenced by suspended solids. While the low brightness in location 2 is caused by the lake's suspension due to the high suspended solids and aquatic hyacinth. For DO values in both locations ranging between 2.6-4.2 mg/L, these results are still within the limits of the quality standard of fresh fish DO.

Fish Management Manggabai

Fish Manggabai is a type of main catch and high economical value. The utilization of these fishes is increasingly reduced because of its increasingly scarce availability. Nowadays, the condition of the mangrove fish habitat is the lake Limboto has undergone. Lake Limboto is caused by mud sedimentation derived from the river Limboto flow, the use of fish traps that are not environmentally friendly as well as the existence of aquaculture activities (Krismono *et al.,* 2017). The condition of Lake Limboto aquatics is thought to have an impact on the growth and survival of fish. Therefore, there is a need for the management of mangrove fish to remain sustainable and can be utilized sustainably. It should be noted that in the management of fish resources in a aquatic must be done in an integrated and not overlapping (Syandri *et al.* , 2011).

Based on the authors observation results during the practice, there has been no effort made by the Government in preserving the native fish of Lake Limboto. However, for the management of Lake Limboto, Gorontalo District government has set it into regional Regulation No. 1 year 2008. This regulation is defined in order to preserve the sustainability and function of Lake Limboto in order to be used by the community sustainably. Regional Regulation No. 1-year 2008 management of Lake Limboto was established by the Government of Gorontalo district with the aim of preventing the destruction and rehabilitating the lake, realizing

the development of Lake management cooperation, increase community participation in the management of the lake and maintain the function of Lake Limboto (Dungga *et al.,* 2018).

IV. CONCLUSION

A manggabai fish spread in PUD Gorontalo province is found in Lake Limboto and Sungai Buladu. The growth of mangrove fish is a negative allometric where the increase in length is faster than the increase in weight. The genital ratio of males and females is 1:2.1, and is in unbalanced conditions. The maturity of the male and female fish gonads is dominated by TKG III. The first length caught (L_C) with the Bunggo (turbular traf) capture is smaller than the first long-time ripe Gonad (L_m). The fecundity ranges from 206.850-738.871 grains. The fish is carnivorous, where the main food is crustaceans.

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