Length-Weight Relationship and Food Habits of Pangasius polyuranodon in Bengawan Solo River, Bojonegoro, East Java

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Abstract. The study of the length-weight relationship and food habits of Pangasius polyuranodon is expected to be an input for the development of science and management of fish resources. The purpose of this study was to analyze the length-weight relationship, condition factors and food habits of juaro fish (P. polyuranodon) in Bengawan Solo River in Bojonegoro Regency, East Java. The sample of juaro fish was collected as many as 63 fish, measured in length and weight, the stomach and gut were taken, put in a small plastic bag and given a solution of formaline as a preservative. Then the gut contents analyzed in the laboratory using the index of preponderance method. The results showed that the total length of P. polyuranodon ranged from 15-51 cm; sex ratio 0.7-0.9; condition factors ranged from 1.09 to 1.23; the length-weight relationships are negative allometric with the following equation Y= 0.2x2.1048 R2 = 0.9737 (April) and Y= 0.2012 x2.1048 R2 = 0.9846 (August). Based on the preponderance index methods, P. polyuranodon is omnivorous. The main food is fish fragments (42.61%); plant fragments (26.15%), detritus (25.66%), fragment crustaceans (3.42%) and crab fragments (2.1%).

Keywords: food, pangasius, management

1. Introduction

Bengawan Solo River is the longest river on the island of Java, with a river length of 600 km. One of the regencies it passes is Bojonegoro Regency, which is astronomically located at positions 1120 25' to 1120 09' East Longitude and 60 59' to 70 37' South Latitude [1]. The high level of community activity along the river has resulted in many modifications and pollution of this river. This is characterized by a decrease in the quality of river water, both in terms of physical, chemical, and biological properties [2]. Pollutants that enter the water will affect the state of the growth pattern of organisms and have an impact on population decline [3].

To maintain the survival of a population, the frequency of males and females is expected to be in balance, at least there are more female fish than male fish. The sex ratio can change before and during spawning. A sex ratio of more than 1 means that the frequency of male fish is greater than that of female fish; a sex ratio equal to 1 means that the frequency of male and

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female fish is balanced. While the sex ratio is less than 1, the frequency of females is greater [4].

The length-weight relationship is used in fisheries biology and management, such as stock models, assessments, and estimates of biomass from long observations [5].

The food eaten by fish is used directly in its metabolic life cycle, which will affect the growth, reproduction, and success rate of fish life in the waters, so that the availability of food in a water is a factor that affects the size of the fish population in these waters. Living freely in the water causes the fish to eat whatever it finds.

Fish resources are not only limited to their economic value, but what is more important is their ecological role. Given the ecological role of fish, it can be used as a bioindicator, namely to monitor environmental damage and pollution in aquatic ecosystems [6].

According to Couprof and Benson [7], condition factors describe the suitability of fish to their environment. Juaro fish (Pangasius polyuranodon) is a type of catfish that has an opportunistic tendency and has the ability to prey on various types of food other than natural fish food. The maximum size can reach 80.0 cm [8]. Research on juaro fish is still limited, including research conducted in the Musi river [9] in the Kampar and Siak rivers [10].

Juaro fish (P. Polyuranodon) is one of the native fish species of Bengawan Solo River which is categorized as Least Concern (LC). The thing that must be considered is that fish that do not have the IUCN redlist or Not Evaluated categories because it is not known at this time whether the population of these fish is threatened, normal, or abundant, then fish species that are not evaluated must continue to be evaluated for their existence in nature.

Based on this background, it is feared that the growth pattern of juaro fish in Bengawan Solo River could be hampered. Therefore, research on the relationship between length and weight and food habits of juaro fish (P. polyuranodon) needs to be done as an input for managing fisheries in Bengawan Solo River.

2. Material and Methods

2.1 Research Time and Location

This research was conducted in April and August 2020 in Bengawan Solo River. Fish sampling was carried out at 3 stations in Bojonegoro Regency, East Java (Figure 1). Samples of fish gut contents were analyzed in the laboratory of Research Institute for Inland Fishries and Fisheries Extension, Palembang, South Sumatera.

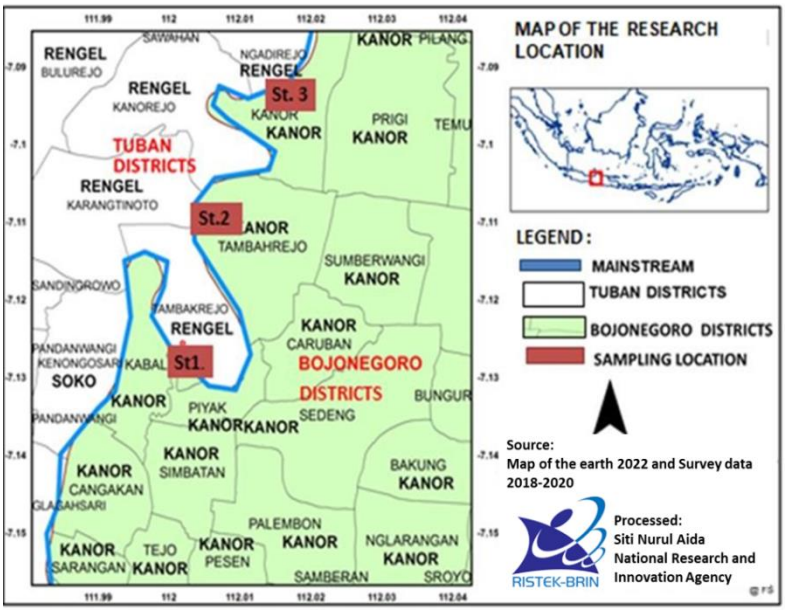

Figure 1. Research Locations

2.2 Research Procedure

Fish samples were collected by fishermen as enumerators, fish were caught using nets and gill nets measuring (1.0; 1.5; and 2 inches) with a net length of 60 meters each. Some of the equipment materials used in this study were coolboxes, digital scales, cameras, microscopes, setting sets, label paper, juaro fish samples. Fish samples were selected by random sampling, then the total length (cm) was measured and weighed (g). The the fish gut are taken, put in a plastic bag, labeled, given a preservative (alcohol), put in a coolbox. Then brought to the laboratory for analysis of the contents of the fish gut.

2.3 Data Analysis

2.3.1 Length – Weigth Relationship

The relationship between length (L) and weight (W) of fish was analyzed based on the formula according to Effendie [11], namely:

$$W = aLb \quad (1)$$

"W" is the weight (g), "L" is the total length (cm), "a" is the regression intercept, and "b" is the regression slope. Isometric growth when b = 3, it means that the growth in length is equal to the growth in weight. Allometric growth if $b \neq 3$, it means that the growth in length is not equal to the growth in weight [12]. The condition factor (K), is calculated by the following formula:

$$K = W/aLb \quad (2)$$

Note:

W = Weigth (g), L = Length (cm), a and b are constants of the relationship between length and weight

2.3.2 Food Habits

The food habits analysis method with the index of preponderance is a combination of the frequency of occurrence method with the volumetric method. This method is used to analyze the food habits of fish whose diet consists of a variety of foods, like juaro fish (P. Polyuranodon) [13]. Analysis of the index of preponderance is calculated using the calculation formula according to Natarajan and Jhingran [14]:

$$IP(\%) = \frac{V_i O_i}{\sum_{i=1}^{n} (V_i O_i)} \times 100 \quad (3)$$

Note:
IP = Index of Preponderance,Vi = Percentage of the volume of food type in the gut, Oi = percentage of the frequency of food type in the gut, n = number of fish food type in the gut.

3. Results and Discussion

3.1 Distribution of the Frequency Size of Juaro Fish (P. polyuranodon)

The number of samples of juaro fish (P. polyuranodon) obtained during the study was 63, with 28 male fish and 35 female fish divided. After the fish were analyzed, 7 classes of total length (PJ) were obtained, where the frequency of the total length of male and female fish was spread between 14-51 cm in size class. The results of this study are not much different from the longest size found in the Musi river, which is 51.1 cm [15], but is much longer than in the Kampar river, which is 31.5 cm [16]. The frequency of the total length of the most male fish is in the size class range of 19.3-24.5 cm, which is as many as 8 fish. Meanwhile, the frequency of total length of female fish was mostly in the size classes of 14-19.2 cm and 35.2-40.2 cm, each with 8 fish (Figure 2.a). This shows that the female and male juaro fish are almost in every size interval, which indicates that the juaro fish spawn without season based on the presence of males and females in each size interval.

In Figure 2(a), it can be seen that the juaro fish caught have various sizes from small to large, which are divided into three groups, namely small (14-24.5 cm), medium (24.6-35.1 cm), and large (35.2-51 cm). The juaro fish caught were dominated by small and medium-sized fish. It was suspected that these fish were in their infancy. Based on the results of the analysis of the total weight size of juaro fish obtained in this study, it was divided into 8 classes where the frequency of the total weight of male and female fish was spread between 50-968.3 cm in each size class (Figure 2.b). The highest frequency of total weight of male and female fish was in the 50–164.7 g size class, with 10 male and 14 female fish. The fish with the heaviest weight is one male fish. The frequency of the size of the total weight of fish; the heavier the fish, the fewer the number of fish.

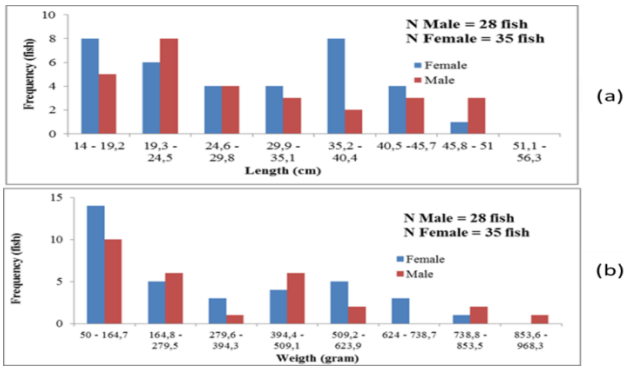

Figure 2. a). Frequency distribution of length (cm) and b). the weight (g) of juaro fish (P.polyuranodon) during the study

The number of male and female fish in the length size interval is almost the same in each size interval, while for the fish weight measurement interval, the number of fish the heavier the fish the smaller the number. Female fish only reach a weight of 738.8-853.5 g and male fish reach a weight of 853.6-968.3 g.

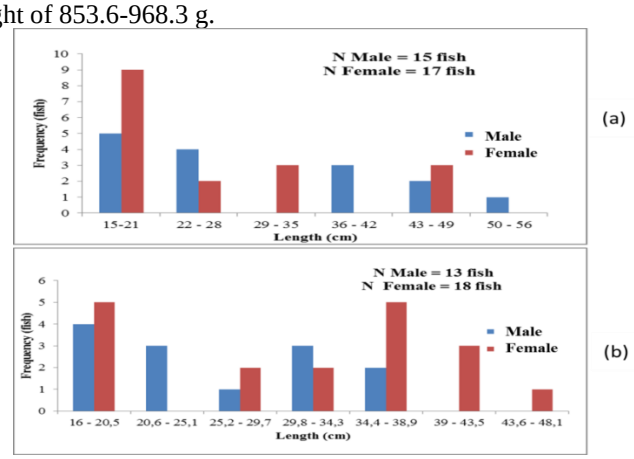

Figure 3. Frequency distribution of juaro fish (P. polyuranodon) at interval length class (cm) april (a) and august (b) 2020

Based on Figure 3 (a), it is known that the frequency distribution of juaro fish length in April 2020 obtained in this study was divided into 6 classes. The frequency of the length of male and female fish is spread between 15-56 cm in size with the highest frequency of fish being in the 15-21 cm size class, with 5 male fish and 9 female fish. The longest fish in April is 1 male fish. While the frequency distribution of juaro fish length in August 2020 is divided into 7 classes which can be seen in Figure 3 (b).

The frequency of the length of male and female fish is spread between 16-48.1 cm in size, with the highest frequency of male fish being in the size class 16-20.5 cm, with a total of 4 male fish, while the highest frequency of female fish is in the size class. 16-20.5 cm and 34.4-38.9 cm with 5 female fish each. The longest fish in August is one female fish.

Fish length and weight play a role as a reference in estimating fish conditions such as health, productivity, physiology, and reproduction [11]. Each individual fish consumes a

variety of different types of food, especially for growth [17]. Size variations are influenced by environmental factors such as nutrition and food, which affect the growth of the fish; differences in growth as a result of environmental influences such as temperature; amount and quality of ingested food; and age [18], [19].

3.2 Sex Ratio of Juaro Fish (P. polyuranodon)

The results of data analysis showed that the sex ratio of juaro fish in Bengawan Solo River was 0.9 in April and 0.7 in August (Figure 4). This condition shows that it is almost close to balance (1), meaning that the distribution of male and female fish is fairly even. At least the frequency of males and females is expected to be in balance to maintain the survival of a population [20]. In contrast to the Musi River, the sex ratio of juaro fish in August was 1.82 to 1 for June [11].

Purdom [21], explains that determining the sex ratio of a fish species is very important as a tool in calculating fish production. In its natural habitat, a species of freshwater fish has a sex ratio of 1:1. If the sex ratio of fish in nature is not balanced, it indicates that the environmental conditions of the waters have been disturbed.

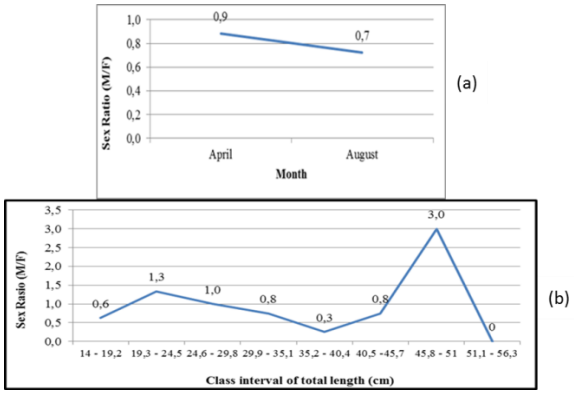

Figure 4. Sex Ratio of juaro fish (P. polyuranodon) based on a) seasons (month) and b) class interval of total length class

According to Nikolsky [4], the optimum sex ratio can change drastically because it is influenced by many factors. Changes in the sex ratio of 1:1 can be caused because female fish are easily preyed on by predators. The natural risk and migration phase of the female parent fish population is different from that of the male parent fish. In nature, the sex ratio ratio is not absolute because it is influenced by distribution patterns caused by food availability, population density, and the balance of the food chain [11].

Based on the total length class interval, the sex ratio (1:1) was obtained, namely the total length class interval was 24.6-29.8 cm. The sex ratio in the total length class interval is 1, with a frequency of 4 male and female fish each. The average total length in each class is dominated by female juaro fish. This can be seen from the sex ratio of less than 1, but between 19.3-24.5 cm, the total length class is dominated by male fish with a sex ratio of 1.3 (Picture 5).

3.3 Length-Weight Relationship of Juaro Fish (P. polyuranodon)

The total number of juaro fish caught in Bengawan Solo River during the study in April 2020 was 32 fish, with a total fish length range of 15-51 cm and a weight range of 55-855 g. Meanwhile, the total number of juaro fish caught in Bengawan Solo River during the study in August 2020 was 31, with a total length range of fish that was 16-45 cm and a weight range of 83–785 g. The relationship between total length and weight of fish can be seen in Figure 5 below. The equation obtained is Y= 0.2x2.1048 R2 = 0.9737 in April and Y= 0.2012 x2.1048 R2 = 0.9846 in August.

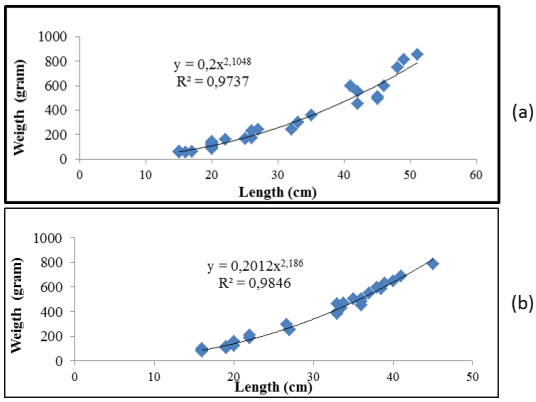

Figure 5. The length-weight relationship of juaro fish (P. polyuranodon) in April (a) and August (b) 2020

The growth pattern of juaro fish in Bengawan Solo in April and August is negative allometric because the value of parameter "b" is smaller than 3 (between 2.1048 - 2.186). This means that the fish is thin, the weight gain of the fish is smaller than the increase in length, and the influencing factor is unfavorable environmental conditions [12]. According to Aida [22], Bengawan Solo River has been heavily polluted due to organic waste. Aida et al. [23], reported that the Solo River was dominated by sapu-sapu fish (Pterygoplichthys pardalis) because the river was heavily polluted by organic matter. The fish that was resistant to organic matter contamination was sapu-sapu fish (P. pardalis).

3.4 Condition Factor of Juaro fish (P. polyuranodon)

The condition factor describes the bulkiness of the fish, which indicates the suitability of the fish to its environment. If the value of the condition factor is large, it indicates the fish is fat or plump, which describes the aquatic environment suitable for the growth of the fish [24].

The condition factor of the male juaro fish in April 2020 was K = 1.23 and that of the female fish was K = 1.15. The condition factor of the male juaro fish in August 2020 was K = 1.09 and the female was K = 1.13. The highest condition factor for juaro fish occurred in April 2020.

According to Anene [25], condition factors are strongly influenced by environmental conditions, both biotic and abiotic, and can be used to determine the status of the aquatic ecosystem where fish live. Conditional factors are influenced by internal factors such as genetics, gender, and age. While external factors such as water quality and the availability of food in nature. The value of the condition factor in fish generally ranges from 2 to 4. The

condition factor value of juaro fish in April and August in Bengawan Solo river was small (between 1.09-1.23), indicating that the fish were thin [11], [26]. This is because Bengawan Solo river has been polluted with organic matter [27]. Based on the plankton diversity index value, Bengawan Solo river is already polluted [28]. Likewise, according to Aida et al. [29], Bengawan Solo river has been polluted with indications that there are many blue-green algae. This type of algae is poisonous and cannot be eaten by fish [30].

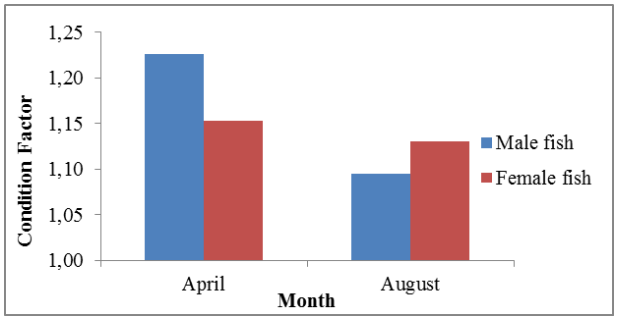

Figure 6. Condition factor of juaro fish (P. polyuranodon)

3.5 Natural Food Habits of Juaro Fish (P. Polyuranodon)

The composition of the food contained in the gut contents of the fish is used to determine its food habits. If the composition of the feed is known, the level of diversity of fish feed is also known, which is influenced by the type of feed consumed by the fish [31]. Based on the gastric content analysis of juaro fish samples in Bengawan Solo River, it is known that there are several types of food that juaro fish consume, including fish pieces (38%) and plants (34%) as the main food, detritus (13%) and unidentified (10%) as complementary food, and crustaceans (3%) and crabs (2%) as additional food. The data obtained shows that juaro fish are categorized as omnivorous fish tend to be carnivores.

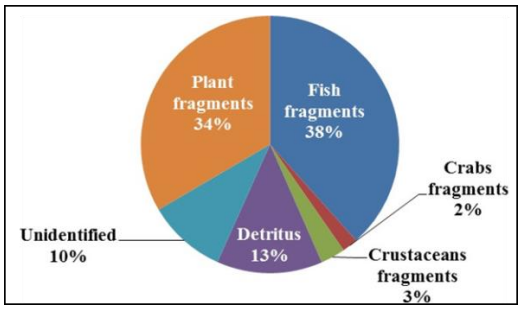

Figure 7. IP chart of juaro fish (P. polyuranodon) in Bengawan Solo River

These results are not much different from the results of previous studies on the food habits of juaro fish (P. polyuranodon), although the location of the research is different. Juaro fish in the Musi River are euryphagic omnivorous fish, with their main diet being benthic animals such as crustaceans, bivalves (mollusca), and aquatic plants [15], [32]. The juaro fish in the Siak River are included in the omnivorous fish group that tends to be carnivorous, with the

main food being gastropods and bivalves (benthic animals) [33]. Based on the results of this study, it is known that juaro fish are able to utilize various types of food, from plants to garbage around the waters. This condition helps juaro fish to survive even though the river where they live is in a polluted condition [16], [33]. The pattern of food habits of these fish can change with increasing age and size of fish, time factors, environmental factors, and the availability of natural food in the waters [34].

4. Conclusion

The growth pattern of juaro fish (P. polyuranodon) in Bengawan Solo is allometric negative, and thin. Environmental conditions are not suitable, because there has been a lot of pollution of organic matter. Juaro fish (P. polyuranodon) is omnivorous. The gut contents in the form of fragments of fish, plants, crustaceans. The main food is fish fragments (38%); plant fragments (34%), detritus (13%), crustaceans fragments (3%), crabs fragments (2%), and unidentified (10%).

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