

Composition of Plankton in Water and Stomach Milkfish at Brackish Water Ponds

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Abstract- Milkfish which cultivated in brackish water ponds utilize plankton as their natural feed. This study aimed to compare the abundance and type of phytoplankton, zooplankton in water and stomach milkfish also the water quality of brackish water ponds. This research uses survey method, samples were taken in 3 brackish water ponds. The composition of phytoplankton was found in three brackish water ponds with 4 divisions, in the fish stomach 6 divisions, zooplankton composition was founded 2 divisions and fish stomach 2 divisions. Milkfish consumed all composition of plankton in water. Based similarity index of plankton composition in water and stomach milkfish about 73%-80%. The water quality of the three brackish water ponds is classified as oligotrophic, abundance of phytoplankton in the range of 630 - 1122 cell/ ml and zooplankton 0-30 ind/ml. Water qualities are classified as good for milkfish cultivation. Therefore, it is recommended to keep the good condition of brackish water ponds.

Keywords— brackish water ponds; milkfish; plankton;

I. INTRODUCTION

Milkfish can grow well in traditional brackish water pond, resistant to disease, adaptable and can take advantage of natural food available in the waters as the main food source [1]. Milkfish cultivation is still mostly managed with traditional technology. Brackish water ponds with traditional technology are favored by milkfish farmers because the business capital is relatively small and the feed provided is only from natural feed [2]. The natural food favored by milkfish is plankton, which consists of phytoplankton and zooplankton [3].

In the food chain, phytoplankton act as producers which become zooplankton food [4]. A type of plankton can be used as natural food, among others, because of the suitability of shape, nutrient content, composition and abundance in the waters. The composition and the abundance of plankton can change according to environmental conditions [5]. The presence of plankton, especially phytoplankton in waters can react to water quality and become a biological indicator to determine water fertility [6]. Water fertility can be seen based on changes in species diversity, composition and presence of phytoplankton species that dominate in these waters [7].

A brackish water pond called to be stable if the abundance and quality of plankton in it can meet the natural feed needs of milkfish in the optimal range [8]. Adequacy of natural feed will increase fish growth so that it can support the survival of cultured fish [9]. One of the factors for the low productivity of milkfish aquaculture is an error in the estimation of the optimal

abundance of plankton in the pond which will have a negative impact on organisms and water quality [10].

The purpose of this study was to determine the ratio of abundance, type of composition of phytoplankton and zooplankton in pond water with milkfish stomach contents and to determine the condition of pond water quality.

II. METHODS

A. Time and Location

The research was conducted in March-April 2021, located in the Traditional Brackish Water Pond for Milkfish Cultivation, Kepel and Tapaan Villages, Bugulkidul District, Pasuruan City, East Java. Water samples were taken from 3 plots of brackish water pond. Brackish water pond 1 and 2 are located at Kepel Village, while the brackish water pond 3 is located in the Tapaan Village. Brackish water pond 1 is located at (7°38'41.609" N 112°55'54.132" E) with the Kepel River flowing. Brackish water pond 2 is located at (7°38'41.940" N 112°55'58.218" E) with the Kampung Baru River flowing. Brackish water pond 3 is located at (7°38'30.468" N 112°55'35.532" E) with the Tapaan River flowing (Figure 1).



Figure 1. Location of Traditional Brackish Water Pond

B. Research Methods

The study was conducted using a survey method, sampling in 3 brackish water ponds was carried out 3 times every 10 days. Sampling of plankton from each brackish water pond was carried out in a composite manner, taken from 5 points each of

5 liters, then filtered with plankton net no. 25 (mesh size 64 µm) until the filtered volume is only 25 ml. The filtered plankton samples (in bottles) were added with 1% lugol preservative and 4% formalin. Milkfish was obtained from the catch of brackish water pond farmers in each plot, that was observed and dissected to take the stomach. Fish stomach samples were put into plastic bags and soaked in 4% formalin. Water samples were taken from each plot of brackish water pond for analysis of nitrate and phosphate values. Water samples and fish stomach were put into a coolbox filled with ice for analysis at the Fish and Health and Environment Laboratory of the Marine and Fisheries Service of East Java Province with a travel distance of ± 1 hour.

C. Plankton Analysis

Plankton samples obtained from the water of the three brackish water ponds were analyzed for abundance index, diversity index and dominance index. The fish's stomach was dissected, the stomach content and its formalin were accommodated in a glass beaker plus 10 ml of distilled water to be observed and analyzed by calculating the percentage of plankton species composition in the stomach.

The similarity of plankton in the water and the stomach of milkfish is calculated using the Index - Bray Curtis [11], with the following formula:

$$IBC = 1 - \frac{\sum |xi - yi|}{\sum (xi + yi)}$$

Keterangan :

IBC = Bray – Curtis similarity index

xi = Number of individuals i in the example x

yi = Number of individuals i in the example y

D. Water Quality Analysis

In situ water quality measurements were carried out for temperature and dissolved oxygen (using a DO meter), brightness (secchi disk), pH (pH meter) and salinity (refractometer). Meanwhile, ex-situ measurements were carried out for nitrate (NO₃⁻¹) and phosphate (PO₄⁻³). Ex-situ measurement of water quality by filling sample water in 1 liter bottles from each sampling location and then carrying out laboratory measurements.

III. RESULTS AND DISCUSSION

A. Identification of Plankton in Brackish Water Ponds

1. Composition of Phytoplankton and Zooplankton

The composition of phytoplankton found in water samples from the three brackish water ponds were the divisions Chlorophyta, Cyanophyta, Bacillariophyta and Charophyta. Meanwhile, the zooplankton groups found were Rotifers and Arthropods. In brackish water pond 1 the average abundance of phytoplankton is 837 cells/ml and the abundance of zooplankton is 30 ind/ml. Phytoplankton abundance in brackish water pond 2 the average was 630 cells/ml and zooplankton

abundance was only 3 ind/ml. Phytoplankton in brackish water pond 3 was relatively more abundant, with an average abundance of 1122 cells/ml and no zooplankton were found. Based on the amount of phytoplankton, the three brackish water ponds observed were classified as oligotrophic (low productivity). The trophic level or productivity of water based on the phytoplankton can be classified into oligotrophic or low productivity if the number of phytoplankton ranges from 0-2.000 cells/ml, mesotrophic level (moderate productivity) the number of phytoplankton is 2.000-15.000 cells/ml and eutrophic level (high productivity) if the phytoplankton is >15.000 cells/ml [12].

2. Diversity Index

The plankton diversity index in brackish water pond 1 showed a yield of 1,300, at brackish water pond 2 it was 1,229 and brackish water pond 3 was 1,324. The index of plankton diversity in the three brackish water ponds was moderate. If the value of H' < 1, then the diversity of the biota community is low. If H' is between 1 < H' < 3, then the stability of the biota community is moderate and if H' > 3 means that the biota community is high. The greater the value of H' indicates the more diverse the biota community in the waters [13].

3. Dominance Index

The dominance index in brackish water pond 1 shows a result of 0.365, in brackish water pond 2 it shows a result of 0.334 and brackish water pond 3 shows a result of 0.340. The value of plankton dominance in the three brackish water ponds is close to 0 (zero) which means that no plankton species dominates. The range of dominance index 0 < D < 0.5 indicates that there is no dominant species and the range of dominance index of 0.5 < D < 1 indicates that there is a dominant species [14]. Utilization of resources and imbalances in the aquatic environment, so that if there is no dominance, it means that there is no competition for the use of resources and a balanced aquatic environment.

B. Identification and Percentage of Plankton in Milkfish Stomach Contents

Plankton found in the stomach of milkfish consists of phytoplankton and zooplankton. Phytoplankton species groups in milkfish stomachs include Chlorophyta, Cyanophyta, Bacillariophyta, Dinophyta, Cryptophyta and Charophyta. The composition of the stomach of milkfish shows the type of phytoplankton that is most commonly found and favored by milkfish in brackish water pond 1, namely the Chlorophyta division, in brackish water pond 2 the Bacillariophyta division and in brackish water pond 3 the Dinophyta and Cyanophyta divisions. The composition of phytoplankton found in the waters and stomach of milkfish can be seen in Figure 2.

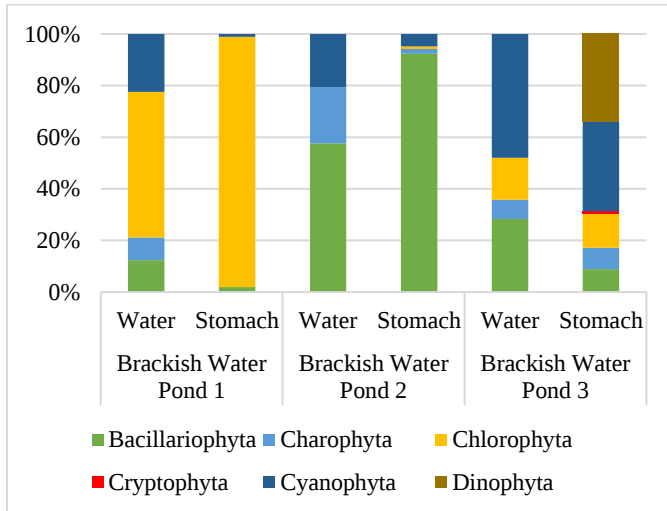


Figure 2. Percentage of phytoplankton composition in water and milkfish stomach

Based on Figure 2, it is suspected that the divisions Chlorophyta, Bacillariophyta and Cyanophyta are the main food of milkfish because they are found in the three brackish water ponds in large numbers, and the Dinophyta division is thought to be the food of choice for milkfish because of its presence in the stomach a lot but not found in brackish water pond 3.

The zooplankton groups found in the stomach of milkfish in the three brackish water ponds were Rotifera and Arthropoda. The composition of the milkfish stomach shows the zooplankton species most commonly found and favored by milkfish in brackish water pond 1, namely the Arthropoda division, while brackish water pond 2 and brackish water pond 3 are the Rotifera division. The composition of zooplankton found in the waters and stomach of milkfish can be seen in Figure 3.

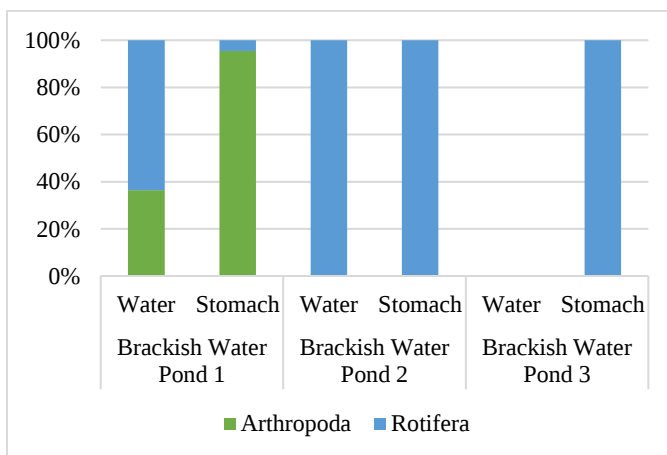


Figure 3. Percentage of phytoplankton composition in waters and milkfish stomach

Milkfish is thought to use zooplankton as additional food that eats from the Arthropoda and Rotifera divisions. The division of plankton found in the stomach, but not found in the water is thought to be due to the wide movement of fish. In addition, it is also suspected that because the fish chose the food so that its presence in the water was reduced, while the food did not come from the point where the water sample was taken. The percentage of phytoplankton and zooplankton found in the water and the stomach of milkfish can be seen in Figure 4.

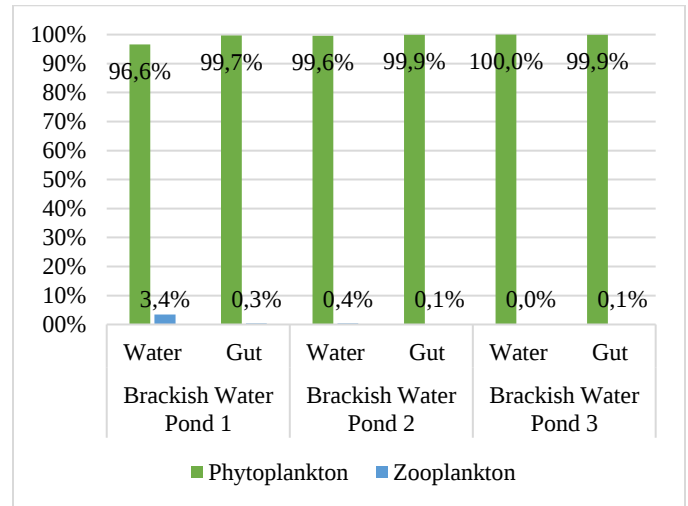


Figure 4. Percentage of phytoplankton and zooplankton found in the water and the milkfish stomach

Based on Figure 4, it shows that the presence of phytoplankton in the water and in the stomach of milkfish is much more than zooplankton. Based on the composition of the type of plankton in the fish's stomach, it shows that milkfish tend to like phytoplankton. This is also supported by the availability of more phytoplankton in the waters than zooplankton because the optimal brightness value is in the range of 26.5 - 35 cm so that phytoplankton can photosynthesize well. Milkfish are classified as herbivorous fish because they eat phytoplankton as their main food [3]. The higher the composition of a type of food in the stomach of the fish, then the type of food becomes the main food or food favored by fish. Meanwhile, the lower the type of food, it can be said as a complement or food that is accidentally eaten [15].

C. Comparison of Plankton Composition in Brackish Water Pond and Stomach Content of Milkfish

Similarity Index

By using the Similarity Index formula, it can be seen the similarity of plankton in the water and in the fish's stomach. At brackish water pond 1 and brackish water pond 3, the similarity index value is 73%, brackish water pond 2 is 80%. The similarity index in the three ponds showed results that were almost close to 1, so it can be concluded that almost all the compositions of plankton species in the water were eaten by milkfish. The similarity index value which is close to 1 indicates the high similarity of the two

locations and the similarity index value is almost close to 0 (zero) locations [16]. Cryptophyta, Dinophyta and Rotifera are plankton that are found in the stomach contents of milkfish but are not found at all in the waters of brackish water pond 3. Waters that have low dominance of plankton types and all types are found in the stomach contents of the fish, indicating that the fish consumes all types of plankton in the waters [17].

D. Water Quality Parameters

The water quality analyzed in the three ponds included physical parameters (temperature and brightness) and chemical parameters (pH, salinity, dissolved oxygen, nitrate and phosphate). The average physical and chemical water quality in 3 brackish water ponds was obtained at a temperature (30 – 32,3 °C). The water temperature in the range of 31,9 – 32,85 °C is considered good for milkfish cultivation. The brightness in the three brackish water ponds is classified as optimal, which is 26,5 - 35 cm [18]. A good brightness value for milkfish cultivation is 20-40 cm [19]. The pH range in the three brackish water ponds is quite good, namely 8.05-8.25. A good pH value for milkfish cultivation is 7 – 8,5 [20]. Salinity in the three ponds is low at 10 ppt. Good salinity for milkfish cultivation is in the range of 15 – 25 ppt [21]. Dissolved oxygen in the three brackish water ponds was obtained in the range of 3.88 – 5.2 mg/l. The optimal dissolved oxygen for milkfish cultivation is in the range of 3 – 8 mg/l [19]. The nitrate value of the three brackish water ponds was not optimal, namely 2.9 – 32.9 mg/l. A good nitrate range for milkfish cultivation is 0.9-3.5 mg/l [22]. Phosphate value in the three ponds were obtained in the range of 0.09 – 1.48 mg/l. The optimal range of phosphate for milkfish cultivation is 0.5-2.0 mg/l [23].

IV. CONCLUSION

The presence of phytoplankton in the water and in the stomach is much more than zooplankton. The composition of the type of phytoplankton found in the three brackish water ponds was 4 divisions, while in the milkfish stomach there were 6 divisions. The composition of zooplankton species found in water samples from the three brackish water ponds and the stomach of milkfish were 2 divisions. The similarity index of the abundance of plankton species in the water and the stomach of milkfish in the three brackish water ponds is around 73%-80%, indicating that milkfish can utilize natural food sources in the waters well. The water quality of the three brackish water ponds is classified as low fertility, the abundance of phytoplankton is 630–1122 cells/ml and the abundance of zooplankton is 0–30 ind/ml. Brackish water pond water quality is still suitable for milkfish cultivation activities.

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