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Analysis of Plankton as Food for Lempuk Fish (*Gobiopterus* spp.) from Ranu Grati, Pasuruan, East Java, Indonesia, as Information for Domestication Efforts

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ABSTRACT

The Lempuk fish (*Gobiopterus* spp.) is a kind of fish that is exclusively found and inhabits the Ranu Grati area in Pasuruan Regency. The Lempuk fish is a prominent tourist attraction and is frequently targeted for fishing due to its significant economic significance. This leads to excessive exploitation, resulting in population decline and posing a threat to its sustainability. Therefore, it is necessary to identify the abundance and type of plankton, as well as its relationship with the study of stomach contents, to gather supporting data for future domestication efforts. The sampling was conducted three times, with a two-week gap, at five distinct sites. The research employed a quantitative-descriptive approach and the sampling a purposive sample technique. The research findings revealed the presence of four distinct classes with 20 different species in the phytoplankton community, as well as four distinct classes with 12 genera in the zooplankton community. The study of stomach conten this fish shows, primary diet of this fish, as shown by their propendergence index, consists of phytoplankton from the Asterionella species and zooplankton from the Daphnia genus.

Keywords: lempuk fish; domestication; plankton; food habits; index preponderance.

INTRODUCTION

Indonesia occupies an important position on the world's biodiversity map because it is included in ten countries with high biodiversity [Baderan and Utina, 2021]. The diversity of freshwater fish is the second highest in the world after Brazil, with around 1,300 species of fish living in Indonesian waters with a population density of 0.72 species/100 km^2. Now this diversity is facing threats from various human activities which can cause the extinction of endemic fish, and it is estimated that there are around 87 types of Indonesian fish that are threatened with extinction [Umar *et al.*, 2015]. Of this number, 66 species (75.9%) of them are freshwater fish. The majority (68.2%) of endangered freshwater fish are endemic fish. Endemic fish are fish that exist only in one particular place, and do not exist in other places. Apart from that, that kind of fish usually have a high level of sensitivity to environmental changes so that environmental changes will trigger extinction or threaten their existence [Qomaria, 2023].

The lempuk fish (*Gobiopterus* spp.) is one of the endemic fish in Indonesia which is only found in Ranu Grati, Pasuruan Regency, East Java [Anitasari *et al.,* 2021]. Ranu Grati is a lake that formed as a result of a volcanic eruption located in Ranuklindungan Village, Grati District, Pasuruan Regency. The funnel-like shape with a deep lake bottom containing mineral sediment is proof of the creation status of Ranu Grati. This lake has an area of around 1.085 hectares, the average depth is 74.07 meters. At some points, the maximum depth is 121.9 meters and is located at an altitude of between 6–91 meters above sea level. Aside from being a recreational facility, this lake is also used for irrigation purposes [Pasuruan Regency Government, 2019].

Lempuk fish are similar to anchovies when viewed from their small size, around 2–3 cm and transparent so that only their eyes and internal organs are visible [Ramadhani, 2021]. Currently, lempuk fish is one of the fisheries commodities for the local community because it has high economic value and is a special attraction for tourists visiting Ranu Grati. So these fish are often exploited by local communities to catch them because of the high selling price, the female lempuk fish that are laying eggs are more expensive and are currently threatened with a population decline due to continuous fishing activities, which could have an impact on population decline and even threaten its sustainability. Several factors that can pose a threat to fish diversity and cause extinction include overfishing, species introduction, pollution, habitat changes and even disappearance [Aguirre *et al.,* 2021]. The first step that can prevent this from happening is by carrying out environmental and biological characterization efforts related to conservation and domestication efforts in the next step.

Domestication is an effort to maintain animals, including fish that usually live wild in their natural habitat (uncontrolled), so that they can live and be bred in controlled conditions [Jaya *et al.,* 2023]. Before domestication efforts were carried out, efforts were made to characterize the environment through the identification and abundance of plankton and their correlation to the study of the stomach contents and food habits of lempuk fish to maintain the preservation and sustainable use of this group of lempuk fish species, efforts are needed to identify and describe their ecological and biological characteristics as well as domestication efforts so that these fish remain sustainable and can live outside their natural habitat.

MATERIALS AND METHODS

Study area

The research was conducted for 4 months from April to August 2023 in Ranu Grati, Ranuklindungan Village, Grati District, Pasuruan Regency, East Java. The location of the research carried out was divided into 5 different stations located on each side of Ranu Grati; there were 4 station points and 1 station in the middle area. A map of research locations is presented in Figure 1. The geographical coordinates for the sampling station in Ranu Grati are presented in Table 1.

Samples collection

The research process was carried out in situ and ex situ. The sampling process was obtained using a drag net and a scoop net with a mesh size of 0.5 cm. A total of 50 lempuk were collected from Ranu Grati. Fish were collected carefully and preserved using a 10% concentration of formalin for analysis of stomach composition and feeding habits. All sampling activities were carried out with assistance from the Pasuruan Regency Fisheries and Marine Department. Furthermore, an analysis was carried out in the Laboratory of Fish Resources and Hydrobiology of the Faculty of Fisheries and Marine Sciences, Brawijaya University to determine the composition of plankton and analyze fish stomach contents.

Several tools and materials were used to support this research. The tools used include a DO meter, a pH meter, a plankton net, a water sampler, a film bottle, a plastic clip, a pen, a marker, label paper, and a coolbox. Then the materials used included lempuk fish (*Gobiopterus* spp.) as a test sample as well as formalin with a concentration of 10% to preserve the sample.

Identification and abundance of plankton (N)

Plankton identification is the process of observing water samples containing plankton using a microscope and then matching their characteristics and morphology with a plankton identification book [Nasution *et al.,* 2019]. Plankton abundance can provide information about the number of plankton cells in a body of water per unit

Table 1. Sampling station and their coordinates

Sampling locations	GPS coordinates
Station 1	113°00’40.7”E 07°43’39.5”S
Station 2	113°00’34.6”E 07°43’54.1”S
Station 3	113°00’25.2”E 07°43’45.2”S
Station 4	113°00’33.6”E 07°43’33.6”S
Station 5	113°00’48.3”E 07°43’34.9”S

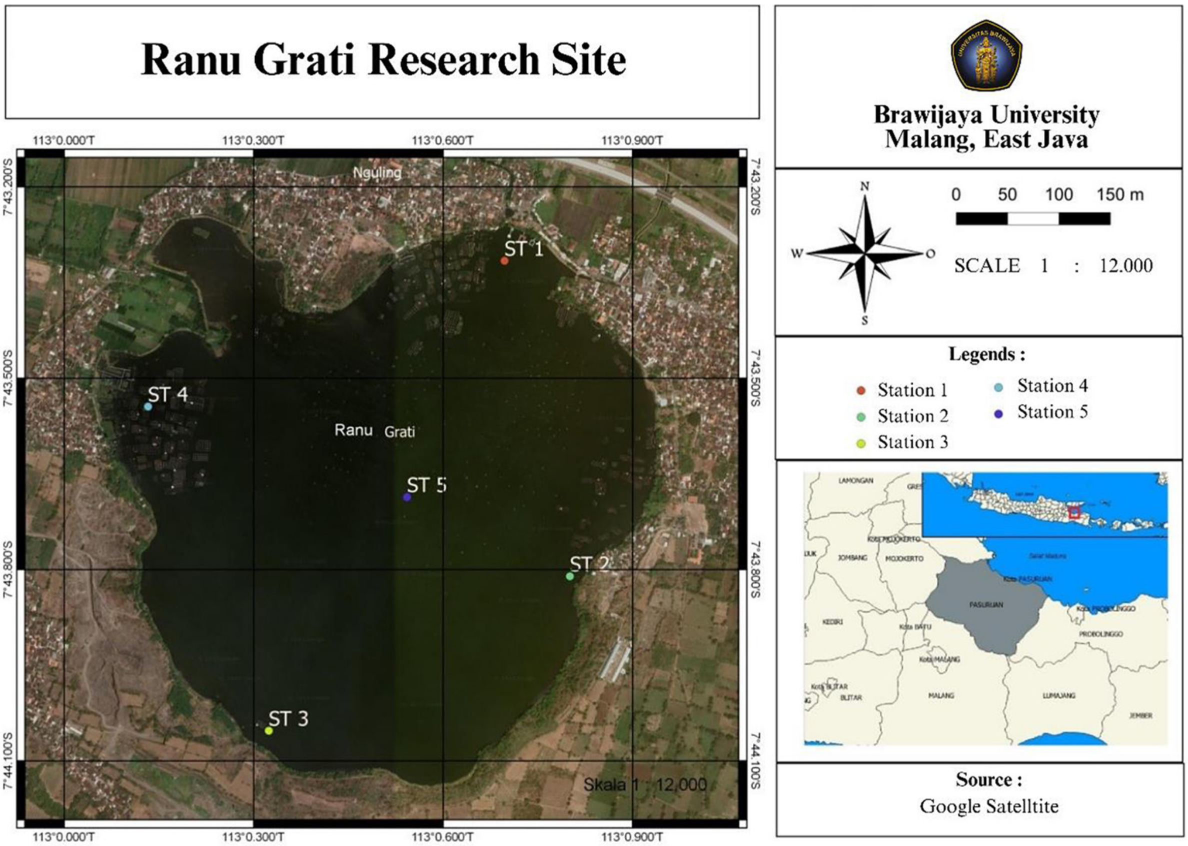

Figure 1. Location of sample sites in Ranu Grati

volume. Phytoplankton abundance can be calculated using a modification of the Lackey Drop Microtransecting Methods [Astuti *et al.,* 2022] with the following formula:

$$N = \frac{T\ x\ V}{L\ x\ p\ x\ v\ x\ w}\ x\ n \quad (1)$$

where: N – number of plankton per liter, n – number of individual plankton observed (cell), T – cover glass area (mm^2), L – wide field of view (mm^2), V – volume of sample water in the sample bottle (ml), v – volume of sample water under the cover glass (ml), w – volume of filtered water (L).

Plankton diversity index (H')

The diversity index value is used to determine the level of plankton diversity in a population. The results of the observations, in the form of the number of plankton types observed, are then applied to the plankton diversity calculation equation. The plankton diversity index uses the Shannon-Weaner formula [Omayio *et al.,* 2019] with the following formula:

$$H' = -\sum\left(\frac{ni}{N}\right) ln\ \left(\frac{ni}{N}\right) \quad (2)$$

where: H' = diversity index, ni = number of individuals/species, N = total number of individuals.

Plankton uniformity index (E)

The uniformity index value is used to indicate the amount of similarity between plankton types in a population. The uniformity index is used to indicate the distribution pattern of biota, namely evenly distributed or not. The uniformity index is calculated using the Pielou uniformity index [Ziling *et al.,* 2021] as follows:

$$E = \frac{H'}{LnS} \quad (3)$$

where: E – uniformity index, S – total number of species.

Plankton dominance index (C)

The dominance index is calculated using the formula of Simpson's day index of dominance [Herawati *et al.,* 2021], as follows:

$$C = \sum\left(\frac{ni}{N}\right)^2 \quad (4)$$

where: C – dominance index.

Preponderance index

The preponderance index is used to calculate or determine fish eating habits quantitatively with a combination of the frequency of occurrence method and the volumetric method [Lingopa *et al.,* 2022]. The types of organisms that become food for lempuk fish can be identified by the Preponderance Index [Herawati *et al.,* 2022] as follows:

$$IP = \frac{Vi \ x \ Oi}{\sum Vi \ x \ Oi} \ x \ 100 \quad (5)$$

where: IP – index of preponderance (%), Vi – volumetric one type of food, Oi – the frequency of occurrence of one type of food, $\sum Vi \times Oi$ – the amount of $Vi \times Oi$ of all types of food.

Water quality measurement

The quality of the water is an important condition that can influence the survival, development, growth, and production levels of fish. A good environment is very necessary for the survival of aquatic organisms [Fauzia and Suseno, 2020]. Several parameters are used to determine water quality include temperature, pH, dissolved oxygen (DO), nitrate and ammonia. Table 2 shows the methods and instruments used for the measurement.

Data analysis

The data is processed and presented in the form of tables or graphs using Microsoft Excel, then analyzed descriptively in tables or graphs by connecting the data with field conditions and related references.

RESULTS AND DISCUSSION

Identification and abundance of plankton in Ranu Grati waters

The results found that plankton found in Ranu Grati waters were divided into two groups phytoplankton and zooplankton . There were 4 different classes of phytoplankton found with 20 different species, namely: from the Bacilaripyceae class, there were *Achnanthes, Cymbella, Diploneis, Fragillaria, Limophora, Novicula, Nitzchia, Pinnularia, Pleurosigma, Rhizosoleia, Stauroneis, and Synendra*; from the Chlorophyceae class, there are *Cosmarium, Closterium, Oocytis, Staurastrum, and Tribonema*; from the Cyanopyceae class, there are *Aphanocapsa and Oscillatoria*; and finally from the Dinopyceae, there is *Peridinum*. Meanwhile, in Zooplankton, it was found that there were 4 different classes with 12 different species, namely from the Rotifera class there were *Aspplanchna, Habrotrocha, Keratella, Euchlanis, and Polyarthra*; from the Arthropoda class there are *Agladiaptomus, Colurella, Epischura, Streblocerus, and Daphnia*; from the Ciliophora class there is *Strombidinopsis*; and from the Metamonda class, there is *Hexamita*. The highest abundance of phytoplankton was at station 1 of the first sampling (336.3 ind/ml), and the lowest abundance of phytoplankton was at station 5 of the third sampling (112.1 ind/ml). Meanwhile, for zooplankton, the highest abundance was at station 1 of the third sampling (124.56 ind/ml), and the lowest abundance of zooplankton was at station 5 of the second sampling (37.36 ind/ml). Complete plankton identification and abundance can be seen in Figure 2.

Plankton plays an important role in aquatic ecosystems. Phytoplankton are primary producers capable of forming organic and inorganic substances. Phytoplankton can carry out photosynthesis, which produces carbohydrates and oxygen and is the beginning of the food chain [Indrayani *et al.,* 2014]. Phytoplankton, which are widely distributed and have a short life cycle, are the primary producers and fundamental biological elements of water ecosystems [Li *et al.*, 2019]. They play a vital role in the energy flow, material cycle, and information transmission in freshwater ecosystems [Aboim et al., 2019; Yuan *et al*., 2014]. The composition, population size, and variety of

Table 2. Methods and instruments for assessing water quality

Parameter	Unit	Method/Instrument
Temperature	°C	Dissolved Oxygen Analyzer type DO9100
pH	-	Water Quality Tester tipe EZ-9901
Dissolved Oxygen (DO)	mg/L	Dissolved Oxygen Analyzer type DO9100
Nitrate (NO_3-)	mg/L	Spectrophotometer
Ammonia (NH_3)	mg/L	Spectrophotometer

phytoplankton serve as crucial indicators of water quality and are considered significant markers of river health [Manzoor *et al.,* 2021]. In the past, phytoplankton has been utilised as a biological indicator to assess alterations in aquatic ecosystems, exhibiting rapid responses to environmental fluctuations [Sawestri *et al.,* 2013]. Through the analysis of the attributes of the phytoplankton community, a comprehensive and timely understanding of the dynamic characteristics of water environmental quality may be obtained [Sabater-Liesa *et al.,* 2018], which cannot be substituted by physical and chemical monitoring. Currently, river health evaluation systems have incorporated biological evaluation indexes and methodologies for assessing water quality. These tools have gained significance in evaluating levels of water pollution and nutrient content. Several studies have examined the utilization of phytoplankton to evaluate water quality and other related factors [Xing *et al.,* 2020; Yang *et al.,* 2015]. Consequently, the utilization of aquatic biological methods for evaluating water quality is crucial in comprehending the influence of human activities on water quality and the variability of spatial and temporal attributes, as well as in implementing efficient ecological preservation measures. The density of zooplankton is highly dependent on the density of phytoplankton because phytoplankton is food for zooplankton; thus, the quantity or abundance of zooplankton will be high in waters with a high content of phytoplankton [Ardiansyah *et al.,* 2023]. The abundance of plankton in an area of water is influenced by several environmental parameters and physiological characteristics. The composition and abundance of plankton at each regional level will change in response to changes in environmental conditions, both physical, chemical, and biological [Fauzia *et al.,* 2016]. Based on the result, it shows that the composition of plankton in Ranu Grati waters has variations. On phytoplankton, the Bacillariophyceae class is a species that is often found compared to other classes. This is because the Bacillariophyceae group, better known as diatoms, is the largest group of algae in fresh water [Nurrachmi *et al.,* 2021]. The Bacillariophyceae class is also more able to adapt to existing environmental conditions, is cosmopolitan, and has

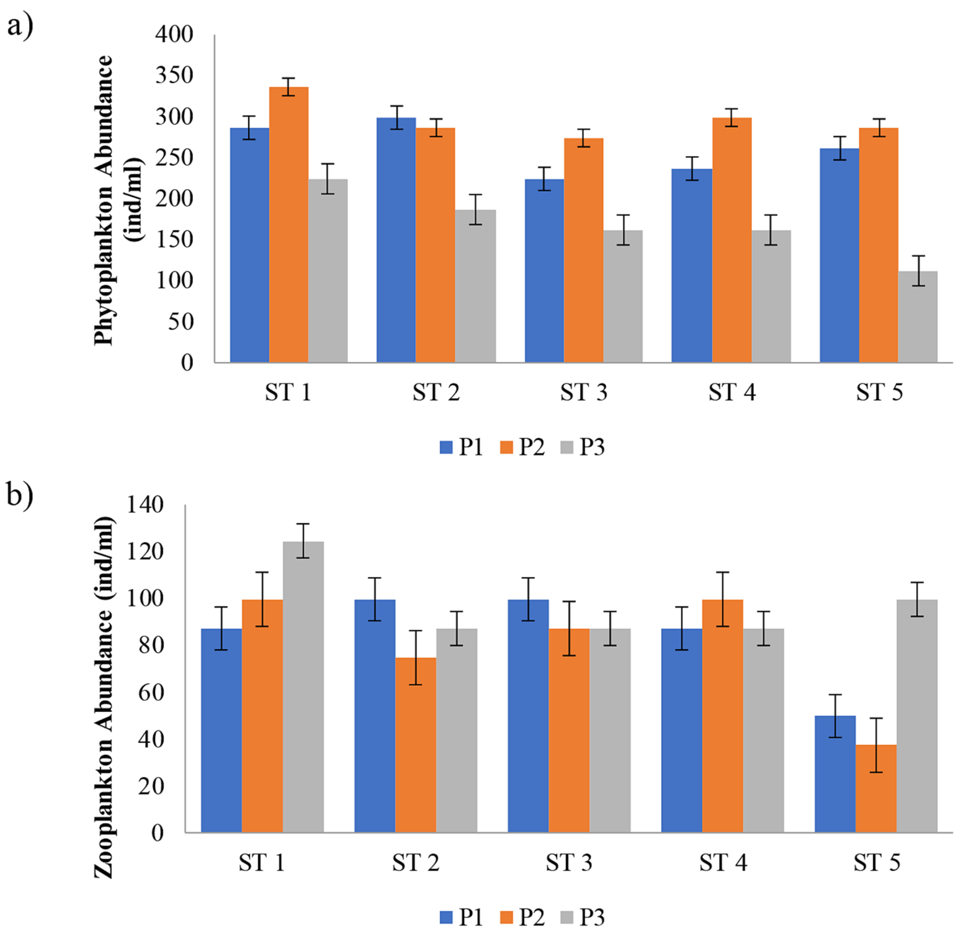

Figure 2. Abundance of phyplankton and zooplankton Ranu Grati

high tolerance and adaptability [Mahmudi *et al.*, 2023]. On zooplankton, the Arthropoda and Rotifera classes are found in Ranu Grati with five species each others. Arthropods and rotifers are zooplankton that can be found in fresh and brackish waters. Rotifers can adapt to physical and chemical environmental factors that have a relatively high content of nutrients or organic matter [Erlania *et al.,* 2016].

Identification and abundance of plankton in the stomach of lempuk fish

Based on Figure 3, the results of the analysis of the abundance of plankton consisting of phytoplankton and zooplankton in the stomach of the lempuk fish are obtained. The highest phytoplankton abundance value in the stomach of the lempuk fish, namely 6.6 ind/ml, was found at Station 1 of the first sampling, while the lowest, namely 2.2 ind/ml, was found at Station 1 of the second sampling. The value of zooplankton abundance in variations in the stomach contents of lempuk fish has almost the same value at each station and sampling, where the lowest value occurs at station 5 of the third sampling because no zooplankton was found in the stomach of lempuk fish at all, and the highest value of 3.3 ind/ml is found at station 3 of the first sampling. Based on the analysis of the stomach contents of lempuk fish, plankton was also found, which was divided into two groups: phytoplankton and zooplankton. Only 3 class (Bacillariophyceae, Chlorophyceae, Cyanopyceae) 7 genera of phytoplankton were found, including *Ampileura, Asterionella, Bacillaria, Pandorina, Ulotrix, Aphanocapsa,* and *Oscillatoria*. Meanwhile, only one genus of zooplankton is found in the stomachs of lempuk fish, namely *Dapnia*. In the first sampling, the lempuk fish caught in Ranu Grati consumed a lot of *Oscillatoria* type phytoplankton, while in the second and third sampling, the lempuk fish caught in Ranu Grati consumed a lot of *Asterionella* type phytoplankton.

The Bacillariophyceae class (*Ampileura, Asterionella, and Bacillaria*) is a class of phytoplankton that dominates the stomach contents of lempuk fish at all stations. That dominance of the

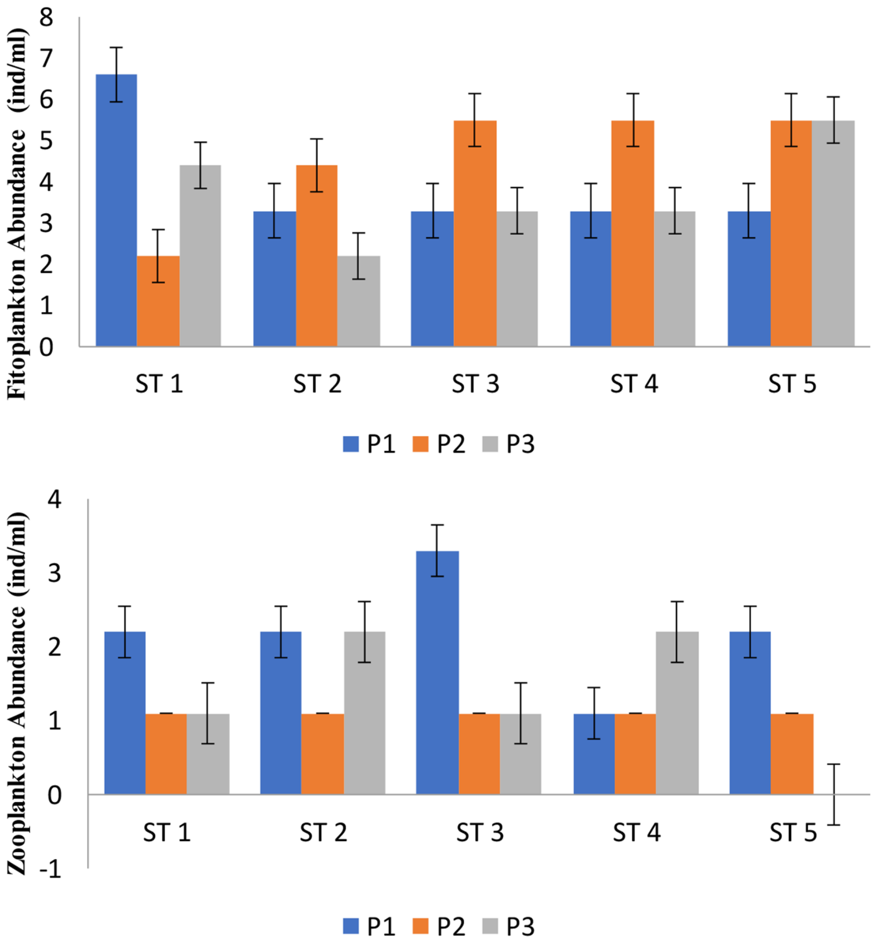

Figure 3. Fitoplankton and zooplankton abundance

Bacillariophyceae class is thought to be due to its excellent ability to adapt to various existing water conditions. The Bacillariophyceae class is phytoplankton, which has a wide tolerance to salinity, temperature, nutrients, and light [Ramadhanty *et al.,* 2020]. Apart from that, the Bacillariophyceae class has a high composition compared to other classes because it can grow quickly even in low-nutrient and light conditions [Lestari et al., 2020]. The phytoplankton species found abundantly in the stomach of lempuk fish is *Asterionella*. *Asterionella* sp. is known as a planktonic diatom, which is generally dominant in mesotrophic and eutrophic waters, and the abundance of this species is correlated with aquatic nutrition [Buzscko and Veres, 2017]. The abundant presence of *Asterionella* shows that this species can compete well with other types of phytoplankton. According to Rafitri *et al.,* (2015), *Asterionella* species have the ability to bind phosphorus better than other genera and will win the competition when the phosphorus concentration in the water is low. Phosphorus is involved in the photosynthesis process to form high-energy compounds and is needed in water as a food ingredient used by all organisms for growth and energy sources. Furthermore, the zooplankton species found abundantly in the stomachs of lempuk fish is *Daphnia*. *Daphnia* is one of the large Clodocera species; they eat phytoplankton and other plant particles that can be digested [Fathurrohim, 2022]. Daphnia is often used to provide information about water pollution. This is because Daphnia can survive at dissolved oxygen concentrations of 3 mg/L [Kartikasari et al., 2020]. Variations in plankton in the stomach of lempuk indicate the preference of lempuk fish for consuming food. This shows that lempuk fish have variations in the plankton they consume, and the most commonly found phytoplankton is the genus *Asterionella*, and zooplankton is the genus *Daphnia*.

Plankton biology index (H', E, C)

The plankton biology index is one of the parameters used in this study to measure uniformity, diversity, and dominance indices. Based on the results found, it shows that the phytoplankton diversity index value in Ranu Grati waters is 1.4–2.6 and the zooplankton diversity value has a range of 1.1–1.9. Then the phytoplankton uniformity index was found to have a range of 0.883–0.975, and zooplankton uniformity had a range of 0.898–1. Apart from that, the phytoplankton dominance index value ranges from 0.09 to 0.3, and zooplankton has a dominance range from 0.14 to 0.33. The detailed plankton biological index calculation results can be seen in Table 3.

Based on the results found, it shows that the index value of phytoplankton diversity in Ranu Grati waters is 1.4–2.6 and the value of zooplankton diversity has a range ranging from 1.1–1.9, which indicates that the diversity of plankton species is moderate. According to Shannon-Wiener, there

Table 3. Plankton biology index of *Gobiopterus* spp. in Ranu Grati

Sampling	Station	Fitoplankton			Zooplankton		
		H`	E	C	H`	E	C
Sampling 1	ST 1	2.4	0.94	0.1	1.7	0.97	0.18
	ST 2	2.6	0.94	0.09	1.5	0.92	0.25
	ST 3	2	0.96	0.1	1.9	0.97	0.15
	ST 4	2.2	0.93	0.1	1.9	1	0.14
	ST 5	2.1	0.90	0.2	1.3	1	0.25
Sampling 2	ST 1	2.6	0.92	0.1	1.9	0.97	0.15
	ST 2	2.3	0.91	0.12	1.7	1	0.16
	ST 3	2.2	0.88	0.2	1.5	0.96	0.22
	ST 4	2.3	0.88	0.1	1.7	0.96	0.18
	ST 5	2.5	0.91	0.1	1.1	1	0.33
Sampling 3	ST 1	2.4	0.96	0.1	1.7	0.89	0.22
	ST 2	2.3	0.96	0.11	1.7	0.89	0.18
	ST 3	2.2	0.97	0.1	1.7	0.89	0.18
	ST 4	2.1	0.95	0.1	1.9	1	0.14
	ST 5	1.4	0.88	0.3	1.7	0.96	0.18

are 3 criteria for diversity index (H`), namely: if H'1 then species diversity is low, the number of individuals is low, and water stability is low; if 1 < H3 then species diversity is moderate, the number of individuals is moderate, and water stability is moderate; if H` > 3, then species diversity is high, the number of individuals is high, and the waters are not polluted [Ochieng *et al.,* 2021]. In addition, the uniformity index of the phytoplankton found has a range ranging from 0.883 to 0.975, and the uniformity of zooplankton has a range ranging from 0.898 to 1, which indicates that the plankton uniformity value has high species uniformity. There are 3 uniformity index criteria (E), namely, if E > 0.6, then the type uniformity is high; if 0.6 > E > 0.4, then the species uniformity is moderate; and if E < 0.4, then the species uniformity is low [Putri *et al.,* 2021]. In addition, the dominance index value of phytoplankton ranges from 0.09 to 0.3 and that of zooplankton ranges from 0.14 to 0.33, which indicates that the plankton dominance index in Ranu Grati waters is low. While, there are 2 criteria for dominance index (C), namely, if 0 < C < 0.5, then no genus dominates, whereas if 0.5 < C < 1, then there is a genus that dominates [Junita, 2020]. Phytoplankton serve as the main producers in aquatic ecosystems and possess the ability to promptly adapt to alterations in the nutritional condition of the water as well as the infiltration of contaminants [Hertika *et al.,* 2019]. Consequently, the phytoplankton diversity index is frequently employed to assess the condition of phytoplankton populations and the presence of water pollution [Meng *et al*., 2020; Inyang *et al*., 2020]. A higher value of the plankton diversity index suggests that the ecosystem in the given area possesses a well-balanced environmental carrying capacity [Wiyarsih *et al.,* 2019]. Medium plankton diversity index scores are indicative of environmental disturbance or pressure. A low result for the plankton diversity index suggests that there is disturbance in the environment and stress on the organisms' structural integrity [Prianto *et al.,* 2017].

Index of preponderance

The index of preponderance (IP) value in the first replicate as shown in Figure 4 shows that the highest IP value of all types of food found in the stomach of lempuk fish is the zooplankton genus *Daphnia* with an average IP value of 36%, followed by the *Asterionella* genus of 26%, *Pandorina* 20%, *Amphipleura* 19%, *Oscillatoria* 19%, *Ulothrix* 15%, *Bacillaria* 12.5%, and *Aphanocapsa* 12.5%. The second replicate showed the highest average value for the phytoplankton genus *Asterionella* with an average IP value of 41%, followed by the genus *Amphipleura* with 25%, *Daphnia* 21%, *Oscillatoria* 20%, *Ulothrix* 18%, *Pandorina* 17%, and *Bacillaria* 12%. Then in the third replication, the highest average value was in the *Asterionella* genus phytoplankton with an average IP value of 38%, followed by the *Daphnia* genus with 32%, *Oscillatoria* 23%, *Bacillaria* 23%, *Amphipleura* 22%, *Ulothrix* 20%, and *Pandorina* 18%.

From the average IP value of the first sampling, it can be concluded that the genera *Daphnia* and *Asterionella* are the main food sources for lempuk fish. The complementary foods found in the first replication are the genera *Pandorina*, *Amphipleura*, *Oscillatoria*, *Ulothrix*, *Bacillaria*, and *Aphanocapsa*. In the second sampling, it can be determined that the genus *Asterionella* is the main food for lempuk fish. Complementary foods found in the second replicate are the genera *Amphipleura*, *Daphnia*, *Oscillatoria*, *Ulothrix*, *Pandorina*, and *Bacillaria*. Then, in the third sampling, it can be categorized that the *Asterionella* and *Daphnia* genera are the main food of lempuk fish. Complementary foods found in the third replicate are the genera *Oscillatoria*, *Bacillaria*, *Amphipleura*, *Ulothrix*, and *Pandorina*. Meanwhile, additional food consists of a mixture of several types of plankton in small quantities. These results are in accordance with the IP value criteria, which are divided into 3 categories: if IP is > 25%, then it is included as the main or dominant food; if it is 4%, then it is excluded.IP ≤ 25%, then it is included as complementary or secondary food, and if IP < 4%, then it is included as additional food [Nurfadillah *et al.,* 2022]. Based on the results of the preponderance index on lempuk fish in Ranu Grati, Kab. Pasuruan stated that the composition of the stomach contents of lempuk fish is classified into two groups, namely phytoplankton and zooplankton. The main foods preferred by lempuk fish according to their preponderance index are phytoplankton from the genus *Asterionella* and zooplankton from the genus *Daphnia*. Relatively the similar results from this study indicate that the condition of the waters of Lake Ranu Grati, Pasuruan Regency, is classified as supportive in providing natural food for lempuk fish in the form of various types of phytoplankton and zooplankton. The results of the research show that the prey type of lempuk fish tends to be a plankton feeder. Plankton feeders are organisms with the most food in the form of zooplankton or phytoplankton [El-Naggar *et al.,* 2019]. The dietary preferences of fish have an impact on various aspects, including the size and color of their food, as well as their hunger for it. The quantity of food required by fish is contingent upon factors such as their feeding behavior, nutritional composition of the food, food conversion efficiency, and the quality of the fish's diet [Zuliani *et al.,* 2016].

Water quality parameters

Some of the water quality parameters that measured are temperature, pH, dissolved oxygen, nitrate, and ammonium. The result showing that the range temperature value was obtained 28.4–31.5° C and the average was 29.64, pH was obtained around 10.13–9.42 and the average was 9.70, dissolved oxygen was obtained around 5.5–10.7 mg/l and the average was 8.22 mg/l, nitrate was obtained around 0.03–0.10 mg/l and the average was 0.05 mg/l, and ammonia was obtained around 0.03–0.10 mg/l and the average was 0.06 mg/l. The results of the water quality analysis study of *Gobiopterus* spp. in Ranu Grati are presented in Table 4.

The quality of water is an important requirement that can affect the survival, development, growth, and level of fish production. A good environment is necessary for the survival of aquatic organisms [Siegers *et al.,* 2020]. The quality of water is a significant factor in the existence of organisms and is subject to variation based on factors such as location, time, and weather conditions [Giri and Qiu 2016]. Alterations in physical and chemical characteristics have the potential to impact the existence of aquatic organisms, including phytoplankton [Desmawati *et al.,* 2020]. Phytoplankton exhibit a strong susceptibility to

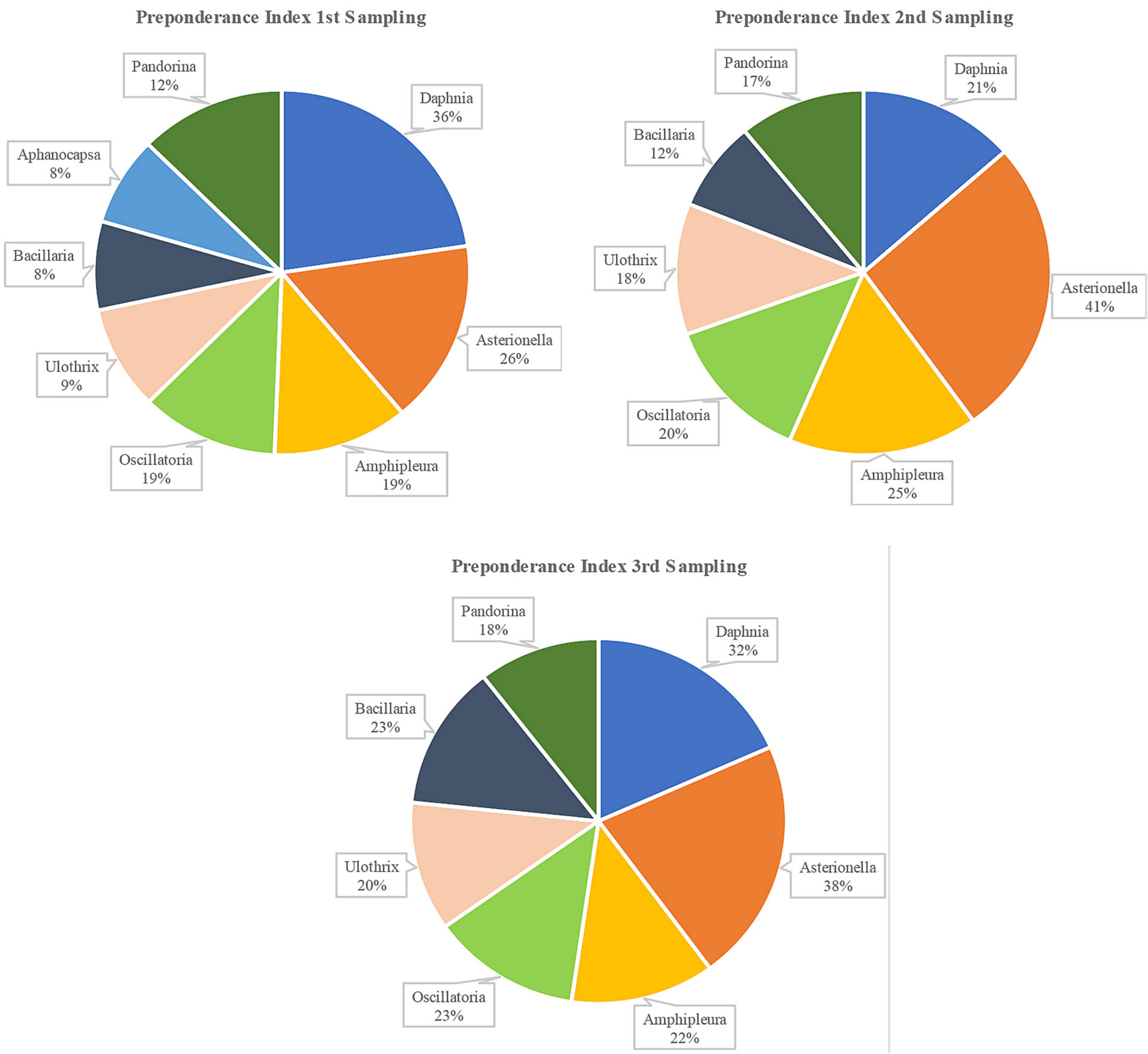

Figure 4. Preponderance index of *Gobiopterus spp*. in Ranu Grati

Table 4. Water quality parameters of *Gobiopterus* spp. in Ranu Grati

Parameter	Variation	Value	Optimum
Temperature (ºC)	Range	28.4 – 31.5	26–33ºC (SNI 8228.4-2015)
	Average ± Standard deviation	29.64 ± 0.76	
pH	Range	10.13 – 9.42	7–9 (SNI 8228.4-2015)
	Average ± Standard deviation	9.70 ± 0.26	
DO (mg/l)	Range	5.5 – 10.7	>4 mg/l (SNI 8228.4-2015)
	Average ± Standard deviation	8.22 ± 1.52	
Nitrate (mg/l)	Range	0.03 – 0.10	0.5 mg/l (SNI 8228.4-2015)
	Average ± Standard deviation	0.05 ± 0.02	
Ammonia (mg/l)	Range	0.03 – 0.10	0.1 mg/l (SNI 8228.4-2015)
	Average ± Standard deviation	0.06 ± 0.02	

alterations in the aquatic environment [Kowiati *et al.,* 2019]. The composition of the phytoplankton community is a crucial factor in assessing the water quality. The community structure encompasses the composition, abundance, variety, dominance, and evenness of phytoplankton [Machado *et al.,* 2018]. The modifications in the composition of phytoplankton communities may indicate alterations in water conditions [Kheireddine *et al.,* 2018]. Water contamination is a prevalent issue. Several parameters to determine the quality of water used in this study are temperature, pH DO, nitrate and ammonia. Water temperature is an important physical factor that influences the lives of aquatic animals and plants, one of which is plankton. Based on water quality standards in Indonesian Goverment [PP No. 82 of 2001], the optimal temperature value for freshwater fish farming is in the range of 26–33ºC. Measurement of the degree of acidity (pH) obtained values classified as optimal and normal. The optimal pH range for fish farming is 6.5–9.0. While the DO value obtained is classified as optimal. Good oxygen levels for freshwater fish farming should not be less than 4 mg/l. Nitrate and ammonia levels obtained also did not exceed a predetermined threshold. This shows that the temperature, pH, DO, nitrate, and ammonia parameters of Ranu Grati waters are within natural limits and are still suitable for supporting the life of lempuk fish.

CONCLUSIONS

The abundance of phytoplankton in Ranu Grati ranges from 112.1 ind/ml to 336.3 ind/ml, and that of zooplankton ranges from 37.36 ind/ml to 124.56 ind/ml. There were 4 different classes (Bacillaripycease, Chlorophyceae, Cyanophyceae, and Dinophyceae) of phytoplankton found with 20 different species. Meanwhile, in zooplankton, it was found that there were 4 different classes (Rotifera, Arthropoda, Ciliophora, and Metamonda) with 12 different species. The results of analysis of stomach contents show that the lempuk fish found in Ranu Grati consume plankton as food, this can be seen from the most commonly found phytoplankton is the genus *Asterionella*, and zooplankton is the genus *Daphnia.* From the diversity index value, it can be said that Ranu Grati has moderately stable waters; from the uniformity index value, it can be said that the uniformity between species is high or classified as even (same); while the dominance index is classified as low or it can be said that no species dominates. Based on the results of the preponderance index, the composition of the stomach contents preferred by lempuk fish is phytoplankton from the genus *Asterionella* and zooplankton from the genus *Daphnia*. Furthermore, the water quality that has been measured on several parameters such as temperature, pH, DO, nitrate, and ammonia is still classified as an optimum value according to the determined water quality standards.

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