Food Habits Study of Cultured Nilem Fish (Osteochilus hasselti C.V.) on Minapaddy at Agriculture Area of Talagasari Village, Kadungora District, Garut Regency and Indonesia

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ABSTRACT

This research was conducted in May 2018 until September 2018, aimed at analyzing the eating habits of nilem fish which are kept in the waters of CV Agri Insan Mandiri, Tegalsari Village, Kadungora District, Garut Regency, West Java. The research method used was purposive sampling for sampling water quality and plankton abundance, as well as simple random sampling method for sampling nilem fish as a data source for eating habits. Data on mineral content in dissolved soil and minerals in the waters is used as supporting data that determines the presence of natural feed. Based on the results of this research, it was found that in the Minapaddy waters found 7 phyla including Bacillariophyta, Euglenophyta, Chlorophyta, Cyanophyta, Ochrophyta, Cryptophyta and Rodophyta. Bacillariophyta and Euglenophyta are the most common phyla. Natural feeds favored by nilem fish come from Bacillariophyta with a total of 10 genera, while those
that are not favored come from Euglenophyta with 2 genus. The composition of dissolved minerals Calcium (Ca), Potassium (K), Iron (Fe) and Silica (Si) exceeds the normal requirements for phytoplankton, especially Bacillariophyta, so that the abundance of plankton is comparable to Euglenophyta which is not utilized by nilem.

**Keywords:** Food habits; nilem fish; minapaddy; mineral composition.

1. **INTRODUCTION**

The increase in population has led to the conversion of land into residential areas. However, the demand for diverse human food needs are also increasing. The consumed food is mostly from the agriculture, livestock and fisheries sectors. The available area for these sectors is not directly proportional to the increase in residential land, integrated technology is needed, which can utilize available land and have the possibility to produce more than one type of food. One example of fisheries is the system of fish farming in rice fields or what is called Minapaddy (Rice-fish).

Rice-fish cultivation is one of a traditional farming practice in Asia, particularly within the rain-fed agribusiness system practicing subsistence agriculturists. Integration of fish aquaculture into the rice cultivating gives important protein to them. More than one half of the animal-based protein accessible in numerous Asian nations are from fishes. A one of a kind agro-landscape in numerous nations over the world, especially in Asian nations are made by the rice-fish culture systems. Such as China, Thailand, Philippines, India, Bangladesh and Indonesia [1]. The minapaddy system is a method of raising fish around rice plants, as an interval between the two rice planting season or raising fish as a substitute for rice crops [2]. Reduction of lower costs of the farmer’s economic load and increases in their additional income from the sale of fishes are obtained at the farm level as rice-fish integration reduces the use of fertilizers, pesticides and herbicides in the fields [3].

Various new modern farming techniques of the rice-fish system are still lacking in the most practical area of rural sectors of the world and need to be spread as soon as possible. Integrated rice-fish farming is ecologically sound has been suggested by many reports as fish improves soil fertility by increasing the availability of nitrogen and phosphorus [4]. In its development the Minapaddy system experienced several variations in its application, including: (1) Minapaddy systems that are managed organically with Azolla planting; (2) the Minapaddy system combined with duck livestock or called 'Perlabek'; (3) the Minapaddy system by modifying the shape of the pond or known as the "Minapaddy pond in the system" [5].

There are two patterns of Minapaddy cultivation of rice cropping that can be done in a single growing season, the first one is the interval time pattern, and the second one is inter-crop pattern. The interval time pattern does fish culture in the fields before the rice planting, the inter-crop pattern raises cultured fish together with rice in a paddy field. Types of fish farmed on the minapaddy system, especially in West Java, namely common carps (Cyprinus carpio), tilapia fish (Oreochromis mossambicus), nile tilapia (Oreochromis niloticus), nilem fish (Osteochilus vittatus) and many more species of freshwater fish can be cultivated with minapaddy system [6].

Minapaddy’s cultivation advantages make some farming businesses interested in conducting experiments on planting rice fields with the system, for example the company CV Agri Insan Mandiri in Talagasari Village, Kadungora District, Garut Regency. The farm built a fish farming pond together with paddy (Minapaddy) with a deep pond system. The soil in the Talagasari region has characteristics of soil and dissolved mineral composition such as macro nutrients and micro nutrients [7]. The plankton culture activity needs various kinds of inorganic compounds, both as macro nutrients (N, P, K, S, Na, Si and Ca) and micronutrients (Fe, Zn, Mn, Cu, Mg, Mo, Co, B and others)[8]. That is what affects the plankton community structure in the waters which will then be used as natural food for nilem fish.

The main food grazed by nilem fish is from phytoplankton mostly comprising classes of Bacillariophyceae, Chlorophyceae, and Cyanophyceae. Nilem fish is known as one type of herbivorous fish which in the larval phase to adults uses plankton as its food source [9]. The existence of nilem fish has an important ecological role in utilizing plankton in the waters as well as having economic value as one of the cultivation products. Factors that influence the
availability and type of natural feed are the quality of water and nutrients from those used as cultivation media for Minapaddy. The composition and wealth of plankton will change at various levels in response to changes in environmental conditions, which are physical, chemical and biological [10].

The purpose of this study was to analyze the utilization of natural food by nilem fish in Minapadi ponds and the relationship related to feed used from Minapadi with quality that is in accordance with the mineral requirements in the agricultural area of CV Agri Insan Mandiri, Talagasari Village, Kadungora District, Garut Regency.

2. METHODOLOGY

2.1 Time and Place

This research was conducted in May - September 2018 which was divided into 2 periods, the sample collection took on May 27 - August 5 at Tropical Climate Dry Season, the observation and obtained data analyze took on August 20 - September 24. The location of the research was conducted in the rice fields area of CV Agri Insan Mandiri in Talagasari Village, Kadungora District, Garut Regency.

2.2 Tool and Materials

The tools used during this research included dipper, anco, needle, sample bottle, digital thermometer, DO meter, pH meter, plankton identification book, microscope, Sedgewick Rafter Cell, label paper and cool box. The materials used in this research include water samples, 4% formalin solution, ice cubes, phenol sulfonic acid, 10% NH₄OH, aquades, SaCl₂, NH₄ molybdate, Signette, Nessler and standard solutions.

2.3 Sample Collection and Measurement

The physical-chemical parameters of the waters analyzed consisted of parameters including dissolved minerals, temperature, pH, DO, nitrate, ammonia and phosphate. Physical-chemical parameters were analyzed in-situ and ex-situ. Ex-situ analysis was carried out at the Laboratory of Aquatic Resource Management at FPIK UNPAD and Water Quality Laboratory at FTSL ITB. Fish sampling was taken after the water sampling and plankton sampling activities which carried out by the research team. The method of fish sample collection used the simple random sampling technique with 10 fish per week for every 6 weeks with the help of anco fishing gear. Caught fishes are dissected and taken their stomach contents to identify the types of natural feed consumed [11]. Aquatic plankton abundance data were obtained from CV Agri Insan Mandiri’s research team as comparative data on the presence of aquatic feed with feed used by fish. Identification of plankton based on planktonology books [12].

2.4 Sample Analysis

The data collected are primary and secondary data. Primary data obtained from field observations include measurements of water quality, captured fish Morphometric data, laboratory observation data in the form of fish gastric contents as the main data for food habits, and data on plankton community structure results which are part of a CV Agri Insan Mandiri research team. Secondary data are obtained from the measurement of mineral water composition. Data analysis using quantitative descriptive analysis that refers to the method of fisheries biology [11].

2.4.1 Abundance

The number of individuals or cells per unit volume are called Plankton Abundance, and can be calculated using the following formula [13]:

\[ K = \frac{1}{A} \times \frac{B \times V}{C \times v} \times N \]

K = phytoplankton abundance (cell/m³);
\(N\) = number of observed phytoplankton; \(B\) = total area/container area of Sedgwick-Rafter Counting Cell (mm²);
\(V\) = volume of filtered water (30 ml);
\(v\) = concentrate volume of Sedgwick-Rafter Counting Cell (ml); \(A\) = volume of filtered water sample (50 l); \(C\) = observation area (mm²)

2.4.2 Index of the largest section (Index of preponderance)

Fish food habits can be analyzed using the index of the largest section (index of preponderance). The largest section index is a combination of event and volumetric frequency methods with the following formula [14]:

\[ IP = \left( \frac{\sum Vi \times Oi}{\sum Vi} \right) \times 100 \]
Information:

**IP** = Index of the Largest Part (Index of Preponderance)

**Vi** = Percentage of one food type

**Oi** = Percentage of frequency of occurrence of one type of food

Σ (Vi x Oi) = Amount of Vi x Oi from all types of food

The Largest Section Index is used to determine the preference and specialization of the types of feed for each type of fish. The type of feed categorized as main feed has a frequency of 50%, while if the proportion of types of food between plants and animals is balanced then the fish is considered an omnivore [15]. The grouping of feed with the Preponderance Index (based on the type of feed) is the Preponderance Index value (IP) ≥ 25% as the main feed, 5% < IP < 25% as complementary feed, and IP ≤ 5% as additional feed [16].

### 2.4.3 Index of Ivlev (Index of Electivity)

Data for the calculation of the Electivity Index is taken from secondary data from the observation of the plankton community structure processed by the joint research team at CV Agri Insan Mandiri. The preference of each organism or type of plankton that is found in fish digestion devices is determined based on the Ivlev index or which can be called the choice index with the Ivlev’s formula [17]

\[ E = \frac{r_i - p_i}{r_i + p_i} \]

Information:

**E** = Ivlev Index (Index of Electivity)

**r** = The relative number of kinds of organisms that are utilized by fish

**p** = The relative amount of various organisms in the waters

Electivity Index is a comparison between fish feed organisms contained in the stomach with fish feed organisms found in the waters. This index value ranges from +1 to -1, if 0 < E < 1 means the feed is popular, and if the value of -1 < E < 0 means that the food is not favored by fish. If the value of E = 0 means there is no selection by fish of the feed [18].

### 3. RESULTS AND DISCUSSION

#### 3.1 Physical and Chemical Quality of Minapaddy Waters

The measurement of physical and chemical quality of water is carried out so that information is available on the feasibility of water quality to carry out fisheries activities, especially nilem fish cultivation in Minapaddy. The range of data displayed is the average value of each sampling point. The results of measuring water quality during the research can be seen in Table 1.

Information:

I. Cyprinidae Fish Standard Quality Range [19].

II. Standard Quality Range class II water for fish aquaculture activities [20].

#### 3.2 Mineral Composition of Minapaddy

Analysis of dissolved mineral content in the waters of Talagasari Village was carried out so that it could become reference information as a determinant of plankton community structure that could influence the food habits of nilem fish. The types of mineral elements observed were selected based on the detected mineral element data from the Talagasari Village Community Service Program report with CV Agri Insan Mandiri which analyzed the soil mineral content of Talagasari Village using the XRF (X-Ray Fluorescence) method in the Laboratory of Soil, Faculty of Agriculture, Padjadjaran University. Analysis of dissolved mineral elements was carried out at the Water Quality Laboratory of the Faculty of Civil and Environmental Engineering, Bandung Institute of Technology.

| Parameter       | During research | Standard quality range$^{(1)}$ | Standard quality range$^{(2)}$ |
|-----------------|-----------------|--------------------------------|-------------------------------|
| Dissolved Oxygen (mg/L) | 6.3 – 7.2       | ≥ 5                            | ≥ 4                           |
| Temperature (°C)    | 25.7 – 27.0     | 18 – 30                        | ± 3,0 from natural temperature|
| pH               | 7.3 – 7.4       | 6.0 – 9.0                      | 6.0 – 9.0                     |
| Nitrate (mg/L)     | 0.758 – 0.898   | ≤ 6                            | ≤ 10                          |
| Phosphate (mg/L)   | 0.218 – 0.240   | ≤ 0.2                          | ≤ 0.2                         |
| Amonia (mg/L)      | 0.007 – 0.010   | -                              | ≤ 0.1                         |
**Tabel 2. Result of ground mineral and dissolved mineral analysis**

| Elements       | Ground mineral (mass %) | Dissolved mineral (mg/L) |
|----------------|-------------------------|--------------------------|
|                | A3 | A4 | A5 | A7 | A9 | A11 | A3 | A4 | A5 | A7 | A9 | A11 |
| K (Potassium)  | 0.2 | 0.261 | 0.153 | 0.228 | 0.154 | 0.191 | 15.8 |
| Mg (Magnesium) | 0.302 | ND | 0.166 | 0.441 | ND | 0.239 | 4.96 |
| S (Sulfide)    | 0.149 | 0.157 | 0.111 | 0.143 | 0.116 | 0.141 | 0.064 |
| Ca (Calsium)   | 0.708 | 0.44 | 0.777 | 1.16 | 0.557 | 0.658 | 52.8 |
| Fe (Iron)      | 72.6 | 66.4 | 82.1 | 72.3 | 79.7 | 76 | 6.35 |
| Si (Silica)    | 19.2 | 22 | 12.2 | 19.1 | 14.2 | 16.7 | 186 |
| Na (Sodium)    | ND | ND | ND | ND | ND | ND | 18.2 |
| Co (Kobalt)    | ND | 0.0961 | ND | 0.028 | ND | <0.001 |
| Zn (Zinc)      | 0.0032 | 0.0215 | 0.0465 | ND | ND | ND | <0.001 |

**Water Hardness**

153 mg/L

Information: ND = Not Detected

The analytical method refers to the APHA (American Public Health Association) standard. Mineral elements detected in the soil in CV Agri Insan Mandiri can be seen in Table 2.

There were 6 soil samples observed in observing soil mineral content, each sample was coded with different numbers (A3, A4, A5, A7, A9 and A11). The purpose of measuring soil minerals is to estimate the identity of minerals dissolved in minapaddy with local minerals in the soil. From these results there is an undetectable element (ND) on the ground, but is detected in water, namely Sodium (Na). Sodium tends to form water-soluble compounds, such as halides, sulfates, nitrates, carboxylates and carbonates [21]. Potassium, calcium, magnesium include macro elements detected. Silica (Si) minerals, chloride has low levels in the soil but is high in water. Mineral levels of zinc (Zn), cobalt (Co), iron (Fe) and sulfide (S) on the soil are higher than the levels dissolved in water.

This hardness in Minapadi waters is 153 mg/L, which indicates that the mineral content is quite high. Water hardness is determined by the concentration of multivalent cations in water, generally represented by calcium ions (Ca$^{2+}$) and magnesium (Mg$^{2+}$) [22]. The hardness of water comes from contact with water with soil and rocks. In addition, hardness describes divalent metal cations, which in the most abundant divalent cation waters are calcium and magnesium. Iron valence two (Fe$^{2+}$) only contributes little to hardness values. This proves that aquatic minerals will have identities with soil minerals, based on 4 minerals measured as part of hardness determinants namely Mg, Ca and Fe [23].

The elements of Ca and K exceed the level of normal needs which are 15 mg/L Ca, 10 mg/LK [24], Si has exceeded the normal requirements which are 4 mg/L [25] and Fe content that exceeds normal needs basis which is 0.3 mg/L [20]. Both Si and Fe elements in this research exceed the normal needs. The element Fe is an important element forming chlorophyll, Ca is one of the elements forming phytoplankton cell walls, while K is an element that functions to metabolize phytoplankton carbohydrates [26]. Silica (Si) is a cell wall formation or frustule from diatoms [27].

Mineral elements Cobalt (Co) and Zinc (Zn), are included as minerals that have an effect on algae [28]. When referring to Government Regulation number 82 of 2001 concerning Water Quality Standards, the maximum limits for Co and Zn elements are 0.2 mg/L and 0.05 mg/L. The results of analysis of dissolved minerals during the research showed that Co and Zn levels were still below the water pollution threshold. Both mineral elements are micro elements needed for photosynthesis of algae or plants [28].

### 3.3 Plankton Community Structure

Based on data obtained from CV Agri Insan Mandiri's research team, the results of the identification of plankton to the phylum level in Minapaddy during the research consisted of 7 phytoplankton phyla namely Chlorophyta, Bacillariophyta, Euglenophyta, Cyanophyceae, Ocrophyta, Rhodophyta, and Cryptophyta and 3 zooplankton phylum, Arthropoda, Rotifera and Ciliophora. The percentage composition of plankton abundance can be seen in Fig. 1.
Fig. 1. Plankton abundance of minapaddy water
The identification results show that Bacillariophyta which are commonly found are genus Diatoma, Nitzschia and Navicula, while the phyla of Chlorophyta are often found and have relatively high abundance from the genus Spirogyra and Scenedesmus, whereas from the Cyanophyta’s most common genus is the Oscillatoria. The most common genus from Euglenophyta phylum are Euglena and Phacus. The genus of the Ocrophyta phylum, Rhodophyta, and Cryptophyta are found only slightly.

Zooplankton which is always found and has a relatively high abundance are the genus Diaphanosoma and Cyclops (adult Cyclops and Cyclops Naupli) from the Arthropod phylum. As for the other types, only a few are found and there is not always every observation.

The Bacillariophyta and Euglenophyta phyla are the phytoplankton found with the highest abundance compared to others. Nutrient supply into a liquid, specifically Nitrogen (N), Phosphate (P) and Silica (Si) is often said to be a limiting factor that can affect the spread and growth of populations and phytoplankton communities [29]. The high abundance of phytoplankton Bacillariophyta is indicated by the high content of Silica minerals above normal levels of 182 mg/L, while according to the American Public Health Association (1992) the normal levels of water soluble silica are 1 - 30 mg/L and concentrations above 100 mg/L are unusual concentration. Fish that use plankton as feed in the Minapaddy waters are only nilem fish, the main types of feed use by nilem are Bacillariophyceae and Chlorophyceae [30]. Based on this, it can be concluded that the abundance of algae in Euglenophyta division is caused by the plankton that is less desirable or used by fish living in these waters, and Bacillariophyta plankton remains abundant due to the very high dissolved silica from the volcanic soil characteristics of the research area.

Phytoplankton variations can occur in terms of production or density. A number of parameters that influence this variation are sunlight intensity, nutrient availability, predation growth rate, competition, and parasites [31]. While in zooplankton there is one dominant genus found in the study site, Diaphanosoma with a relative abundance of 42.77%. Diaphanosoma which belongs to the order of Cladocera is a zooplankton, which has a very wide tolerance to salinity. Other zooplankton with the most abundance after Diaphanosoma are from the Cyclops genus. Cyclops have a longer life cycle than Diaphanosoma, because the larvae require several molting times before they are produced by adults. This is what causes more diaphanosoma to be found than the Cyclops.

3.4 Nilem Fish

Nilem fish stocked in Minapaddy are measured 100 fish/kg or ± 10 grams per fish which will be harvested when around 35 - 40 grams per fish. The length and weight of the nilem fish samples obtained during the research can be seen in Fig. 2.

The group of fish divided into 6 groups based on 6 times the sampling time once a week, except for the second sample taken two weeks after the first sample due to field technical problems that did not allow the implementation of sampling activities by researchers at that location. There are special conditions for the 6th sampling when the rice has been harvested and the water is reduced so that the fish taken is fish that has been transferred to the reservoir.

Fig. 2. Fish length (1) and fish weight (2)
3.5 Food Habits

3.5.1 Index of largest section and index of preponderance

The Largest Section Index data was obtained from observations of the contents of the stomach 10 fish nilem per 6 times sampling. Grouping of feed types [15], namely: (1) Phytoplankton; (2) Zooplankton; (3) Plants (parts of leaves, stems, seeds); (4) Insects; (5) Worms (annelids and non-annelids); (6) Molluscs (bivalves, gastropods); (7) Shrimp; (8). Fish (all parts including scales and fins); (9) Animal Fractions (not identified); (10) Detritus. The following are the results of the calculation of the Largest Section Index of fish samples from week 1 to 6 presented in graphical form in Fig. 3.

Based on observations from 6 fish samples, it can be ascertained that nilem fish in the waters of CV Agri Insan Mandiri in Talagasri Village, Kadungora, Garut Regency are phytoplankton eaters with an average frequency of IBT 61.73% at phytoplankton feed from 6 weeks of fish samples. Only at the 6th week the number of detritus exceeds 50% due to the condition of the Minapaddy that has been harvested and the water is reduced so that the fish taken are fish that have been removed. The average IBT for detritus alone is IBT 35.59% as the second most after phytoplankton.

The grouping of the preponderance index based on feed type groups was calculated based on the class of feed type to determine the main feed (IP ≥25%), supplementary feed (5% <IP <25%), and supplementary feed (IP ≤ 5%). The preponderant index grouping data is presented in Fig. 4.

The Largest Section Index (IBT) shows that nilem fish in CV Agri Insan Mandiri use phytoplankton as the main feed. Plankton identification results showed that of the 6 groups of fish samples, the plankton used as main feed was from the Bacillariophyta group with an average IP of 43.91%, followed by Cyanophyta with an average IP of 8.89% and Chlorophyta with an average IP of 8.34%. Compared to the plankton community structure data, Bacillariophyta is plankton that has a high abundance compared to other plankton groups.

Bacillariophyceae plankton class is diatom type plankton that uses dissolved silica as a cell wall. This is in accordance with the statement which is diatom (Bacillariophyceae) requires silica for frustule formation (cell wall). After this organism dies biogenic from silica which accumulates in the body it dissolves in water [32]. Nilem fish are herbivorous fish that utilize the main feeds of the plankton species Bacillariophyceae and Chlorophyceae [30]. The low preponderant index value of Chlorophyceae and Cyanophyceae caused by the availability of natural feed is relatively less common in the waters.

3.5.2 Electivity index

Determination of the Choice Index or Ivlev Index is used to analyze what types of feed are most desirable for nilem based on the availability of available feed. Data on the relative amount of plankton derived from plankton abundance per number of plankton identified in the observation of plankton community structure, whereas for the relative amount of feed used by fish comes from the amount of a type of feed found in fish entrails per number of plankton found. All feed genus identified from 6 different sample groups were accumulated, either from observing the contents of the stomach or identifying the plankton community structure. The Choice Index calculated is the choice index for phytoplankton feed because based on the Largest Section Index, the main feed of nilem is phytoplankton. The results of the choice index calculation can be seen in Fig. 5.

Based on the data obtained, there are 18 genus of phytoplankton found in the entrails offish and in water samples. Plankton types that have a Choice Index value of 0<E≤1 are desirable feeds, while types that have a value of 0>E are the opposite. The E value that is closer to 1 indicates that the food is in great demand by fish so that the abundance of the plankton species is almost fully utilized, it is found in plankton of the genus Fragilaria, Gyrosigma, Melosira (Bacillariophyta) and Tetraedron (Chlorophyta). The value of E which is closer to -1 indicates that the feed is not very desirable for fish although it has abundance at the site where the fish live, for example in Euglena, Phacus (Euglenophyta) and Syrophyga (Chlorophyta). Some types of feed have an E value that is close to 0, whether the feed is in demand or not, this indicates that the presence of one plankton genus in the waters with plankton that is utilized is relatively balanced.

Most of the feed favored by nilem fish includes diatom plankton (Bacillariophyceae), except Nitzchia. Other types of feed outside the preferred Bacillariophyceae plankton are Tetraedron, Anabaena (Chlorophyceae) and Oscillatoria (Cyanophyceae).
Fig. 3. Largest section index of Nilem fish stomach
Fig. 4. Preponderance index of Nilem fish stomach
Fig. 5. Electivity index Nilem fish
The level of preference for food in fish varies, influencing factors such as the availability of feed in nature, the size and appetite of fish for the feed [33].

The comparison between abundance and utilization of plankton by fish shows that Bacillariophyceae type plankton has an abundance and utilization of feed by high nilem fish. Bacillariophyceae plankton is a type of plankton that is most favored by nilem fish [30]. On the other hand, Euglenophyceae plankton has the most abundance after Bacillariophyceae but is the type of feed that is least preferred by nilem fish. The distinctive feature of Euglenophyceae is that it can move quickly because it has a mobile whip, and carotene cells are not encased in cellulose walls, but by protein particles like animal cells [34].

Based on the calculation of the correlation between dissolved minerals and the presence of phytoplankton carried out by CV Agri Insan Mandiri research team, there are genus of phytoplankton that correlate with the presence of these minerals and are found in the entrails of fish, namely Melosira, Pinnularia, Stauroneis, Surirella and Synedra. These genus have relatively high choice index values which are above 0.5. This value is higher than Diatoma and Navicula which are the 2 most abundant genus of Bacillariophyta in the waters. This shows that the presence of dissolved minerals affects the existence of the type of feed that is favored by nilem in Minapaddy waters.

The high presence of diatom plankton in the waters in accordance with the results of analysis of dissolved mineral content in which the content of Silica is the main element forming diatom cell walls (frustule). Silica is an element needed by diatoms, especially for the formation of cell walls. The silica element is taken by diatoms in the form of dissolved in water, namely as Si (OH)4 [31]. The abundance of diatoms in the Minapaddy waters has been successfully utilized by nilem fish seen from the preponderant index and choice index. Bacillariophyceae and Chlorophyceae classes are natural foods that are mostly used by nilem [29]. The high population of Euglenophyceae in the waters is because the plankton is not utilized by nilem fish, it can be seen from the value of the Nilem Fish Index for Euglena and Phacus plankton near -1.

4. CONCLUSION

Based on the results of this research analysis nilem fish is the right fish to be cultivated in the Talagasari Village area because the waters have physical and chemical quality of water that supports Cyprinidae fish cultivation and has characteristics of mineral content such as Ca, K, Si, and Fe that exceed normal requirements and support the survival of phytoplankton, especially the types of diatoms. The abundance of diatom plankton is well utilized by nilem fish because Bacillariophyceae phytoplankton are the main feed of nilem fish, abundant plankton phylum Euglenophyta which almost matches Bacillariophyta due to the characteristic Euglenopyta which is able to compete in the struggle for nutrients without being utilized or consumed by fish living in these waters. The lack of abundance of other plankton species such as Cyanophyta and Chlorophyta is due to the type of feed used by nilem fish, but the condition of the dissolved mineral composition supports the existence of Bacillariophyta so that Cyanophyta and Chlorophyta compete in macro nutrient struggles but are also used by nilem fish.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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