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POTENTIAL OF MILKFISH CULTIVATION AS A UTILIZATION OF PLANKTON IN BATU NAMPAR WATERS

Potensi Budidaya Ikan Bandeng Sebagai Pemanfaatan Plankton di Perairan Batu Nampar

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ABSTRACT

The waters of Ekas Bay have a high concentration of nutrients originating from fish farming activities in floating net cages. Excessive nutrients in the waters will trigger plankton blooms. Plankton growth can be controlled by providing organisms that can utilize its presence as food, one of which is milkfish. The aim of this research is to inventory/record the types of plankton in the waters of Batu Nampar and see the suitability of the existing plankton types and those that can be used as natural milkfish food. The method used in this research is the survey method. The observations focused more on data collection on plankton types. Water samples are taken and observations of other water quality parameters are carried out 3 times every month. The types of plankton inventoried at the time of the study were: *Synedra ulna*, *Fragilaria*, *Hemiaulus sinensis*, *Skeletonema costatum*, *Triceratium taves*, *Coscinodiscus granii*, *Pseudo nitzschia*, *Dytilum sol*, *Cerataulina smithii*, *Clamydocapsa* sp, *Navicula elegans*, *Aulacodiscus gracilis*, *Cydotella* sp., *Globorotolia pumilio*, *Ceratium* sp., crustacean larvae, *Pontellina plumata*. There is more plankton than Bacillariophyceae, which is a type of milkfish feed, so the waters of the Batu Nampar KJA have the potential to be used for milkfish cultivation.

ABSTRAK

Perairan Teluk Ekas mempunyai konsentrasi unsur hara yang tinggi yang berasal dari kegiatan budidaya ikan di keramba jaring apung. Nutrisi yang berlebihan di perairan akan memicu berkembangnya plankton. Pertumbuhan plankton dapat dikendalikan dengan menyediakan organisme yang dapat memanfaatkan keberadaannya sebagai makanan, salah satunya adalah ikan bandeng. Tujuan dari penelitian ini adalah untuk menginventarisasi/mencatat jenis-jenis plankton yang ada di perairan Batu Nampar dan melihat kesesuaian jenis-jenis plankton yang ada dengan yang dapat dijadikan pakan alami ikan bandeng. Metode yang digunakan dalam penelitian ini adalah metode survei. Pengamatan lebih terfokus pada pengumpulan data jenis plankton. Pengambilan sampel air dan pengamatan parameter kualitas air lainnya dilakukan 3 kali setiap bulan. Jenis plankton yang diinventarisasi pada saat penelitian adalah: *Synedra ulna*, *Fragilaria*, *Hemiaulus sinensis*, *Skeletonema costatum*, *Triceratium taves*, *Coscinodiscus granii*, *Pseudo nitzschia*, *Dytilum sol*, *Cerataulina smithii*, *Clamydocapsa* sp, *Navicula elegans*, *Aulacodiscus gracilis*, *Cydotella* sp., *Globorotolia pumilio*, *Ceratium* sp., larva krusasea, *Pontellina plumata*. Jumlah planktonnya lebih banyak dibandingkan Bacillariophyceae yang merupakan salah satu jenis pakan ikan bandeng, sehingga perairan KJA Batu Nampar berpotensi untuk dimanfaatkan untuk budidaya ikan bandeng.

Kata kunci	*Plankton, Kualitas air, nutrisi, bandeng*
Keywords	*Plankton, Water quality, nutrients, milkfish*
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INTRODUCTION

For more than two decades, Ekas Bay has been a place for cultivation using the Floating Net Karamba system. The types of biota cultivated are groupers and lobsters. Biota cultivated using the KJA system are fed with trash fish. The food provided will not be eaten by the fish, some will definitely be wasted, thereby increasing the input of organic matter in the waters. The amount of organic material that is greater than its carrying capacity will cause changes in the water quality in these waters. According to Junaidi et al., 2014, Batu Nampar waters are classified as "moderately polluted" waters based on the Storet index. Naturally, organic material comes from the excretion of cultivated biota and the death of plankton. The input of organic material that enters the waters will be broken down by detritus in the form of a complex of microorganisms into its constituent materials. The process of breaking down large organic materials into suspended organic materials can increase the turbidity value in waters. Apart from that, the results of the conversion into nutrients can support the excessive growth of plankton or what is called blooming algae.

Nutrients in Batu Nampar waters have exceeded the quality standards required in the Minister of Environment Decree No. 51 of 2004 when referring to Setyowati, et al., (2013) and Junaidi et al., (2014). Excess nutrients will make plankton grow abundantly. The fertile growth of phytoplankton will still be limited by other water quality parameters. The high number of plankton in the waters will reduce light penetration because the phytoplankton on the surface will cover the plankton below and the dynamics of the amount of dissolved oxygen will fluctuate greatly. At night until morning before there is sunlight, oxygen will be at its lowest point and during the day when sunlight is maximum, oxygen solubility reaches saturation.

Nutrients that are already present in waters can be reduced by harvesting nutrients in biomass and reducing the amount of organic material input. Harvesting nutrients in the form of biomass can be done by looking at the food chain in these waters. Nutrients are used by phytoplankton and then transferred to first-order consumers. It is impossible to harvest phytoplankton manually so harvesting is done indirectly, namely through first level consumers or biota that eat phytoplankton or herbivores.

Herbivore organisms usually have a filter feeder way of eating. These organisms can be fish and shellfish. However, to control plankton density, planktivorous fish are usually used. Planktivorous fish can be cultivated in floating net cages alongside the main cultivated fish. Planktivorous fish cultivation aims to utilize abundant phytoplankton so that it can reduce plankton abundance.

Several times fish have been used to control the growth of phytoplankton and aquatic plants in fresh waters, such as restocking sunfish in the Cirata reservoir, stocking milkfish in the Jatiluhur reservoir in 2001, 2007 and 2009 and stocking nilem fish in the Cirata reservoir. All these steps are attempted to control the trophic status of waters that are already eutrophic so that they do not become dystrophic or can become mesotrophic.

Milkfish is widely used as a harvester/utilizer of phytoplankton in both fresh and marine waters. Milkfish is a euryhaline fish or has a wide salinity range. Apart from that, milkfish is an economically important fish.

However, before introducing milkfish in the Batu Nampar KJA, it is necessary to analyze the suitability of several environmental parameters and what is no less important is the type of phytoplankton that can be utilized by milkfish. Therefore, the aim of this research is to inventory/record the types of phytoplankton in Batu Nampar waters.

RESEARCH METHODS

The method used in this research is the survey method. The observations focused more on collecting data on plankton types. Water sampling and observations of other water quality parameters are carried out 3 times every month.

Identify Plankton

Plankton enumeration is carried out using the sweep method and density is expressed in units of cells/L. Plankton types are identified using the identified book Yamaji (1976) and Omura et.a.,l (2012). Plankton will be analyzed for environmental indices by:

1. Relative Abundance (KR)

Determination of relative abundance is calculated using the formula according to Dahuri (2003) as follows:

$$\mathrm{KR} = \frac{\mathrm{a}}{\mathrm{a + b + c}} \times 100\%$$

Note :
a : The number of individuals of a particular type found
a, b, c : The total number of species found

2. Species diversity index or Shannon index (H)

This index is used to determine the biodiversity of the biota studied. The diversity index is calculated based on the Shannon & Weiner formula (Abel 1989).

$$H = \sum_{l=1}^{s} Pi \cdot LnPi \longrightarrow Pi = \frac{ni}{N}$$

Note :
Pi = the relative abundance of the i-th type of biota is 0.0 – 1.0
ni = the number of cells of a type
N = the number of cells of all types present in the sample
S = number of types of biota in the sample

The diversity results criteria (H') based on Shannon-Wiener (Krebs 1989) are:
H'≤ 3. 32 : Low diversity
3.32 <H'<9.97 : moderate diversity
H'≥ 9.97 : high diversity

3. Dominance index (D) is calculated according to Odum (1971)

This index is used to determine the dominance of the type of biota studied. Species dominance is calculated based on Simpson's dominance index formula, namely:

$$D = \Sigma (Pi^2) \quad Pi = ni / N$$

Note :
ni = number of i-th individuals
N = the number of individuals of all species in the sample

Simpson's Dominance Index criteria are divided into 3 categories (Odum, 1993):
D' = 0 – 0,30 = Low Dominance
D' = 0,31 – 0,60 = Medium Dominance
D' = 0,61 – 1,0 = High Dominance

RESULT AND DISCUSSION

Types of Plankton

From the observations, 17 types of plankton were obtained consisting of 6 classes as in Figure 2. The class most collected was Bacillariophyceae with an abundance of 325 cells/L. Bacillariophyceae is the natural food of biota that live in the sea and has a high population in brackish and marine waters and is known as diatoms. Diatom cells are coated with cell walls made from silica. Diatoms are able to carry out photosynthesis because they contain chlorophyll. In general, diatoms are divided into three orders, namely

Coscinodiscacea, diatoms which are round and have a radially symmetrical body shape, Fragilariaceae, pen diatoms without raphes which have a bilaterally symmetrical shape and Bacillariceae, pen diatoms with raphes. The genera of the Bacillariophyceae class in Batunampar waters consist of 12 and many are pennales/needle diatoms. Plankton from the Chlorophyceae class is the class with the second largest number.

The presence of the Dinophyceae class is a bad sign for aquatic resources and must be followed up to prevent blooming. This is confirmed by Cokrowati et al. (2015), that the waters of South Batunampar have the potential for the emergence of Harmful Algae Bloom's (HABs). Certain algae are a sign that the environmental balance in the waters has been damaged so that conditions only benefit certain types of algae.

Apart from plankton, phytoplankton is also collected from animal plankton/zooplankton. There are two classes that are part of the zooplankton group, namely crustacean larvae and Hexanauplia. It is thought that the crustacean larvae are the larvae of sand lobsters, which are often found in Batunampar waters. Crustacean larvae and Hexanauplia are phytoplankton utilizers or first level consumers (herbivores).

Water quality

The sampling time in Batunampar coincided with the second transition season. namely in August – September. During the transition season, the waves are very strong and cause the entire water column to mix completely. This can be seen by the high phosphate parameter values and above the required quality standards.

When viewed from the phosphorus water quality parameters, Batunampar coastal waters are included in rich of nutrient waters/fertile waters (PO4 = 0.25 mg/l) and the water quality exceeds the quality standards of Minister of Environment Decree No. 51 of 2004 which is a maximum of 0.015 mg/L.

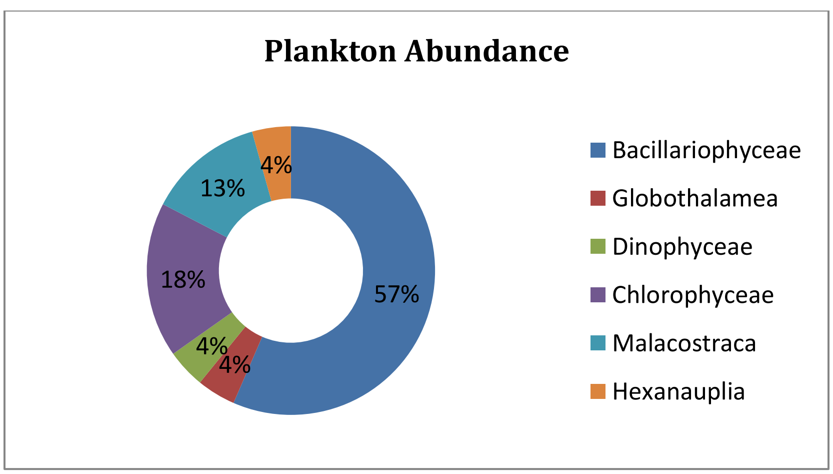

Figure 1. Class and abundance of plankton in the Batunampar KJA area

Other water quality parameters are still below quality standards (Table 2). This is different from the situation in 2012. Based on research by Junaidi et al., (2014), Ekas Bay was in the status of moderately polluted waters with 3 parameters above the quality standards, namely ammonia, nitrate and phosphate parameters.

Based on the results of the water quality analysis, there are fundamental differences in several parameters, especially nitrogen parameters (TAN and nitrate). The change in water quality from fertile waters in 2013 to moderate waters was due to the fact that in 2012-2016 the community carried out less cultivation activities using the KJA system. The sluggishness of fish farming using the KJA system is because many people have switched to catching lobster larvae which have high economic value. The small number of cultivation activities makes the waters capable of self-purification. The results of independent purification reduce parameters that were previously above quality standards because they have changed in shape and are used by purification agents. The success of independent purification is also due to the fact that there is no increase in inputs that contribute to pollution.

Table 2. Average Water Quality in the Batunampar KJA Area

No	Water Quality	Batunampar	KepMenLH No.51
1	Suhu (^{0}C)	25,8	Alami
2	Kecerahan (meter)	4	>5
2	pH	8,12	7-8,5
3	Dissolved Oxygen /DO (mg/L)	5,5	>5
4	Total Amonia Nitrat (mg/L)	0,26	0,3
5	Fosfat (mg/L)	0,03	0,015
6	Nitrat (mg/L)	0,001	0,008
7	Salinitas (ppt)	33,5	Alami

Environmental Index

The Diversity Index (H) of plankton in Batunampar is 2.64 and the Dominance index (D = 0.08). The species that have the highest diversity index are: Synedra sp., Fragilaria sp., and Clamydocapsa sp. (Table 3).

Seeing a diversity index below 3 based on Abel (1979) indicates that plankton diversity in Batunampar waters, especially the KJA area, is low. The low diversity is possible because environmental conditions do not support the life of various types of plankton. Based on Radiara and Erlania (2015) that in Ekas Bay, turbidity can reach 25.4 NTU. High turbidity values are one of the limiting factors for the diversity of phytoplankton types that grow there. High turbidity will prevent sunlight from entering the waters, if light is limited then photosynthesis will also be limited.

This condition of high turbidity also means that there is no dominant plankton. Light is a limiting factor besides nutrients on plankton diversity. Because light is energy that will be stored through the process of photosynthesis by phytoplankton which will ultimately be utilized by zooplankton or other herbivores.

Batunampar waters, especially the KJA area, are critical areas based on the environmental index which is confirmed by the quality value of the fish taken. Special handling is needed so that the level of turbidity can be reduced by adding filter feeder organisms.

Table 3. Types of plankton and environmental index in the Batunampar KJA area

Class	Family	Species	Average	H	C
Bacillariophyceae	*Diatomaceae*	*Synedra ulna*	2	0.27	0.02
Bacillariophyceae	*Fragilariaceae*	*Fragilaria*	2	0.27	0.02
Bacillariophyceae	*Hemiaulaceae*	*Hemiaulus sinensis*	0.5	0.11	0.00
Bacillariophyceae	*Skeletonemaceae*	*Skeletonema costatum*	0.5	0.11	0.00
Bacillariophyceae	*Triceratiaceae*	*Triceratium taves*	0.5	0.11	0.00
Bacillariophyceae	*Coscinodiscaceae*	*Coscinodiscus granii*	1	0.18	0.00
Bacillariophyceae	*Bacillariaceae*	*Pseudo nitzschia*	0.5	0.11	0.00
Bacillariophyceae	*Lithodesmiaceae*	*Dytilum sol*	0.5	0.11	0.00
Bacillariophyceae	*Triceratiaceae*	*Cerataulina smithii*	0.5	0.11	0.00
Chlorophyceae	*Gloeocystaceae*	*Clamydocapsa sp*	2	0.27	0.02
Bacillariophyceae	*Naviculaceae*	*Navicula elegans*	1	0.18	0.00
Bacillariophyceae	*Aulacodiscaceae*	*Aulacodiscus gracilis*	0.5	0.11	0.00
Bacillariophyceae	*Stephanodiscaceae*	*Cydotella sp*	0.5	0.11	0.00
Globothalamea	*Globorotaliidae*	*Globorotolia pumilio*	0.5	0.11	0.00
Dinophyceae	*Ceratiaceae*	*Ceratium sp*	0.5	0.11	0.00
Malacostraca	*Palinuridae*	*larva crustacea*	1.5	0.23	0.01
Hexanauplia	*Pontellidae*	*Pontellina plumata*	0.5	0.11	0.00
		Amount	15	2.64	0.08

Compatibility of Phytoplankton with Milkfish Types

The most common type of phytoplankton found in Batunampar is diatoms. Diatoms are the phytoplankton most often found in Indonesian waters (Nontji, 2008). The large number of diatoms in waters is because they have the ability to adapt to the environment, are cosmopolitan, and are resistant to extreme conditions and have high reproductive power (Odum, 1971).

Based on Triyanto et al., 2014, the diet of milkfish varies from phytoplankton which is dominated by the Cyanophyceae class, namely 10.05-31.12%, while zooplankton is dominated by the Copepoda class (3.33-27.79%). The type of milkfish food varies depending on its life stage and habitat. It was stated that the main food of adult milkfish consists of benthic and planktonic organisms consisting of gastropods, lamellibranchia, foraminifera, filamentous algae, diatoms, copepods, nematodes and detritus. The results of research by Lückstädt & Reiti (2002) on the eating habits of juvenile milkfish in brackish water lagoons in Kiribati during the day and at night did not show any differences. The results of food analysis in the fish's stomach show that the type of food consists of Chloropyhta, Cyanophyceae, Bacillariophyceae, Diatoms, Crustacea, and detritus.

The abundance of Bacillariophyceae is 325 cells/L which can be utilized by milkfish plus the presence of crustacean larvae. However, low abundance indicated by a low dominance index does not necessarily mean that milkfish are able to survive with a good growth rate. So further research is needed on the growth rate of milkfish cultivated in KJA to utilize plankton, especially phytoplankton in Batunampar waters.

CONCLUSION

The conclusions from the research results are:

1. The types of plankton that were inventoried at the time of the research were: *Synedra ulna, Fragilaria, Hemiaulus sinensis, Skeletonema costatum, Triceratium taves, Coscinodiscus granii, Pseudo nitzschia, Dytilum sol, Cerataulina smithii, Clamydocapsa* sp*, Navicula elegans, Aulacodiscus gracilis, Cydotella* sp*., Globorotolia pumilio, Ceratium* sp*., crustacean larvae, Pontellina plumata*
2. There are more plankton than Bacillariophyceae which is a type of food for milkfish.

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