Original Research Article

Distribution and Community StructureofMollusca in Jatigede Reservoir Sumedang, as Natural Feed Materials

ABSTRACT

Jatigede Reservoir is located in Sumedang Regency, West Java Province, and was built by damming the Cimanuk River. Mollusca live in shallow waters and can be found around the Jatigede Reservoir. Mollusca have minimal movement, so they tend to settle in their habitat, attaching to substrates such as rocks, plants, and soil surfaces. Mollusca can serve as indicators of water quality and can be utilized as natural feed materials due to their significant nutritional content. The research aims to analyze the distribution and community structure of mollusca around Jatigede Reservoir, Sumedang, as alternative feed materials. This study was conducted at Jatigede Reservoir, Sumedang Regency, West Java from January to February 2024. Mollusca sampling was carried out using the square transect method, consisting of 3 plots measuring 1 x 1 m^2 at 5 research stations with 4 repetitions. Data analysis in this study used quantitative descriptive analysis. The results showed that the mollusca community structure in Jatigede Reservoir, Sumedang, had Shannon-Whienner diversity index (H') values ranging from 0 - 1.08, categorized as low to moderate diversity. Evenness index (E) values ranged from 0 - 0.76, categorized as low to high evenness. Dominance index values ranged from 0.42 - 1, categorized as moderate to high dominance. Each research station was dominated by the species *Filopaludinajavanica*. Based on the water quality index (FBI), Jatigede Reservoir, Sumedang, is categorized as slightly poor to poor with values ranging from 6 - 6.57. Species found during the study include *Filopaludinajavanica*, *Pilsbryoconchaexilis*, *Anodonta woodiana*, *Thiara scabra*, and *Indoplanorbisexustus*. Species that can be used as alternative feed materials or supplementary feed materials include *Filopaludinajavanica*.

Keywords: Mollusca, Abundance, Diversity, Dominance, Pollution Status, Feed Materials.

1. INTRODUCTION

Jatigede Reservoir is located in Sumedang Regency, West Java Province, and was built by damming the Cimanuk River. Physically, this reservoir was constructed starting in 2010 and completed in 2015 with an area of approximately 4,122 hectares.The Jatigede Reservoir inundates five districts, namely Jatigede, Jatinunggal, Wado, Darmaraja, and Cisitu[1]. The reservoir area can be utilized for various fisheries activities due to its significant resource potential, one of which is as a location for fish farming. The cultivation activities carried out include fish farming in floating net cages (FNC).

Feed is an important factor in fish farming activities. Feeds consist of natural and artificial feeds. Natural feeds are still not widely utilized due to their limited availability. However, natural feeds can be cultivated by considering growth factors such as temperature, light intensity, and organic content. Types of natural feeds include plankton, benthos, aquatic plants, and fish.

Mollusca are soft-bodied, slimy animals that lack segments. Their body structure is diverse and bilaterally symmetrical, and some possess shells. Of the seven classes of mollusks, 80% are gastropods, 15% are bivalves, and the remaining are phyla polyplacophora, cephalopods, scaphopods, aplacophorans, and monoplacophorans. Mollusca inhabit shallow waters and can be found around the Jatigede reservoir. Mollusca movement is very limited, tending to settle in their habitats, such as adhering to substrates such as rocks, plants, and also on the soil surface. The presence of mollusca in Jatigede Reservoir can be utilized as feed due to their sufficient nutritional content. *Tutut* contains 10.7% protein, 0.06% fat, 129.2 mg/100g calcium, 60.5 mg/100g phosphorus, and 10.2 mg/100g iron[2]. The protein content in *Keong Bakau* is 12.16%, with 0.38% fat, essential amino acids like glutamate at 1.2%, and non-essential amino acids like histidine at 1.56%[3].

Feed costs reach 60-80% of the total production costs in intensive farming activities. Limited feed availability and high prices are inhibiting factors in efforts to increase fish production. As a result, the production obtained does not meet expectations [4].

The nutritional content of mollusca can enhance weight growth in fish and shrimp. Feed with high digestibility and growth-promoting properties will lead to greater feed efficiency. This is consistent with the research by Gideon *et al*. [5], feed containing mollusca flour results in a feed efficiency value of 85.72%. Besides benefiting aquaculture, the nutritional content of mollusca can also enhance livestock production, such as duck. High egg production is influenced by the high energy content in the feed. The protein content in *Keong Mas* is 44-46.2%. The energy requirement for laying ducks is 2,700 kcal/kg, while feed containing *Keong Mas* and *Rajungan* has higher energy, ranging from 2,742.30 to 2,776.80 kcal/kg[6].

Based on this background, research is needed to determine and identify the distribution and community structure of mollusca in Jatigede Reservoir, Sumedang, as an alternative feed material.

2. METHODS

2.1 Location

The study was conducted from January to February 2024 at the Jatigede Reservoir. Sampling was carried out four times at five observation stations with a two-week interval. The research stations consisted of five stations in Darmaraja District based on topography, mollusca availability, and fishing activities.Sukamenak Village is located at coordinates 6°55'53.56" S dan 108° 5'15.47"E, Sukaratu Village is located at coordinates 6°55'14.57" S dan 108° 4'49.74"E, Tarunajaya Village is located at coordinates 6°54'13.57" S dan 108° 4'33.78"E, Karang Pakuan Village is located at coordinates 6°53'30.32" S dan 108° 4'15.85"E, and Paku Alam Village is located at coordinates 6°53'4.74" S dan 108° 4'29.75"E (**Figure 1**).

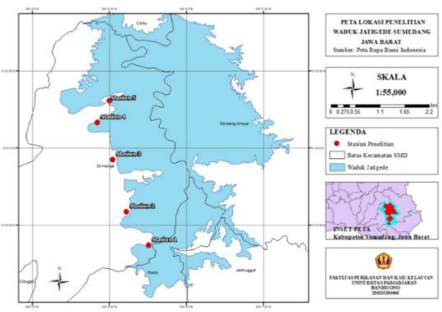

Fig.1. Research Location

2.2 Sampling

Mollusca sampling was conducted using the transect quadrat method. A transect is a straight line drawn across the water surface, while a quadrat is a square frame placed along this line [7]. Each transect line consisted of 3 plots measuring 1 x 1 m², installed alternately. Mollusca samples were directly collected using a scoop in each plot. The collected mollusca were then preserved in ziplock plastic bags containing 4% formalin solution and identified using the identification guide "*Recent & Fossil Indonesian Shells*" (Dharma 2005).

Substrate samples were collected using a scoop at a depth of 5-10 cm. The samples were placed in ziplock plastic bags, labeled, and analyzed in the laboratory. Water quality measurements were conducted in situ, including temperature, acidity (pH), and dissolved oxygen (DO). Measurements were repeated three times at each observation station simultaneously with mollusk and substrate sampling.

2.3 Data Analysis

The analysis of mollusca community structure was conducted through calculations of density index, diversity index, evenness index, dominance index, and Family Biotic Index (FBI).

2.3.1 Density Index

Species density refers to the number of individuals per unit area of observation [8]. The formula for calculating mollusca density according to Krebs (1989) as cited in Aditya and Nugraha[8]:

$$\mathbf{D} = \frac{\mathbf{n}}{\mathbf{A}}$$

Explanation:
D : Individual density (ind/m^2)
N : Number of individuals (ind)
A : Area of sample collection square (m^2)

2.3.2 Diversity Index

The diversity index aims to assess the condition of mollusca and ecosystems. This index can be calculated using the Shannon-Wiener Diversity Index (H') formula proposed by Shannon and Wiener in 1963 (Brower and Zar, 1977, as cited inAditya and Nugraha[8]:

$$\mathbf{H'} = -\sum_{t=1}^{s} \mathbf{pi\ Ln\ Pi}$$

Explanation:
H' : Diversity Index
Pi : Proportion of the number of individuals of species i to the total number of individuals(pi = Ni/N)
N : Total number of individuals of each species
Ni : Total number of individuals of species i
s : Number of species (individuals)

2.3.3 Evenness Index

The evenness index (E) aims to assess the distribution pattern of biota in an ecosystem, indicating whether it is uniform or not. The distribution of aquatic biota is considered uniform when the evenness index is high. The evenness index can be calculated using the formula proposed by Krebs in 1985, as cited in Sidik[9]:

$$\mathbf{E} = \frac{\mathbf{H'}}{\mathbf{H\ max}}$$

Explanation:
E' : Evenness Index
H' : Diversity Index
H max : Maximum species evenness (Log_2(s))
S : The number of species found

2.3.4 Dominance Index

The dominance index is used to provide an overview of the dominance or dominance of certain species in a community [10]. The Dominance Index is calculated using Simpson's index of dominance formula (Bakus, 2007, as cited in Aditya and Nugraha[8]:

$$\mathbf{D} = \frac{\sum \mathbf{ni\ (ni - 1)}}{\mathbf{N\ (N - 1)}}$$

Explanation:
D : Dominance Index
ni : Total number of individuals of the first species (ind)
N : Total number of individuals from all species (ind)

2.3.5 Family Biotic Index (FBI)

The Family Biotic Index (FBI) is a method used to calculate pollution levels using macroinvertebrate indicators based on their families [11]. The FBI value can be calculated using the formula by Hilsenhoff (1988) as cited in Rustiasih[11]:

$$\mathbf{FBI} = \sum \frac{\boldsymbol{Xi} \ \mathbf{x}\ \boldsymbol{ti}}{\mathbf{N}}$$

Explanation:
FBI : *Family Biotic Index*
Xi : Total number of individuals in the family group (ind)
N : Total number of individuals from all species (ind)

The interpretation of FBI values to determine water quality is categorized according to Hilsenhoff (1988), as shown in **Table1**.

Table 1. Water Quality based on FBI Value

FBI	Water Quality	Pollution Level
0,00-3,75	Excellent	Not polluted by organic matter
3,76-4,25	Very good	Slightly polluted by organic matter
4,26-5,00	Good	Contaminated by some organic matter
5,01-5,75	Fairly good	Contaminated by quite a bit of organic matter
5,76-6,50	Fairly poor	Contaminated by a lot of organic matter
6,51-7,25	Poor	Heavily contaminated by organic matter
7,25-10,00	Very poor	Severely contaminated by organic matter

3. RESULTS AND DISCUSSION

The study was conducted during the rainy season, increasing water volume by approximately 2-5 meters at all stations during the research. This had an impact on the types of mollusca found. According to Shalihah[12], depth influences temperature and brightness, thus affecting the distribution of mollusca.

3.1 Water Quality

The measured parameters include temperature, acidity level (pH), and dissolved oxygen (DO).The physical and chemical water parameters data for the Jatigede Reservoir during the research can be seen in **Table 2**.

Table 2. The Water Quality of Jatigede Reservoir

Stasiun	Temperature □	pH	DO (Mg/l)
1	27,83-32,67	5,63 – 8,14	5,33 – 8,47
2	28,8 – 32	6,97 – 8,6	4,57 – 7,13
3	28,73 – 32,27	7,37 – 8,24	4,6 – 6,07
4	29,4 – 33,43	6,63 – 8,1	4,67 – 6,53
5	29,53 – 33,2	7,03 – 7,57	5,07 – 6,7

The water temperature of Jatigede Reservoir during the research ranged from 27.83 to 33.43°C. The lowest average temperature was found at station 1, at 30.08 ± 2.07°C, while the highest average temperature was recorded at station 4, at 31.68 ± 2.5°C. According to Wulandari [13], the water temperature of Jatigede Reservoir tends to be warm, ranging from 28.8 to 29.7°C. The optimal temperature for the growth of macrozoobenthos is between 25 and 31°C [14].

The pH values in Jatigede Reservoir overall range from 5,63 to 8,6. The lowest average pH value is found at station 1, at 6.82 ± 1.34, while the highest average pH value is recorded at station 3, at 7.83 ± 0.45. These findings are not significantly different from those of Fitriadi[15], who reported pH values in Jatigede Reservoir ranging from 7.35 to 7.51.The optimal pH range for the life of mollusks is between 5.7 and 8.4 [16].Station3 has the highest average pH value due to agricultural and anthropogenic activities such as vehicle washing around the reservoir area. An increase in pH towards the basic side can be attributed to the entry of materials containing hydroxyl groups[16]. Additionally, high organic matter content can lead to elevated water pH levels. pH affects the activities and life of microorganisms because high pH is used in the decomposition process of organic matter[17].

The Dissolved Oxygen (DO) values overall range from 4.57 to 8.47 mg/L. The lowest average dissolved oxygen value is found at station 3, at 5.07 ± 0.68 mg/L, while the highest average value is recorded at station 1, at 6.54 ± 1.38 mg/L.The dissolved oxygen levels in Jatigede Reservoir have values greater than 4, indicating that the dissolved oxygen conditions in the waters of Jatigede Reservoir are still tolerable for the life of mollusca.

3.2 Density Index

Based on the study results, five species of mollusca were identified: *Filopaludinajavanica, Pilsbryoconchaexilis, Anodonta woodiana, Thiara scabra*, and *Indoplanorbisexustus*. The data on mollusca density in Jatigede Reservoir can be seen in **Table 3**.

Table 3. Density Index of Mollusca in Jatigede Reservoir

No	Species	Density (Ind/m^2)					Number of Individuals
		Station 1	Station 2	Station 3	Station 4	Station 5	
1	*Filopaludina javanica*	77	34	147	156	201	**615**
2	*Pilsbryoconcha exilis*	23	-	-	-	-	**23**
3	*Anodonta woodiana*	13	-	-	-	-	**13**
4	*Thiara scabra*	14	-	-	-	-	**14**
5	*Indoplanorbis exustus*	-	3	-	-	-	**3**
	TOTAL	**127**	**37**	**147**	**156**	**201**	**668**

Station 1 has a density value of 127 ind/m², consisting of 77 ind/m² Filopaludinajavanica, 23 ind/m² Pilsbryoconchaexilis, 13 ind/m² Anodonta woodiana, and 14 ind/m² Thiara scabra. Station 2 has a density value of 37 ind/m², consisting of 34 ind/m² Filopaludinajavanica and 3 ind/m² Indoplanorbisexustus. Meanwhile, stations 3-5 consist of only one species, Filopaludinajavanica, with densities of 147 ind/m², 156 ind/m², and 201 ind/m², respectively.

Based on the results, the lowest density is found at station 2, with 37 ind/m², while the highest density is found at station 5, with 201 ind/m². Mollusca density is influenced by the content of organic matter, substrate type, and environmental conditions. Station 2 is characterized by a muddy clay substrate, whereas station 5 is characterized by a sandy clay substrate. The substrate type is crucial for the development of benthic organisms. Sandy substrate contains more oxygen and facilitates mollusca movement to other areas. In contrast, muddy substrate contains less oxygen, requiring organisms to adapt to such conditions[18].

3.3 Diversity Index

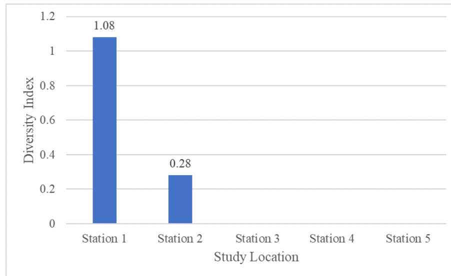

Fig. 2. The Shannon-Whienner DIversity Index

Based on the results, the Shannon-Wiener diversity index (H') of mollusca in Jatigede Reservoir is lowest at stations 3, 4, and 5, with a value of 0. Station 2 has a diversity index value of 0.28, while station 1 has the highest diversity index value at 1.08. Thus, it can be concluded that the diversity index of mollusca in Jatigede Reservoir falls within the category of low to moderate diversity index.

The high diversity index at station 1 indicates favorable environmental conditions for mollusca life. This is also evident from the high dissolved oxygen content at this station. Low diversity index values indicate that the water is dominated by a single species, or the ecosystem is unstable due to organic pollution originating from fishing activities at stations 2, 3, and 4; agricultural activities at stations 3 and 4; boat traffic at stations 2 and 3; and anthropogenic activities at stations 3, 4, and 5, limiting the presence of only a few mollusca species in the water. Additionally, according to Lutfi [19], the low species diversity may also result from habitat mismatch.

3.4 Evenness Index

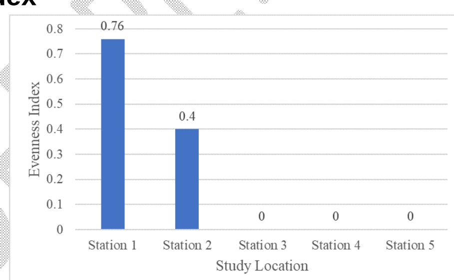

Fig. 3. The Evenness Indeks of Molluscain Jatigede Reservoir

The evenness index (E) of mollusca in Jatigede Reservoir is lowest at stations 3, 4, and 5, with a value of 0. Station 2 has aevenness index value of 0.4, while station 1 has the highest evenness index value at 0.76. The evenness values of mollusks in Jatigede Reservoir overall fall into the low category, except for station 1, which falls into the high category. The high diversity at station 1 results in a high evenness index, as it has a muddy clay substrate rich in organic matter, which serves as a food source for mollusca. According to Sukawati[20], organic matter suspended in the substrate is the main food source for clams. The conditions at stations 2-5 indicate that these areas are starting to experience pressure due to environmental changes resulting from various activities such as fishing, agriculture, and anthropogenic activities. Environmental pressure is beginning to appear at station 1 as well, although it does not directly affect it.

3.5 Dominance Index

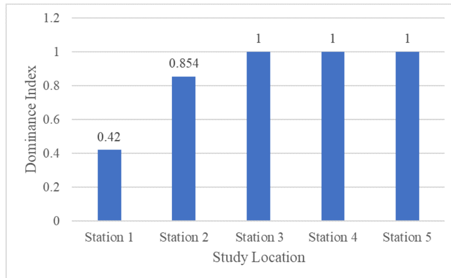

Fig.4. Dominance Index of Mollusca in Jatigede Reservoir

The dominance index of mollusca in Jatigede Reservoir is lowest at station 1, at 0.42. Station 2 has a dominance index value of 0.854, while the highest dominance index is found at stations 3, 4, and 5, at 1. According to Sidik[9], station 1 falls into the moderate dominance category, while stations 2-5 fall into the high dominance category. *Filopaludinajavanica* is the dominant species and can be found at all research stations, with the highest dominance occurring at stations 2-5. The dominance is due to highly favorable environmental conditions that support the growth and development of the apple snail. *Filopaludinajavanica*, or commonly known as the *keongtutut*, is a mollusca capable of living in various habitats and is widely distributed due to its high adaptability [21].

3.6 Family Biotic Index

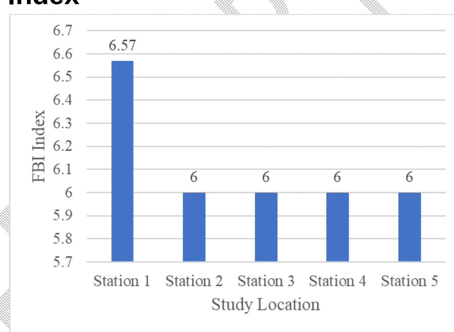

Fig.5. Family Biotic Index

The FBI values at all five stations range from 6 to 6.57. Station 1 has an FBI value of 6.57, while stations 2, 3, 4, and 5 have the same FBI value of 6. The interpretation of water quality based on the FBI according to Hilsenhoff (1988) in Rustiasih[11] categorizes station 1 as having poor water quality with a high level of pollution due to significant organic contamination. Meanwhile, stations 2-5 are classified as having slightly poor water quality with a moderate level of organic pollution. Overall, based on the FBI Index, the water quality of Jatigede Reservoir is considered slightly poor due to the significant organic contamination originating from agricultural, farming, fishing, and anthropogenic activities surrounding the reservoir. According to Akbar [22], FBI values indicating poor water quality are greatly influenced by the high levels of pollutants entering the water. Each family has different threshold values for pollutants. Macrozoobenthos families have high tolerance values as they are resistant to pollution levels, while families sensitive to pollution have low tolerance values.

3.7 Substrate

The substrate parameter data can be seen in **Table 4**.The pH values of the substrate overall are slightly acidic, with only station 5 being neutral. According to Martuti [23], substrates with a pH between 6 - 7 are considered fairly neutral, although slight acidity can still be tolerated or considered sufficiently conducive for mollusca development. Excessive substrate acidity can render it highly sensitive to biological processes such as organic matter decomposition by macrozoobenthos.

The organic matter content at stations 1 and 5 is higher compared to the other stations. This is because station 1 is an area with fishing activities and agriculture, while station 5 is close to residential areas. The organic content in the substrate originates from plant and animal detritus or from natural and anthropogenic sources. Organic matter from the land enters the water through river flow and rainwater runoff [24].

The nitrate content ranges from 0.04% to 1.13%, while the phosphate content ranges from 0.36% to 0.68%. Nitrate and phosphate are essential nutrients that play a crucial role in the growth and metabolism of plants and serve as indicators of water quality [25]

Table 4. pH Substrate, C-Organik, Nitrat and Posfat

Stasiun	Parameter Substrat			
	pH	C-Organic (%)	Nitrate (%)	Phosphate (%)
1	6,25	2,82	0,04	0,53
2	6,22	1,4	0,12	0,5
3	6,09	1,68	0,04	0,44
4	6,05	1,67	0,13	0,68
5	6,83	2,44	0,05	0,36

Table 5. Texture Substrate

Station	Result			Texture Substrate
	Sand (%)	Silt (%)	Clay (%)	
1	2	67	31	Silty clay loam
2	11	63	26	Silty loam
3	9	68	23	Silty loam
4	5	65	30	Silty clay loam
5	70	29	1	Sandy loam
Average	19,4	58,4	22,2	-

All five stations have clay substrate content (**Table 5**). Clay has a high organic matter content, thus allowing the presence of mollusks in the water. This is because mollusca require organic matter for their survival. Additionally, substrates with sand, mud, and clay content are highly suitable as mollusca habitats [26].

Sandy substrate contains less organic matter compared to muddy substrate. The fine texture of mud with small particles facilitates the absorption of organic matter because fine particles have a large surface area, thus capable of retaining more dissolved organic matter [18]. Sandy substrate has higher oxygen content but fewer nutrients compared to fine substrate. This is because sandy substrate allows for good oxidation due to the presence of larger pore water, resulting in organic matter being quickly depleted [27]. In fine substrate, although oxygen content is low, nutrient content is high [26].

4. CONCLUSION

Based on the results of the research that has been carried out, it can be concluded that:

1. The mollusca species Filopaludina javanica is distributed across all stations, while Pilsbryoconcha exilis, Anodonta woodiana, and Thiara scabra are only found at station 1, and Indoplanorbis exustus is only found at station 2.
2. The mollusca community structure in Jatigede Reservoir, Sumedang, exhibits Shannon-Wiener diversity index (H') values ranging from 0 to 1.08, which fall into the category of low to moderate diversity. The evanness index (E) values range from 0 to 0.76, indicating low to high evanness. The dominance index values range from 0.42 to 1, indicating moderate to high dominance. Each research station is dominated by the species Filopaludina javanica. Based on the FBI values, the water quality of Jatigede Reservoir, Sumedang, falls into the category of slightly poor to poor, with values ranging from 6 to 6.57, indicating significant organic pollution in the reservoir water.

REFERENCES

[1] A. Nurhayati, T. Herawati, W. Lili, A. Yustiati, and I. Nurruhwati, "Study of the Socio-Economic and Environmental Value of Capture Fisheries Resources in the Jatigede Reservoir, Sumedang Regency, West Java Province," J. Penyul., vol. 16, no. 1, pp. 122–133, 2020, doi: 10.25015/16202025262.

[2] L. R. Tanjung, "Lake Maninjau Molluscs: Nutritional Content and Economic Potential," LIMNOTEK Perair. Trop Land. in Indonesia., vol. 22, no. 2, pp. 188–128, 2015.

[3] H. P. E. Sari, S. P. Febri, K. A. Putri, A. Y. Persada, and I. R. Aprita, "Utilization of Mangrove Snail Pests (Telescopium Telescopium) as Alternative Feed in a Group of Farmers in Alue Kumba Village, East Aceh," SELAPARANG J. Pengabdi. Masy. Progress, vol. 6, no. 4, p. 2007, 2022, doi: 10.31764/jpmb.v6i4.10933.

[4] R. M. Nanariain, C. Lumenta, and H. Pangkey, "Utilization of Plantain Peel Flour (Musa paradisiaca) in the Formulation of Tilapia (Oreochromis niloticus) Feed," Budid. Waters., vol. 5, no. 1, pp. 21–31, 2017.

[5] W. Gideon, Yulisman, and A. D. Sasanti, "Use of Kijing Meal (Pilsbryoconcha Sp.) as a Substitute for Fish Meal in the Formulation of Siamese Catfish (Pangasius hypopthalmus) Feed," J. Rawa Indonesian Aquaculture., vol. 2, no. 2, pp. 215–224, 2014.

[6] N. Nurjannah, S. Yanto, and P. Patang, "Pemanfaatan Keong Mas (*Pomacea canaliculata* L) dan Limbah Cangkang Rajungan (*Portunus pelagicus*) Menjadi Pakan Ternak untuk Meningkatkan Produksi Telur Itik," *J. Pendidik. Teknol. Pertan.*, vol. 3, no. 2, pp. 137–147, 2017, doi: 10.26858/jptp.v3i2.5525.

[7] R. Nurmasari, A. H. A. Putri, S. Rosmaida, U. Nurkhalifah, and F. Ramadhan, "Identification of Water Cover and Conditions in the Seagrass Ecosystem on Tidung Kecil Island," J. Teknol. Fisheries. and Marine., vol. 14, no. 1, pp. 25–32, 2023, doi: 10.24319/jtpk.14.25-32.

[8] I. Aditya and W. A. Nugraha, "Gastropod Community Structure in the Mangrove Ecosystem in Pancer Cengkrong, Trenggalek Regency," Juv. Ilm. To the sea. and Fisheries., vol. 1, no. 2, pp. 210–219, 2020, doi: 10.21107/juvenil.v1i2.7575.

[9] R. Y. Sidik, I. Dewiyanti, and C. Octavina, "Macrozoobenthos Community Structure in Several River Estuaries, Susoh District, Southwest Aceh Regency," J. Ilm. Ms. To the sea. and Fisheries. Unsyiah, vol. 1, no. 2, pp. 287–296, 2016.

[10] S. Rejeki, Irwani, and F. M. Hisyam, "Fish Community Structure in the Mangrove Ecosystem in Bedono Village, Sayung, Demak," Bul. Oceanography Mar., vol. 2, no. 4, pp. 78–86, 2013.

[11] E. Rustiasih, I. W. Arthana, and A. H. W. Sari, "Diversity and Abundance of

Macroinvertebrates as Biomonitoring of Tukad Badung Water Quality, Bali," Curr. Trends Aquat. Sci., vol. 1, no. 1, pp. 16–23, 2018, doi: 10.24843/ctas.2018.v01.i01.p03.
[12] H. N. Shalihah, P. W. Purnomo, and N. Widyorini, "Diversity of Molluscs Based on Sediment Texture and Organic Material Content at the Betahwalang River Estuary, Demak Regency," SAINTEK Fisheries. Indonesia. J. Fish. Sci. Technol., vol. 13, no. 1, pp. 58–64, 2017, doi: 10.14710/ijfst.13.1.58-64.
[13] D. Y. Wulandari, N. TM Pratiwi, F. Nur Rizqi, I. Puspa Ayu, and A. Iswantari, "Plankton Community Structure and Water Quality Assessment of Jatigede Reservoir, Sumedang, West Java," J. Biol. Indonesia., vol. 19, no. 1, pp. 35–42, 2023, doi: 10.47349/jbi/19012023/205.
[14] M. N. Supriyanto, Jailani, and P. Taru, "Macrozoobenthic Community Structure in Seagrass Meadows in the Bay Waters of Balikpapan City, East Kalimantan," Trop. Aquat. Sci., vol. 2, no. 2, pp. 161–169, 2023.
[15] R. Fitriadi, N. T. M. Pratiwi, and R. Kurnia, "Phytoplankton Community and Nutrient Concentration in Jatigede Reservoir," J. Agricultural Science. Indonesia., vol. 26, no. 1, pp. 143–150, 2021, doi: 10.18343/jipi.26.1.143.
[16] M. S. Syawal, Y. Wardiatno, and S. Hariyadi, "The Effect of Anthropogenic Activities on Water Quality, Sediments and Molluscs in Lake Maninjau, West Sumatra," J. Biol. Trop., vol. 16, no. 1, pp. 1–14, 2016.
[17] P. W. Purnomo, P. Soedarsono, and M. N. Putri, "Vertical Profile of Water Base Organic Material with Different Utilization Backgrounds in Rawa Pening," J. Manag. Aquat. Resour., vol. 2, no. 23, pp. 27–36, 2013.
[18] S. L. Simanjuntak, M. R. Muskananfola, and W. T. Taufani, "Analysis of Sediment Texture and Organic Material on the Abundance of Macrozoobenthos in the Jajar River Estuary, Demak," Manag. Aquat. Resort. J., vol. 7, no. 4, pp. 423–430, 2018, doi: 10.14710/marj.v7i4.22665.
[19] A. Lutfi, W. P. Pramudita, N. Khotimah, N. Afifah, and Setyoko, "Diversity of Mollusk Communities in the Mangrove Forest Area of Pulau Dua Region, Banten Province," J. Natural and Environmental Sciences., vol. 14, no. 1, pp. 25–32, 2023.
[20] N. K. A. Sukawati, I. W. Restu, and S. A. Saraswati, "Distribution and Structure of Mollusk Communities on Mertasari Beach, Denpasar City, Bali Province," J. Mar. Aquat. Sci., vol. 4, no. 1, pp. 78–85, 2018, doi: 10.24843/jmas.2018.v4.i01.78-85.
[21] R. M. Marwoto and N. R. Isnaningsih, "Overview of Freshwater Mollusk Diversity in Several Sites in the Ciliwung - Cisadane Watershed," Ber. Biol., vol. 13, no. 2, pp. 181–189, 2014.
[22] S. S. Akbar, "Identification of Types and Abundance of Microplastics in the Water of the Brantas River, Sidoarjo Regency, East Java," Environmental Pollut. J., vol. 1, no. 3, pp. 229–236, 2021.
[23] N. K. T. Martuti and G. W. Rahmadhani, "Keanekaragaman makrozoobentos di sekitar alat pemecah ombak wilayah pesisir Kota Semarang sebagai data awal upaya konservasi," *Indones. J. Math. Nat. Sci.*, vol. 46, no. 2, pp. 74–82, 2023.
[24] J. Jamaludin, S. Sedjati, and E. Supriyantini, "Organic Material Content and Sediment Characteristics in Betahwalang Waters, Demak," Bul. Oceanography Mar., vol. 10, no. 2, pp. 143–150, 2021, doi: 10.14710/buloma.v10i2.30046.
[25] A. F. Azzahra, M. Munasik, and A. Djunaedi, "Nitrate (NO3-) and Phosphate (PO4-3) Content in Sediment on Seagrass Cover Conditions on Prawean Beach, Jepara," J. Mar. Res., vol. 11, no. 4, pp. 648–656, 2022, doi: 10.14710/jmr.v11i4.33924.
[26] Magfirah, Emiyarti, L. O. Muh, and Y. Haya, "Sediment Characteristics and Their Relationship with Macrozoobenthos Community Structure in the Tahi Ite River, Rarowatu District, Bombana Regency, Southeast Sulawesi," J. Mina Laut Indones., vol. 4, no. 14, pp. 117–131, 2014.
[27] N. Simanjuntak, Rifardi, and A. Tanjung, "Relationship of sediment characteristics and sediment organic matter with the abundance of blood clams (Anadara granosa) in

the waters of Tanjung Balai Asahan, North Sumatra Province," J. Perikan. and Marine., vol. 25, no. 1, pp. 6–17, 2020.