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Analysis of Water Quality Parameters of Mangrove Waters Aek Horsik Village Tapanuli Tengah District for Fishery Cultivation

Analisis Parameter Kualitas Perairan Mangrove Desa Aek Horsik Kabupaten Tapanuli Tengah untuk Budidaya Perikanan

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Abstract

Water quality is a condition of water based on physical, chemical, and biological properties that suit the needs of aquatic organisms and humans, such as water quality in fisheries, agriculture, drinking water, hospitals, and industry. This research aims to analyze the feasibility of water quality parameters for mangrove waters in AekHorsik village, Tapanuli Tengah Regency, as a location for developing fisheries cultivation. The research method used is a descriptive method with quantitative data analysis. The results of this research show that the chemical parameters obtained were pH (7.3-7.9 ppt), salinity (12-22 ppt), ammonia (0.25-0.29 mg/L), and DO (5.0-55 ppm). The physical parameters obtained are temperature (30-32^{o}C), brightness (0.53-0.95 m), current speed (0.05-0.08 m/sec), and depth (0.53-0.95 m). The biological parameters obtained were phytoplankton abundance of 3,400-6,100 14,450 ind/L and macrozobenthos abundance of 104.9-179.0 ind/m^2. Based on these results, it can be seen that the water quality parameters of mangrove waters in AekHorsik village, Tapanuli Tengah Regency, are suitable as a location for developing fisheries cultivation.

Keywords: Forest Mangrove, Chemistry, Physics, Biology

Abstrak

Kualitas air adalah suatu kondisi air berdasarkan sifat fisik, kimia, dan biologi yang sesuai dengan kebutuhan organisme perairan dan manusia, seperti kualitas air pada perikanan, pertanian, air minum, rumah sakit, dan industri. Penelitian ini bertujuan untuk menganalisis kelayakan parameter kualitas air perairan mangrove di desa AekHorsik Kabupaten Tapanuli Tengah sebagai lokasi pengembangan budidaya perikanan. Metode penelitian yang digunakan adalah metode deskriptif dengan analisis data kuantitatif. Hasil penelitian menunjukkan parameter kimia yang diperoleh adalah pH (7,3-7,9 ppt), salinitas (12-22 ppt), amonia (0,25-0,29 mg/L) dan DO (5,0-55 ppm). Parameter fisik yang diperoleh adalah suhu (30-32^{O}C.), kecerahan (0,53-0,95 m), kecepatan arus (0,05-0,08 m/s) dan kedalaman (0,53-0,95 m). Parameter biologi yang diperoleh adalah kelimpahan fitoplankton sebesar 3.400-6.100 14.450 ind/L dan kelimpahan makrozoobentos sebesar 104,9-179,0 ind/m^2. Berdasarkan hasil tersebut dapat diketahui bahwa parameter kualitas air perairan mangrove di desa AekHorsik Kabupaten Tapanuli Tengah layak dijadikan lokasi pengembangan budidaya perikanan.

Kata kunci: Hutan Mangrove, Kimia, Fisika, Biologi

1. Introduction

North Sumatra Province is one of Indonesia's provinces with a mangrove forest area of 36,000 ha in 2014. The Tapanuli Tengah region is one of the regions in North Sumatra, located at coordinates 1^{O}11'00"-2^{O}22'00" LU and 9^{O}07'00"-98^{O}12' 00" BT. In the Tapanuli Tengah district, the mangrove forest area is 6,931 ha, the water area is ±1,011 ha, and the canopy condition is approximately 75% good (Unedo et al., 2020). Mangrove ecosystems or mangrove forests can be defined as ecosystems with extreme physical factors, namely habitats flooded with high salinity water along the banks and rivers with muddy soil (Herianto & Subiandono, 2016). Mangrove forests are tropical natural resources with many social, economic, and ecological benefits. The waters are unique because the organisms in these waters must have a high capacity or tolerance for these characteristics. Mangrove forests are identical to brackish water formed when sea and river water meet because they have unique chemical, physical, and biological properties.

AekHorsik Village is a coastal area with very large mangrove waters. Mangrove waters are a very important source for meeting the livelihood needs of the people of AekHorsik village, both through harvests and farming for fishermen. One of the agricultural activities in AekHorsik village is PT BKK (Berkah Kasih Karunia), where the leading commodity is Vaname shrimp, whose primary water source comes from a reservoir that is influenced by the tides that pass through the mangrove forest. The quality of mangrove waters, both chemically, physically, and biologically, still greatly influences the success of a name shrimp cultivation. Water quality is a condition of water based on physical, chemical, and biological properties that suit the needs of aquatic organisms and humans, such as water quality in fisheries, agriculture, drinking water, hospitals, industry, etc. (Koniyo, 2020). Mangrove damage can occur naturally or due to pressure from surrounding communities. Natural damage to the mangrove ecosystem is much smaller than damage caused by humans. Natural damage is usually a natural cycle that occurs, and this damage can be repaired because nature can repair itself. Natural damage is caused by natural phenomena such as hurricanes or storms and prolonged dry climates, which cause the growth of salinity in plants. Human activities also cause damage because many human activities around mangrove forest areas cause changes in the chemical, physical, and biological properties of mangrove habitats. Suitable water quality parameters make organic farming areas work stably and vice versa (Wafi et al., 2021).

Based on the description above, agricultural and community activities certainly dramatically impact the life of mangrove aquatic organisms and places for developing fisheries cultivation. Therefore, conducting an "analysis of mangrove water quality parameters in AekHorsik Village, Tapanuli Tengah Regency, for fisheries cultivation is necessary. This research aims to analyze the feasibility of water quality parameters for mangrove waters in Aek Horsik village, Tapanuli Tengah Regency, as a location for developing fisheries cultivation.

2. Material and Method

2.1. Time and Place

This research was conducted in May-June 2023 in Aek Horsik Village, Tapanuli Tengah Regency, North Sumatra Province.

2.2. Methods

The method that will be used in this research is a descriptive method with a quantitative approach, which aims to describe the data obtained during the research and then explain it through descriptions in a scientific way, namely based on existing theories and combining theory with data obtained during the research. Stations in this research will use the purpose sampling method (intentionally) to determine observation stations or measure water samples by looking at considerations based on factors such as ease of access, cost, and time during the research. The division of stations is based on the condition of the mangrove forest. Namely, Station I is in the upstream area, Station II is in the middle area, and Station III is in the downstream area. Each station is divided into 3 points, so there were nine sampling points in this study.

2.3. Parameters Measurement

2.3.1. Chemical Parameters

pH measurement using reagent strips. pH is often used to determine the level of acidity or alkalinity of water (Ramadhani, 2013). Salinity is the dissolved salt content in brackish water. Salinity measurement using a refractometer. Dissolved oxygen is the amount of oxygen dissolved in water. DO measurements using the Monitor DO meter test kit. Ammonia results from the breaking down of protein from food waste and fish metabolism products that settle in waterways (Arifin, 2016). Ammonia measurement using ammonia test strips

2.3.2. Physics Parameters

Temperature is a physical parameter that regulates the ecological conditions of a water body. It is measured using a thermometer. Brightness is the penetration distance of sunlight into water. Temperature measurement using disc. Current speed is the mass movement of water from one place to another. To calculate the measured current speed, the equation (Kusumawati et al., 2018).

$$v = s/t$$

Information:
v = current speed (m/s),
t = time (s),
s = jar (m)

The depth of the water can be measured using bathymetry or a straightforward tool, namely a weighted rope, then inserted into the bottom of the water. Then, the rope will be counted from the weight limit to the water level limit, which has been marked on the rope (Kusumawati et al., 2018).

2.3.3. Biological Parameters

Phytoplankton abundance using the APHA formula method (1989), namely:

$$K = \frac{N \times C}{V0 - V1}$$

Information:
K = number of individuals
C = Volume of water in the sample bottle 250 mL
V0 = Volume of filtered water (100000)
V1 = Volume pipet tetes (0,05 mL)

The abundance of organisms in a body of water can be expressed as the number of individuals per unit area. The formula can calculate abundance (Odum in Maulud et al., 2017).

$$Xi = \frac{ni}{A}$$

Information:
Xi = Abundance of biota types
ni = number of individuals of the i-th species
A = Area of the ith type quadrant (m^2)

3. Result and Discussion

3.1 Chemical Parameters

Based on measurements carried out during the research, the pH values for each station are presented in Table 1.

Table 1. pH value of mangrove waters at each station

Station	Sampling Time		
	Morning (High tide)	Afternoon (Low tide)	Afternoon (Low Tide)
ST 1	7,2	8,0	7,8
ST 2	7,3	7,8	7,5
ST 3	7,3	7,8	7,7
Average	7,3	7,9	7,7

Based on the table above, it can be seen that the average pH value obtained during the research ranged from 7.3-7.9 ppt. The pH of these waters is still relatively suitable for use as a water source for fish and shrimp farming activities. This is by Sinaga et al. (2021), which states that the general requirements for the quality of water sources for cultivation activities range between 7.0 and 9.0. The pH in the morning is lower compared to the pH in the afternoon and evening, and this is thought to be caused by the biota in the water respiration and producing CO_2, so the waters are more likely to be acidic. This is by Amalina et al. (2015), who state that high CO_2 concentrations cause the low pH value of water due to microbial activity in decomposing organic matter. Apart from the CO_2 content, The high, low pH in the morning (tide) at Station I is also due to land activities that end up in the mangrove waters, such as community discharge that enters the river and comes into direct contact with Station I, plus the drainage from shrimp pond cultivation activities which flows towards Station I.

The highest pH is at station 1 during the day (low tide) at 7.9. The high pH during the day is thought to be due to phytoplankton dissolved in the water being able to carry out the process of photosynthesis so that oxygen levels in the water increase so that the pH of the water tends to be more alkaline. Temperature changes also cause changes in pH in the morning, afternoon, and evening due to the intensity of sunlight at high and low tides. However, in estuary areas on large islands with a lot of river flow, the water pH tends to be lower because the river flow tends to be more acidic.

Based on the measurements that have been made, the salinity values for each station can be seen in Table 2.

Table 2. Salinity values of mangrove waters at each station

Station	Sampling Time (ppt)		
	Morning (High tide)	Afternoon (Low tide)	Afternoon (Low Tide)
ST 1	19	5	12
ST 2	22	13	16
ST 3	25	19	22
Average	22	12	17

Table 2 shows that the average salinity value obtained during the research ranged from 12-22 ppt. This salinity is still considered optimum for brackish areas. Choirudin et al. (2014) state that salinity for brackish areas or mangrove ecosystems ranges from 0-28 ppt. Mangrove waters so that salinity increases, while there is a decrease in salinity during the day. This is due to the waters being at low tide. Then, there is an increase in salinity again in the afternoon (high tide). The tides of sea waters influence changes in salinity between morning, afternoon, and evening.

Based on the results of measurements carried out during the research, the ammonia values for each station are presented in Table 3.

Table 3. Ammonia values in mangrove waters at each station

Station	Sampling Time (mg/L)		
	Morning (High tide)	Afternoon (Low tide)	Afternoon (Low Tide)
ST 1	0,31	0,23	0,32
ST 2	0,25	0,33	0,29
ST 3	0,19	0,25	0,27
Average	0,25	0,27	0,29

Based on Table 3, it can be seen that the ammonia values obtained during the research ranged from 0.25-0.29 mg/L. The ammonia obtained during the research is still considered optimal for cultivation activities as a water source. This is the opinion of Sinaga (2021), who stated that ammonia is suitable for the quality of water sources for cultivation activities and is in the range of 0.3-0.4 mg/L. The lowest ammonia is found at station III in the morning. This is influenced by the condition of the substrate at station III, which is dominantly sandy, where the sandy substrate contains few decomposing microbes. At the same time, the highest ammonia is found at station II in the afternoon (low tide), which is thought to be caused by The substrate at this station being mud. The water conditions have bent so that this affects the sediment that is trapped from both stations I to II and stations III to II. The level of ammonia in water is also influenced by temperature. Putri et al. (2019) state that ammonia dissolves easily in water and is very toxic to the environment at low temperatures and high pH.

Based on measurements carried out during the research, the DO values for each station are presented in Table 4.

Table 4. Dissolved oxygen content in mangrove waters at each station

Station	Sampling Time (ppm)		
	Morning (High tide)	Afternoon (low tide)	Afternoon (High tide)
ST 1	5,0	5,5	5,5
ST 2	5,2	5,8	5,8
ST 3	4,9	5,3	5,3
Average	5,0	5,5	5,5

Table 4 shows that the DO values obtained during the research ranged from 5.0 to 5.5. The DO obtained during the research is considered suitable as a water source for cultivation activities. DO that is most suitable for the quality of water sources for cultivation activities ranges from 5 to 8. The lowest DO results dissolved in water are at station III in the morning, and the highest DO is at station II in the afternoon and evening. Fluctuations occurred based on the results of DO measurements during the research. There is low DO at all stations in the morning compared to DO in the afternoon and evening. The highest DO is at station II on one day (low tide). This is caused by a photosynthesis process by phytoplankton in the waters.

In contrast, in the morning, there is no photosynthesis process, where the DO condition is also influenced by the activity of aquatic biota at night, both in respiration and decomposition processes. This is the opinion of Situmorang (2015), who states that high levels of suspended particles in the waters cause low DO values in the morning. The added opinion of Purnamasari et al. (2017) states that during the day and evening, waters tend to have high levels of dissolved oxygen due to the photosynthesis process of phytoplankton, which produces oxygen, which causes dissolved oxygen to increase. Dissolved oxygen levels vary daily (daily) and seasonal, depending on the mixing and movement of pasta air that enters the air (turbulence), activity photosynthesis, respiration, and results waste (air waste). Putri et al. (2019) clarify this by stating that open areas facilitate oxygen diffusion between air and water.

3.2. Physical Parameters

Based on the measurements carried out during the research, the temperature values for each station can be seen in Table 5.

Table 5. Mangrove water temperature values at each station

Station	Sampling Time (^{O}C)		
	Morning (High tide)	Afternoon (low tide)	Afternoon (High tide)
ST 1	29	32	31
ST 2	30	32	31
ST 3	30	33	32
Average	30	32	31

Based on Table 5, it can be seen that the average temperature obtained during the research ranged from 30-32^{O}C. The temperature obtained during the research is still considered suitable for fish cultivation activities. This is the opinion of Mainassy (2017), which states that the optimal brackish water temperature in fish cultivation activities is around 28.60-32.80^{O}C. Temperature changes every morning, afternoon, and evening. This is the opinion of Muarif (2016), who states that the pattern of temperature changes in waters based on time shows a pattern of temperature changes that are low in the morning, increase in the afternoon, and decrease in the afternoon. Based on the measurement results for each station, it was found that the lowest temperature was at station I in the morning because the waters were not exposed to sunlight, and the water conditions were high tide, while the highest temperature was at station III in the afternoon. This was because the water conditions at the station were more open than other stations, so the exposure to more sunlight and waters in a receding position with low depth caused the water temperature to increase. The results of temperature measurements at each station did not experience significant changes in temperature. This is the opinion of Asrini et al. (2017), who states that the greater the intensity of sunlight in downstream areas, the greater the heat exchange between water and air downstream, increasing temperature. Water currents and turbulence in different upstream, middle, and downstream areas also cause the temperature distribution. The brightness values at each station are presented in Table 6.

Table 6. Mangrove water brightness values at each station

Station	Sampling Time		
	Morning (High tide)	Afternoon (low tide)	Afternoon (High tide)
ST 1	0,56	0,32	0,64
ST 2	1,15	0,54	1,25
ST 3	0,92	0,41	0,95
Average	0,88	0,42	0,95

Table 6 shows that the brightness values obtained during the research ranged from 0.53 to 0.95 m. The brightness obtained during the research is still considered suitable for cultivation activities. The results of the brightness measurements during the research showed changes in the morning, afternoon, and evening. The lowest brightness measurement results were at station III during the day and the highest at station II in the afternoon. The difference in brightness in the morning and afternoon is caused by the tidal conditions of the waters, where there is high tide in the morning, while in the afternoon, there is low tide. The brightness of the waters is influenced by ocean currents, which carry suspended solids that spread in various directions. This follows the opinion of Riter et al. (2018), who states that the level of light penetration is greatly influenced by particles suspended and dissolved in water, thereby reducing the rate of photosynthesis. Brightness shows the ability of light to penetrate water. Apart from tidal currents, the depth and substrate of the bottom of the water are among the factors that contribute to the high brightness value. This was also clarified by Syahrul et al. (2021), who that brightness is strongly influenced by weather, measurement time, turbidity, and suspended solids.

Based on the measurements carried out during the research, the current speed values for each station are presented in Table 7.

Table 7. Mangrove water flow velocity values at each station

Station	Sampling Time (m/s)		
	Morning (High tide)	Afternoon (low tide)	Afternoon (High tide)
ST 1	0,07	0,10	0,05
ST 2	0,03	0,05	0,02
ST 3	0,08	0,09	0,08
Average	0,06	0,08	0,05

Based on Table 7, it can be seen that the current velocity values obtained during the research ranged from 0.05-0.08 m/s. The current speed obtained during the research is still considered feasible because the current speed is relatively slow. This is by Syahrul et al. (2021), which states that waters with currents > 1 m/s can be categorized as waters with very fast currents, the speed of waters with currents >0.5-1 m/s is categorized as fast currents, current speed 0.25-0.5 m/s is categorized as a slow current and a current speed of <0.1 m/s is classified as a very slow current.

The lowest current speed measurement results are at station II in the afternoon, and the highest is at station I in the afternoon. This is because the water conditions in the afternoon are high tide, while during the day, the water conditions are low. Consequently, influencer pairs that flow the estuary river and surface have good for-moment highs and lows. The current role of sea-holding is very important in the circulation of air. Besides transporting substances dissolved and suspended, Genre also affects the solubility of oxygen in the water. Currents play an active role in influencing processes that occur in waters, such as chemical, biological, and physical processes. The current speed at high tide is higher than at low tide, whereas at high tide, the current speed is higher than at the lowest low tide conditions. This is related to tides refluxing sea water; the sea level is high, so the flow is fast; in time, the air recedes surface, and the sea is low, so the speed flow is slow. This is supported by Simatupang et al. (2016), who state that the maximum tidal current speed occurs when the water level is high, and the minimum tidal current speed occurs when the water level is low.

Based on measurements carried out during the research, the depth values for each station are presented in Table 8.

Table 8. Value of depth of mangrove waters at each station

Station	Sampling Time		
	Morning (High tide)	Afternoon (low tide)	Afternoon (High tide)
ST 1	0,56	0,32	0,64
ST 2	1,15	0,54	1,25
ST 3	0,92	0,41	0,95
Average	0,88	0,42	0,95

Table 8 shows that the depth values obtained during the research ranged from 0.53 to 0.95 m. The depth obtained during the study is considered adequate for the water source quality because sunlight still penetrates it. Prabowo et al. (2016) state that the intensity of incoming sunlight decreases as depth increases. The lowest depth measurement results are at station I in the afternoon, and the highest is at station II in the morning. The difference in depth at each station is influenced by the tidal. Conditions of the waters and the faults found at the bottom of the mangrove waters. This is clarified by the opinion of Yulianto et al. (2018), who states that the depth of water affects the penetration of light into the water; the deeper the water, the lower the light intensity. Internal factors that influence the distribution of temperature, salinity, and dissolved oxygen are the depth and shape of the bottom topography of a body of water. Each body of water has a different depth and bottom shape, so the temperature, salinity, and dissolved oxygen distribution patterns differ.

3.3. Biological Parameter

Based on measurements carried out during the research, the results of phytoplankton abundance at each station can be seen in Table 9.

Table 9. Phytoplankton is abundant in mangrove waters at each station

Phytoplankton Abundance (ind/L)

Class	Species	Sampling Place		
		ST I	ST II	ST III
Cyanophyceae	*Synedrasp*	0.300	0.200	0150
	Euglena Viridissp	0.450	0.400	0.250
Euglenophyceae	*Euglena Protista*	0.400	0.300	0.200
	Euglena sp	0.350	0.350	0.300
	Ankistrodesmussp	0.400	0.450	0.250
	Scenedesmussp	0.300	0.350	0.150
Chlorophyceae	*Caudate Tetrahedron*	0.450	0.200	0.200
	Clostridium sharp	0.300	0.200	0.200
	Boat sp	0.550	0.450	0.250
	Nitzchiasp	0.700	0.600	0.450
Baciliarophyceae	*Post office*	0.450	0.300	0.200
	Nitzchia Sigma	0.400	0.350	0.300
	Cosmariumsp	0.500	0.500	0.150
Zygnematophyceae	*Staurastrumsp*	0.300	0.200	0.100
	Staurastra curcuma	0.250	0.100	0.250
Amount		6.100	4.950	3.400
Total		14.450		

Based on Table 9, it can be seen that the abundance of phytoplankton is 3,400-6,100 ind/L. The abundance obtained during the research was categorized as low fertility waters (oligotrophic). The lowest abundance is found at station III of class Upper Zygnematophyceae. This is by Dewi et al. (2018), who stated that the influence of the large influx of seawater resulted in many phytoplankton being carried away by the current. The low abundance of phytoplankton at station III is due to the sandy mud substrate. At the time of sampling, the water conditions experienced high tides. Hence, the movement

of phytoplankton is due to water currents, and the Zygnematophyceae class is a class of phytoplankton found in almost all freshwater habitats. The high abundance of phytoplankton at station I was due to the high tide water conditions at the sampling time, so phytoplankton experienced movement from downstream to upstream. The muddy substrate is another thing that causes the high abundance of phytoplankton at station I. The Baciliarophyceae class is a type of phytoplankton that can grow rapidly, even in relatively extreme or low nutrient and light conditions. It can utilize nutrients better than other classes, so its abundance is high. Cahyaningtyas et al. (2013) state that the Baciliarophyceae class can regenerate and has a stronger and greater reproductive rate than other classes.

Based on the measurements carried out during the research, the types of macrozoentos were obtained, which can be seen in Table 10.

Table 10. The abundance of macrozoobenthos in mangrove waters at each station

No	Commodity Name	Species	Abundance of Biota (ind/m^2)		
			Station 1	Station 2	Station 3
	Gastropods				
1	Black Devil Snail	*Faunus ater*	167,9	104,1	0,0
2	Mangrove Snail	*Telescopium telescopium*	4,3	1,0	0,0
3	Cone Snail	*Telebralia marshes*	0,3	0,7	0,0
4	Turbo/Zebra Snail	*Nerita* sp	0,3	0,1	0,0
5	Belitong snails	*Telebralia sulcata*	0,6	3,3	0,0
6	Sea Snail	*Cerithidea cingulata*	0,0	0,0	102,7
	Bivalves				
1	Mind	*Polymesoda expansa*	4,9	0,9	0,0
2	Blood clams	*Anadara* sp	0,0	0,0	0,9
	Crustacea				
1	Mud Crab	*Scylla paramamosain*	0,0	0,1	1,3
2	Brown Crab		0,7	0,3	0,0
Amount			179,0	110,4	104,9

Based on Table 10, it can be seen that the abundance of macrozobenthos is 104.9-179.0 ind/m^2. The abundance at each station is different due to the difference in the substrate of Station I and Station II being muddy while Station III is sandy mud. The abundance at station I is higher than at stations II and III, presumably because station I is located around mangrove vegetation, influencing the number of species. The essential components of the mangrove ecosystem food chain come from mangrove vegetation, which is decomposed by bacteria and fungi into nutrients that are utilized by phytoplankton, algae, the mangrove plant itself and partly as litter and used by fish, shrimp, and crabs as food.

The Gastropod class is the macrozobenthos with the highest abundance value. This is because Grastopoda has a solid adaptation to environmental changes. After all, it has a hard shell and a more active mobile nature to survive compared to other classes. This is the opinion of Nybakkken in Alwi et al. (2020), which states that Gastropods have an operculum that tightly closes the shell gaps. When the tide flows, it inserts itself into the shell and closes the gap using the operculum so that the lack of water can be overcome.

4. Conclusions

Based on the results obtained during the research, it can be concluded that: 1)The chemical parameters obtained were pH (7.3-7.9 ppt), salinity (12-22 ppt), ammonia (0.25-0.29 mg/L) and DO (5.0-55 ppm). The physical parameters obtained are temperature (30-32^{O}C), brightness (0.53-0.95 m), current speed (0.05-0.08 m/s), and depth (0.53-0.95 m). The biological parameters obtained were phytoplankton abundance of 3,400-6,100 14,450 ind/L and macrozobenthos abundance of 104.9-179.0 ind/m^2. Based on these results, it can be seen that the water quality parameters of mangrove waters in AekHorsik village, Tapanuli Tengah Regency, are suitable as a location for developing fisheries cultivation. 2) The types of phytoplankton in AekHorsik village consist of classes *Cyanophyceae*, *Euglenophyceae*, *Chlorophyceae*, *Baciliarophyceae*, and *Zygnematophyceae*. 3) The types of macrozobenthos in AekHorsik village consist of the Gastropoda, Bivalvia, and Crustecea classes.

5. References

[APHA] American Public Health Association. (1989). *Standard methods for the water work association and WPCF (Water Pollution Control Federation)*. Washington D.C. p1527.

Alwi, D., Muhammad, S.H., Herat, H. (2020). Keanekaragaman dan kelimpahan makrozobentos pada ekosistem mangrove Desa Daruba Pantai Kabupaten Pulau Marotai. *Jurnal Enggano*, 5(1): 64-77.

Amalina, Y.N., Salimin, Z., Sudarno, S. (2015). Pengaruh pH dan waktu proses dalam penyisihan logam berat Cr, Fe, Zn, Cu, Mn, dan Ni dalam air limbah indutri elektroplating dengan proses oksidasi biokimia. *Jurnal Teknik Lingkungan,* 4(3).

Arifin, M.Y. (2016). Pertumbuhan dan survival rate ikan nila (*Oreochromis* sp) strain merah dan strain hitam yang dipelihara pada media bersalinitas. *Jurnal Ilmiah Universitas Batanghari Jambi*, 16(1): 159-166.

Asrini, N.K., Adnyana, I.W.S., Rai, I.N. (2017). Studi analisis kualitas air di daerah aliran Sungai Pakerisan Provinsi Bali. *Ecotrophic*, 11(2).

Cahyaningtyas, I., Hutabarat, S., Soedarsono, P. (2013). Studi analisa plankton untuk menemukan tingkat pencemaran di muara Sungai Babon Semarang. *Management of Aquatic Resources Journal (MAQUARES*), 2(3): 74-84.

Choirudin, I.R., Supardjo, M.N., Muskananfola, M.R. (2014). Studi hubungan kandungan bahan organik sendimen dengan kelimpahan makrozoobentos di muara Sungai Wedug Kabupaten Demak. *Management of Aquatic Resources Journal (MAQUARES*), 3(3): 168-176.

Dewi, I.P., Sari, L.I., Suryana, I. (2018). Plankton community structure in estuaries in Anggana District, Kutai Kartanegara Regency. *Journal Aquarine,* 5(1).

Herianto, H., Subiandono, E. (2016). Peran biomasa mangrove dalam menyimpan karbon di Kubu Raya, Kalimantan Barat. *Jurnal Analisis Kebijakan,* 13(1): 1-12

Koniyo, Y. (2020). Analisis kualitas air pada lokasi budidaya ikan air tawar di Kecamatan Suwawa Tengah. *JTech*. 8(1): 52–58.

Kusumawati, I., Setyowati, M., Salena, I.Y. (2018). Identifikasi komposisi sampah laut di pesisir Aceh Barat. *Jurnal Perikanan Tropis*, 5(1): 59-69.

Mainassy, M. (2017). Pengaruh parameter fisika dan kimia terhadap kehadiran ikan lompa (*Thryssa baelama* forsskal) di Perairan Lhok Bubon Kecamatan Samatiga Kabupaten Aceh Barat. *Jurnal Manajeman Sumber Daya Akuatik,* 2.

Maulud, A., Purnawan, S., Nurfadillah, N. (2017). Kelimpahan biota penempel yang terdapat pada mangrove di muara Alue Naga Kecamatan Syiah Kuala Kota Banda Aceh. *Jurnal Ilmiah Mahasiswa Kelautan Perikanan Unsyiah*, *2*(4).

Muarif, M. (2016). Karakteristik suhu perairan di kolam budidaya perikanan. *Jurnal Mina Sains*, 2(9): 96-101.

Prabowo, A., Simarmata, A.H., Siagian, M. (2016). *Types and Abundance of Phytoplankton of the Boko-Boko Peart swamp in the Langgam Village, Langgam District, Palalawan Regency, Riau Province*. Faculty of Fisheries and Marine. Universitas Riau

Purnamasari, I., Purnama, D., Utami, M.A.F. (2017). Pertumbuhan udangvaname (*Litopenaeus vannamei*) di tambak intensif. *Jurnal Enggano,* 2(1): 58-67.

Putri, W.A E., Purwiyanto, A. I.S., Agustriani, F., Suteja, Y. (2019). Kondisi nitrat, nitrit, amonia, fosfat, dan bod di muara Sungai Banyuasin, Sumatera Selatan. *Jurnal Ilmu Kelautan Tropis,* 11(1): 65-74.

Ramadhani, S. (2013). *Analisis status kualitas perairan daerah aliran Sungai Hilir Krueng Meureubo Aceh Barat.* Fakultas Perikanan dan Ilmu Kelautan. Universitas Teuku Umar. Meulaboh.

Riter, J., Suryono, C. A., Pratikto, I. (2018). Pemetaan karakteristik fisika-kimia perairan dan pemodelan arus di Kabupaten Sidoarjo. *Journal of Marine Research,* 7(3): 223-230.

Simatupang, C.M., Surbakti, H., Agussalim, A. (2016). Analisis data arus di perairan muara Sungai Banyuasin Provinsi Sumatera Selatan. *Maspari Journal UNSRI*, 8(1): 15–24

Sinaga, A. (2021). Pemetaan kualitas perairan payau yang potensial di tambak Kuala Langsa. *Jurnal Ilmiah Samudra Aquatika*. 5(2): 39-44.

Situmorang, H. (2015). *Absorbsi orthofosfat (PO_4^{3-}) oleh tanaman air kayu apu (Pistia stratiotes L.) pada limbah cair rumah sakit safiul anwar dengan presentase penutupan dan lama kontak.* Universitas Brawijaya.

Syahrul, M.N., Fajril, T., Reski, F. (2021). Analisis kesesuaian kualitas air sungai dalam mendukung kegiatan budidaya perikanan di Desa Batetangnga, Kecamatan Binuang, Provinsi Sulawesi Barat. *Journal of Fisheries and Marine Science*, 3(1).

Unedo, U., Siburian, P., Purba, O.P. (2020). Profile Potensi pulau-pulau kecil untuk meningkatkan ekonomi masyarakat pesisir. *Jurnal Dinas Kelautan dan Perikanan Kabupaten Tapenuli Tengah.*

Wafi, A., Ariadi, H. (2021). Estimasi daya listrik untuk produksi oksigen oleh kincir air selama periode "*blink feeding*" budidaya udang vaname (*Litopenaeus vannamei*). *Indonesian Journal of Fisheries Science and Technology Available,* 18(1): 19-25.

Yulianto, M., Muskananfola, M.R., Rahman, A. (2018). Sebaran spasio temporal kelimpahan fitoplankton dan klorofil-a di Perairan Ujung Kartini Jepara. *Saintek Perikanan: Indonesia Journal of Fisheries Science and Tecnology,* 14(1): 1-7