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Water Quality Assessment for Aquaculture and Chemical Content of Mangrove – Based Food

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ABSTRACT

Rudhi Pribadi, Aditya Sukma Bahari, Winda Ariesta Nur Fadilla: Water Quality Assessment for Aquaculture and Chemical Content of Mangrove – Based Food.

School is one of the facilities as a place of learning for students. The school becomes a place to sharpen scientific knowledge and soft skills of students. Research on water quality was carried out at SMPN 3 Satu Atap, Sayung District, Demak Regency. Researchers see the potential that exists in schools in the form of ponds that are not used and only become trash bins so that the potential is not utilized optimally. In addition, the researchers also tested the content of tannins and cyanide acids.

The results of measuring water quality, environmental conditions are still able to support aquaculture. Sediment types dominated by silt and medium - high organic matter are good parameters. The calculation of the abundance of phytoplankton and zooplankton also showed good results with found several genera such as Nitzschia, Navicula and Rhizosoleni for phytoplankton and Temora, Acartia, Lucifer and Nauplius for zooplankton.

The content of tannin and HCN in mangrove leaves in SDN 1 Bedono based on the results of the study must still be treated soaking before being made into mangrove chips. The leaves used are leaves of Avicennia marina, which local people usually call the name Api - Api or Brayo. Soaking for 12 hours is the most efficient treatment if it will do production for mangrove leaf chips. The content of the mangrove leaves tannins that have not been given treatment ranges from 47.03 - 47.46 gr / kg and with 12-hour immersion can reduce tannin levels to range between 30.08 - 30.49 mg / kg. While for HCN content without immersion ranged from 0.2490 - 0.2592 mg / kg and soaking for 12 hours can reduce the content to 50% with values ranging from 0.819 - 0.952 mg / kg. Processing techniques with frying and giving flour on mangrove leaves with soaking for 12 hours to be processed into chips are also able to reduce the rejuvenation of tannin and cyanide content.

Keywords: Aquaculture, Water Quality, Tanin, Cyanide Acid, Mangrove

I. Introduction

1.1 Background

Research is a fundamental thing for people to explore an area or object with scientific step to get information and new knowledge. Object of study, methods, research implementation and research report that are based on scientific attitude. Hopefully, every result of the research can be utilized for all stakeholders, government, private sector or society in each sector.

School is a place for kids to get formal education. The student got an education included exact and social education each them and can be an asset for their in the future. In teaching and learning activities, not only look about the curriculum but also the quality of school environment as well as food safe grade in the school area should be concern by teacher. If the environment and food quality in school area was safe, it does not matter for learning activities, but if the environment and food quality in unsafe condition, it can be threaten for student in learning activities.

Water quality assessment will apply in SMPN 3 Satu Atap, Sayung Sub – District, Demak Regency. The team was analyzed the potential in SMPN 3 Satu Atap in Tugu Village had the unused pools, but the pools only be garbage and not be optimally utilized. This is a big potential to use the pools for aquaculture like fish pond, shrimp pond, shell pond or seaweed pond. In ponds activities, student can be joined and can be extracurricular activities for student or being optional study for the school to create soft skills of student more great then before. But, before making the ponds, we need analyze of water quality, sediment and other environmental parameters to make sure the location representative for aquaculture and the biota to be cultivated precisely.

Before making fishpond, we needed preliminary studies to assess the water quality of fishponds area. Location of Sayung Regency near with Semarang industrial area, it really possible the industrial waste can pollute Sayung Regency area especially in Bedono and Tugu Village. Heavy metals like Cadmium (Cd) and Lead (Pb) can impact with the results of fishponds production later. Heavy metals can effect to fish health and damage fish organs. This should be focused in fishpond production to control fish health and safe for consumption.

Beside of water quality assessment, researcher will make a small fishpond trial to know resistant of each fish species to heavy metal in the fishpond. Tilapia (Nila Salin) and milk fish will be testing in the fishpond trial for 4 months. This activities can be first introduction to student in SMP N 3 Satu Atap before big scale aquaculture..

In this research, researcher has interested for chemical content of mangrove – based food test especially snack from Avicenniaceae leaves. Mangrove snack and chips has been landmark in Bedono village but never tested about tanin, hydrogen cyanide (HCN) and chemical content others. Mangrove chips from Avicenniaceae leaves in Bedono village had been traditional souvenir and consumed by local communities, visitor from other city and maybe was consumed by SDN 1 Bedono student. Based on this case, researcher was interested to know mangrove snack and chips can be cooked without treatment or treatment needed.

1.2 Purpose

1. To identify water quality for aquaculture purposes as a resilience activities in flooding area.
2. To know the best fish species for aquaculture activities.
3. To determined chemical content of mangrove – based food.
4. To collect base line data for further Sister School programs.

1.3 Expected Outcome

From the results of the reserch, it is known that the flooded area are possible or not for aquaculture activity. This productive pond is expected to be a learning tool for the students in aquaculture knowledge. In addition, this activity can also be an extracurricular activity or can be included in additional subjects, so that soft skills from students can be more diverse and can be applied in the parent's farm if they have it. Utilization of flood areas into aquaculture ponds is also one of the team's efforts in providing solutions to land use for schools. After finding out the results, the people that involved in the development of Sister School can make the results of this research into a study material for school development in the future.

For the chemical content research, the results of the reserach are expected to help the community in improving the quality of the foods from the Bedono Village. If these foods are truly safe from substances that are not supposed to be consumed by humans, these foods can be marketed more widely and all people can consume these foods.

II. The Benefits and Importance of Research

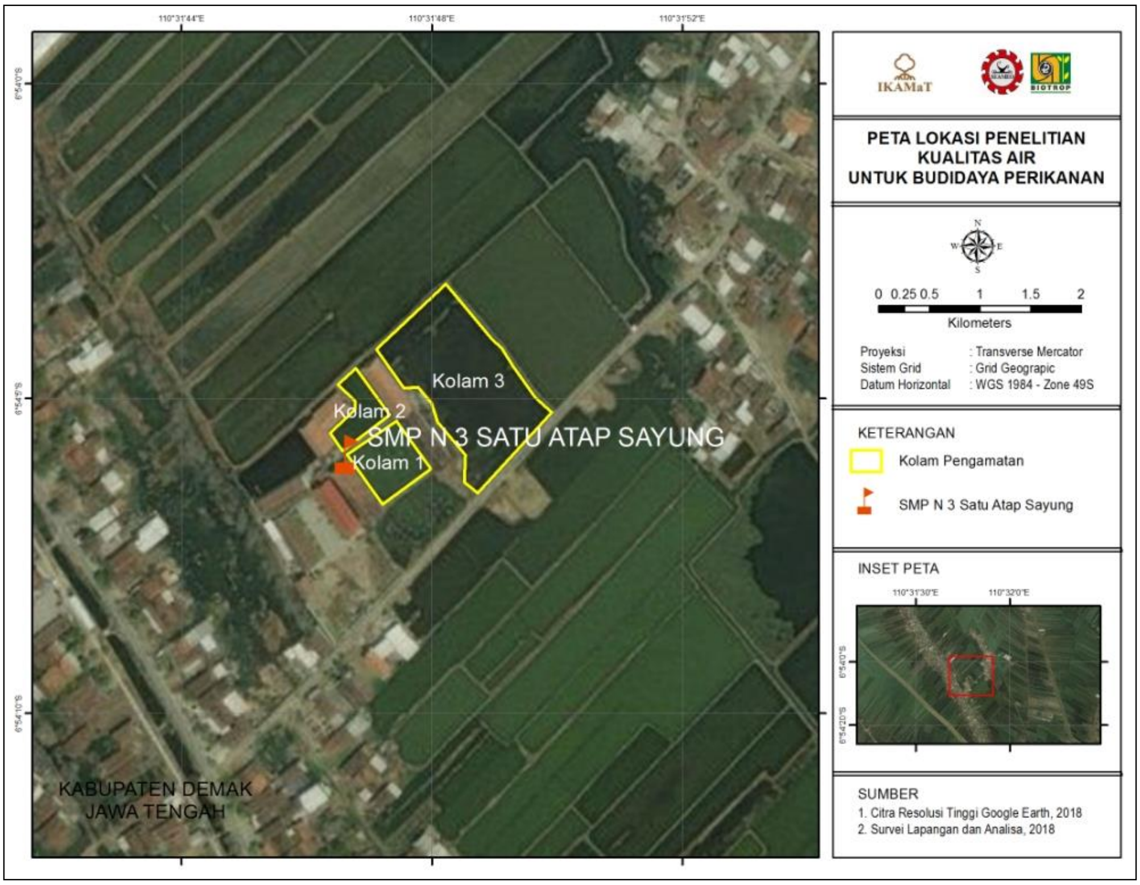
The unused ponds in SMPN 3 Satu Atap should be able to be used as a useful area for the students. Because all these ponds only become large trash bins, this also become a threat to students because bacteria, mosquitoes and viruses can develop in these ponds. It is different if the ponds are used as productive ponds which can be used with the intercropping method by combining milkfish, tilapia saline, or other economical brackish water fish in dry season and shellfish with seaweed in the rainy season. Schools can get additional funds from the cultivation, and the students get aquaculture knowledge and can be applied at home if parents have it.

While testing the food content can help the community in improving the quality of food. Because all this time the community wanted to test the food but did not know the procedures and cost constraints for testing. So that this research is expected to be able to help the community in improving the quality of chips from Avicenniaceae leaves.

III. Methodology

3.1 Water Quality Test

The location of data collection is the flooding area in SMPN 3 Satu Atap Sayung area. The research team determined 3 stations in data collection including Pond I, Pond II and Pond III. Each pond gets the same treatment in measurements, except that in Pond I there is a trial pond for survival conducted by the research team. Determination of Pond I as the location of the fish survival test pond is also the result of discussion between the research team and the school to find out which pond represents the conditions in the research area. The team also involves representatives of SMPN 3 Satu Atap Sayung students in observation, this is to facilitate observation and supervision. The team from junior high school students helped the research team during the observations and also helped monitor the pond so that the pond was not disturbed by irresponsible parties. The research team conducted observations always on Wednesday every week, and carried out for 2 months of research. During the 2 months of research the team conducted observations including water quality, environmental parameters, plankton, and conditions that affect the aquaculture activities.



Picture 1. Map of research location at SMPN 3 Satu Atap Sayung.

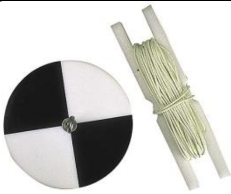
Retrieval of field data for water quality in ponds in SMPN 3 Satu Atap including water samples and pond sediments. Test water quality samples based on parameters in PP No. 82/2001 concerning water quality management and water pollution control. The team also decided to test sediment samples including Copper (Cu), Lead (Pb) and sediment organic materials. In addition to conducting laboratory tests, the research team also conducted weekly observations of indoor pond parameters including salinity, pH, ambient temperature, water temperature, DO and brightness to determine fluctuations in pond conditions for 2 months.

Water samples is taken 2 times. The first take is done at the beginning of the research which is expected to be able to know the initial conditions of the research environment. The second take was taken at the time of the last observation (2 months), which was expected to know whether there was a change between before the study and after the study. Taking sediment samples for testing Cu and Pb was carried out 2 times like a water sample. However, for sediment sampling to test organic matter and grain size is carried out only at the beginning of water sampling.

esting of sediment samples for Copper (Cu) and Lead (Pb) tests was carried out at the Water Quality Laboratory, Testing and Equipment Center, Public Works Agency for Highways and Cipta Karya, Central Java Provincial Government. Testing of sediment samples for grain size tests was carried out at the Soil Mechanics Laboratory, Faculty of Engineering, Diponegoro University. Testing of sediment samples for testing sediment organic matter was carried out at the Integrated Research and Testing Laboratory, Gadjah Mada University. While for testing water quality samples carried out at the Environmental Laboratory, Environmental Agency, Semarang City. The selection of test laboratories is based on team considerations and the suitability of the testing methods required by the team.

Table 1. Tools and materials used in water and sediment quality research

No	Name	Picture	Function
1.	Sample Bottle		Water sample container in field data collection
2.	Ziplock		Sediment sample container
3.	Thermometer		Measuring air and environment temperature
4.	pH Meter		Measuring the level of acid or alkaline water

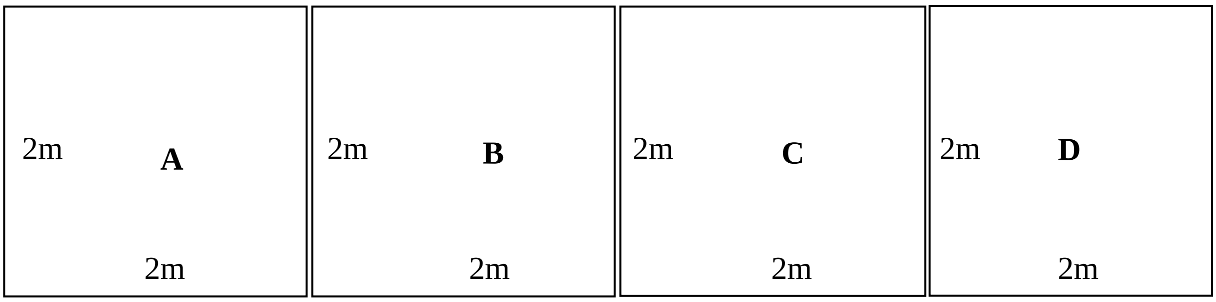
No	Name	Picture	Function
5.	DO Meter		Measuring *dissolve oxygen* in the water
6.	Refractometer		Measuring the water salinity
7.	Secchi disk		Measuring the brightness of water
8.	*Sediment grab*		Take sediment samples
9.	Camera		Documenting activities
10.	Stationary		Write conditions and field measurements
11.	*Personal Computer* /Laptop		Processing test results data and field observations

The research team also made a trial pond to determine the survival of 3 (three) fish species, namely Tilapia (*Oreochromis niloticus*), Catfish (*Clarias gariepinus*) and Milkfish (*Chanos chanos*). The three species were chosen because they have high economic value and the hypothesis of the research team of each species has good resistance in the estuary region of the river and has resistance to waters that have salinity.

In addition, the research team is also expected to be able to provide input for the implementation of cultivation in the SMPN 3 Satu Atap region in the future regarding what species is good for aquaculture, what techniques are used and other aspects for aquaculture.

In addition to testing the resilience of fish, the research team also conducted a growth test on *Gracilaria verrucosa* seaweed. Seaweed is one of the biota that is able to maintain the quality of the waters by producing oxygen for the waters. Seaweed also has high economic value and is one of the biota with simple maintenance in cultivation. This can also be an input whether future aquaculture can be intercropped between one species of fish and seaweed.

Calculation of the area of the trial pond is a consideration of the researchers because it will affect the density of fish in the trial. Stocking density must be considered in fish farming, because stocking densities will affect competition to get food and space for biota. Of these two factors can affect the growth rate of cultivated fish. Stocking density will also affect the quality of pond waters, and if the quality of the waters decreases will cause death from aquaculture fish. So the team decided to load a pond with an area of 4 m^2 with 75 fish in it. The research team also discussed with pond farmers in the research area to determine the size of the pond and the right number of fish.



Picture 2. Trial pond design

Before there was a pond

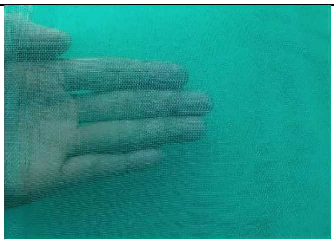
The process of making a trial pond

After there was a pond

The test pond is ready for fish

Picture 3. The location of determining and making a fish survival testing pond

Table 2. Tools and materials used for the trial pond

No	Name	Picture	Function
1.	Net		Pond divider
2.	Bamboo		Framework of the trial pond
3.	Organic fish feed		Additional nutrition for trial fish
4.	Camera		Documenting activities

No	Name	Picture	Function
5.	Analytical scales		Measuring foish weight
6.	Stationary		Write conditions and field measurements
7.	*Personal computer*		Processing test results data and field observations

In Table 2, attached a list of tools and materials used in making the trial pond. Materials to make a trial pool using easily available materials in the research area at SMPN 3 Satu Atap. This is also to find out the resistance of materials such as bamboo as a framework for making a trial pond. In the trial pond, the feed used in the study is organic food. This is to maintain the condition of the waters and also reduce the intake of chemicals, because when using feed pellets feared will affect the chemical and physical conditions of the research location.

Sampling and identification of plankton were also carried out in this research activity. Plankton is one of the biota which is very important in both intensive, semi-intensive and traditional aquaculture activities. Plankton samples taken were until zooplankton and phytoplankton. Both phytoplankton or zooplankton are both very influential in water quality. Plankton can be a determinant in the brightness and fertility of the waters. Sampling uses plankton net and is drawn along the observation ponds.

Plankton sampling is carried out on the same day and hour. In this study, the team took samples every 8 o'clock in the morning. Taking plankton samples is recommended for as early as possible. Observations are carried out every 2 weeks for 2 months. Samples that have been taken with planktonet will be inserted into the sample bottle which has been filled with 4% formalin. The comparison of plankton samples with preservatives is 1: 5. The bottle of sample used has a volume of ± 200 ml. In identifying plankton, the research team was assisted by plankton experts from the Master of Marine Sciences, Faculty of Fisheries and Marine Sciences, Diponegoro University.

Table 3. Tools and materials used for sampling and identification of plankton

No	Name	Picture	Function
1.	Plankton net		Sampling of plankton in the field
2.	Sample Bottle		Sample container in the field
3.	Formalin (CH_2O) 4%		Preservation of samples from the field
4.	Microscope		Observation and identification of plankton on a laboratory scale

3.2 Chemical Content

Chemicals test on mangrove leaf chips, the research team analyzed the content of tannins and hydrogen cyanide (HCN) in the leaves and chips of mangrove leaves. Both of these substances must be contained in each mangrove leaf but the levels are different. The results obtained from the test results are expected to be able to find out how safe these foods are for consumption. The sample to be tested in the study is the leaves and chips of mangrove leaves from the genus Avicenniaceae. The species of the genus Avicenniaceae indeed dominates in the region of SDN 1 Bedono, so that by ordinary people processing leaves to be made into chips. There were 3 treatments for leaf samples which were leaves without soaking, 12-hour immersion and 24-hour immersion. Each leaf sample after the treatment was partially ground to be used as a test sample. The non-pulverized samples were then processed into mangrove leaf chips and laboratory tests were also conducted to determine the content of tannins and cyanide acid (HCN) in processed chips. Testing of tannin and HCN content was carried out at the Testing and Calibration Laboratory, the Center for Industrial Pollution Prevention Technology, The Ministry of Industry.

Picture 4. Location of sampling of mangrove leaves for chemical content.

IV. Results and Discussion

4.1 Results

4.1.1. Water Quality

This research is a preliminary data compilation in aquaculture activities which will be applied at SMPN 3 Satu Atap Sayung. Before conducting aquaculture activities, the prospective location must be studied scientifically first. This assessment is one of the stages of planning in aquaculture activities. This research is to find out the existing conditions, external and internal factors and various aspects that can affect aquaculture activities in the future.

The coastal area is a transition area between terrestrial ecosystems and marine ecosystems that have their own characteristics and are sensitive to changes in environmental conditions including pollutants. Sources of heavy metals in waters in general can come from the waste of workshop, agriculture, electricity, explosives factories, preservatives, pesticides, chemical industries, gold processing and many others (Said *et al*, 2014). Based on this, SMPN 3 Satu Atap has a very potential as a pollution area because the location of the school is close to industrial estates, settlements and rice fields which are usually a source of water pollutants. If heavy metals are not handled from the start, then aquaculture biota (fish, shrimp, shellfish and seaweed) can be exposed to heavy metals and can enter the human body through the biota consumed.

The research team divided the observation station into 3 (three), namely Pond I, Pond II and Pond III. The initial condition of the pond - the observation pond is quite interesting to observe. The conditions of Pond I and Pond II at the beginning of the observation are almost the same, namely the condition of the water that is very good with a good level of brightness. The bases of ponds I and II are clearly visible, even fish, snakes, shrimp and several other biota can be seen. However, the ponds have only become trash bins. In Pond II, the school had spread the seeds of shrimp and milkfish, but the results obtained were not optimal even many seeds were lost when the tide came. When the school will harvest even the results are very far from the target. However, for Pond III the condition is murky and neglected. Pond III is indeed behind the school and is the most open and very easily affected by external factors. The embankment of the pond is quite low and if the tide can enter into Pond III. Previously the area of SMPN 3 Satu Atap was dry land, and now the school has been surrounded by water.

Fish and pond bottom are clearly visible

Fish and Hydrilla sp. seen in the waters

The pool has only been a place for garbage from the school

Trash inside the observation pond II

Picture 5. Excisting conditions of observation ponds before observing at SMPN 3 Satu Atap Sayung

On the 30 May observation, high tide occurred which resulted in the entire pond becoming cloudy and the conditions very different compared to previous observations. This can be seen from the observations written in Tabel 7 which are very different when observed on 30 May from observations in the previous weeks. The levels of heavy metals in a water can change according to the season, intake and flooding that affect heavy pond content in the waters and sediment. Tidal charts in the research area can be seen in Appendix 1 for April and in Appendix 2 for May.

The ROB flooding that occurred not only affected the observation pool, but this disaster affected all existing farms in the village. Fish that were in the farms were also carried away by floods and caused huge losses to the pond farmers. This is a note from the research team to observe the movement of tidal currents to mitigate disasters that will occur for the coming years. Either by controlling in aquaculture methods or coping with the selection of structures that can mitigate ROB in aquaculture activities.

Pond conditions on 11 April 2018

Pond conditions on 23 May 2018

Pond conditions on 30 May 2018

Pond conditions on 31 July 2018

Picture 6. The condition of the observation pool before the ROB until after ROB.

ROB floods that occur in research locations greatly affect the ecological conditions that exist in the research location. *Hydrilla* sp., which previously flourished in Pond I and Pond II, became dead after the ROB flood. *Hydrilla* sp. did not appear at the bottom of the waters after the ROB flood. *Hydrilla* sp. can adapt to salinity, but at the time of flood the ROB of water salinity changes dramatically. In addition, several other biota are also not seen in recent observations such as snakes, fish and shrimp.

Before ROB

After ROB

Picture 7. The condition of *Hydrilla* sp. before and after ROB in the observation pond.

The results of water quality testing are presented in Table 4. From the test results, use the quality standard PP No. 82 of 2001 with Class II and Class III quality classifications. Class II is the quality of water for water recreation facilities, infrastructure, freshwater fish farmers, livestock, water for irrigating crops. Class III is water quality for the cultivation of freshwater fish, livestock and water to irrigate crops. Another standard motto that is a reference for the team is Kepmen LH No. 51 of 2004 to find out the threshold of heavy metals in water. Sampling was carried out 2 times in each observation station, namely on 11 April 2018 and 30 May 2018. This collection was carried out to determine the quality of water at the start of the study and at the end of the research.

Aquatic biota is very sensitive to excess Cu in water bodies. The dissolved Cu concentration of 0.01 mg / L can result in the death of phytoplankton. The death is because heavy metal Cu can inhibit enzyme activity in phytoplankton cell division. While for Pb content in water with levels between 0.1 - 0.2 mg / L it has been able to cause poisoning in certain types of fish (Tarigan *et al.*, 2003). Phytoplankton are biota that enter the food chain in aquaculture ponds. If the smallest biota has been contaminated with heavy metals, then the *top predator* can also accumulate heavy metals. Thus, cultivated biota can threaten humans who consume it.

The test results from the research showed that the Cu content in the waters had 2 different results from different observations. At the first observation, the three ponds were in good condition with the test results all below the threshold. However, at the time of the second observation, based on the quality standards of Kepmen LH No. 51 of 2004 the three pools are above the prescribed threshold (0.008 mg / L), namely Pond I (0.0141 mg / L), Pond II (0.0176 mg / L) and Pond III (0.0168 mg / L).

Naturally, Pb can be found in surface water or in the air. Pb pollutant sources come from several industries that have the potential to produce Pb waste such as the casting industry, the battery industry, the fuel industry and the chemical industry that uses coloring agents (Sudarmaji *et al*., 2006). Pb is one of the non-essential heavy metals that is dangerous and can cause poisoning in living things. This heavy metal can be a dangerous poison if it accumulates in large quantities and the body is unable to handle it (Purnomo *et al.*, 2007).

From the results obtained in testing Pb content in water, it can be categorized that the study area has been contaminated by Lead (Pb) heavy metals. Pb that is in the water both in the first and second observations, the results of the tests are all above the quality standards set by the government both PP No. 82 of 2001 (0.03 mg / L) and Kepmen LH No. 51 of 2004 (0.008 mg / L). Pond I in the first sample is 0.0891 mg / L and in the second sample is 0.0891 mg / L. Pond II in the first sample was 0.1148 mg / L and in the second sample was 0.0891 mg / L. Pond III in the first sample is 0.0977 mg / L and in the second sample is 0.0805 mg / L.

For comparison of data, the results of the research of Pb content in pond water by Madusari *et al.* in 2016 in Pekalongan, the results were 0,0008 mg / L. From this data, heavy metals in Pekalongan are still very far below the threshold of the two available regulations. In contrast to the results obtained by the research team whose metal content weighed far above the threshold. Heavy metals in the water can enter the body of the fish through several ways, namely through breathing which will absorb heavy metals through the gills and can enter the circulation of blood, through food absorbed through the digestive tract and absorption of water through the body surface (Madusari *et al.*, 2016).

First water sampling is taken on 11 April 2018

Second water sampling is taken on 30 May 2018

Picture 8. The process of water sampling at the research location for 2 times period

Heavy metals that are in water will be suspended to the bottom of the water. If the substrate that has been contaminated will cause new problems for the waters. Heavy metals bound to sediment are relatively difficult to dissolve back into the water (Purnomo *et al.*, 2007). So if the susbtrat has been contaminated with heavy metals, it is not impossible that benthos biota can also be contaminated with heavy metals.

Tabel 4. Water quality test results in 3 stations at SMPN 3 Satu Atap Sayung.

No	POND	I		II		III		PP. 82 tahun 2001		Kepmen LH No. 51 tahun 2004
		11 April	30 May	11 April	30 May	11 April	30 May	II	III	BIOTA
PHYSICS										
1	Themperature (˚C)	30,9	29,4	30,9	29,2	30,8	29,0	Dev. 3	Dev. 3	-
2	Dissolved residue (mg/L)	6890	28000	6610	41300	5150	42800	1000	1000	-
3	Suspended resideu (mg/L)	10	86	12	137	9	166	50	400	80
4	Dissolved Oxygen (mg/L)	4,71	3,37	4,95	1,32	4,47	6,47	4	3	>5
5	Salinity (%)	3,80	17,40	3,60	26,60	2,80	27,60	-	-	-
CHEMICALS										
1	pH	8,29	7,52	8,44	8,56	8,26	7,87	6 – 9	6 – 9	7 – 8,5
2	Cadmium (Cd) (mg/L)	0,0085	0,0030	0,0080	0,0013	0,0091	0,0048	0,01	0,01	0,001
3	Copper (Cu) (mg/L)	0,0060	0,0141	0,0070	0,0176	0,0060	0,0168	0,02	0,02	0,008
4	Zinc (Zn) (mg/L)	0,0250	0,0338	0,0481	0,2262	0,0400	0,1118	0,05	0,05	0,05
5	Chrome (VI) (mg/L)	0,0001	0,0001	0,0001	0,0001	0,0001	0,0001	0,05	0,05	0,005
6	Lead (Pb) (mg/L)	0,0891	0,0891	0,1148	0,0891	0,0977	0,0805	0,03	0,03	0,008
7	Iron (Fe) (mg/L)	0,0698	0,0262	0,5006	0,4244	0,0555	0,1359	-	-	-
8	Sulfide (H_2S) (mg/L)	0,0277	0,0298	0,027	0,0242	0,0256	0,0242	0,002	0,002	0,01
9	Mangan (Mn) (mg/L)	< 0,0032	1,0296	0,0756	0,0619	0,0644	2,5956	-	-	-
10	Nitrat (mg/L)	0,7751	0,2548	0,5958	0,6650	0,6116	1,1902	10	20	0,008

No	POND	I		II		III		PP. 82 tahun 2001		Kepmen LH No. 51 tahun 2004
		11 April	30 May	11 April	30 May	11 April	30 May	II	III	BIOTA
11	Nitrit (mg/L)	0,1094	0,0120	0,0021	0,0886	0,0789	0,1867	0,06	0,06	-
12	Free Ammonia (mg/L)	0,4277	0,0485	0,4490	0,0249	0,7958	0,0185	-	-	-
13	Sulphate (mg/L)	174,25	152,96	142,09	86,11	129,66	195,276	-	-	-
14	Chloride (mg/L)	1161,6	5114,5	1094,8	5243,0	786,46	5602,8	-	-	-
15	BOD5 (mg/L)	8	409	6	417	4	480	3	6	20
16	COD (mg/L)	17,591	975,41	13,045	987,47	9,18	980,07	25	50	-

*** Color indicates the test results exceed the threshold for each quality standard**

- Exceeding the standard quality threshold of PP 82 of 2001 deviation II
- Exceeding the standard quality threshold of PP 82 of 2001 deviation III
- Exceeding the quality standard threshold of Kepmen LH no. 51 of 2004
- Exceeding the second threshold of quality standards

The research team also conducted research on sediments from each observation pond. This is to find out how much the content of Copper (Cu) and Lead (Pb) in sediments has accumulated so far. Testing of heavy metal content of Cu and Pb using AAS (*Atomic Absorption Spectrometric*). Sampling is done twice. As with samples for water quality, the test samples for heavy metal content of sediments were also taken on April 11, 2018 and May 30, 2018 in all three observation ponds. The highest Cu content in Pond I in the second observation was 0.0763 mg / 100g. While the highest Pb content was in Pond III in the third observation at 0.0726 mg / 100g. The team used quality standards from the *Canadian Council of Ministers of the Environment* (CCME) in 2001 regarding the *Canadian Environmental Quality Guidelines* for marine sediments and heavy metal content in the three observation pools still below the existing quality standards.

In this observation, after testing heavy metals Copper (Cu) and Lead (Pb) it was found that the majority of Cu content was higher than Pb in 2 sampling times. It is very striking for the two heavy metals from the results obtained between the first observation before ROB and after ROB. This can be seen from Table 4, from the test results it can be seen that the Cu content rises quite a lot in the first and second sampling. The highest increase occurred in Pond I from 0.0164 mg / 100g to 0.0763 mg / 100g.

Pond I is indeed the most isolated pond compared to other observation ponds. In the initial hypothesis, Pond I is the safest pond against outside interference, the water is only infiltration water. However, if there is a high ROB as observed on the 30th, the ROB water will be trapped directly and when it recedes it cannot come out again. This is the factor why the increase in Pond I I is the highest.

Table 5. Test results for heavy metal content in the sediment pond at SMPN 3 Satu Atap Sayung.

POND	**Cu (mg/100g)**		**ISQG* (mg/100g)**	**Pb (mg/100g)**		**ISQG* (mg/100g)**
	11 April	30 May		11 April	30 May	
I	0,0164	0,0763	1,87	≤ 0,06	0,0543	3,02
II	0,0164	0,0300	1,87	≤ 0,06	0,0090	3,02
III	0,0112	0,0427	1,87	≤ 0,06	0,0726	3,02

*Interim Marine Sediment Quality Guidelines 2001 (CCME)

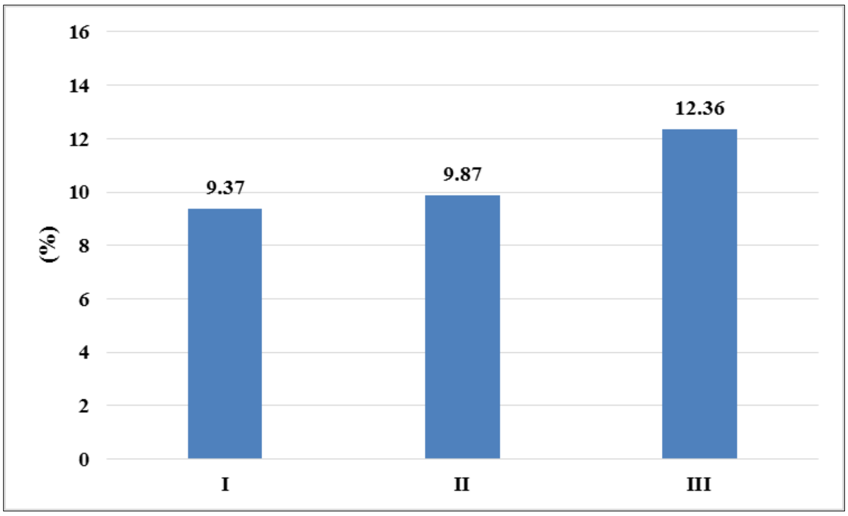
The research team tested the content of sediment organic matter. This is to find out how high the content of organic matter in sediments in each observation pond. Organic material is a food source for marine biota especially for benthic organisms (Hawari *et al.*, 2013). In addition, organic matter is one indicator to determine the fertility of sediments in a waters. Pond that has the highest organic content, namely Pond III of 12.36% b / b. This is not a reference in determining the good or bad of a water condition. It's just that, if we know the sediment organic matter in a waters then we can look for any factors that make the sediment organic material in that location high or low.

The most striking difference between Pond III and other observation ponds is the presence of mangroves in Pond III. This can be an important factor because falling mangrove leaf litter can decompose in Pond III and increase the loss of organic matter in the sediment. The basic type of pond is also an important factor, the base of Pond III is mostly covered by grasses which can also be the producers of organic matter in the pond.

Table 6. Test results for sediment organic matter in the sediment pond at SMPN 3 Satu Atap Sayung

POND	I	Kategori *	II	Kategori *	III	Kategori *
Sediment Organic Material (% b/b)	9,37	Medium	9,87	Medium	12,36	High

*Landon (1991)

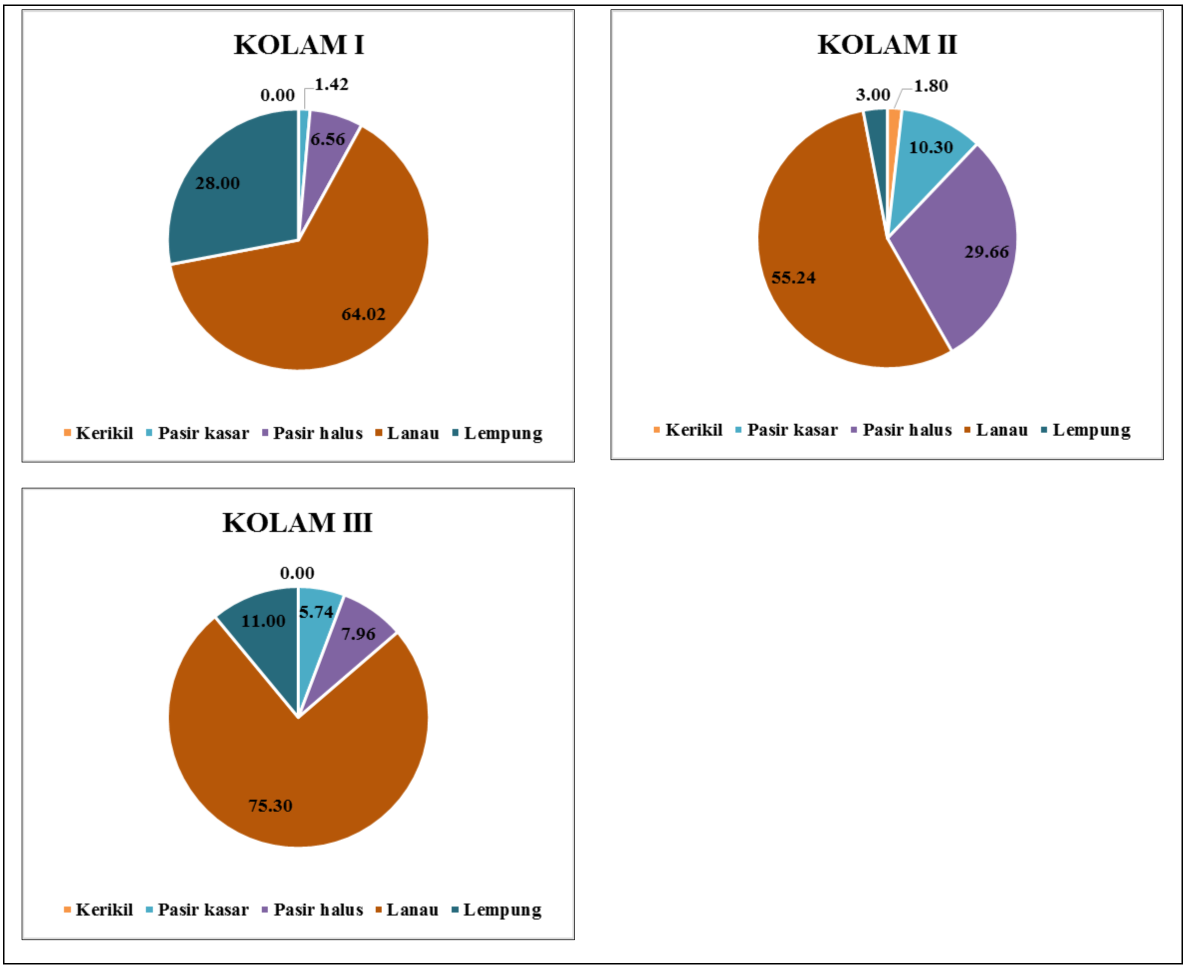


Picture 9. The organic matter content in sediments in 3 (three) ponds at SMPN 3 Satu Atap, Sayung

The research team also tested the grain size. The grain size in the bottom of the water greatly affects what biota grows and develops in that location. There are 4 classifications for grain size in this research, namely gravel, coarse sand, fine sand, silt and clay. The test results from each observation pond are found in Table 6.

Table 7. Test results of the grain size of the sediment pond at SMPN 3 Satu Atap Sayung. (AASHTO *Classificication*)

CLASSIFICATION (%)	POND		
	I	II	III
Gravel	0,00	1,80	0,00
Rough sands	1,42	10,30	5,74
Fine sand	6,56	29,66	7,96
Silt	64,02	55,24	75,30
Clay	28,00	3,00	11,00
TOTAL	**100,00**	**100,00**	**100,00**



Picture 10. Graph of grain size of sediments in each observation pond.

From the results of testing, silt is a category that dominates in each pond. This shows that the sediment categories that exist in each pond in a common language can be categorized as mud. The ponds that have the highest sand category are Pond II both for coarse sand (10.30%) and fine sand (29.66%).

Taking sediment samples from each test was carried out at the same time. Sampling is done by using a sediment grab to facilitate retrieval. At the first observation the team did not get a significant obstacle, but in the second observation the sediment sampling team was constrained by *Hydrilla* sp. which died and was suspended at the bottom of the pond so that it mixed with the sediment during collection.

Taking sediment samples at the first observation using sediment grab

Preparation in sample collection

Taking sediment samples at the second observation

The second observation sample is quite difficult because the sediment mixes with the dead *Hydrilla* sp.

Picture 11. The process of sediment sampling at SMPN 3 Satu Atap, Sayung for some aspect for testing.

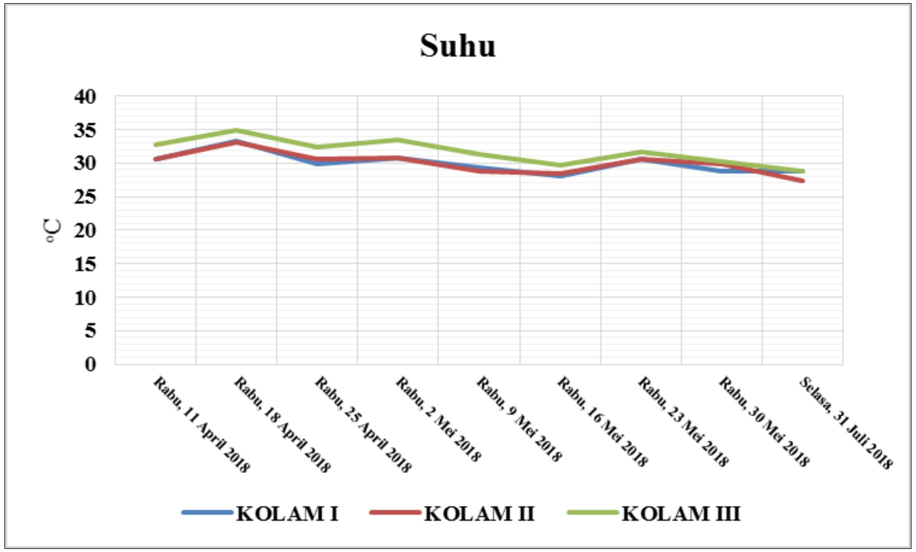
The research team also observed periodic environmental parameters every week for 8 weeks. This is done to find out the in situ conditions that exist in the research location. Observations include pH, temperature, salinity, DO and brightness. These environmental parameters are one of the important aspects in the success of fish farming. Matters to be considered to increase fish production are conducting water quality management, feed management, and optimal stocking density (Karlyssa *et al*., 2014).

The results of the weekly observations made by the team are presented in Table 7. Observations were made every Wednesday for 2 months of observation. However, additional observations were made to find out information about the observation pond after the ROB disaster occurred. The team tried to compare the data obtained in the field with the data that other research teams had obtained first. From the observations made, the pH in the research location ranged from 6-8 ppt. This is almost as close as the research conducted by Astuti *et al*., 2016 with the pH values obtained ranging from 7-8 ppt. The water temperature of each observation pond ranges from 27.3 ˚C - 35.0 ˚C. While for the research of Astuti *et al*., 2016 the temperature of cultivation ponds ranged from 28 ˚C - 30 ˚C. The salinity in the observation area ranges from 0.1% - 3.3%. The increase in salinity is greatly affected by ROB floods that occur at the end of the observation.

Tide enters into the pond and increases salinity drastically and this is also a factor in the biota, where the three observation ponds experience mass death. DO in the observation pond ranged from 2.44 mg / L - 10.62 mg / L. Decreased DO values are also due to *Hydrilla* sp. and phytoplankton in the pond unable to produce oxygen properly because of the pond's murky. When ROB flooding occurs in DO observation pools, it decreases and ROB floods also affect brightness. The lowest level of water brightness occurs at the time of observation on 30 May 2018 for all observation ponds. At the time before the ROB, indirect measurements of water brightness also measured depth because the secchi disk disks used were visible to the bottom of the water. However, at the time of ROB, the brightness value also dropped dramatically. Decreased brightness in the waters because the pond becomes cloudy. The murky pond due to ROB flooding brings along fine, undisciplined sediments into the pond. The murky pond also resulted in the research team having difficulty monitoring fish in the trial pond.

Table 8. Observations of environmental parameters during 8 weeks (2 months) observations in research station.

NO	Day / Date	pH			TEMPERATURE (˚C)			SALINITY (%)			DO (mg/L)			BRIGHTNESS (cm)		
		POOL			POOL			POOL			POOL			POOL		
		I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
1	Wednesday, 11 April 2018	7	7	7	30,6	30,6	32,7	0,2	0,2	0,1	7,41	8,21	6,30	75	92	57
2	Wednesday, 18 April 2018	8	7	7	33,3	33,1	35,0	0,3	0,2	0,2	7,84	10,62	6,56	73	89	43
3	Wednesday, 25 April 2018	7	7	7	29,9	30,5	32,4	0,2	0,2	0,2	5,20	6,73	7,62	74	114	24
4	Wednesday, 2 May 2018	7	7	7	30,7	30,7	33,5	0,3	0,3	0,3	7,82	8,07	8,32	78	89	46
5	Wednesday, 9 May 2018	6	6	6	29,3	28,7	31,3	0,3	0,4	0,5	7,25	7,45	8,25	66	64	42
6	Wednesday, 16 May 2018	7	7	7	28,1	28,4	29,7	0,4	0,7	0,7	4,74	4,98	4,61	78	66	38
7	Wednesday, 23 May 2018	7	7	7	30,6	30,5	31,7	0,6	1,9	1,2	2,82	4,95	2,63	77	34	55
8	Tuesday, 30 May 2018	6	6	6	28,8	29,8	30,3	1,4	2,4	2,3	2,63	5,91	2,44	42	35	15
9	Tuesday, 31 Juli 2018	7	7	7	28,9	27,3	28,9	2,7	3,0	3,3	3,40	5,28	3,23	58	69	40


Suhu
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Rabu, 9 Mei 2018
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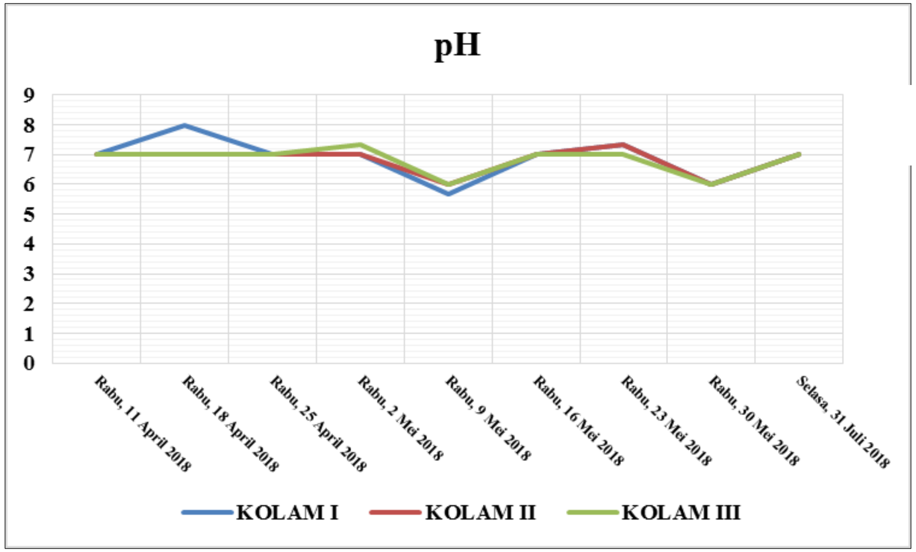
Rabu, 30 Mei 2018
Selasa, 31 Juli 2018
KOLAM I
KOLAM II
KOLAM III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Rabu, 9 Mei 2018
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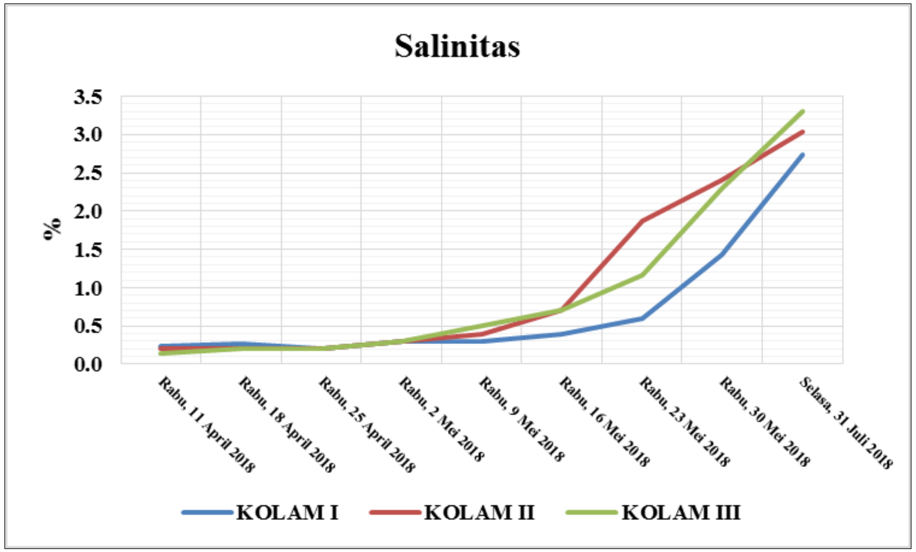
Rabu, 23 Mei 2018
Rabu, 30 Mei 2018
Selasa, 31 Juli 2018
KOLAM I
KOLAM II
KOLAM III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Rabu, 11 April 2018
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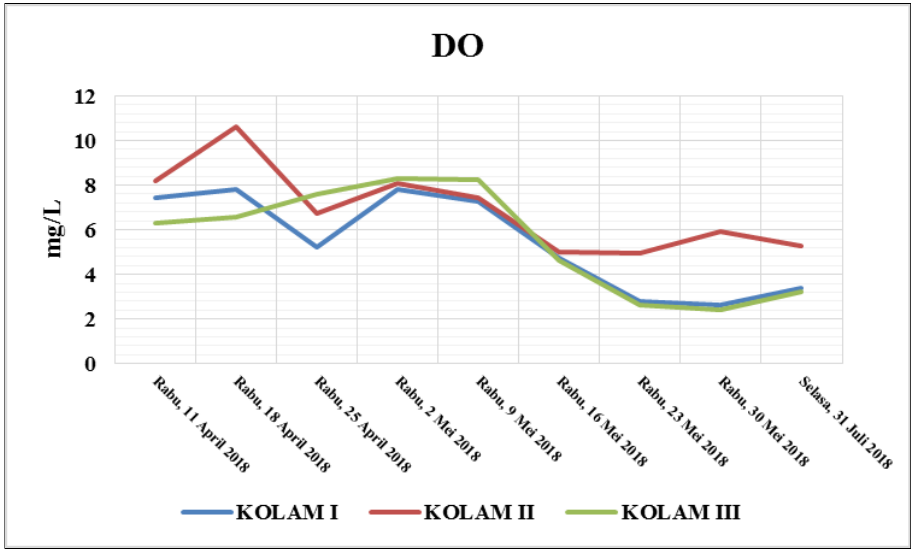
Selasa, 31 Juli 2018
KOLAM I
KOLAM II
KOLAM III


DO
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Rabu, 2 Mei 2018
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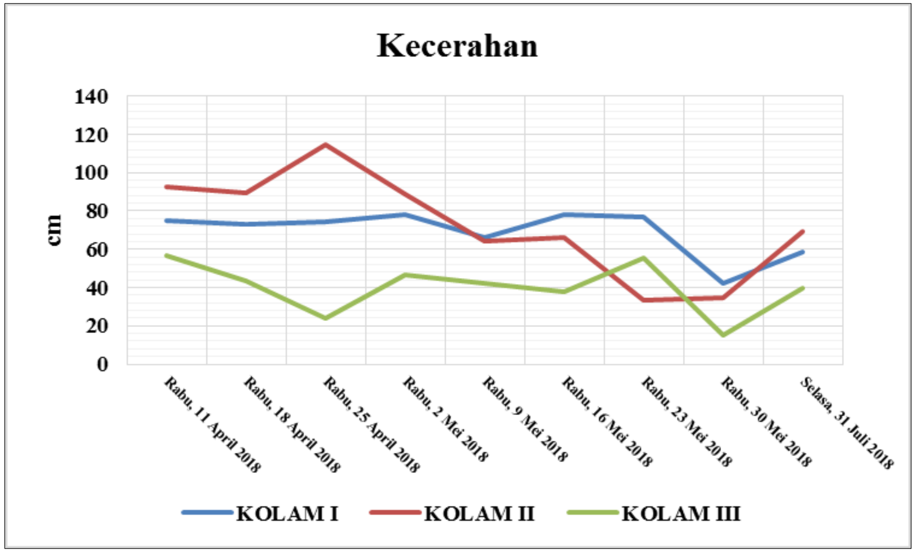
Rabu, 23 Mei 2018
Rabu, 30 Mei 2018
Selasa, 31 Juli 2018
KOLAM I
KOLAM II
KOLAM III



Picture 12. Observations of environmental parameters were carried out for 8 weeks (2 months) observations in all observation ponds.

Measurement of temperature and salinity of the observation pond

pH measurement in each observation pond

Measurement of water brightness

Student involvement in monitoring

Picture 13. Weekly monitoring for water quality control at each observation pond at SMPN 3 Satu Atap Sayung

The results of observing the survival rate in the pond also obtained interesting results in this study. At the beginning of the research, the team selected three fish species used in the trials, namely Tilapia (*Oreochromis niloticus*), Catfish (*Clarias gariepinus*) and Milkfish (*Chanos chanos*). At the beginning of the observation, some Tilapia died and it was seen that Catfish were more able to live in the first week of the research. The second week the research team also still saw the same movement that Catfish were better able to live in the area compared to indigo. However, when the ROB flood came, the team saw mass deaths in the Catfish trial pond. The Catfish are all dead and no one is able to live. For more details about fish growth can be seen in Table 8.

Tilapia habitat is fresh water such as rivers, lakes, reservoirs and swamps. However, Tilapia is also able to live and adapt to waters that have salinity between 0 - 35 ppt. However, the best salinity for Tilapia saline to grow and develop is 0-30 ppt (Prayudi *et al*., 2015). Based on observations of environmental parameters, the ponds in SMPN 3 Satu Atap under normal conditions are still included in the environment which is good for saline Tilapia to grow and develop.

Unlike the case with Tilapia, Catfish have its own uniqueness in terms of this durability. Catfish look strong at the beginning of the observation but at the last observation Catfish is the type that has the greatest mortality rate. This can occur because the difference in salinity has changed dramatically due to the occurrence of ROB in the research area. Catfish are not able to survive because of rising salinity in the waters. On observations at weeks 3 and 4, Catfish were also seen to experience changes in body shape that could be due to lack of nutrition. Lack of nutrients can occur in Catfish due to incompatibility of the type of feed used in the research. Catfish are fish that use floating feed types for aquaculture, so this is a growth inhibitor because the feed used in this research is sinking feed. The observations for live and dead fish in the observation are listed in Table 8.

Tabel 9. Observation survival rate of fish in each pond.

No.		DEATH FISH			LIVE FISH		
		TILAPIA	CATFISH	MILKFISH	TILAPIA	CATFISH	MILKFISH
Wednesday, 18 April 2018							
1	P (cm)	10	-	-	-	-	-
	L (cm)	3,2	-	-	-	-	-
	B (g)	-	-	-	-	-	-
2	P (cm)	10	-	-	-	-	-
	L (cm)	3,2	-	-	-	-	-
	B (g)	-	-	-	-	-	-
Wednesday, 25 April 2018							
1	P (cm)	-	-	-	10	9,5	4
	L (cm)	-	-	-	3,2	1,5	0,6
	B (g)	-	-	-	15,6	5,29	0,1
2	P (cm)	-	-	-	10,9	10,5	3
	L (cm)	-	-	-	3,5	1,5	0,7
	B (g)	-	-	-	20,56	8	0,17
3	P (cm)	-	-	-	9,1	11,6	3,8
	L (cm)	-	-	-	2,9	2	0,6

No.		DEATH FISH			LIVE FISH		
		TILAPIA	CATFISH	MILKFISH	TILAPIA	CATFISH	MILKFISH
	B (g)	-	-	-	11,83	10,59	0,23
4	P (cm)	-	-	-	9,6	10,8	4
	L (cm)	-	-	-	3,2	1,5	0,6
	B (g)	-	-	-	15,64	7,84	0,58
5	P (cm)	-	-	-	9,8	10,4	3,5
	L (cm)	-	-	-	3,3	1,3	0,6
	B (g)	-	-	-	15,31	7,42	0,17
Wednesday, 2 May 2018							
1	P (cm)	-	10	-	12	10,5	4
	L (cm)	-	2	-	3	2,5	1,5
	B (g)	-	5,36	-	31,17	8,56	0,21
2	P (cm)	-	-	-	10	10	3,5
	L (cm)	-	-	-	3,5	2,5	1
	B (g)	-	-	-	21,02	7,13	0,12
3	P (cm)	-	-	-	9,5	10,5	5
	L (cm)	-	-	-	2	3	1,5
	B (g)	-	-	-	13,55	7,56	0,8
4	P (cm)	-	-	-	12	11	4
	L (cm)	-	-	-	4	3	1
	B (g)	-	-	-	30,39	8,58	0,98
5	P (cm)	-	-	-	9,5	9,5	2,5
	L (cm)	-	-	-	3	2,5	1
	B (g)	-	-	-	15,3	7,16	0,1
Wednesday, 9 May 2018-							
1	P (cm)	-	-	-	10,5	9,5	4,2
	L (cm)	-	-	-	3,1	1,9	1

No.		DEATH FISH			LIVE FISH		
		TILAPIA	CATFISH	MILKFISH	TILAPIA	CATFISH	MILKFISH
	B (g)	-	-	-	22,8	7,2	0,4
2	P (cm)	-	-	-	11,5	11,2	4
	L (cm)	-	-	-	3,6	2,1	1,4
	B (g)	-	-	-	31,2	16,5	1,8
3	P (cm)	-	-	-	10,4	9,5	3,5
	L (cm)	-	-	-	3	1,4	1
	B (g)	-	-	-	19,9	8,1	0,7
4	P (cm)	-	-	-	9,6	10	3,8
	L (cm)	-	-	-	3,5	1,1	1,3
	B (g)	-	-	-	18,4	7,4	0,4
5	P (cm)	-	-	-	12,6	10,8	3,6
	L (cm)	-	-	-	4,6	1,5	1
	B (g)	-	-	-	37,5	12,6	1,6
Wednesday, 16 May 2018-							
1	P (cm)	-	11	-	11	11	4,5
	L (cm)	-	2,5	-	3,3	2	0,7
	B (g)	-	12,11	-	21,4	10,9	0,8
2	P (cm)	-	-	-	10,5	10	4,5
	L (cm)	-	-	-	3,5	1,5	0,5
	B (g)	-	-	-	23,5	5	0,8
3	P (cm)	-	-	-	11	12,5	4,3
	L (cm)	-	-	-	4	2,7	0,4
	B (g)	-	-	-	24,1	13,3	0,5
4	P (cm)	-	-	-	10	12,5	5
	L (cm)	-	-	-	3	2,5	1
	B (g)	-	-	-	19,2	13,4	1,3

No.		DEATH FISH			LIVE FISH		
		TILAPIA	CATFISH	MILKFISH	TILAPIA	CATFISH	MILKFISH
5	P (cm)	-	-	-	12,1	11,5	5
	L (cm)	-	-	-	3,5	2	0,8
	B (g)	-	-	-	25,8	10,1	1,1
Wednesday, 23 May2018							
1	P (cm)	-	-	4,9	10,5	11,5	5
	L (cm)	-	-	0,8	3	1,9	0,9
	B (g)	-	-	0,9	18,9	6,9	0,9
2	P (cm)	-	-	-	10,6	9,1	3,7
	L (cm)	-	-	-	3,2	1,8	0,6
	B (g)	-	-	-	19,6	6,1	0,4
3	P (cm)	-	-	-	11	11,5	6,5
	L (cm)	-	-	-	3,9	1,8	1,1
	B (g)	-	-	-	23,7	10	2,1
4	P (cm)	-	-	-	12	11,1	1,9
	L (cm)	-	-	-	3,9	11,3	0,7
	B (g)	-	-	-	26,2	5,9	0,6
5	P (cm)	-	-	-	11,6	9,5	4
	L (cm)	-	-	-	4	1,3	0,7
	B (g)	-	-	-	27,3	4,8	0,4
Wednesday, 30 May 2018							
1	P (cm)	-	-	-	-	-	-
	L (cm)	-	-	-	-	-	-
	B (g)	-	-	-	-	-	-
2	P (cm)	-	-	-	-	-	-
	L (cm)	-	-	-	-	-	-
	B (g)	-	-	-	-	-	-

No.		DEATH FISH			LIVE FISH		
		TILAPIA	**CATFISH**	**MILKFISH**	**TILAPIA**	**CATFISH**	**MILKFISH**
3	P (cm)	-	-	-	-	-	-
	L (cm)	-	-	-	-	-	-
	B (g)	-	-	-	-	-	-
4	P (cm)	-	-	-	-	-	-
	L (cm)	-	-	-	-	-	-
	B (g)	-	-	-	-	-	-
5	P (cm)	-	-	-	-	-	-
	L (cm)	-	-	-	-	-	-
	B (g)	-	-	-	-	-	-
Tuesday, 31 July 2018							
1	P (cm)	-	-	-	13,5	-	5
	L (cm)	-	-	-	4,5	-	0,5
	B (g)	-	-	-	40,5	-	1,6
2	P (cm)	-	-	-	12,5	-	5,4
	L (cm)	-	-	-	4,5	-	0,7
	B (g)	-	-	-	34,4	-	1,2
3	P (cm)	-	-	-	13	-	5,7
	L (cm)	-	-	-	4,4	-	0,9
	B (g)	-	-	-	39,9	-	1,8
4	P (cm)	-	-	-	15,2	-	5,9
	L (cm)	-	-	-	4,4	-	0,5
	B (g)	-	-	-	38,4	-	1,7
5	P (cm)	-	-	-	14,7	-	5,5
	L (cm)	-	-	-	4,2	-	0,8
	B (g)	-	-	-	33,6	-	1,6

From Picture 14, it is seen the development of fish from the second week of observation until the seventh week before the occurrence of the ROB flood. Fish in the experimental pond are able to withstand the environmental conditions of the weeks. However, it appears that Catfish do not show significant development. This is indicated because of the lack of proper feed used, but for testing the salinity of Catfish, it can compete before the ROB occurs. While for the Tilapia the development is a little slow but with the existing salinity able to survive. For the final results of the observations (July 31, 2018) it was found that Tilapia was able to survive as many as 17 birds (out of 75), Milkfish 50 - 60 (from 100), Catfish entirely dead (out of 75) and seaweed as much as 244, 6 gr (of 15 kg). Tilapia can be an option in the aquaculture activitiy at SMPN 3 Satu Atap for the future.

Seaweed stocked in the observation pond looks good in the weeks before the ROB. The team in the field did not make weekly observations, because for the seaweed the team would conduct a weighing when the initial distribution and harvesting at the end of the observation. In general, seaweed farmers are able to harvest seaweed in 1 - 1.5 months at the beginning of stocking and 1 month in the following months. Especially for Central Java Province, seaweed farmers have a fairly wide market because seaweed can be used for processed food, cosmetics and medicines. In fact, in Jepara some farmers are able to produce up to 2 tons per harvest and the harvest is ordered directly by the buyer.

Milkfish (2nd Week)

Milkfish (7th Week)

Tilapia (2nd Week)

Tilapia (7th Week)

Catfish (2nd Week)

Catfish (7th Week)

Picture 14. Conditions of trial fish in the experimental pond at SMPN 3 Satu Atap Sayung.

In addition to the above parameters, the research team also took samples for phytoplankton and zooplankton at observation stations at SMPN 3 Satu Atap Sayung. Observations of phytoplankton and zooplankton were also used to determine the quality of waters in the area of SMPN 3 Satu Atap Sayung. Observations were made to determine abundance, diversity index, uniformity index and dominance index. Phytoplankton observations can also determine the level of pollution based on species found, while observing zooplankton can find out how much potential natural nutrients for fish to be cultivated.

Plankton has a large function in aquaculture activities, among others, phytoplankton is one of the producers of oxygen in water, zooplankton is a natural feed for aquaculture biota at the beginning of the initial seeding and other plankton functions that are able to absorb harmful compounds such as ammonia, nitrite and nitrate (Utojo, 2015). In addition to the abundant benefits, phytoplankton is also not always good. If there is a blooming, it will affect the quality of the waters, especially the brightness of the waters when during the day and at night the oxygen level will decrease because oxygen is used by phytoplankton in the process of respiration. This will reduce oxygen levels in the waters and can lead to death of aquaculture biota.

Plankton net withdrawal in the sampling process

Plankton samples after being put into a 4% formalin sample container

Picture 15. The process of taking plankton samples at SMPN 3 Satu Atap Sayung

The composition structure of plankton in the waters is also influenced by the sampling location, tides and seasons at the time of sampling. Each place has several genera that represent the location of retrieval. Sampling in this study was carried out for 4 times (T0, T1, T2 and T3). Observations on T3 are observations after the occurrence of ROB floods.

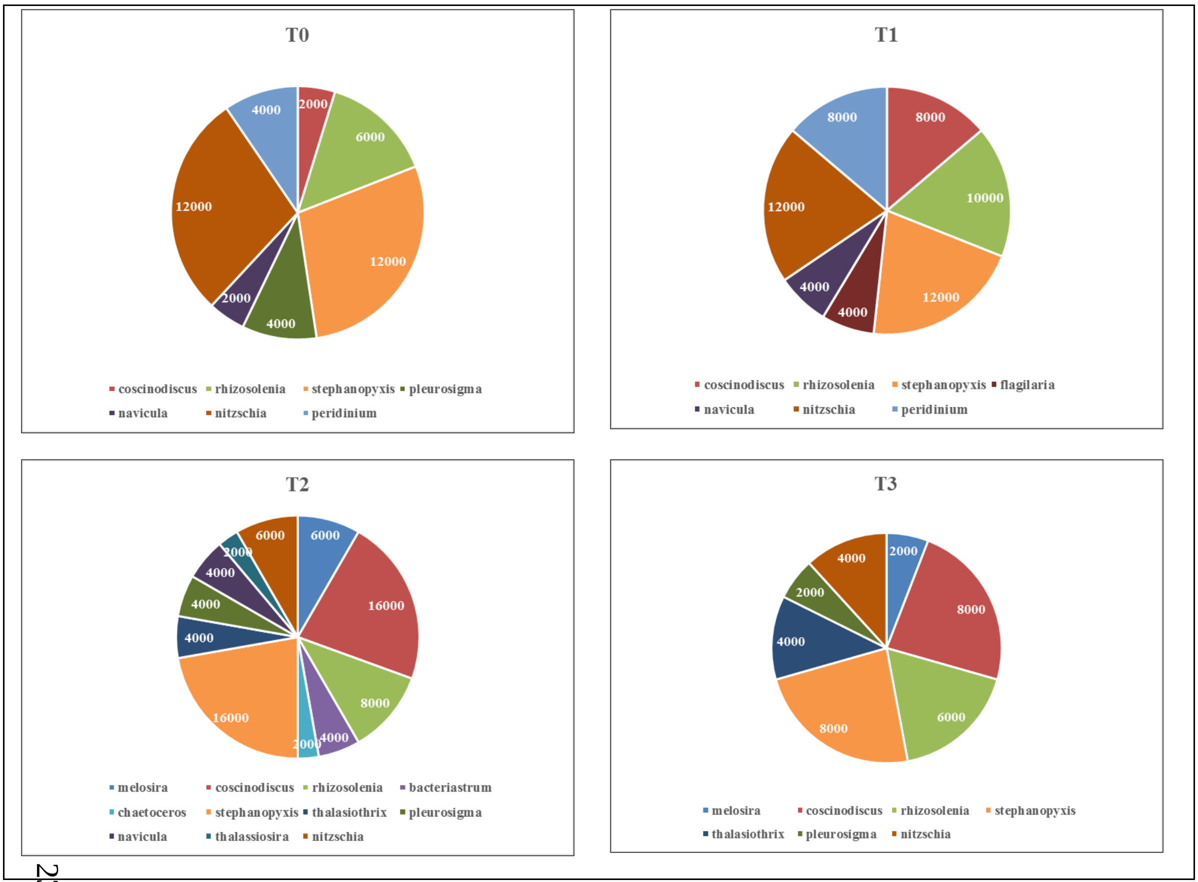
Based on observations, phytoplankton found in Table 9. There were 2 phyla and 13 genera found including Bacillariophyceae phylum found in 12 genera and Dinophyceae phylum found in 1 genus. There are several genera that are commonly found in areas of aquaculture ponds such as navicula and nitzschia. The number of genera found is quite large because the location in One Roof Junior High School 3 is included in the flooded area.

Table 10. The result of identification of phytoplankton found in the observation station at SMPN 3 Satu Atap, Sayung.

No	Filum	Family	Genus	STATIONS											
				T0			T1			T2			T3		
				I	II	III	I	II	III	I	II	III	I	II	III
1	Bacillariophyceae	**melosiraceae**	melosira	-	-	2	-	-	3	3	2	2	1	1	2
2		**coscinodiscaceae**	coscinodiscus	1	2	1	4	5	3	8	6	4	4	2	2
3		**rhizosoleniaceae**	rhizosolenia	3	2	4	5	2	4	4	2	4	3	3	5
4		**bacteriastraceae**	bacteriastrum	-	-	-	-	-	-	2	3	1	-	-	-
5			chaetoceros	-	-	-	-	-	-	1	2	1	-	1	1
6		**skeletonemaceae**	stephanopyxis	6	4	4	6	4	4	8	8	6	4	4	3
7		**flagilaria**	thalasiothrix	-	-	-	-	-	2	2	2	2	2	-	-
8			flagilaria	-	-	-	2	-	-	-	3	-	-	1	-
9		**naviculaceae**	pleurosigma	2	1	1	-	4	-	2	4	2	1		1
10			navicula	1	2	-	2	6	-	2	2	8	-	2	-
11		**thalassiosiraceae**	thalassiosira	-	1	-	-	4	-	1	2	-	-	-	-
12		**nitzschiaceae**	nitzschia	6	4	2	6	-	8	3	2	4	2	4	1
13	**Dinophyceae**		peridinium	2	-	-	4	-	-	-	1	1	-	-	-

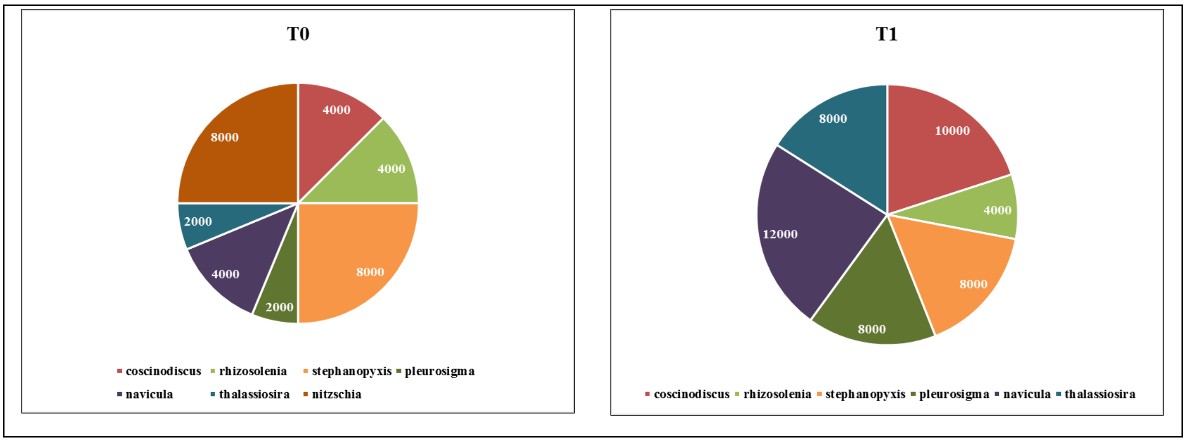
Table 11. Phytoplankton abundance at each flooded pool at SMPN 3 Satu Atap, Sayung

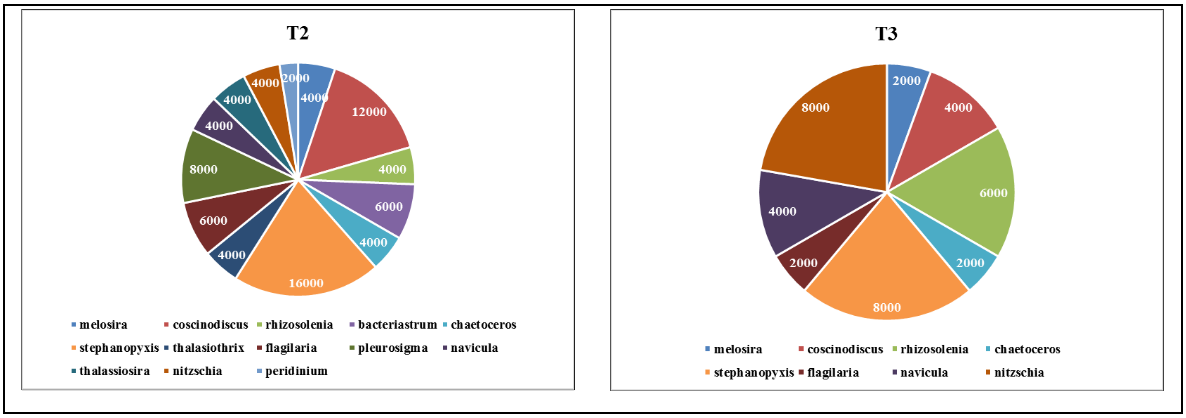
No	Filum	Family	Genus	STATIONS											
				T0			T1			T2			T3		
				I	II	III	I	II	III	I	II	III	I	II	III
1	**Bacillariophyceae**	**melosiraceae**	melosira	-	-	4000	-	-	6000	6000	4000	4000	2000	2000	4000
2		**coscinodiscaceae**	coscinodiscus	2000	4000	2000	8000	10000	6000	16000	12000	8000	8000	4000	4000
3		**rhizosoleniaceae**	rhizosolenia	6000	4000	8000	10000	4000	8000	8000	4000	8000	6000	6000	10000
4		**bacteriastraceae**	bacteriastrum	-	-	-	-	-	-	4000	6000	2000	-	-	-
5			chaetoceros	-	-	-	-	-	-	2000	4000	2000	-	2000	2000
6		**skeletonemaceae**	stephanopyxis	12000	8000	8000	12000	8000	8000	16000	16000	12000	8000	8000	6000
7		**flagilaria**	thalasiothrix	-	-	-	-	-	4000	4000	4000	4000	4000	-	-
8			flagilaria	-	-	-	4000	-	-	-	6000	-	-	2000	-
9		**naviculaceae**	pleurosigma	4000	2000	2000	-	8000	-	4000	8000	4000	2000	-	2000
10			navicula	2000	4000	-	4000	12000	-	4000	4000	16000	-	4000	-
11		**thalassiosiraceae**	thalassiosira	-	2000	-	-	8000	-	2000	4000		-	-	-
12		**nitzschiaceae**	nitzschia	12000	8000	4000	12000	-	16000	6000	4000	8000	4000	8000	2000
13	**Dinophyceae**		peridinium	4000	-	-	8000	-	-	-	2000	2000	-	-	-
Abundance (Cell / L)				42000	32000	**28000**	58000	50000	48000	72000	**78000**	70000	34000	36000	30000
Diversity Index				1.73	1.82	**1.65**	1.87	1.75	1.69	2.17	**2.40**	2.18	1.82	1.94	1.77
Uniformity Index				**0.89**	0.94	0.92	**0.96**	0.97	0.94	0.90	0.94	0.91	0.94	0.93	0.91
Dominance Index				**0.11**	0.06	0.08	0.04	**0.03**	0.06	0.10	0.06	0.09	0.06	0.07	0.09



Picture 16. Phytoplankton abundance (cell / L) diagram in Pond I in 4 observations at SMPN 3 Satu Atap, Sayung

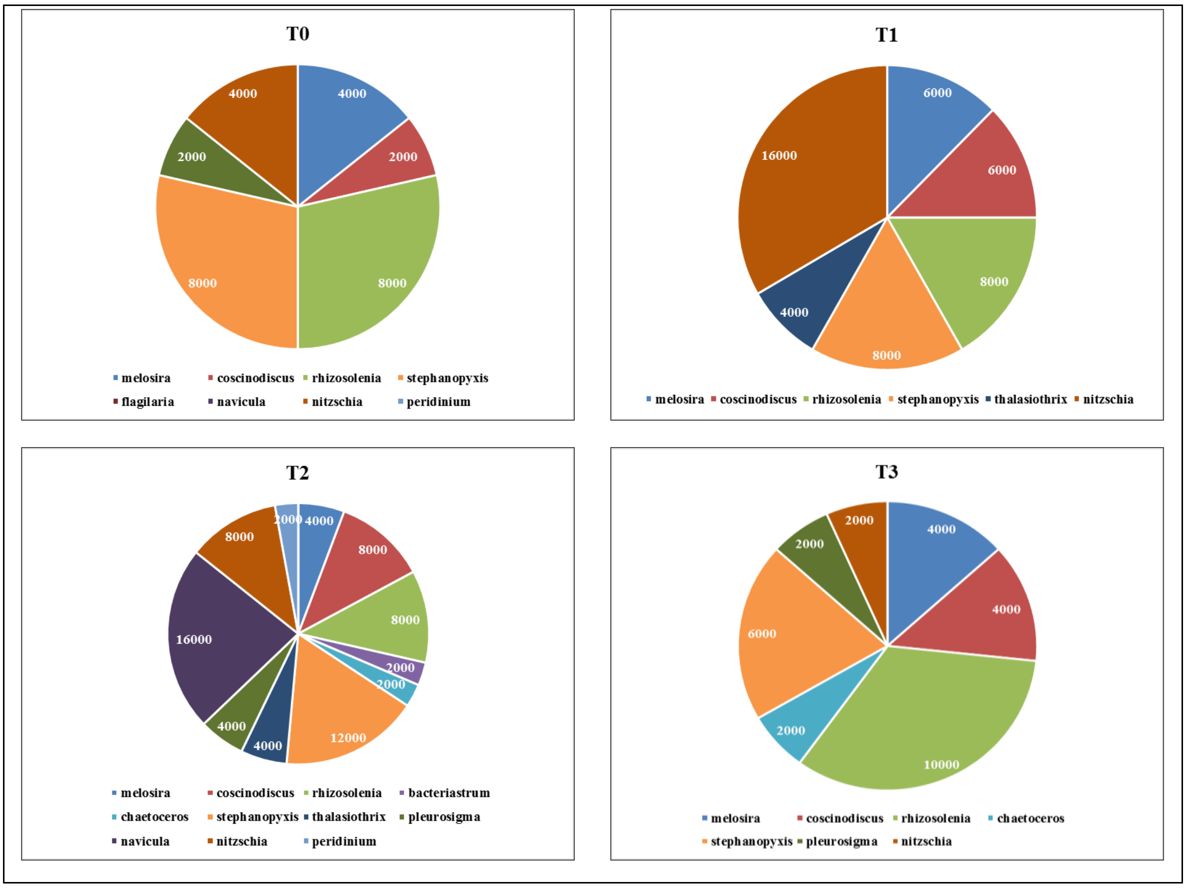
In sampling in Pond I for 4 times, the genus is the genus that most dominates in each time taken. In addition, the genus nitzschia is in the second position in sampling T0 and T1 while the genus coscinodiscus is in the second position in sampling T2 and T3.





Picture 17. Phytoplankton abundance (cell / L) diagram in Pond II in 4 observations at SMPN 3 Satu Atap, Sayung

For the results of observations in Pond II for 4 times the sampling in the field, the same results are obtained as in Pond I that the genus stephanopyxis is still the genus that has the highest abundance of each sampling in the field.



Picture 18. Phytoplankton abundance (cell / L) diagram in Pond III in 4 observations at SMPN 3 Satu Atap, Sayung

Unlike the previous pond, Pond III has more open characteristics and is easily contaminated with outside waters. The genus that dominates in Pond III is different in each retrieval. In T0 genus which has the highest abundance is stephanopyxis and rhizosolenia. In T1 genus which has the highest abundance is nitzschia, in T2 genus navicula and for T3 genus rhizosolenia.

While for the results of observations of zooplankton at SMPN 3 Satu Atap Sayung, 2 phyla were found, namely crustacean (7 genera) and rotatoria (1 genus). The genus - zooplankton found genus that are capable of living and able to adapt to salinity.

Table 12. The result of identification from zooplankton found in t the observation station at SMPN 3 Satu Atap, Sayung.

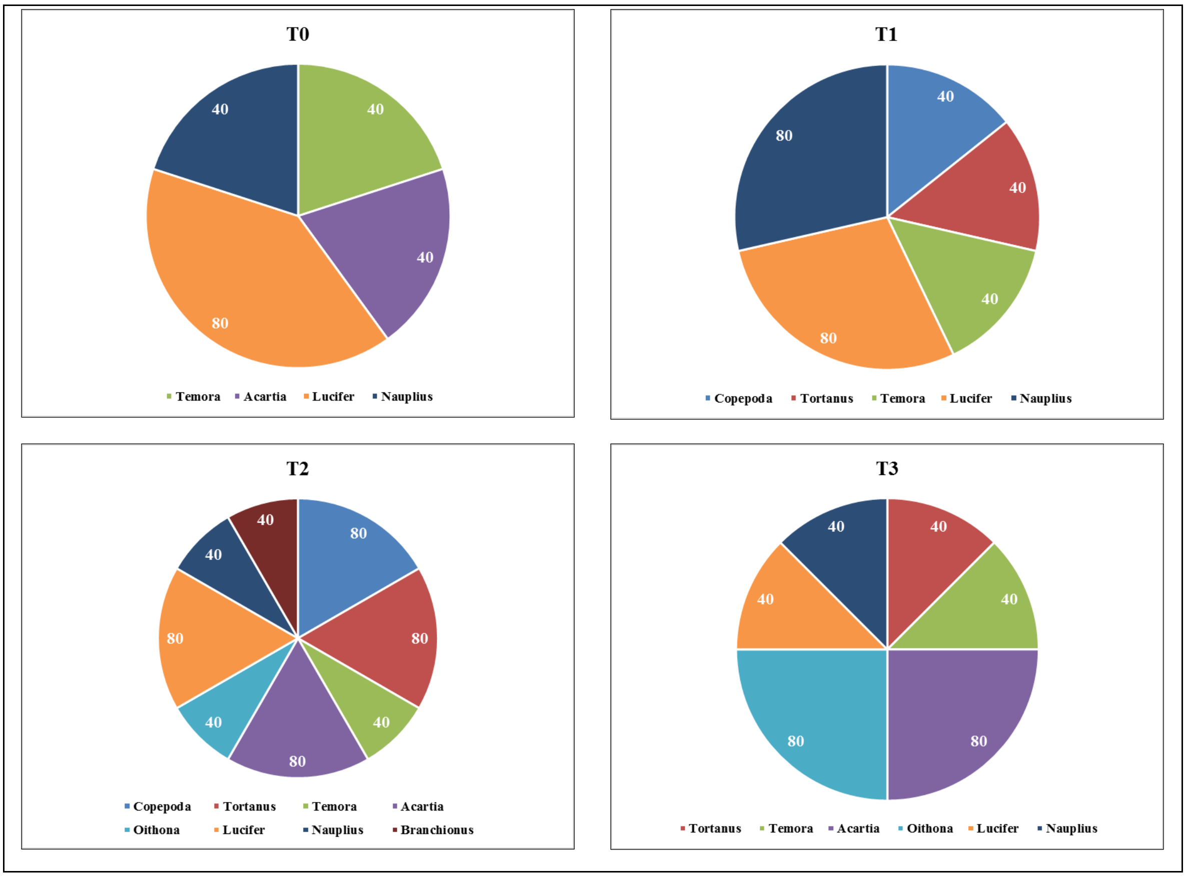
No	Filum	Genus	STATIONS											
			TO			T1			T2			T3		
			I	II	III	I	II	III	I	II	III	I	II	III
1	**Crustaceae**	Copepoda	-	1	-	1	-	1	2	1	2	-	1	1
2		Tortanus	-	1	1	1	-	-	2	2	1	1	-	-
3		Temora	1	-	1	1	-	1	1	-	1	1	-	1
4		Acartia	1	1	-	-	1	1	2	1	1	2	1	1
5		Oithona	-	1	1	-	-	-	1	1	2	2	1	2
6		Lucifer	2	1	-	2	1	-	2	1	1	1	2	2
7		Nauplius	1	2	-	2	2	-	1	2	1	1	2	2
8	**Rotatoria**	Branchionus	-	-	1	-	1	-	1	-	1	-	-	-

Table 13. Zooplankton abundance at each observation station at SMPN 3 Satu Atap, Sayung

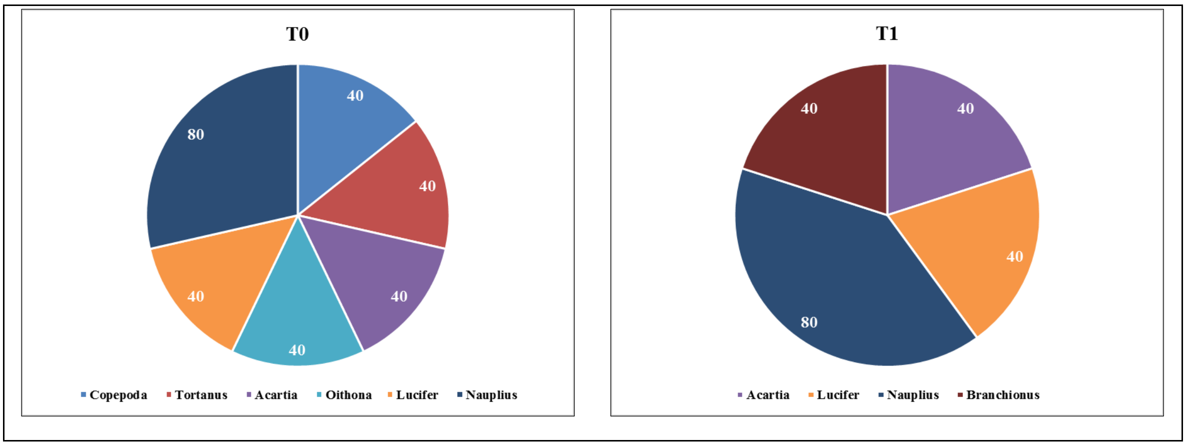
No	Filum	Genus	STATIONS											
			TO			T1			T2			T3		
			I	II	III	I	II	III	I	II	III	I	II	III
1	**Crustaceae**	Copepoda	-	40	-	40	-	40	80	40	80	-	40	40
2		Tortanus	-	40	40	40	-	-	80	80	40	40	-	-
3		Temora	40	-	40	40	-	40	40	-	40	40	-	40
4		Acartia	40	40	-	-	40	40	80	40	40	80	40	40
5		Oithona	-	40	40	-	-	-	40	40	80	80	40	80
6		Lucifer	80	40	-	80	40	-	80	40	40	40	80	80
7		Nauplius	40	80	-	80	80	-	40	80	40	40	80	80
8	**Rotatoria**	Branchionus	-	-	40	-	40	-	40	-	-	-	-	-
Abundance (Cell / L)			200	280	160	280	200	**120**	**480**	320	360	320	280	360
Diversity Index			1.92	2.52	2.00	2.24	1.92	**1.58**	**2.92**	2.50	2.73	2.50	2.24	2.50
Uniformity Index			**0.96**	0.98	**1.00**	**0.96**	**0.96**	**1.00**	0.97	0.97	0.97	0.97	**0.96**	0.97

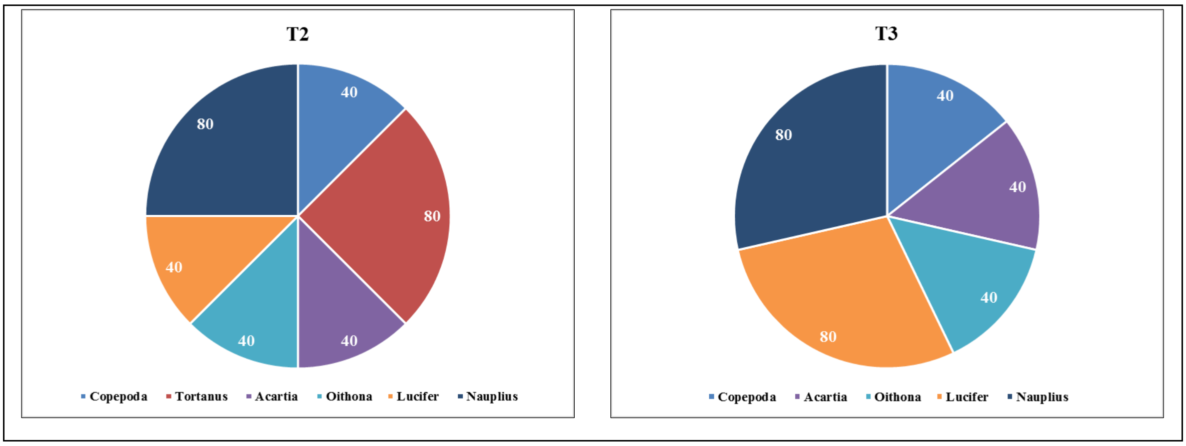
Dominance Index	**0.04**	0.02	**0.00**	**0.04**	**0.04**	**0.00**	0.03	0.03	0.03	0.03	**0.04**	0.03

Zooplankton abundance in all three relalif data collection ponds is more evenly distributed. There is no genus that seems to dominate as happened in the observation of phytoplants. Some genera such as temora, acartia, lucifer and nauplius are genus - genus that are often found in zooplankton observations. From the observations of the abundance of zooplankton, phylum crustaceans are the most commonly found because indeed this phylum is the most resistant to salinity and is commonly found in tidal regions.

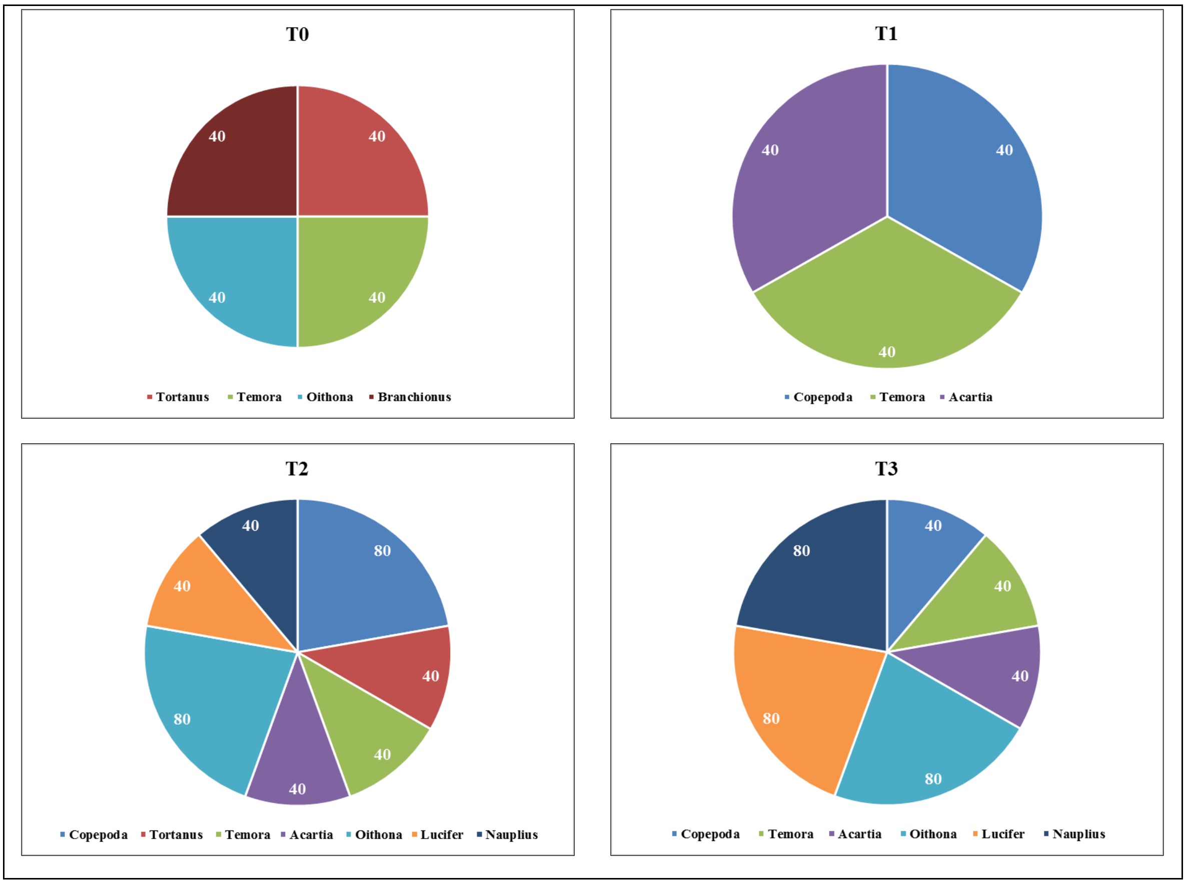


Picture 19. Zooplankton abundance (ind / L) graph in Pond I at SMPN 3 Satu Atap, Sayung.





Picture 20. Zooplankton abundance (ind / L) graph in Pond II at SMPN 3 Satu Atap, Sayung.



Picture 21. Zooplankton abundance graph (ind / L) in Pond II at SMPN 3 Satu Atap, Sayung.

4.1.2. Chemical Content

Avicennia marina is one of the major mangrove species that usually lives in tidal areas with sandy mud or mud substrate with small waves such as the northern coast of Java. *Avicennia marina* fruit and leaves are commonly used by coastal communities as traditional snacks. Mangrove leaves especially *Avicennia marina* leaves contain anti-nutrient compounds in the form of Tanin and HCN (NH_3) so that if it is to be treated it needs special treatment to reduce the levels of the two compounds in the food so it is not harmful to the body that consumes it. In Bedono Village, mangrove leaf chips are a typical food that is well-known and has become a souvenir in the region. But so far there has been no research activity that proves that mangrove leaf chips are safe from anti-nutritional compounds.

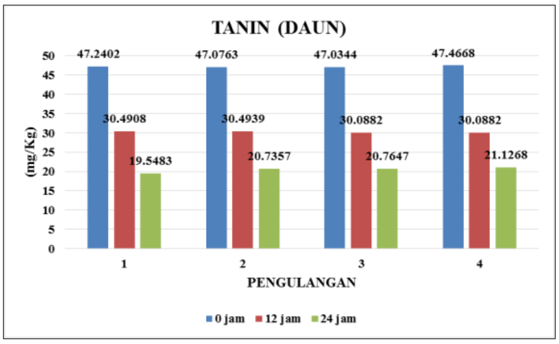
The research team tested the chemicals on the leaves of *Avicennia marina* in the area of SDN 1 Bedono, Sayung. The community around SDN 1 Bedono used to use leaves from *Avicennia marina* as a base for making mangrove leaf chips. *Avicennia marina* itself is usually called as a local community as a tree of fire - fire. This research was conducted referring to the sister school activities carried out at SDN 1 Bedono. The school is trying to further develop mangrove leaf chips which are now locally owned by tourist visitors in Bedono Village. *Avicennia marina* thrives in Bedono Village because this village is a good area for mangroves to grow and develop.

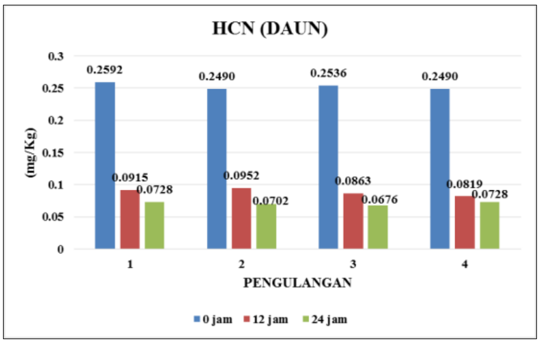
In this effort, before the future development, the product feasibility test must be carried out in the form of a test for tannin and cyanide acid (HCN) content. *Avicennia marina* contains vitamins, fat, calories, amino acids, protein, fiber, carbohydrates, and minerals (Fe, Mg, Ca, K and Na) in sufficiently high amounts in their leaves (Soenardjo et al, 2017). Mangroves are indeed plants that naturally contain tannins and cyanide acids in them. Each part of the tree from the roots to the tips of the leaves contains both of these compounds. The leaves of *Avicennia marina* are one of the leaves that have high fiber and carbohydrate. There are also several bioactive components contained in *Avicennia marina* leaves such as flavonoids, steroids and reducing sugars (Jacoeb *et al*., 2011). Based on various types of potential in the leaves of *Avicennia marina*, the preparations made from the leaves of *Avicennia marina.*

Table 14. The results of the content test of Tanin and HCN in mangrove leaves in each treatement

TIMES	*Avicennia marina* LEAVES					
	Tanin (mg/kg)*			HCN (mg/kg)**		
	0 hour	12 hour	24 hour	0 hour	12 hour	24 hour
I	47.2402	30.4908	19.5483	0.2592	0.0915	0.0728
II	47.0763	30.4939	20.7357	0.2490	0.0952	0.0702
III	47.0344	30.0882	20.7647	0.2536	0.0863	0.0676
IV	47.4668	30.0882	21.1268	0.2490	0.0819	0.0728

*AOAC Test ** Spectrophotometry Test





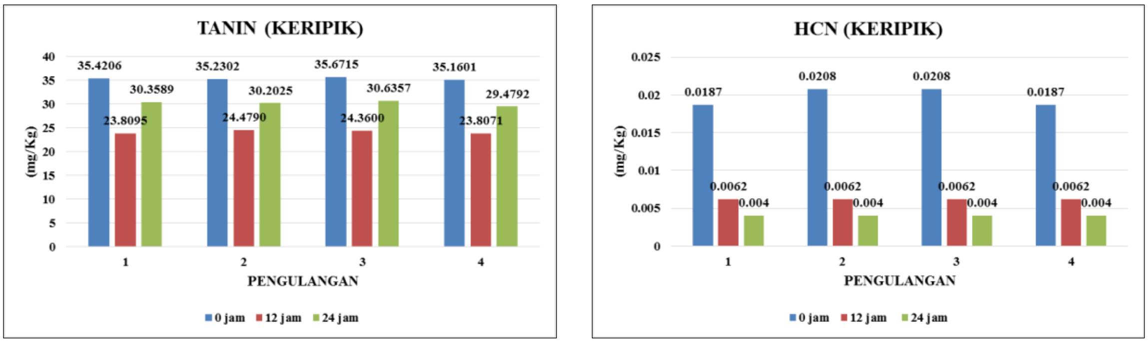
Picture 22. Graph of Tanin and Cyanide Acid (HCN) content in mangrove leaves at each treatment.

From the results of the tannin and cyanide acid (HCN) test presented in Picture 22 based on Table 13, it can be seen that the treatment in the form of soaking for several hours can reduce (reduce) the content of tannins and HCN in the mangrove leaves. The test samples were carried out in 4 samples. For tannin content, at immersion within 12 hours, the content of tannins contained in 4 test samples was able to reduce the tannin content of ± 17 mg / kg. Meanwhile, the treatment of soaking mangrove leaves in 4 test samples for 24 hours, the tannin content was reduced by ± 27 mg / kg. While for HCN content in 4 test samples also dropped because of the soaking treatment carried out. In the immersion treatment of the 4 samples carried out, it was able to reduce the HCN content of ± 0.15 mg / kg. Treating soaking can reduce the HCN content by 50%. While for the immersion treatment of 4 samples, the HCN content was reduced by ± 0.17 mg / kg. During immersion, the water used is not replaced. Leaf samples from soaking results were also directly used as a base for mangrove leaf chips.

Table 15. Test results for the content test of tanin and HCN in mangrove leaf chips in each treatment.

TIMES	*Avicennia marina* LEAVES CHIPS					
	Tanin (mg/kg)*			HCN (mg/kg)**		
	0 hour	12 hour	24 hour	0 hour	12 hour	24 hour
I	35.4206	23.8095	30.3589	0.0187	0.0062	<0.004
II	35.2302	24.4790	30.2025	0.0208	0.0062	<0.004
III	35.6715	24.3600	30.6357	0.0208	0.0062	<0.004
IV	35.1601	23.8071	29.4792	0.0187	0.0062	<0.004

*Uji AOAC **Uji Spektrofotometri



Picture 23. Graph of Tanin and Cyanide Acid (HCN) content in mangrove leaves at each treatment.

The sample of chips used in the test is a sample of the results of the immersion treatment carried out. This is so that the content of tannin and cyanide acid (HCN) in the sample is known to start from leaf samples until it has become chips. In processing into chips, all equipment uses equipment commonly used for mothers in processing. All ingredients used such as flour, salt and oil are still in a new condition and have never been used. This is to minimize contaminants from other ingredients.

This test is to determine whether there is a decrease in tannin and HCN content due to high temperature frying treatment. From the results obtained, there is an anomaly on the results of testing the tannin content. In immersion samples and 12-hour immersion, the tannin content experienced decline after chips, while for chips with 24-hour immersion increased tannin content. This needs to be done in-depth observation and research to find out the anomaly. While for the HCN content of each sample also decreased, even for samples with 24-hour immersion, the HCN content obtained was very small, which was <0.004 mg / kg.

4.2 Discussion

4.2.1 Water Quality

From the results of the research obtained, many aspects were discussed in this research. Research aspects include observing water quality on a weekly basis, testing sediments (grain size, content of Pb and Cu, organic matter), testing heavy metals content in water and testing biological parameters in the form of measurements of phytoplankton and zooplankton in observation ponds. Every aspect that is observed is aspects in the preparation of the data baseline in order to aquaculture activity at SMPN 3 Satu Atap Sayung.

At the time of observation, anomalies were observed on the last observation. This is because at that time a ROB disaster occurred in all coastal areas of Semarang City and Demak Regency. This is evident from the tidal data in Appendix 1 and Appendix 2. ROB floods come suddenly, giving rise to drastic and rapid environmental changes. During the ROB flood, the highest species of fish died was Catfish (*Clarias gariepinus*). Catfish are the species with the highest mortality because they have different skin layers compared to Tilapia and Milkfish. Skin from catfish is more sensitive and more easily affected by changes in the environment. Another interesting result of this study is that Tilapia (*Oreochromis niloticus*) which previously occurred at the beginning of the death but was able to survive even in extreme conditions during ROB floods. This is a good result because Tilapia can be an option for cultivated species to aquaculture activity in the future.

From the results of observations, Pond I is the best location for conducting aquaculture ponds compared to Pond II and Pond III. The safety aspect of contaminants is the biggest thing why the team chose Pond I as the best location for aquaculture. In addition, Pond I is the safest area if the future aquaculture team will treat the pond. Pond I is the most stable pond of environmental conditions compared to other ponds. Aside from contaminant factors, the selection of Pond I as a aquaculture location is also seen from the results of the tests in various aspects of the research. Pond I is the most strategic location for aquaculture activities. Various chemical, physical and biological factors that have been tested, show that Pond I is the best pool compared to other ponds for this initial activity.

There were a number of suggestions from the research team for plans to implement aquaculture activities at SMPN 3 Satu Atap Sayung, namely:

1. There is a need for treatment of ponds that will be used as aquaculture area in the future, starting from pond preparation in the form of organic fertilizer, making sturdy and high pond walls and water treatment to get the right water for aquaculture activities.
2. There needs to be consideration in selecting fish species that will be cultivated with techniques that are suitable for fish species. Because each species has different characteristics and different techniques in cultivation.
3. Milkfish species are commonly used by local people, but for Tilapia, of course, it must be done trial and error to find out the best cultivation patterns in the area of SMPN 3 Satu Atap Sayung. However, for the initial stages, the most important thing is to know that Tilapia is able to live in areas that have salinity.
4. Aquaculture techniques that should be done at SMPN 3 Satu Atap Sayung for the future are better to use traditional pond methods. The selection of traditional pond methods is used as a means of introducing students and schools first and looking for the best patterns in future management. Because, all this time it has become a shared thinking, namely the management of ponds in aquaculture activities. Traditional methods are the most likely method because they are relatively simple and students can take part in running them.
5. Education of students and school parties on aquaculture also needs to be done, so that future program implementers can be held directly by the school and students.
6. Waste management must also be done, because waste is one of the threats and challenges nowadays. Waste is a problem because every corner of the school is still found in garbage. If you want to use it as a aquaculture field, the area must be clean and good so that the resulting aquaculture products are in food grade.

ROB floods that occur are routine disasters faced by community in the area of SMPN 3 Satu Atap Sayung. If the ROB flood comes, it will certainly affect the existing aquaculture activities. Although water does not pass through the pond but the water is able to enter through the recharge and the pores of the ponds that it will still be able to enter the aquaculture pond. This requires strong fish species. If we want to diversify species in aquaculture, Catfish can be done but use tarpaulins ponds with small sizes so that supervision of Catfish ponds is easier and water control is also simpler.

Aquaculture can also be done by intercropping. For example, intercropping is a combination of fish and shellfish. Shellfish are biota that live in the bottom of the waters (benthos), so they are suitable to be cultivated in areas that often flood. If there is a flood, the shells will not come out of the aquaculture area. This can also be applied in SMPN 3 Satu Atap which incidentally is a subscription area for ROB floods.

4.2.2 Chemical Content

Avicennia marina leaves are the basic ingredients in the manufacture of mangrove leaf chips. The location of the research was conducted at SDN 1 Bedono. Bedono Village is a religious tourism village especially in Central Java. Local people usually refer to *Avicennia marina* as Api - Api or Brayo. Api-api leaf chips have become a typical food in Bedono Village. The research team tested the content of Tanin and cyanide acid (HCN) in the leaves and chips of mangrove leaves. Tests were carried out on 4 mangrove leaf samples with three treatments namely 0 hours, 12 hours and 24 hours immersion. While testing samples of mangrove leaf chips are chips made from leaves from soaking results.

Traditionally, people actually already know a number of techniques in reducing the content of tannins both in leaves and fruit. There are differences in treatment between fruit and *Avicennia marina* leaves processing in reducing tannin content. The community is accustomed to using rubbing ash (ash from burning rice husks) to reduce the bitter taste of the *Avicennia marina* from the tannin. The content of the tannin is usually higher than in the leaves, so the people do the treatment. Unlike the fruit, there is less tannin content, so soaking using rubbing ash is not really needed. Even so far the community only washed the leaves from the excerpt to be used as material for mangrove leaves. Based on the results of tests conducted, the content of tannins and HCN is indeed still far from the threshold. The maximum threshold for HCN for human consumption is 50 mg / kg. If humans consume more than the threshold can lead to poisoning to death. HCN is indeed a natural compound that exists in nature, be it food ingredients, industrial materials or households. While for tannins it is indeed contained in some mangrove salves such as tea.

From the results of the tests carried out, soaking treatment can reduce the levels of tannins and HCN in the mangrove leaves. Although without using rubbing rice husk ash, the content of tannin and HCN can reduce more than 25% of the content of tannin and HCN to 60% in the mangrove leaves. Although the results of the tannin test showed that the mangrove leaves even without soaking can still be processed into food, it is still better to continue soaking. This needs to be done because if we consume mangrove leaf chips without immersion, of course there will be accumulation of tannins in our body faster. Likewise with HCN, soaking is still needed, because HCN is a very dangerous compound if it has accumulated too much in the human body.

Tests of mangrove chips, showed that the processing techniques by frying and giving flour were still able to reduce the content of tannins and HCN in mangrove leaf chips. However, from the test results, the frying technique can increase the tannin content by 24-hour immersion. This shows that 12-hour immersion is more effective and safer than 24-hour immersion. At 24-hour immersion the tannin content rises when frying is done.

From this research proves that mangrove leaf chips in SDN 1 Bedono will be safer to consume if 12 hours of immersion is done first. In addition, the note from the research team was that there was a need to drain or drain the oil in the chips. Because almost all products produced are still too much oil in it. This can cause chips to break or smell quickly. Diversification of taste also needs to be done to be more attractive from various ages to be able to enjoy manrove leaf chips. Better packaging can also increase the selling value of the product. In addition, if the packaging of the product is good, it will increase the price and quality of the product and expand sales, which are still in around of SDN 1 Bedono.

V. Conclusion

The conclusions obtained from this research are:

1. Water quality at the location of data collection is still in good condition, this is evidenced by the results of the water test, the content of heavy metals sedimented, grain size, phytoplankton and zooplankton and quantitative observations in the field.
2. Aquaculture of fish life test found that Milkfish (*Chanos chanos*) and Tilapia (*Oreochromis niloticus*) are two species that have high survival.
3. Pond I is the station that has the greatest potential to become a fish aquaculture in SMPN 3 Satu Atap.
4. The content of tannin and cyanide acid (HCN) in mangrove leaves and mangrove leaf chips is still small and safe for consumption.
5. 12-hour immersion is the most effective treatment to reduce the content of tannins and cyanide acid for the basic ingredients of mangrove chips.

VI. Research Coordinator and Researcher Member

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   - Rehabilitation Team of Mangrove Ecosystems and Biodiversity for PT. PJB O&M Rembang, Kabupaten Rembang, Provinsi Jawa Tengah (2016)
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- Identification of Marine Protected Area in The Eastern Coast of Nanggroe Aceh Darussalam (2008)
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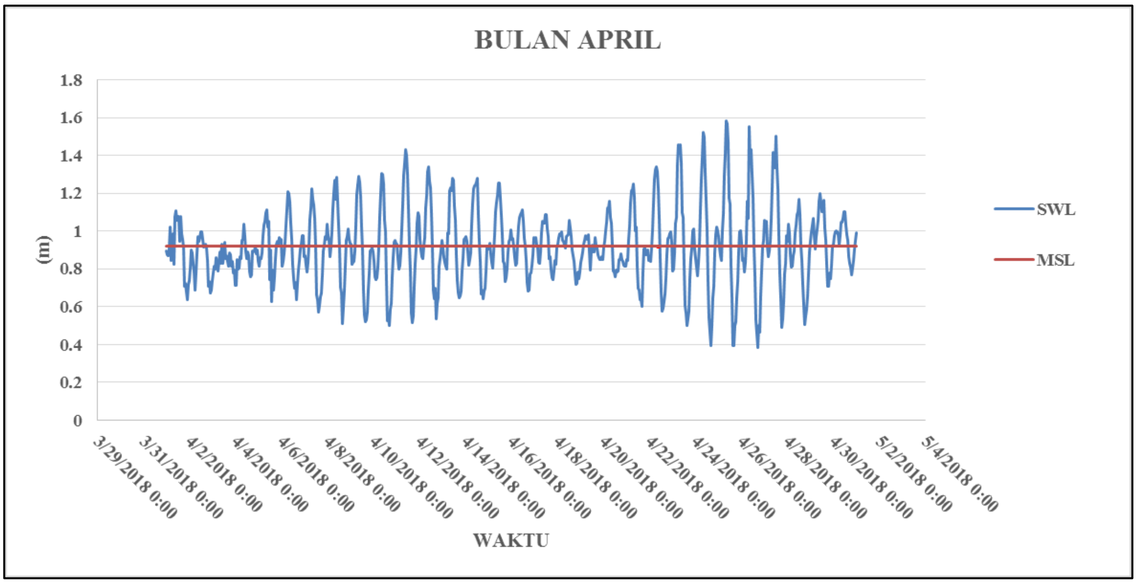
APPENDIX

1. Grafik pasang surut air laut di perairan Teluk Semarang Bulan April 2018



2. Grafik pasang surut air laut di perairan Teluk Semarang Bulan Mei 2018