Original Research Article

THE UTILIZATION OF IoT USING GROW MY FISHAPP IN AFRICAN SHARPTOOTH CATFISH (*Clarias sp*)CULTIVATION EMPLOYING BIOFLOC TECHNOLOGYIN APUNGVILLAGE, BULUNGAN REGENCY, NORTH KALIMANTAN PROVINCE

ABSTRACT

This research aims at introducing the Grow My Fish application (or app) as an IoT for collecting and processing data on water quality in biofloc tank for cultivators. IoT in itself has been widely used by several sectors, and one of them is the fisheries sector. Grow My Fishis an app specifically designed to support research in the fisheries field. This research was conducted in Apung Village, Tanjung Selor District, Bulungan Regency from October through December 2023. Bioflocis an innovation in fisheries field.It is known as an eco-friendly innovation thanks to its ability to process the wastes produced by fish into natural feed in the assistance of the probioticthat was mixed into the water. However, the persistent main issue until recently in this biofloc innovation is water quality. Many cultivatorsso far recorded their water quality measurements on a book. This made it a little hard for these cultivatorsto process the data. For this reason, an IoT that facilitated cultivatorsin processing the data on water quality, mortality, fish weight, and amount of feed was born.

Keywords: African sharptooth catfish; Biofloc; IoT; Grow My Fish; Water quality

1. INTRODUCTION

The fisheries sector has given birth to an eco-friendly innovation, namely fish cultivation employing biofloc technology. Making a good use of beneficial microorganisms, this biofloc innovation is well-known among cultivatorsfor its effectiveness and efficiency in increasing the harvests. Bioflocconsists of 2 words, namely*"Bio"* which means life and *"Floc"*which means a lump.From these two words, it can be defined as a group of various organisms such as bacteria, fungi, protozoa, and algae in one lump (Suprapto and Legian, 2013). Bioflocalso utilizes oxygen and microorganismsthat can be turned into fish feed in the tank. The oxygen in the bioflocccultivation is supplied through the aerator and it needs to be constantly turned on for 24 hours, to prevent any sedimentation. When sedimentation occurs, farmers will need to drain the tank manually [14,15].

Excessive feeding leads the toxic ammoniac to deposit, resulting in unsafe environment for the fish.The cultivation employing biofloc technologyproduces microorganismsfrom probioticto decompose wastes and generate feed raw materials for the cultivated fish.

One freshwater fish many cultivatorsare fans of is African sharptooth catfish. In addition, the African sharptooth catfishis still continuously developed by the government to increase the fisheries sector production. The problem is that the successful cultivation of African sharptooth catfishwith biofloc technology is affected by water qualityparameterssuch as temperature, pH, and DO (Supriyanto et al., 2019 in Ilham Firman Ashari et al., 2022). Poor water qualitywill negatively affect the fish growth.This is because when the water qualityis poor, the flocwill not grow or form and it eventually affects the fish. This will lower the fish's appetite because of the water's strong odor as a result of ungrown floc. The worst consequence is that it can lead to the fish's mass death. The water qualityis poor for fish cultivation with biofloc technologywhen the temperatureis 25–30℃, pH is 6.5–8, DO is >3 and the water is greenish (**SNI 6484.3:2014).**Additionally, fish cultivatorsstill use books to record their water quality measurement results so far.This makes it hard for them to process the data they have obtained.

Currently, Indonesia is one of those countries that has entered the 4.0 era, in which Artificial Intelligence(AI)and internet of Things (IoT)have begun to be widely used. In this era,technologies have been created to help cultivatorsin their attempt to achieve food security*.*One of these technologies is Grow My Fish*,*an app designed to support research in fisheries field to facilitate data processing. Using this Grow My fish app, cultivatorscan simply input the data on water quality, fish weight, amount of feed, fish mortality, and farmer's observation data and market real time.

This research aims at introducing the Grow My Fish app as a means to collect and process data while cultivating fish. In addition, it aims at discovering the effectiveness of data collection and processing when using the manual method and Grow My Fish app.

2. METHOD

The research was conducted in Apung Village, Bulungan Regency, North Kalimantan Province,from Octoberthrough December 2023. It began with making the biofloc tankand this was assisted by students and employees from Borneo Tarakan University.The biofloc tankwas a circle of 3-meter diameter in shape, made of tarpaulin with an iron frame. In this project, the research participated in the land processing, tank assembly, and even pavement construction.The method used involved collecting the data on water qualityand inputting them into the Grow My Fish app.This made it easier for data processing and the data would be permanently saved in the app.

Before using the Grow My Fish app to collect the water qualitydata, the app needed to be installed first in the mobile phones or notebooks of each cultivator. This Grow My Fish app had been available on PlayStore. The steps to installit are as follows:

First, open Play Store then click the search bar and write Grow My Fishon it. Click install

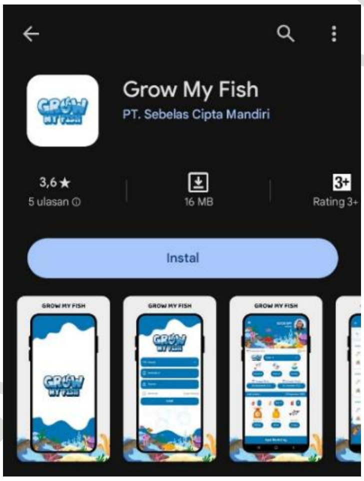


Figure 1. Grow My Fish app

Afterwards, login to the app in the login menu. The only problem is that this application can only be used if the cultivatorhas registered with PT SCM as the owner of this app.The registration was intended to let the company know what institution was the cultivatorfrom and to obtain an account.

Figure 2. Login menu appearance

After logging in as cultivator, a dashboard will pop up. There, the cultivatorcould complete such data as the tank, cultivation activity, farmer's survey, market survey and also mini games as an entertainment to let the cultivatorrest while having free time.

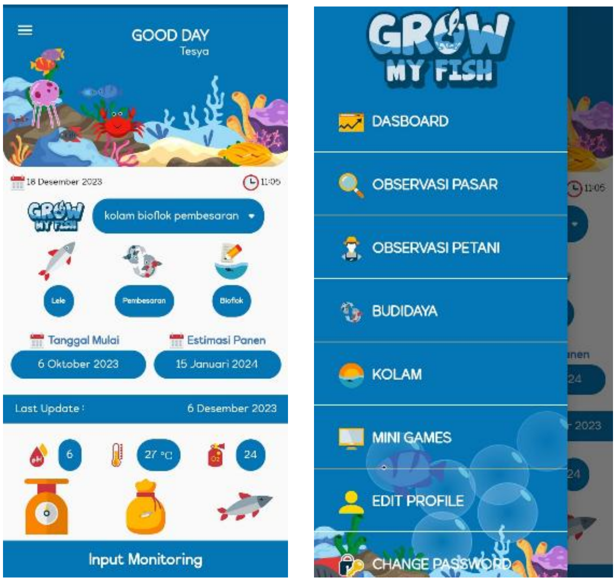


Figure 3. Dashboard menu

Next, go to the cultivation menu to input your cultivation data. In addition, the cultivatorcan also input the data from their monitoring of water quality, amount of feed, fish weight, and mortality.In this cultivation menu,cultivators can input the data on their tanks such as the cultivation method (biofloc, RAS, Torrential current), fish species, number of fish stocked, stocking/restocking date and estimated fish harvest.In addition to going straight to the app, the data will automatically be inputted to Excel sheet and can be immediately downloaded to make things easier for the cultivator.

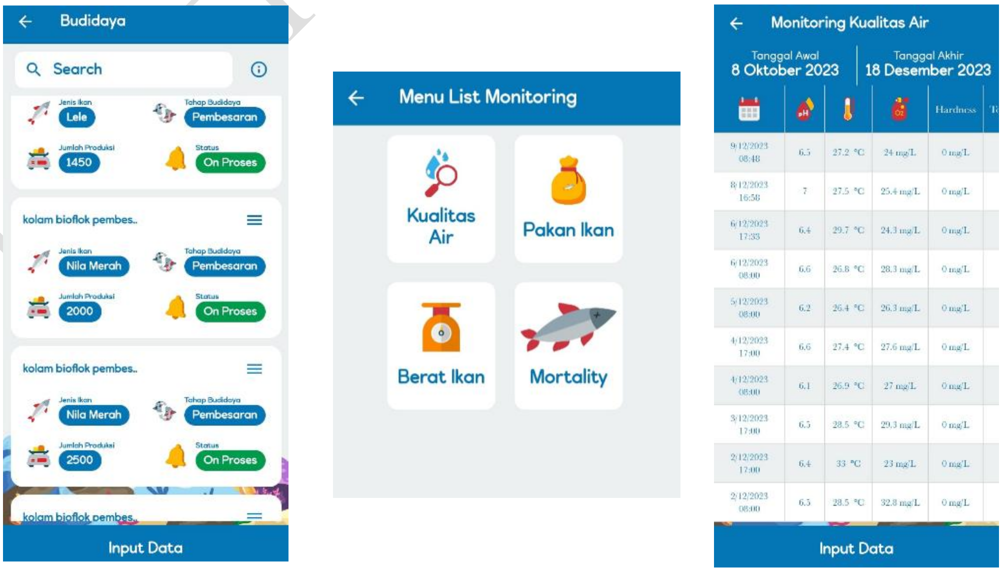


Figure 4. Input of data from Monitoring

The data from the monitoring can be inputted every day and repeatedly. In addition, if the water qualityin the tank is poor and the cultivatortakes an action, the cultivatorcan also inputted the data regarding the actions taken into the Grow My Fish app. Thus, when what this cultivatordid solved the problem, this data can be used as a reference and it can also help other cultivatorsin dealing with the same problems.

In addition to the data on water quality,the cultivatorcan also input the data regarding the amount of feedused everyday, the fish average weight, and the fish mortality. This app is used not only by cultivatorswho raise the fish, but also by those who keep the fish for seeding and nursery purposes. And, of course, the available menu will also differ.However, both share the same main issue, i.e., water qualitymonitoring. Other than inputting the cultivation data, the cultivatorcan also input data on the tank they used, including the tank type and land area.

If the cultivators want time series data,then they need to go to the dashboardmenuon the data processed by the users. The monitoring data chart can only be seen by the users.

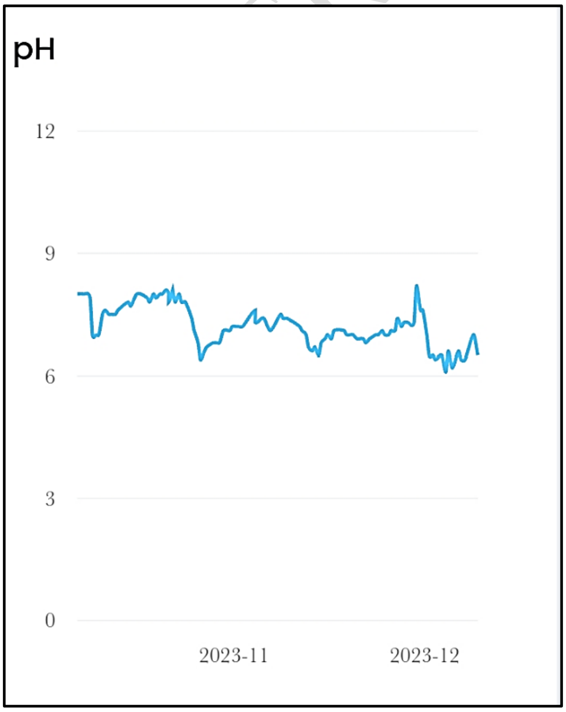
3. RESULT AND DISCUSSION

3.1 Collected Data

The water qualitydata were important for cultivators, since they could be used for the cultivation in the next cycle. Furthermore, the quality needed to be checked on a regular basis. In this research, the research checked the water qualityevery morning and late afternoon on daily basis. In addition, the researcher also sampled the fish once every 10 days. This was to figure out the fish weight to re-calculate the amount of feedthat needed to be given later.

3.1.1 data on pH

The good pH for cultivating African sharptooth catfishusing biofloc technologywas 6.5–8 (**SNI 6484.3:2014**).The neutral pH was 6–7.Hence, a pH <6 could be interpreted as acidic and >7 was considered basic. An action needed to be immediately taken when the water pH decreased or increased. Less optimal pH might make the fish stressed, more vulnerable to disease, and could reduce its growth and productivity (Diansari et al, 2013 in Safsafubun et al 2023).



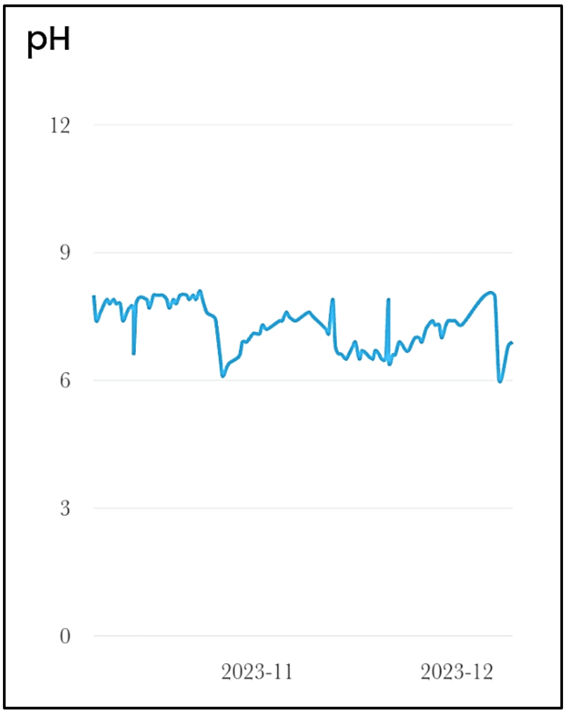


Figure 5. A chart from processed pH data

From the chart above, it could be concluded that during the cultivation, the water pH was still in compliance with SNI. However, some days witnessed that the water pH was >8,thus the researcher took a measure of putting two Catappa leaves into the tank. The chart was the data that had been processed from the ones that the researcher inputted in the Grow My Fish app.

3.1.2 Temperature data

Other than pH, temperatureis also highly important in fish cultivation. Temperature is the controlling factor that can affect the digestion and metabolism in the fish body. Changes in temperaturetypically occurred during season transition.This has the potential of making it difficult for the fish to digest its food. This was also the case in Apung Village.The season in this research site kept on changing. The change occurring in the research site was that it would rain for one week and dried the next. This made the fish growth varied as a result of its difficulty in digesting the food.

Table 1. Effect of temperatureon African sharptooth catfish'sfeed consumption response (Ahmad Rafiq, 2022)

Temperature	Feed consumption response
Close to 0	Minimum crisis condition
8–10	No response to feeding
15	Decreased feeding
22	50% optimum
28–30	Decreased feeding

33	50% optimum
35	Decreased feeding
36–38	No response to feeding
38–42	Minimum crisis condition

From Table1,it could be interpreted that African sharptooth catfishin biofloc tankwould live better at warm temperatureranging from 25℃to 30℃.It was imperative to maintain the temperature to prevent it from significantly increasing more than 4℃since this would lead to the fish death and stress.

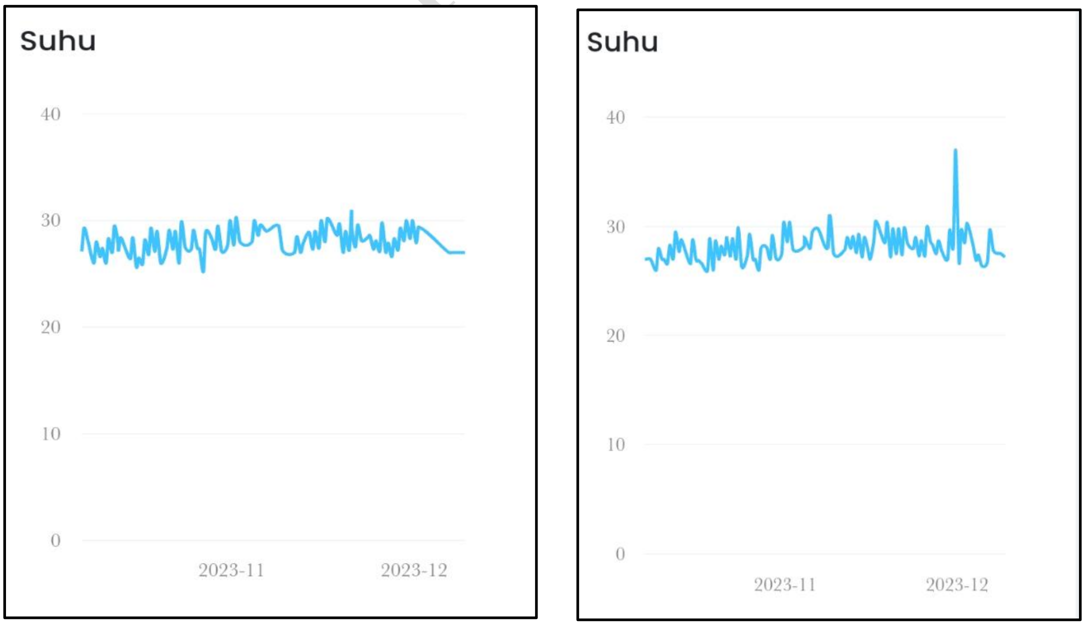


Figure 6. Temperature chart

From Figure 6,it can be seen that the high temperaturewas recorded at 37℃, yet it occurred only in one day and led to the death of 25 fish. The chart was obtained from the data that had been processed from the Grow My Fish app.

3.1.3 DO (Dissolved oxygen) data

DO is one factor that affects the water qualityin biofloc technology. The amount of oxygen dissolved in water is important to keep the water conducive for aquatic organisms.The DOconcentration in water can be affected by some factors such as water temperature, atmospheric pressure, biological activities and pollution. Low dissolved oxygencan render the decomposition, reproduction and growth processes in the tank less optimal and it can eventually lead to death for the fish. The good oxygen level for a biofloc tankis >3 mg/l.To stabilize the dissolved oxygen,an aerator is used. Aerator itself is a tool to help increase the oxygen value in the water, to allow more oxygen to get into the water.

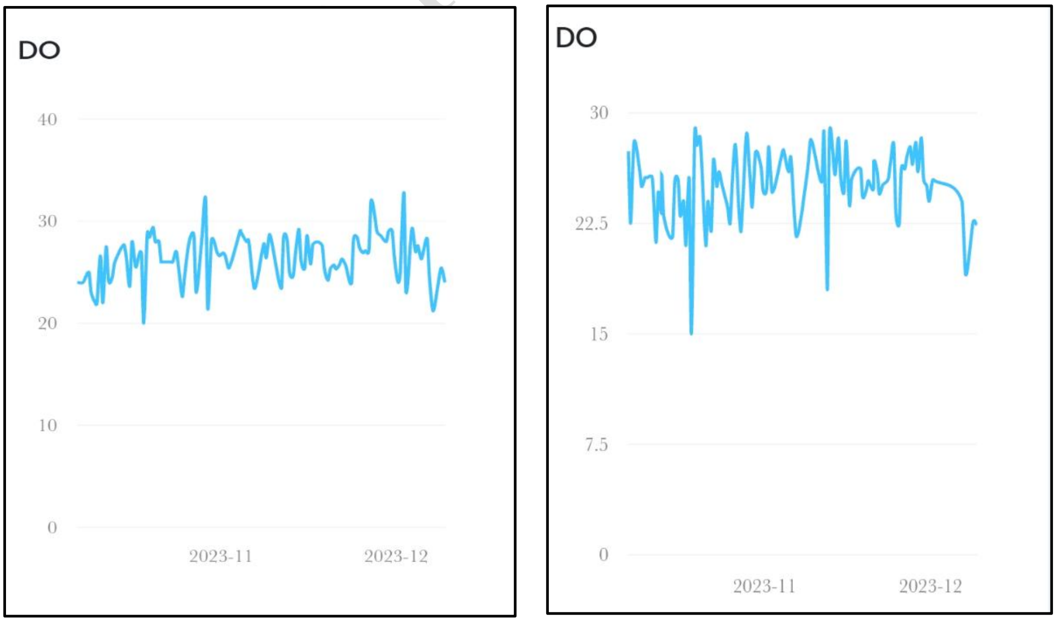


Figure 7. DO data chart

Figure 7 showed that the dissolved oxygenstill frequently increased drastically.This made the death of fish inevitable in this research. The chart above was the processed data from the Grow My Fish app.

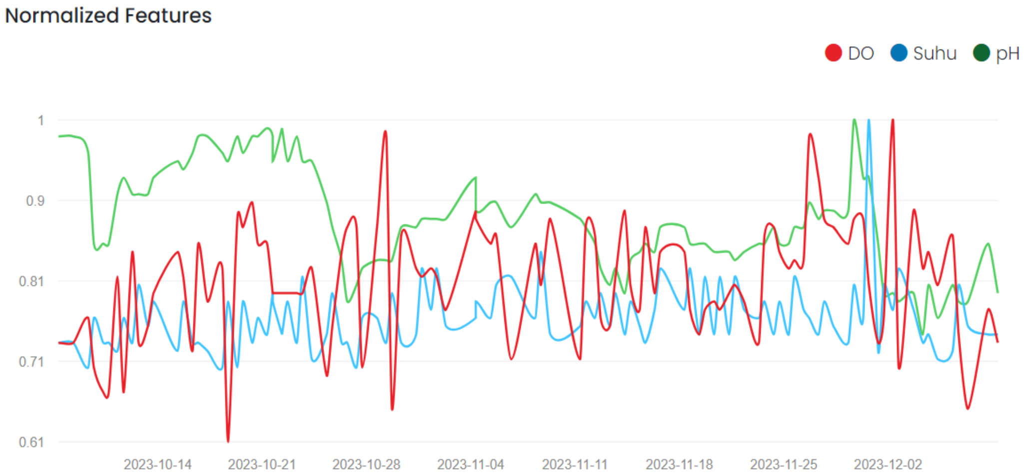


Figure 8. Combined water qualitydata chart

In addition to separate data, this app also the combined water quality chart. This allowed us to see the comparison.Figure 8 shows the combined chart from the water qualityparameter data. From the chart above, it can be seen that some parts declined steeply.This was the data on the day where the water quality was not controlled.

3.2 Other Parameter Data (fish weight, amount of feed, mortality)

The collected data were not limited only to water quality. In the Grow My Fishapp, the researcher also inputted such data as fish weight, amount of feedand mortality.In addition to water quality, the cultivatorshould also own data on fish weightfor every sampling, amount of feedused and the fish mortalityin one cycle.

These data could be inputtedby the cultivatorto the Grow My Fish app.This allowed the cultivatorto readily discover the FCR and losses they might suffer from. Yet, in these parameters, the data had not been processed as a chart.

3.2.1 Data on Amount of feed

Figure 9. Data on amount of feed

The feed data were calculated whenever a sampling was carried out. This sampling itself was done once every 10 days. Other than to discover the amount of feed,the sampling was also aimed at finding out the fish growth. To feed the African sharptooth catfish,the researcher used FR 3%. From the data in Figure 9, the amount of feedfor every 10 days would increase by 100 gr. And this could be interpreted that the fish also grew.

3.2.2 Fish weightdata

Figure 10. Fish weightdata

The fish weightdata were also obtained after the sampling. The sampling was done once every 10 days. From Figure 10, it can be seen that the fish weightincreased every 10 days. These were the data on fish weight per 1 fish. As many as 5 fish were sampled from the tank.

3.2.3 Fish mortalitydata

Figure 11. Mortality ikandata

Fish mortality is the rate or level of fish death in general. In this research, the fish mortalitywas relatively low. This was because African sharptooth catfishwas cannibalistic. From the data in Figure 11, 77 fish died in total.The cause for cannibalism in African sharptooth catfishwas generally because of their varied sizes (Yang et al., 2015 in Putri et al., 2022).

From the research that Enggar Patrio et al., (2022)conducted on water qualityin tarpaulin tank for African sharptooth catfish's growth, the data on water qualityparametersshowed that the lowest temperaturewas 26.6℃and the highest was 28.8℃.

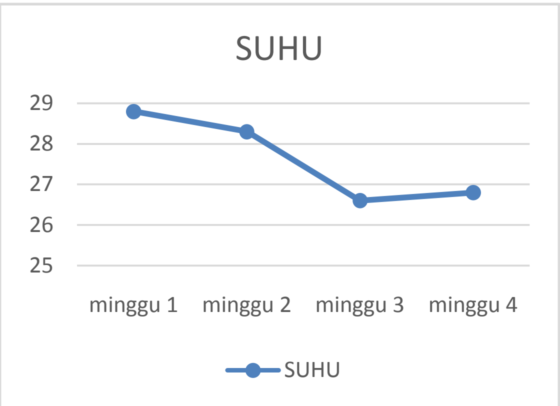


Chart 1. Results of tarpaulin tank temperaturemeasurement

In addition, the pH data showed that it ranged from 7.5 to 7.9.It means the tank was still feasible for cultivating the fish.

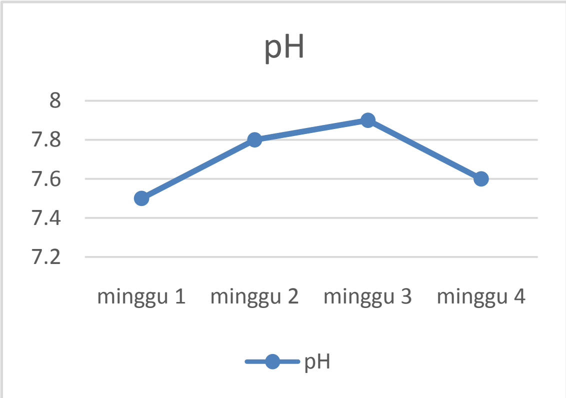


Chart 2. Results of tarpaulin tank pH measurement

The data collected for DO show that the dissolved oxygenlevel in the tank of 7.06 m2 wide, and 9.42 m2 diameter, and fish stocking density of ±4000 fish ranged between 0.80 and 1.19 ppm.This means that it did not meet the good standard quality requirement for the fish growth and survival.

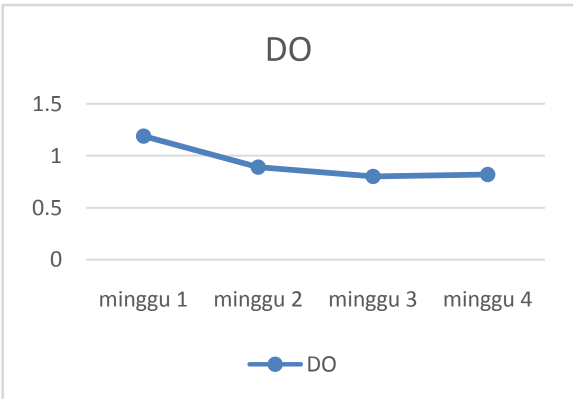


Chart 3. Results of tarpaulin tank DO measurement

CONCLUSION

From the research that been carried out, it could be concluded that the use of Grow My Fish app was highly effective in helping cultivatorsprocess and collect the data they needed. Additionally, from the data they had inputted from the African sharptooth catfish cultivation employing biofloc technology, it was found that the water qualityparameterswere still compliant with **SNI 6484.3:2014**. The pH ranged from 6.5 to 8.The lowest temperaturewas 25.2℃and the highest was 37℃,in which this occurred only once. Meanwhile, the DOvalue was >3 mg/l.Nevertheless, the fish death in the biofloc tankcultivation was still inevitable since the DO increased drastically. In addition, the high temperatureled to the death of 25 fish. Thus, it could be interpreted that the DO value had met the SNI,despite its frequent drastic increase.

When the African sharptooth catfish cultivation using biofloc technologywas compared to that using tarpaulin tank, there were still some weaknesses. For the pHand temperaturevalues, they both met the provisions of SNI.Hence, it can be said that they were still feasible for use to cultivate the fish (optimal for fish cultivation). Meanwhile, for their DO values, both could still be said less optimal.The DO value for tarpaulin tank ranged from 0.80 to 1.19 ppm.This means it was still <3 ppm and could possibly hinder the fish growth.

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