JPPIPA 10(11) (2024)

Jurnal Penelitian Pendidikan IPA

Journal of Research in Science Education

http://jppipa.unram.ac.id/index.php/jppipa/index

Farm Sangkuriang Catfish (*Clarias gariepinus*) for 59 Days

Nurlena Andalia[1*], Susanti Djakfar[2], T. Iskandar Shah[3]

[1] Biology Education, Faculty of Teacher Training and Education Universitas Serambi Mekkah Banda Aceh, Indonesia.
[2] Management Economics Faculty of Economics, Universitas Serambi Mekkah Banda Aceh, Indonesia.
[3] Development Foundation Serambi Mekkah, Banda Aceh, Indonesia.

Received: January 15, 2024
Revised: July 28, 2024
Accepted: November 25, 2024
Published: November 30, 2024

Corresponding Author:
Nurlena Andalia
nurlena.andalia@serambimekkah.ac.id

DOI: 10.29303/jppipa.v10i11.6945

Abstract: This study aims to determine the cultivation of sangkuriang catfish (Clarias gariepines) for 59 days. The method used in this study is observation by collecting primary data directly from the field. During the study, the highest pool water temperature was found in the second week of 29.11 oC and the lowest temperature of pool water was found in the third week of 28.22 oC. The temperature of the pool water in the morning is lower than in the afternoon. This is influenced by sunlight that directly enters the pond which results in an increase in the metabolic process of the catfish body. The pH of Sangkuriang catfish farming pond ranges from 7.8-7.25. If the highest pH value indicates that the waters are alkaline, on the contrary, if the low pH value indicates acidic, the conclusion is that the salinity treatment of the medium does not have a significant enough effect ($P<0.05$) on the survival rate of catfish. Sangkuriang catfish is a type of fish that is able to survive and breed in conditions where water is less oxygen and low pH levels, in the first week the oxygen degree is 1.25 and the lowest at 0.65. Catfish tend to be more active in warm water temperatures, but they can also survive in winters with lower temperatures. However, they may become less active and require extra attention to ensure the water temperature remains within limits they can tolerate.

Keywords: Aquaculture; *Clarias gariepinus*; Sangkuriang Catfish

Introduction

Indonesia is an archipelagic country that has a fairly large water area, thus making Indonesia obtain a wealth of abundant marine and fishery resources that can be one of the mainstays to support national development. With proper management and utilization policies, marine and fishery resources can make a meaningful contribution to the welfare of a nation (Ramadhan, 2018).

Indonesia is currently still making efforts in developing the marine and fisheries sector, because as an archipelagic country and has a large sea area, it is natural that the marine and fisheries sector is one of the mainstays in state income. The development of the marine and fisheries sector cannot be separated from the development of coastal communities, most of whom work as fishermen and fish traders. Fishermen must be able to develop themselves into changing times, so that existing marine and fishery resources can be utilized optimally (Khairuddin, 2022).

The fisheries sector has progressed quite rapidly because many people are interested in doing aquaculture or inland fisheries business. Aquaculture business is currently growing and varied. The diversity of commodity types began to increase and cultivation technology is also growing (Widjayanthi et al., 2021).

Sangkuriang catfish is one type of freshwater fish that has been widely cultivated and consumed by the people of Indonesia, because it has a good taste of meat and an affordable price. Therefore, sangkuriang catfish has a considerable contribution to improving community nutrition. Catfish is a fishery commodity relatively easy to cultivate in dense and high-stocked

How to Cite:
Andalia, N., Djakfar, S., & Shah, T. I. (2024). Farm Sangkuriang Catfish (Clarias gariepinus) for 59 Days. *Jurnal Penelitian Pendidikan IPA*, *10*(11), 9709–9717. https://doi.org/10.29303/jppipa.v10i11.6945

land and water sources, and aquaculture technology is easily controlled by the community (Siswandoko et al., 2017). Catfish have rapid growth and adaptability to a fairly high environment (Sitio et al., 2017).

Catfish is a freshwater fish belonging to the class Actinopterygii. Catfish contain many minerals including Potassium, iron, magnesium, zinc, phosphorus and others. In catfish meat there are proteins, Omega-3 and Omega-6 fatty acids. Vitamins contained in catfish meat include: vitamin A, Thiamine content (Vitamin B1), and riboflavin (Vitamin B2). Various advantages of catfish are low in calories and fat, a source of high protein that helps the body build lean muscle mass and increase the effectiveness of immune function (Mulyadi et al., 2021).

Catfish cultivation business provides promising business prospects because of the high public demand for catfish for needs and consumption (Widjayanthi et al., 2021). Catfish cultivation business provides promising business prospects because of the high demand of the community for catfish for needs and consumption.

Catfish business is a very promising business prospect because of the high demand for catfish to meet family consumption needs and menus at food stalls and lesehan. The high demand for catfish today makes catfish farmers make various innovations to optimize catfish business and production. One of the innovations in catfish cultivation is the boster system. The boster system is one of the super intensive catfish cultivation, namely by applying high stocking density technology, which is more than 500-1000 heads per m^2 and using boster supplement products to improve the quality and quantity of catfish production. The boster system uses clean water in its cultivation activities and provides pellets as catfish food (Assefa et al., 2018). People's need for catfish consumption every year is increasing. In order to meet the needs of national catfish, increasing catfish production is always carried out every year. In 2014 the increase in national catfish production amounted to 613,000 tons, in 2015 amounted to 1,058,400 tons and in 2016 amounted to 1,217,100 tons (Directorate General of Fisheries Budi daya, 2016). One important factor in efforts to increase catfish production is feed.

Catfish have a unique digestive system, including a rather short intestine. A short intestine helps catfish digest food efficiently because catfish food is generally insects, worms, and other organic remains that are easily digested. By having a short intestine, catfish can process their food quickly and get the nutrients needed for catfish growth. Fish growth is influenced by seed quality, feed quality, age, and water quality (Mulqan et al., 2017).

The addition of probiotics to catfish feed can provide several benefits. Probiotics are live microorganisms that have a positive impact on the digestive system of fish and help promote fish growth and health. Probiotics come from a Latin word meaning for life, also called beneficial bacteria. Probiotics are the result of Prof. Ibnu Sahidri's research in the laboratory of the Brackish Water Aquaculture Center (BBAP) Ujung Betee, Aceh Province. Rabal comes from the abbreviations yeast and lactic acid. Initially, it was intended for fish, but when tested on broilers the effect was very satisfying and other advantages were low cost and easy manufacturing (Riyadi et al., 2021).

Maintenance with an intensive system, catfish feed is very dependent on the farmer, the goal is to make it easier to control pond water because in carrying out intensive catfish enlargement cultivation, water treatment techniques must be correct, enlargement ponds must have intake paralons and water disposal paralons in separate positions to replace water (Delis et al., 2022).

In order for catfish to be of high quality and produce catfish that harvest quickly, the provision of all feed needs, both in quantity and quality, is fulfilled and the pond must always be replaced with water. The right strategy in seed rearing pond preparation, water replenishment, market management, water quality management, harvest management and catfish cultivation marketing (Dayat, 2017; Rabilla et al., 2019). Given that feed costs are around 60-70% of total costs used for feed, then if it can reduce feed costs/prices, it means it can increase production cost efficiency, and in turn can increase revenue. Where the growth and survival of farmed fish is feed. Fish feed can be said to be of high quality if the feed contains nutrients that are easily digested by fish. The type and composition of feed must also be in accordance with the availability of enzymes in the digestive tract of fish, so that fish are able to digest feed properly (Mokoginta et al., 2021).

This research is important for enhancing aquaculture practices, supporting sustainable catfish farming, and ensuring stable fish production under different environmental conditions.

Method

Place and Time of Research

This research was conducted in the Regions Mata Ie, Kabupaten Aceh Besar, Aceh. The location is very strategic because the area has an abundance of groundwater, making the ponds always get new water.

Materials

Tools and materials the tools used in this study were thermometers, DO meters, pH meters, rulers, analytical scales, aerators, oxygen stones, water pumps, buckets, cameras and stationery, and cultivation ponds

in the form of tarpaulins. The material used is catfish fry, as well as feed.

The preparation of the pond size is for Sangkuriang catfish farming of 6x5 m, then the pond is filled with water as high as 40-50 cm, so that the cubic water is 6x5x1/2=15 cubic per pond. Solid stocking of 150 seedlings per cubic pool water, so for each pond with the above size, sangkuriang catfish seedlings are stocked into the pond to 2000 to 2250 ponds, the pond water comes from groundwater. The quality of pond water must always be maintained, catfish like a good pond environment for their growth. Every morning and evening, the dirt contained in the bottom of the pool must be removed and cleaned. Catfish ponds in the dry season the water becomes dirty/ cloudy so that it can cause dirt and odor causing catfish to be less healthy and long developing. While in the rainy season, the pond water is not easily dirty/ turbid and makes catfish always fresh because they get new water. The technology used for catfish farming is not difficult, only patience is needed in controlling all changes in water quality as a medium for raising catfish in addition to the feed provided (Augusta, 2016).

Water Quality Measurement

Water quality measurement using pH, DO and temperature. Water quality measurement is carried out in catfish breeding ponds.

Observed Parameters

The water quality parameters observed in this study are the quality of aquaculture pond water which includes pH, temperature, and DO for the growth of Sangkuriang catfish seedlings.

Selection of Seedlings

The catfish seeds taken were selected from super seeds, where the first sort had the character of agile and agile seeds and the size of the seedlings was larger than other seeds. The size of the seedlings taken ranges from 7-8 ml or 9-10 ml.

Seedling enlargement

Place catfish seedlings in a pond, first fill the pond water 40-50 cm high. Seedling enlargement is carried out by, seedlings must be acclimatized between 10-20 minutes using or equalizing the temperature and adaptation of seedlings to the pond water, both temperature and pond water, the pellets used are -2 ml (2 ml) until the age of catfish is 1 month or the size reaches LBG (Lele Baru Gede), while the age over 1 month uses pellets size -3 ml until the catfish become adults or ready to harvest. The separation between the size of the new large catfish and the size of the smaller catfish is separated by placing the catfish into different ponds through sorting.

Figure. 1 Lele baru gede (LBG)

Catfish Feed

Catfish feed consists of 3 types, namely mabar is pellets sold in the market with a protein content of 29 to 30%, while the size of the pellets ranges from -2 ml to -3 ml. The next feed uses azola, which is found in a separate pond and only overgrown with azola as feed other than pellet pack. The next feed is fish from auctions that have been rejected by collectors because they are exposed to fishermen's nets, then the fish is boiled until the bones are soft then ground then packed plastic and stored in the freezer, if the feed is frozen it makes it easier for catfish to consume it also the protein content in the fish is very high. Where protein is a nutrient that is needed by fish for the growth process, especially when fish are at the age of fry (Anis et al., 2019).

Catfish feed consists of 3 types, namely mabar is pellets sold in the market with a protein content of 29 to 30%, while the size of the pellets ranges from -2 ml to -3 ml. The next feed uses azola, which is found in a separate pond and only overgrown with azola as feed other than pellet pack. The next feed is fish from auctions that have been rejected by collectors because they are exposed to fishermen's nets, then the fish is boiled until the bones are soft then ground then packed plastic and stored in the freezer, if the feed is frozen it makes it easier for catfish to consume it also the protein content in the fish is very high. Where protein is a nutrient that is needed by fish for the growth process, especially when fish are at the age of fry (Hariani et al., 2017).

Good quality feed can increase the growth and survival of fish during cultivation so that fish production also becomes better. Addition of rabal probiotics to pellet mixtures sold in the market or homemade pellets. The feed given to fish is added to rabal probiotics made by yourself, rabal probiotics are added so that fish growth is faster and the appetite of catfish is good.

Probiotic rebates are mixed in fish feed with a dose of 15 ml for 1 kg of pellet feed. First, rabal probiotics are mixed or diluted with water so that they are not too thick as much as 2-3 times the amount of rabal probiotics used, then mixed in the feed then let stand 5-15 minutes so that the probiotics soak in and mix with pellets. In one kg of feed, rabal probiotics are used as much as 15 ml.

Feeding

Catfish feed is given every 3 hours, at 8 am given fish that has been boiled and ground, at 11 am Azola, at 2 pm pellets, at 4 pm fish that have been boiled and ground, at 7 pm pellets, at 10 pm pellets, above 10 pm Azola is given natural feed during the rainy season.

Figure 2. Azolla

Figure 3. Pellets from fresh fish

While in the dry season the feed is given every 4 hours, namely at 8 am fish that have been boiled and ground, at 12 noon pellets + azola, at 4 pm fish that have been boiled and ground, at 8 pm pellets, at 11 pm pellets + azola, the function of feeding is distinguished by hours to maintain moisture content, so as not to quickly turbid and dirty, because in the dry season the fish eat less. Feed plays an important role in catfish farming activities starting from hatcheries, enlargement until fish are ready to be harvested. Generally, catfish farmers rely on factory feed in the form of pellets sold in the market. Every feed given to catfish is always added rabal probiotics. While in the dry season the feed is given every 4 hours, namely at 8 am fish that have been boiled and ground, at 12 noon pellets + azola, at 4 pm fish that have been boiled and ground, at 8 pm pellets, at 11 pm pellets + azola, the function of feeding is distinguished by hours to maintain moisture content, so as not to quickly turbid and dirty, because in the dry season the fish eat less. Feed plays an important role in catfish farming activities starting from hatcheries, enlargement until fish are ready to be harvested. Generally, catfish farmers rely on factory feed in the form of pellets sold in the market. Every feed given to catfish is always added rabal probiotics.

Data Analysis

Observational data are presented using tables and graphs. Data presentation and analysis are carried out descriptively.

Results and Discussion

Pond Water Quality

Parameters Water quality is a major factor in sangkuriang catfish farming. Measurements of water quality parameters measured include:

Temperature

Data from measurements made in the morning and evening for 4 weeks of observation, obtained an average value of water temperature of 28 ^{0}C. Temperature has an important role in determining the growth of farmed sangkuriang catfish, the average results obtained are categorized as good in the success of freshwater fish life. During the activity, the highest pool water temperature was found in the second week of 29.11 ^{0}C and the lowest temperature of pool water was found in the third week of 28.22 ^{0}C. The temperature of the pool water in the morning is lower than in the afternoon. This is influenced by sunlight that directly enters the pond which results in an increase in the metabolic process of the catfish body.

Table 1. Temperature Measurement Results

Week to	Morning	Afternoon
1	26.15	29.01
2	27.7	29.11
3	26.63	28.22
4	8.92	28.75

The optimum water temperature in intensive Sangkuriang catfish maintenance is 25 – 30 ^{0}C (Wibowo et al., 2020). In line with research conducted by Santi et al. (2017) the optimum temperature for growth between

3 mg and 1 g is 32° C. The third temperature, 36.5°C, is the masculinizing temperature for this species.

Catfish can usually live in the dry season because catfish have the ability to survive in poor water conditions. However, climate change and pollution can affect the living conditions of catfish and other fish in their natural habitat. Catfish in the dry season sleep in the mud, and will wake up when it rains, catfish during the dry season and in the open or natural habitat will sleep long until it rains (in the rainy season). Water-based ecosystem temperature is essential to ensure the presence, production and adequate metabolic activity in fish (Ogunji et al., 2017). In fish as well as other organisms like it, the physiological and hemical processes of the body function according to the prevailing water temperature (Holt et al., 2015).

Metabolism during the dry season decreases more, and fish production becomes 10 weeks, and the percentage usually decreases (Yusnaini et al., 2019). From 1 pond in the dry season the number of catfish populations decreases, in addition to damaged water, the catfish becomes jaundice, but can be anticipated by separating and given papaya leaves that have been blended as much as 1 sheet mixed with 2 cloves of garlic brushed into catfish feed. Then the water is changed daily morning or evening, until the catfish recover from jaundice.

Rabal probiotics can be used in catfish pellet mixtures with a ratio of 1 kg of pellets: 100-200 ml of water or 1 glass of aqua, in maintaining the quality of rabal probiotic pond water can also be mixed tastefully into catfish ponds. Per cubic pool water with a ratio of rabal probitics used is 1/2 to 1 liter of rabal probiotics. In line with the research conducted, the survival rate of catfish kept for 20 days ranges from 98.33-100%. In the control treatment (0 ppt), the salinity of 2 ppt, 4 ppt, and 6 ppt was 100% and at the salinity of 8 ppt was 98.33%. The addition of probiotics by bibbling catfish feed, these probiotics can be used in a mixture of pellets/ catfish meal 1 kg pellets: 100-200 ml of water or 1 glass of aqua/ half a glass of aqua and in maintaining the quality of pool water mixed with rabal probiotics.

Some of the benefits of adding probiotics to catfish include: Rabal probiotics can be used in catfish pellet mixtures with a ratio of 1 kg of pellets: 100-200 ml of water or 1 glass of aqua, in maintaining the quality of rabal probiotic pond water can also be mixed tastefully into catfish ponds. Per cubic pool water with a ratio of rabal probitics used is 1/2 to 1 liter of rabal probiotics. In line with the research conducted, the survival rate of catfish kept for 20 days ranges from 98.33-100%. In the control treatment (0 ppt), the salinity of 2 ppt, 4 ppt, and 6 ppt was 100% and at the salinity of 8 ppt was 98.33%.

The addition of probiotics by bibbling catfish feed, these probiotics can be used in a mixture of pellets/ catfish meal 1 kg pellets: 100-200 ml of water or 1 glass of aqua/ half a glass of aqua and in maintaining the quality of pool water mixed with rabal probiotics. Some of the benefits of adding probiotics to catfish include improved digestion is probiotics help break down and digest nutrients in feed more efficiently, so fish can take in more nutrients from the feed they consume. Improve fish health is probiotics can help boost fish's immune systems, making them more resistant to disease and unhealthy environmental conditions. Prevent disease by boosting fish immunity, probiotics can help prevent pathogen and disease attacks on catfish ponds. Increase Growth is probiotics can accelerate fish growth by increasing digestive efficiency and nutrient absorption. Reduce waste by improving digestion, probiotics can help reduce waste produced by fish, thus maintaining water quality in ponds.

Jaundice in catfish, also known as jaundice or "yellow syndrome" is a disease caused by protozoan parasites of the genus Trypanosoma. This disease often occurs in catfish and can result in large losses in fish farming. Symptoms of jaundice in catfish include discoloration, that is, infected catfish usually have a color that fades or looks yellow. Loss of appetite i.e. fish tend to lose appetite and become lethargic. Growth is stunted, i.e. fish growth is stunted, and fish appear thin or unhealthy. Then abnormal behavior where fish can exhibit abnormal behavior such as swimming irregularly or stranded at the bottom of the pond.

To prevent jaundice in catfish, good aquaculture management practices are essential, including pond hygiene, ensure maintenance ponds remain clean and free of feed residue and organic impurities. Monitoring the health of fish, watch for signs of disease in fish regularly. If any fish look sick, immediately isolate and treat. Quality feeding, give high-quality feed and according to the needs of catfish. Parasitic control, the use of antiparasitic drugs recommended by fisheries experts can help control parasitic infections. Control population density, do not overstock ponds with too many fish. High population densities can exacerbate the spread of disease. To overcome this, we must pay attention to the stocking density in the pond, which is usually in a 1 cubic pond ratio of 200 heads or lowered by 1/4 or 1/2. It depends on the quality of the water source.

The Relationship of Water Salinity to Catfish

Development Similar to tilapia, catfish also have a fairly good tolerance to salinity. Salinity is the salt content in a water, the salt in question is various ions dissolved in water including table salt/ NaCl (Sanutra et al., 2022).

Table 2. pH Value Measurement Results

Week to	Average Measurement Results
1	7.8
2	7.10
3	7. 15
4	7.25

Based on the results of the study, the results obtained by the pH of the Sangkuriang catfish cultivation pond are presented in the form of the table above, where the pH value ranges from 7.8-7.25. If the highest pH value indicates that the waters are alkaline, on the contrary, if the low pH value indicates acidic, the conclusion is that the salinity treatment of the media does not have a significant enough effect ($P<0.05$) on the survival rate of catfish (Sitio et al., 2017).

Oxygen Degree (DO)

Generally, catfish live normally in an environment that has a dissolved oxygen content of 4 mg/ l (Qalit et al., 2017). Sangkuriang catfish is a type of fish that is able to survive and breed in conditions where water lacks oxygen and low pH levels. The results of the study said the dissolved oxygen content for sangkuriang catfish species can be at the lowest temperature, catfish are able to survive in waters with oxygen concentrations below 3 ppm. However, a good dissolved oxygen concentration for live fish is 5 ppm. In waters with oxygen concentrations below 4 ppm, some species of fish are still able to survive, but appetite begins to decline. For this reason, a good oxygen concentration in aquaculture is between 5-7 ppm (Patriono et al., 2022).

Table 3. Measurement Results DO

Week to	Average Measurement Results DO
1	1.25
2	0.97
3	0.98
4	0.65

Catfish are also equipped with breathing apparatus in the form of arborescent organs that resemble leaves and are red in color. The function of this organ is to take oxygen directly into the air, so that catfish are able to survive in conditions of minimum oxygen (Primaningtyas et al., 2015). Good growth and development in this species of fish is influenced by the levels of oxygen (O_2) and carbon dioxide (CO_2) dissolved in water. Based on variety analysis showed that media salinity treatment had no real effect ($P<0.05$) on catfish survival rates.

Measurement

The maintenance of catfish for 8 weeks requires careful attention to several aspects of cultivation. Here are some important things to note during the 8-week maintenance period, namely the pool and the environment, make sure the maintenance pool is in clean condition, with good water circulation. Monitor the temperature, pH, and oxygen level of the water regularly. Feed, give high-quality feed that corresponds to the growth phase of catfish. Adjust the amount of feed based on fish growth and water quality. Fish health, watch for signs of disease such as discoloration, lethargy, or strange behavior in fish.

Table 4. Measurement Results

Week to	Average Measurement Results (cm)
1	6-7
2	8-9
3	11-12
4	15-18

Figure 4. Catfish ready for harvest

If sick fish are found, immediately take appropriate measures, including separating sick fish from healthy ones. Filtration and aeration system, make sure the pool filtration and aeration system is functioning properly. Good water circulation and adequate oxygen levels are essential for fish health. Growth monitoring, periodically record the growth of fish. Pay attention to whether the fish reaches the desired weight and size during the 8-week period. Pool cleaning, do regular pool cleaning to avoid the accumulation of dirt and other organic substances that can affect water quality. Take steps to protect fish from pests and predators such as birds and reptiles that can enter the pond. Water quality monitoring, regularly check water quality to ensure that parameters such as temperature, pH, ammonia, nitrite, and nitrate are within safe ranges for fish growth.

Changes in water salinity can adversely affect the development of catfish. Catfish are freshwater fish, so they are better suited to living in environments with low salinity or no salt at all. The rise in salinity of the water can cause stress in catfish, disrupt the ion balance in their bodies, and affect their growth and reproduction.

Therefore, significant changes in the salinity of water can be detrimental to the development of catfish.

Based on the results of research that has been carried out, the productivity and quality of Sangkuriang catfish farming have been obtained, catfish are nocturnal, in line with the research conducted (Anis et al., 2019) said catfish are types of fish that are active in activities and foraging at night or nocturnal, which means catfish are active at night and tend to rest during the day. At night, they look for food, such as insects, larvae, and other organic matter at the bottom of the waters. This nocturnal habit helps them avoid predators and compete with other fish species that are active during the day. This type of fish has its own advantages compared to other types of freshwater fish. This catfish has its own advantages and at the same time can improve and develop breeding skills, especially catfish (Dayat, 2017; Susan et al., 2016). The growth and development index of this fish is relatively fast, with a high level of adaptability, which is able to live in poor water quality, relatively resistant to various diseases and can be maintained in various cultivation containers.

Giving probiotics to catfish pellets can improve fish health, reduce the risk of disease, and improve growth. Probiotics are good microorganisms that help maintain the balance of bacteria in the digestive system of fish. Typically, probiotics are added to catfish pellets in capsule or powder form, and then the pellets are mixed with probiotics before being given to fish. However, the right dosage and type of probiotic used should be adjusted to the recommendations of experts or fish feed manufacturers.

Sangkuriang Catfish (Clarias gariepinus var. sangkuriang) is one type of freshwater fish that is widely cultivated and consumed in Indonesia. This is because this fish has fast growth and high economic prices (Elpawati et al., 2015).

Conclusion

Catfish tend to be more active in warm water temperatures, but they can also survive winters with lower temperatures. However, they may become less active and require extra attention to ensure the water temperature remains within limits they can tolerate. In the rainy season catfish will wake up from sleep and this is the time for catfish to enlarge their bodies and multiply, and catfish metabolism will increase in the rainy season, and their appetite will increase and growth will increase, it can be seen with catfish growth, catfish can be harvested in between 7-8 weeks. During the rainy season the water will be maintained because there is circulation because the pool receives continuous every rain. Because when it rains, dirt can be removed quickly and water quality is maintained, where in the dry season the hot air becomes evaporation and water quality is more quickly damaged and polluted by ammonia plus the remaining feed makes dirty water and bacteria easier to develop.

Acknowledgments
The research team would like to thank the Serambi Mekkah University.

Author Contributions
Conceptualization: Nurlena Andalia, Data curation: Susanti Djakfar, Funding acquisition: Nurlena Andalia, Methodology: T. Iskandar Shah, Visualization: Susanti Djakfar. Writing–original draft: Nurlena Andalia, Writing–review & editing: Nurlena Andalia, Susanti Djakfar, T. Iskandar Shah.

Funding
This research received no external funding.

Conflicts of Interest
The authors declare no conflict of interest.

References

Anis, M. Y., & Hariani, D. (2019). Pemberian EM4 (Effective Microorganisme 4) Hasil Kultur dalam Media yang Berbeda pada Pakan untuk Budi daya Lele (Clarias sp.). *Jurnal Riset Biologi Dan Aplikasinya*, *1*(1), 1. https://doi.org/10.26740/jrba.v1n1.p1-8

Assefa, A., & Abunna, F. (2018). Maintenance of Fish Health in Aquaculture: Review of Epidemiological Approaches for Prevention and Control of Infectious Disease of Fish. *Veterinary Medicine International*, *2018*, 1–10. https://doi.org/10.1155/2018/5432497

Augusta, T. S. (2016). Dinamika Perubahan Kualitas Air Terhadap Pertumbuhan Ikan Lele Dumbo (Clarias gariepinus) yang Dipelihara di Kolam Tanah. *Jurnal Ilmu Hewani Tropika*, *5*(1), 41–44. Retrieved from https://unkripjournal.com/index.php/JIHT/article/view/86/85

Dayat, H. (2017). Pelatihan Kewirausahaan Budi Daya Ikan Lele Dumbo Untuk Pemberdayaan Pemuda Di Desa Kemiri Kecamatan Jayakerta Kabupaten Karawang. *Jurnal Pendidikan Luar Sekolah*, *13*(1), 121–133. Retrieved from https://ejournal.upi.edu/index.php/pls/article/view/8731/5419

Delis, P. C., Elisdiana, Y., Maharani, H. W., & Diantari, R. (2022). Budidaya Lele Berbasis Teknologi Bioflock Pada Kelompok Pembudidaya Ikan Mandiri Sentosa Di Kecamatan Jati Agung Lampung Selatan. *Jurnal Pengabdian Fakultas*

Pertanian Universitas Lampung, *1*(2), 384. https://doi.org/10.23960/jpfp.v1i2.6339

Elpawati, Pratiwi, D. R., & Radiastuti, N. (2015). Aplikasi affective Microorganisme 10 (EM10) Untuk Pertumbuhan Ikan Lele Sangkuriang di Kolam Budidaya Lele Jombang, Tangerang. *Al-Kauniyah Jurnal Biologi*, *8*(1), 6–14. https://doi.org/10.15408/kauniyah.v8i1.2699

Hariani, D., & Purnomo, T. (2017). Pemberian Probiotik Dalam Pakan Untuk Budidaya Ikan Lele. *STIGMA: Jurnal Matematika Dan Ilmu Pengetahuan Alam Unipa*, *10*(1). https://doi.org/10.36456/stigma.vol10.no1.a582

Holt, R. E., & Jørgensen, C. (2015). Climate change in fish: effects of respiratory constraints on optimal life history and behaviour. *Biology Letters*, *11*(2), 20141032. https://doi.org/10.1098/rsbl.2014.1032

Khairuddin, A. (2022). Peran Dinas Kelautan Dan Perikanan Provinsi Aceh Dalam Pemberdayaan Nelayan Melalui Penyediaan Cold Storage Di Kota Sabang. *Jurnal Ilmiah Mahasiswa Fakultas Ilmu Sosial & Ilmu Politik*, *7*(4). Retrieved from file:///C:/Users/Acer Aspire E3-111/Downloads/22348-50049-1-PB.pdf

Mokoginta, L. F., Sinjal, H. J., Pangemanan, N. P. L., Pelle, W. E., & Solang, J. (2021). Pertumbuhan dan kelangsungan hidup ikan Nila (Oreochromis niloticus) yang diberi pakan komersil dengan penambahan Effective Microorganism-4. *E-Journal Budidaya Perairan*, *10*(2), 166. https://doi.org/10.35800/bdp.10.2.2022.37624

Mulqan, M., Rahimi, E., Afdhal, S., & Dewiyanti, I. (2017). *Pertumbuhan dan kelangsungan hidup benih ikan nila gesit (Oreochromis niloticus) pada sistem akuaponik dengan jenis tanaman yang berbeda* [Syiah Kuala University]. Retrieved from https://d1wqtxts1xzle7.cloudfront.net/56235759/188527-ID-pertumbuhan-dan-kelangsungan-hidup-benih-libre.pdf?

Mulyadi, M., & Indriati, K. (2021). Pendampingan Pengolahan Lele Menjadi Abon Lele Tanpa Minyak di Desa Sampora, Tangerang. *Jurnal Pengabdian Masyarakat Charitas*, *1*(1), 27–32. https://doi.org/10.25170/charitas.v1i1.2690

Ogunji, J. O., & Awoke, J. (2017). Effect of environmental regulated water temperature variations on survival, growth performance and haematology of African catfish, Clarias gariepinus. *Our Nature*, *15*(1–2), 26–33. https://doi.org/10.3126/on.v15i1-2.18791

Patriono, E., Amalia, R., & Sitia, M. (2022). Kualitas air kolam budidaya dan kolam terpal untuk pertumbuhan ikan Lele Sangkuriang (Clarias gariepinus) pada kelompok pembudidaya ikan Lele di Kabupaten PALI Sumatera Selatan. *Sriwijaya Bioscientia*, *2*(3), 83–88. https://doi.org/10.24233/sribios.2.3.2021.378

Primaningtyas, A. W., Hastuti, S., & Subandiyono. (2015). Performa produksi ikan lele (Clarias gariepinus) yang dipelihara dalam sistem budidaya berbeda. *Journal of Aquaculture Management and Technology*, *4*(4), 51–60. Retrieved from http://ejournal-s1.undip.ac.id/index.php/jamt

Qalit, A., Fardian, F., & Rahman, A. (2017). Rancang Bangun Prototipe Pemantauan Kadar pH dan Kontrol Suhu Serta Pemberian Pakan Otomatis pada Budidaya Ikan Lele Sangkuriang Berbasis IoT. *Jurnal Komputer, Informasi Teknologi, Dan Elektro*, *2*(3), 8–15. Retrieved from https://jurnal.usk.ac.id/kitektro/article/view/8324

Rabilla, R. R., Satria, A., & Yuliati, L. N. (2019). Strategi Pemasaran Lele Sangkuriang Organik Surya Kencana Farm Kota Bogor. *MANAJEMEN IKM: Jurnal Manajemen Pengembangan Industri Kecil Menengah*, *13*(2), 137–142. https://doi.org/10.29244/mikm.13.2.137-142

Ramadhan. (2018). *Strategi Pemerintah Dalam Meningkatkan Kesejahteraan Nelayan Di Kota Banda Aceh*. Universitas Islam Negeri Ar-Raniry Darussalam Banda Aceh.

Riyadi, S., Gandasari, D., & Putra, K. (2021). The Pengaruh Pemberian Probiotik Rabal Plus terhadap Peningkatan Produksi dan Kualitas Telur Itik di Desa Panggangsari, Kecamatan Losari, Kabupaten Cirebon. *Jurnal Triton*, *12*(2), 38–47. https://doi.org/10.47687/jt.v12i2.207

Santi, S., Rougeot, C., Toguyeni, A., Gennotte, V., Kebe, I., & Melard, C. (2017). Temperature Preference and Sex Differentiation in African Catfish, Clarias gariepinus. *Journal of Experimental Zoology Part A: Ecological and Integrative Physiology*, *327*(1), 28–37. https://doi.org/10.1002/jez.2066

Sanutra, S., Syazali, M., & Erfan, M. (2022). Identifikasi Jenis-Jenis Ikan Yang Terdapat Di Sungai Ampenan, Mataram Nusa Tenggara Barat. *BIOCHEPHY: Journal of Science Education*, *02*(2), 47–52. https://doi.org/10.52562/biochephy.v2i2.514

Siswandoko, R. D., Elfitasari, T., & Rachmawati, D. (2017). Analisis Kelayakan Usaha Pembesaran Budidaya Ikan Lele (Clarias Sp) Pokdakan Mina Makmur Di Desa Sidoharjo Kecamatan Pati Kabupaten Pati. *Journal of Aquaculture Management and Technology*, *6*(4), 175–181. Retrieved from https://ejournal3.undip.ac.id/index.php/jamt/article/view/20557/19341

Sitio, M. H. F., Jubaedah, D., & Syaifudin, M. (2017). Kelangsungan Hidup Dan Pertumbuhan Benih Ikan Lele (Clarias sp.) Pada Salinitas Media Yang

Berbeda. *Jurnal Akuakultur Rawa Indonesia*, *5*(1), 83–96. https://doi.org/10.36706/jari.v5i1.5810

Susan, S., & Sophia, A. (2016). Pemberdayaan Masyarakat pada Kelompok Ternak Lele "Pangeran Jalon" di Desa Losarang, Indramayu (Community Development of Catfish Breeder Group "Pangeran Jalon" in Losarang Village, Indramayu). *Jurnal CARE: Jurnal Resolusi Konflik, CSR, Dan Pemberdayaan*, *1*(1), 50–56. Retrieved from https://journal.ipb.ac.id/index.php/jurnalcare/article/view/15296

Wibowo, R. A., Mochammad Djaohar, & Nur Hanifah Yuninda. (2020). Prototype Pengendalian Motor Untuk Menstabilkan pH Air Kolam Ikan Lele Menggunakan Sensor pH Dan Ultrasonic Berbasis Arduino Uno. *Journal of Electrical Vocational Education and Technology*, *3*(1), 43–46. https://doi.org/10.21009/JEVET.0033.08

Widjayanthi, L., & Mauladani, Z. A. (2021). Teknologi Sistem Boster Pada Budidaya Lele: Dalam Perspektif Komunikasi Di Desa Jambewangi Kecamatan Sempu Kabupaten Banyuwangi. *Jurnal AGRISEP: Kajian Masalah Sosial Ekonomi Pertanian Dan Agribisnis*, *20*(01), 141–156. https://doi.org/10.31186/jagrisep.20.01.141-156

Yusnaini, Y., Nur, I., Pengerang, U. K., Patadjai, R. S., & Indrayani, I. (2019). Pertumbuhan Ikan Lele (Clarias sp.) pada Saluran Drainase Lahan Gambut. *Jurnal Sains Dan Inovasi Perikanan*, *3*(1), 73–77. Retrieved from http://eprints.unm.ac.id/28146/1/Pertumbuhan ikan lele 2019.pdf