Original Research Article

STATE OF WATER QUALITY AND MANAGEMENT OF PATIN FISH CULTIVATION IN CINDAI ALU, BANJAR DISTRICT

ABSTRACT

There is an interesting thing that has not been touched, namely the evaluation of the environmental feasibility of catfish which is the main commodity of the Cindai Alus Minapolitan Area. This activity focuses on the results of evaluating the quality of water suitable for catfish farming and the management of this culture. This study aims to analyze the condition of water quality and management of catfish farming in Cindai Alus, Banjar Regency. This research was conducted in Cindai Alus Village, Banjar Regency. The sample used in this study, namely using 5 representative catfish cultivators based on field observations that have been made. The cultivators in question are pond A, pond S, pond F, pond K, and pond D. The condition of the water quality for catfish cultivation in Cindai Alus Village is not yet environmentally friendly, as can be seen from the many parameter values that do not meet the quality standards of water quality. determined by the government. The management of catfish farming in Cindai Alus Village is not suitable for Good Fish Cultivation (CBIB) which has been determined by the guidelines of the Indonesian Ministry of Maritime Affairs and Fisheries.

KeyWords: Pangas catfish, Water Quality, Management, Cultivation, Cindai Alus

INTRODUCTION

The number of catfish cultivation in one of the villages in Martapura District, Cindai Alus village, is one of the catfish Minapolitan areas with a production of 14,492.8 tons in 2022. Cindai alus is included in the aquaculture-based minapolitan area, which has created a new aquaculture area and supports regional economy so that it is claimed to be able to increase production significantly. The Minapolitan area in Banjar Regency has been able to produce 35 to 40 tons of catfish in one day to be marketed to regencies/cities in the provinces of South Kalimantan, Central Kalimantan and East Kalimantan. Ministry of Maritime Affairs and Fisheries [KKP] data for 2023 states that the total production of catfish aquaculture in 2020 will reach 327,145.78 tons. The abundant production of catfish (Pangasius sp.) aquaculture in Banjar Regency indicates the community's interest in good consumption of catfish. This is because catfish has several advantages including having a tasty meat taste, large individual size, and thick meat size (Andriani, 2014). In addition, catfish with abundant production is due to the growth of fish that can grow quickly (Khan et al., 2018).

Cultivation of catfish in Banjar Regency is a commodity that has bright prospects for cultivation. This activity is thought to have shown a degradation of the quality of environmental waters in line with the increasing enthusiasm of local residents for freshwater fish farming in ponds. Using good feed efficiency, about 30% solid waste is produced (Dauda, 2019). Furthermore, this solid waste will clog fish gills and also lead which can cause death (Akinwole et al., 2016). A new challenge for the selection of ingredients in fish feeds with the lowest environmental risk (Solberg, 2021). According to the Food and Agriculture Organization (FAO), aquaculture is considered sustainable if its management, location of fish ponds and use of natural resources takes social implications, institutional orientation into account, and ensures economic feasibility, social justice and acceptable impact on the environment. (FAO, 2019). The high organic and inorganic compounds, especially some nitrogen and phosphorus compounds will greatly affect the content of dissolved solids and nutrients in the media environment which under certain conditions can be toxic through a decrease in dissolved oxygen content, changing the structure of aquatic organisms and the growth of disease-causing organisms (Wiramiharja, 2017).

Some of these impacts, of course, need to be watched out for by knowing the carrying capacity of the pond, so that what action can be taken for the sustainability of the

aquaculture business in the pond. This also includes sludge generated from pool disposal so that it can have a positive or negative impact on the environment (Febrianty, 2019). The cause is thought to be excess capacity in aquaculture, especially in inland public waters such as reservoirs, rivers and lakes or a large amount of feed is wasted due to excess feeding or poor feed quality. There are interesting things that have not been touched, namely the evaluation of the environmental feasibility of catfish which is the main commodity of the Cindai Alus Minapolitan Area. This activity focuses on the results of evaluating the quality of water suitable for catfish farming and the management of this culture. This study aims to analyze the condition of water quality and management of catfish farming in Cindai Alus, Banjar Regency.

MATERIALS AND METHODS

This research was conducted in Cindai Alus Village, Banjar Regency, namely in the following figure.

Comment [M1]: Insert the geographical location map of study area in Indonesia

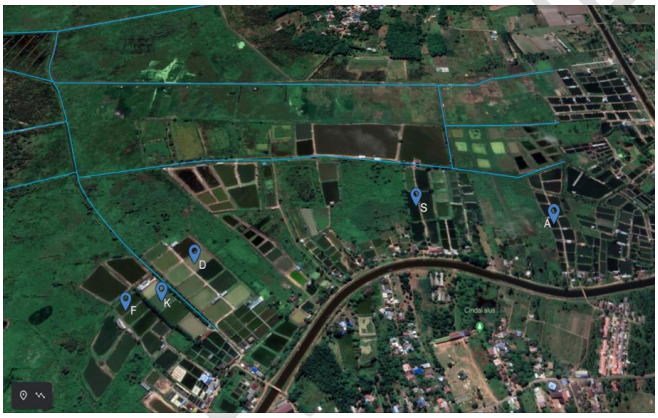

Figure 1. Map of Research Locations

The population in this study is based on the area of catfish cultivation using the classification of a large business pond with an area of more than 10,000 m² (Febriyanti, 2019). The sample used in this study, namely using 5 representative catfish cultivators based on field observations that have been made. The cultivators in question are pond A, pond S, pond F, pond K, and pond D. Data collection techniques in this study were limited to primary data and secondary data. Data collection on water quality, pH, DO and temperature was carried out in situ at the location of 5 catfish cultivators in the village of Cindai Alus, 2 samples were taken at each cultivator location, namely at the sample point of the fish farming pond and water disposal (Outlet). 2 sample points of irrigation water sources (inlet), 1 sample point in the river before pond water discharge, and 1 sample point in the river when pond water is discharged. Sampling of ammonia water quality was carried out by using plastic bottles at the location of 5 catfish cultivators in the village of Cindai Alus, 2 samples were taken at each cultivator location, namely at the sample point of fish farming ponds and water disposal (Outlet). Furthermore, 2 sample points for irrigation water sources (inlet), 1 sample point in the river before pond water discharge, and 1 sample point in the river when pond water is discharged. Data analysis to see the condition and management of the quality of catfish aquaculture water is carried out by descriptive analysis, which is a method used to describe or analyze a research result but not used to make broader conclusions (Sugiyono, 2017).

RESULTS AND DISCUSSION

Water quality

In this research, water quality tests were conducted on 5 cultivators in the Minapolitan Cindai Alus area on May 1, 2023 to measure the acidity of pH, dissolved oxygen (DO), water temperature, and ammonia levels in the water. The measurement results will be compared with the quality standards set by the government according to PP No. 22 of 2021 concerning Environmental Protection and Management Organizers. Categories will be carried out in the form of suitable and inappropriate sentences depending on the results of the measurements carried out.

1. Water pH level

Table 1. Results of measuring Ph levels.

Location	Sample	PH Score	QUALITY STANDARDS PP 22 YEAR 2021	INFORMATION
INLET	**INLET 1**	6.33	6 - 8 ppm	FEASIBLE
	INLET 2	6.32		FEASIBLE
A	**FISHPOND**	5.88		NOT FEASIBLE
	OUTLET	5.89		NOT FEASIBLE
S	**FISHPOND**	6.24		FEASIBLE
	OUTLET	6.71		FEASIBLE
F	**FISHPOND**	6.17		FEASIBLE
	OUTLET	6.08		FEASIBLE
K	**FISHPOND**	6.2		FEASIBLE
	OUTLET	5.77		NOT FEASIBLE
D	**FISHPOND**	6.37		FEASIBLE
	OUTLET	5.77		NOT FEASIBLE
RIVER	**BEFORE THERE WAS DISPOSAL OF FISHPOND WATER**	5.97		NOT FEASIBLE
	FISHPOND DISPOSAL	6.24		FEASIBLE

Source: Primary Data (2023)

Comment [M2]: Why all pH values are below 7 (acidity)

The results recorded in Table 1 found that of the 14 sample points measured, 9 samples met the quality standards of PP 22 of 2021 on the Implementation of Environmental Protection and Management, while 5 sample points showed results below the standards set by the government. Sample points in pond S and pond F also meet the established quality standards. The results of observations on the sample pool A showed that it was not feasible with the expected conditions. This is caused by the absence of a change in the flowing water, the color of the pond which has turned dark green to brown, and the high density of fish which causes the pH of the pond water to be below the quality standard set by the government. These findings support research conducted by Bui et al (2014), which stated that the density of fish in a pond or culture system can affect the pH of the water through certain mechanisms. At high densities, fish will produce metabolic wastes such as ammonia, which increases the organic load in the water. An increase in organic load can cause a decrease in water pH. high densities can also reduce dissolved oxygen in the water, which ultimately affects pH." The fact is that in pond A fish can survive and grow well because the value is not far below the standard and also according to research conducted by Magalhães et al. (2013) that catfish can survive in a fairly low pH, which is around 4 to 5.5. In the sample points K and D ponds a decent pH value can be seen, while at the outlet point the pH value is not feasible. This phenomenon is caused by the location of the pond's position which is side by side and the abundant presence of weathered and dead plants.

2. DO (*Dissolved Oxygen*)

The parameter of dissolved oxygen in water, hereinafter referred to as DO, in catfish

farming is very important because oxygen is a critical element needed by fish for their breathing processes.

Table 2 Measurement Results of DO Levels.

Location	Sample	DO Score	QUALITY STANDARDS PP 22 YEAR 2021	INFORMATION
INLET	**INLET 1**	3.2	4.5 - 6.5 Ppm	NOT FEASIBLE
	INLET 2	4.4		NOT FEASIBLE
A	**FISHPOND**	2.0		NOT FEASIBLE
	OUTLET	2.1		NOT FEASIBLE
S	**FISHPOND**	3.6		NOT FEASIBLE
	OUTLET	3.8		NOT FEASIBLE
F	**FISHPOND**	7.3		NOT FEASIBLE
	OUTLET	4.9		FEASIBLE
K	**FISHPOND**	5.9		FEASIBLE
	OUTLET	3.7		NOT FEASIBLE
D	**FISHPOND**	5.3		FEASIBLE
	OUTLET	3.7		NOT FEASIBLE
RIVER	**BEFORE THERE WAS DISPOSAL OF FISHPOND WATER**	2.4		NOT FEASIBLE
	FISHPOND DISPOSAL	5.6		FEASIBLE

Source: Primary Data (2023)

The results recorded in Table 2, it was found that of the 14 sample points measured, 5 samples met the PP 22 of 2021 quality standards, while 9 sample points showed results below the standards set by the government. More than 60% of the sample locations indicated that the results of measuring DO levels in these waters were not in accordance with the water quality standards set by the government. A minimum DO level of 3 ppm is considered important in fish farming to ensure adequate oxygen supply for fish. Low DO conditions below this threshold can cause oxygen stress in fish and potentially impair their growth and health (Singh et al .2019). From the above results, about 80% of ponds, including inlets or irrigation channels made by the government, meet the requirements with proper DO levels.

Researchers will discuss the results of measuring DO levels at two sample points, namely pond A and the river before the existence of the pond. Pond A shows that DO levels reach 2.0 ppm in the pond and 2.1 ppm at the pond outlet. The decrease in DO levels was due to the very high density of fish and the brownish green color of the water. Research conducted by Li et al (2019) explains that organic or plant decomposition and fish density can affect DO (Dissolved Oxygen) levels in catfish cultivation. The measurement results in other sample ponds showed DO values above the minimum limit for catfish farming environment. On average at these sample points, the density of fish is relatively low, the transparency of the water is good, and there is no excessive decomposition of organic matter.

3 Water Temperature

Water temperature is a parameter that greatly influences the metabolism and growth of pangasius catfish.

Table 3 Results of Measurement of Temperature Levels.

Location	Sample	Temperature Score	QUALITY STANDARDS PP 22 YEAR 2021	INFORMATION

INLET	**INLET 1**	29.9		FEASIBLE
	INLET 2	31.1		NOT FEASIBLE
A	**FISHPOND**	31.2	26 - 31 ^{0}C	NOT FEASIBLE
	OUTLET	31.5		NOT FEASIBLE
S	**FISHPOND**	31.5		NOT FEASIBLE
	OUTLET	33.7		NOT FEASIBLE
F	**FISHPOND**	32.6		NOT FEASIBLE
	OUTLET	32.2		NOT FEASIBLE
K	**FISHPOND**	32.6		NOT FEASIBLE
	OUTLET	31.8		NOT FEASIBLE
D	**FISHPOND**	32.1		NOT FEASIBLE
	OUTLET	31.8		NOT FEASIBLE
RIVER	**BEFORE THERE WAS DISPOSAL OF FISHPOND WATER**	31.6		NOT FEASIBLE
	FISHPOND DISPOSAL	31.7		NOT FEASIBLE

Source: Primary Data (2023)

The results recorded in Table 3, it was found that of the 14 sample points measured, 1 sample met the PP 22 of 2021 quality standards, while 13 sample points showed results below the standards set by the government. This shows that there is an increase in temperature in the aquaculture waters which at the time this data was taken around 11.00 WITA to 17.00 WITA so the measurement results were very high. Coupled with the extreme weather that hit Indonesia and the absence of tree vegetation around the cultural waters so that the waters became open. Actually good water sampling is done in the morning or evening, but when sampling there are problems in the morning because the cultivator is not at the cultivation site so it is taken during the day. Research conducted by Hung et al. (2019), catfish can tolerate water temperatures outside their optimal range for a certain period of time.

4 Ammonia

High levels of ammonia in water can be very toxic to catfish. The concentration of ammonia must be kept low, usually below 0.02 mg/.

Table 4 results of measuring ammonia levels.

Location	Sample	Ammonia Score	QUALITY STANDARDS PP 22 YEAR 2021	INFORMATION
INLET	**INLET 1**	0.06		FEASIBLE
	INLET 2	0.1		FEASIBLE
A	**FISHPOND**	3.0	<0,2 Mg	NOT FEASIBLE
	OUTLET	0.6		NOT FEASIBLE
S	**FISHPOND**	6.0		NOT FEASIBLE
	OUTLET	1.17		NOT FEASIBLE
F	**FISHPOND**	2.6		NOT FEASIBLE
	OUTLET	0.4		NOT FEASIBLE
K	**FISHPOND**	0.1		FEASIBLE
	OUTLET	1.63		NOT FEASIBLE
D	**FISHPOND**	0.11		FEASIBLE

	OUTLET	1.4		NOT FEASIBLE
RIVER	**BEFORE THERE WAS DISPOSAL OF FISHPOND WATER**	1.5		NOT FEASIBLE
	FISHPOND DISPOSAL	1.1		NOT FEASIBLE

Source: Primary Data (2023)

The results recorded in Table 4, it was found that of the 14 sample points measured, 4 samples met the PP 22 of 2021 quality standards, while 10 sample points showed results below the standards set by the government. From these results, it can be concluded that the waters are polluted because the values are far from the standards set by the government. Ammonia at inlet 1 and inlet 2 shows a value that meets environmental standards for catfish, which is a source of water for catfish culture in all sample point locations. This is a good capital for cultivating catfish. The water enters the aquaculture pond, there is an increase in high ammonia concentrations. This is caused by the lack of waste treatment and water quality measurement in the cultivation process. This situation is very detrimental to the health of the catfish in the aquaculture ponds and also to the environment where pond waste is disposed of, causing water contamination (Supriyanto, et al. 2020).

Samples from pond outlets S, K, and D showed that there were high levels of ammonia that exceeded the threshold. The outlet washer is overgrown with swamp plant vegetation which causes high organic decomposition in the stream. Disposal of water from ponds also worsens water quality. The same thing also happened at the sample point of the river before there was disposal of pond water or river flow, where an ammonia level of 1.5 mg/L was considered dangerous for fish habitat. The reason is that the river flow is a rice field water flow which has a high level of organic matter decomposition, so that the water is polluted.

Management of Catfish Cultivation in Cindai Alus Village

Management of catfish farming involves a number of practices and strategies to ensure optimal growth and health of catfish. Researchers in this case conducted surveys and interviews at cultivator locations and compared them with the Regulation of the National Standardization Agency of the Republic of Indonesia Number 4 of 2021 concerning Schemes for the Feasibility Assessment of Indonesian National Standards for the Agriculture, Plantation, Livestock and Fishery Sectors (full guidelines attached in the attachment) explaining the results as follows.

Table 5. Results of analysis of the management of catfish farming in the village of Cindai Alus with PP no 4. 2021

No	Indicator	Survey and Interview Results
1	Location	FEASIBLE
2	Source water	FEASIBLE
3	Design and layout	NOT FEASIBLE
4	Equipment	NOT FEASIBLE
5	Container preparation	NOT FEASIBLE
6	Seed	NOT FEASIBLE
7	Selection of species and stocking density	FEASIBLE
8	Feed	NOT FEASIBLE
9	Health management	NOT FEASIBLE
10	Water management	NOT FEASIBLE
11	Cleanliness of location and facilities	NOT FEASIBLE
12	Harvest and post harvest	NOT FEASIBLE
13	Waste management	NOT FEASIBLE
14	Management of the environment	NOT FEASIBLE

15	Manpower	NOT FEASIBLE
16	Training	NOT FEASIBLE
17	Documentation	NOT FEASIBLE

The results of the data in Table 5 show that of the 17 indicators of good freshwater cultivation practices (CBIB) PP No. 4 of 2021, only 3 indicators are appropriate. this shows that cultivation management carried out by Cinda Alus village cultivators is not feasible with good cultivation methods (CBIB) set by the government.

1 Location Selection

The spatial layout of the Cindai Alus Village area is identified as a minapolitan area that relies on irrigation water sources to support catfish farming activities, the policy around this minapolitan area prohibits the establishment of industries that have the potential to pollute the environment, especially in the waters context. The research location is also feasible according to the Standard Cultivation Indicators (CBIB) with the criteria of adequate access to clean water, good drainage, sufficient land availability, and far from sources of pollution.

2 Source Water

CBIB's standard aquaculture indicator standards say the availability and quality of water meets the requirements for fish farming whose final product is safe for human consumption. In fact, the source of water used by catfish cultivators is irrigation water provided by the government. This irrigation water was originally designed for agricultural purposes and as a raw material for drinking water for PDAM Intan Banjar.

3 Design and layout

The standard CBIB cultivation indicator standard said that the cultivation container can support the production process. The cultivators in Cindai Alus Village did not carry out a specific design and layout for catfish farming ponds. The determination of the layout depends on the area of land and the shape of the land owned by the cultivator. Farmers do not carry out optimal arrangements and designs for catfish farming.

4 Equipment

The standard CBIB cultivation indicator says Cultivation equipment is made from environmentally friendly materials. The equipment used by farmers, from the feed production process to post-harvest equipment, is not environmentally friendly. It can be said that the use of this equipment is not feasible according to CBIB principles.

5 Container Preparation

CBIB cultivation indicator standard says Containers are prepared in a sanitary manner, namely by draining the bottom and filtering the water that enters the container to prevent the entry of parasitic hosts, pests or predators. Provision of lime, fertilizers and chemicals are used according to the dosage and rules for their use. Fish cultivators generally have prepared containers such as draining the pond and applying lime before the fish seeds are put into the pond.

6 Fish Seed

CBIB cultivation indicator standards Say the seeds used come from CPIB-certified hatcheries and/or have a certificate of healthy origin from the authorized agency or laboratory. The fish seeds used by cultivators vary greatly. The size of the seeds that are sown in fish ponds is not uniform, depending on the availability of existing seeds. The cultivator also does not know whether the seeds used come from a CPIB-certified hatchery unit and/or have a certificate of healthy origin from the authorized agency or laboratory. It was concluded that the selection of seeds by farmers was not feasible with the principles of good fish farming methods.

7 Selection of Species and Stocking Density

CBIB cultivation indicator standard says Selection of species in polyculture by reducing the potential for disease transmission between cultivated species. Catfish cultivators have chosen the right species for fish farming, namely catfish. Stocking density is generally appropriate with the requirements of 5 fish cultivators, except for fish pond A which does not meet the requirements. This can be seen from the characteristics of the respondents. According to CBIB, the ideal stocking density for fish is between 10-15 fish per meter. Farmers have a stocking density of under 10 fish per meter. Thus, it can be concluded that

farmers have followed the principles of good fish farming (CBIB).

8 Fish Feeding

The standard CBIB cultivation indicator standard says the commercial artificial feed used must be registered with the competent authority, and the homemade feed is made with materials recommended by the competent authority with hygienic handling. Catfish cultivators generally use commercial feed and independent feed. This is not feasible according to the CBIB principles for cultivating catfish.

9 Health Management

CBIB cultivation indicator standard says Fish health is maintained and monitored visually and/or laboratory when necessary. Fish cultivators in Cindai Alus Village do not manage the health of catfish. such as the absence of checking the health of fish in the laboratory, the separation of aquaculture ponds and the administration of drugs when fish are sick. Based on this, it can be concluded that the management of fish pests and diseases is not feasible with the CBIB guidelines (Good Fish Cultivation Practices).

10 Water Management

The CBIB cultivation indicator standard says that water quality is maintained so that it meets the requirements for appropriate maintenance water for the type of fish being kept. The water quality conditions in catfish cultivation can be said to be supportive when viewed from the water source originating from irrigation, as seen in the inlet samples.

11 Cleanliness of Location and Facilities

CBIB aquaculture standard indicator standard Says Facilities and locations are kept clean and free from contamination. Fish farming units need to implement Good Hygiene Practices (GHP) to suppress contamination, especially from human and animal waste or excrement. Equipment is cleaned after use and (if necessary) disinfected to prevent the spread of disease. Based on these conditions, it can be concluded that fish rearing management is not feasible with the principles listed in Good Fish Cultivation Practices (CBIB).

12 Harvesting and Post Harvest

Standard CBIB cultivation indicator standards Say Harvest and handling of produce is carried out quickly to prevent damage and minimize contamination. Catfish cultivators harvest fish twice a year, but this activity is irregular and depends on the condition of the fish and the cultivator's finances. Generally, harvest time for one pond takes 2-5 days, which can cause losses for fish farmers. This includes fish mortality, loss of fish weight, injury or illness to fish, as well as worker fatigue because fish harvesting starts from evening to early morning. This practice is against the principles of Good Fish Farming Practices (CBIB).

13 Waste Management

Standard CBIB Cultivation Indicator Standards Say Handling of liquid, solid waste and other hazardous materials is carried out to minimize environmental impacts and product contamination as required. Control of water pollution is also important for catfish farmers. Farmers need to pay attention to factors such as proper fish density in ponds, management of water quality through monitoring of water parameters, and the use of effective water treatment technologies and methods. In the case of catfish cultivators in Cindai Alus, these things have never been done, which is detrimental to catfish farming because the waste is not treated at all. This practice is clearly not feasible with the principles of good fish farming.

14 Environment Management

Standard CBIB cultivation indicators say the cultivation unit carries out environmental management in accordance with applicable regulations and conducts periodic monitoring of the quality of the cultivation environment and outside the cultivation unit area. Farmers only pay attention to the environment from the perspective of the water supply needed for their cultivation, without considering the waste generated from these cultivation activities. Farmer management is not feasible with the principles of good fish farming in the context of environmental sustainability.

15 Worker

The standard CBIB cultivation indicator says Workers who harvest are in good health (free from infectious diseases), Workers who handle fish during harvest and postharvest show no indications of suffering from injuries, infections or diseases that can contaminate fish. From interviews with 5 cultivators, information was obtained that 3 cultivators used workers from relatives or family, while 2

cultivators used workers who were not from the family. The average worker salary ranges from 1,500,000 to 2,000,000 which is below the Provincial Minimum Wage (UMP).

16 Training

CBIB standard aquaculture indicator standard Says Workers should be given training or socialization and understand Good Hygene Practices (GHP) regarding fish health and welfare management including: fish behavior habits, physiology, clinical symptoms and types of disease how to maintain equipment related to fish health and welfare, how to management of water quality and the environment as well as how to handle fish. The results of interviews with cultivators show that they do not know this. Cultivators believe that workers who are already working have sufficient knowledge in cultivation because they are experienced. Farmers think that the training will increase production costs and reduce profits. This is clearly not feasible with good fish farming methods. Actually, the training can increase production yields and make the cultivation environment more environmentally friendly.

17 Documentation

The standard CBIB cultivation indicator standard says cultivators document activities at the pre-production, production, harvest and post-harvest stages for traceability. The catfish cultivators in Cindai Alus Village did not carry out the documentation process in their business activities. Monitoring and evaluation in the management of fish farming is not carried out properly by cultivators. This is due to deficiencies in administrative records and monitoring of fish growth, including weight, length, and health condition of fish. Farmers have limited knowledge about the concept of monitoring and evaluation in their cultivation business. They only see this aspect from the point of view of economic value or profits.

CONCLUSION

The condition of the water quality for catfish cultivation in Cindai Alus Village is not environmentally friendly, as can be seen from the many parameter values that do not meet the water quality standards set by the government. The management of catfish farming in Cindai Alus Village is not suitable for Good Fish Cultivation (CBIB) which has been determined by the guidelines of the Indonesian Ministry of Maritime Affairs and Fisheries.

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