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Implementation of Ecosystem Approach to Aquaculture (EAA) on Tilapia Commodities in Klaten District

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ABSTRACT Ministry of maritime affairs and fisheries (MMAF) has issued guidance on ecosystem approach aquaculture (EAA) as a tool for profitable and sustainable management of aquaculture areas. The Minapolitan area of Klaten district with the superior commodity Tilapia fish has not yet fully implemented EAA. The purpose of this study are: (1) evaluating the management of tilapia fish commodity cultivation areas in Klaten district based on EAA indicators and (2) providing recommendations for interventions to improve the management of tilapia cultivation fishery areas in Klaten district based on EAA indicators. The methods of data analysis used in this study is quantitative analysis using descriptive approach. Data collection uses triangulation techniques where respondents are determined intentionally (purposefully). The study site was in Minapolitan Area 1 (Karanganom, Tulung and Polanharjo) and Minapolitan Area 2 (Ngawen, Kebonarum, and South Klaten) of Klaten regency. The result showed that the management of aquaculture areas with Tilapia as a commodity in Klaten district based on the EAA parameter is in adequate condition with a value of 2.26 for Minapolitan Area 1 and 2.13 for Minapolitan Area 2. Recommendations for interventions are improvements to institutional parameters, monitoring, and evaluation, as well as the role of environmental management in the area.

Keywords: Area management; EAA implementation; minapolitan; tilapia

INTRODUCTION

Aquaculture activities have developed since 1980 as fisheries production from catches has stagnated and some have declined. Sea-caught fish make a major contribution as a source of protein for the world community, especially for those living in poor countries (FAO, 2020). Capture fisheries activities, which catch 92,3 million tons from the sea per year are not yet able to meet world demand. To meet the need for this protein source, it is necessary to encourage aquaculture industry development. In 2022, it was recorded that 130,9 million tons were produced from the aquaculture sector (FAO, 2024), and it is estimated that by 2050, aquaculture could supply almost two-thirds of the world's fish consumption needs (Willot *et al*., 2019).

Aquaculture production in Indonesia for grow-out businesses reached 14.8 million tons in 2020. The tilapia commodity contributed 1.1 million tons that year. Meanwhile, for Central Java Province, tilapia production reached 93,569 tons, or 8% of the total national production value (BPS, 2022). The Indonesian government, through the ministry of maritime affairs and fisheries (MMAF) encourages various fish cultivation activities in ocean and land areas. We continue to carry out improvements in management policies and technical research related to fish cultivation to increase production in the aquaculture sector. One of the breakthroughts was the creation of an area-based fisheries development policy. Area based aquaculture development has been initiated since 2011 with the launch of the Minapolitan program, which is currently known as aquaculture villages (MMAF, 2021).

Since 2011, Klaten Regency has been one of the pilot locations for the Minapolitan program with the superior commodity of tilapia fish. Records shows a relatively significant in this sectors output. In 2023, Klaten Regency recorded a production of fresh fish for consumtion of 30,451 tons. Meanwhile, tilapia commodity production amounted 18,833 tons (BPS Klaten, 2024).

The increasing production value achieved by the aquaculture sector has resulted in various challenges in its implementation. This sector causes a variety of problems, including the limitations of marine catches as a raw material for making fish feed. Apart from that, aquaculture also has external problems in the form of climate change, which can affect aquaculture production. The threat of a water crisis poses another challenge to fish farming activities, particularlu in freshwater environments. This is because cultivating freshwater fish requires a large supply of fresh water. The existence of competition for land and water use between freshwater fish cultivation and agricultural activities is a challenge for this sector (Bosma & Verdegem, 2011).

Along with the many problems with aquaculture activities, it is not surprising that some public views have emerged that aquaculture is classified as an "exploitative" economic activity that requires a lot of energy and resources and has the potential to produce waste in every production chain (Subasinghe, 2017; Little *et al*., 2018). An approach that can be used to reduce external, environmental, and social problems, as well as increase the positive aspects of aquaculture, is considering the ecosystem in aquaculture development (FAO, 2008).

In 2019, the MMAF through the directorate general of aquaculture (DJPB), encouraged the implementation of the Ecosystem Approach to Aquaculture (EAA) recommended by FAO in Indonesia by issuing Regulation Number 154/PER-DJPB/2019 concerning technical instructions for managing aquaculture areas using an ecosystem approach (EAA). The application of EAA in aquaculture development and management of aquaculture areas considers three principles, namely: 1) ecosystem sustainability, 2) equitable welfare, and 3) integrated governance (MMAF, 2021).

Klaten Regency has never conducted research on the application of EAA to tilapia fish commodities. This research

will evaluate the application of EAA in the management of the Minapolitan area of Klaten Regency and provide recommendations for interventions to improve the status of area management based on the EAA assessment parameters. The tilapia cultivation area in Klaten Regency is focused on the Minapolitan area, which has been determined by Decree of the Minister of Maritime Affairs and Fisheries Number KEP.39/MEN/2011. This determination was followed up by the Regional Government by making Karanganom, Tulung, and Polanharjo subdistricts into Minapolitan 1 (MP1) areas in 2011 and followed in 2015, Ngawen, Kebonarum, and South Klaten subdistricts became Minapolitan 2 (MP2) areas. The establishment of this regional policy has had a positive impact on increasing the amount of aquaculture production in Klaten Regency by 73-85 % compared to before the policy was issued (Triana, 2018).

The problem that wants to be explored is the extent to which the ecosystem approach to managing aquaculture areas with tilapia fish commodities in Klaten Regency has been implemented. In addition, this study aims to identify the EAA parameters that require improvement to enhance the management of aquaculture areas through an ecosystem approach. The objectives of this research are 1) evaluating the management of aquaculture areas with tilapia as a commodity in Klaten Regency based on EAA indicators, and 2) roviding intervention recommendations for managing aquaculture areas with tilapia as a commodity in Klaten Regency based on EAA indicators.

Research related to the application of ecosystem-based aquaculture has been carried out, such as evaluating the Minapolitan area for shrimp commodities (Zakiyah, 2014), evaluating shellfish commodities in mariculture (Kluger *et al*., 2017), for seaweed commodities (Gretchen *et al*., 2019), and evaluating the application of ecosystem-based aquaculture for shrimp commodities in Indonesia (Lasima *et al*., 2021). However, no one has ever evaluated the application of ecosystem-based aquaculture of tilapia commudities cultivated on land.

MATERIALS AND METHODS

The research was conducted from November 2023 to January 2024, located in the Minapolitan 1 area ,which consists of the Karanganom districts (Jeblog Village), Tulung districts (Daleman and Wunut Villages), and Polanharjo districts (Janti, Nganjat, Sidowayah, Ponggok, and Jimus Villages), as well as the Minapolitan 2 area which consists of Ngawen District (Duwet and Manjungan Villages), Kebonarum (Ngrundul Village), and South Klaten (Sumberejo and Nglinggi Villages) (Figure 1).

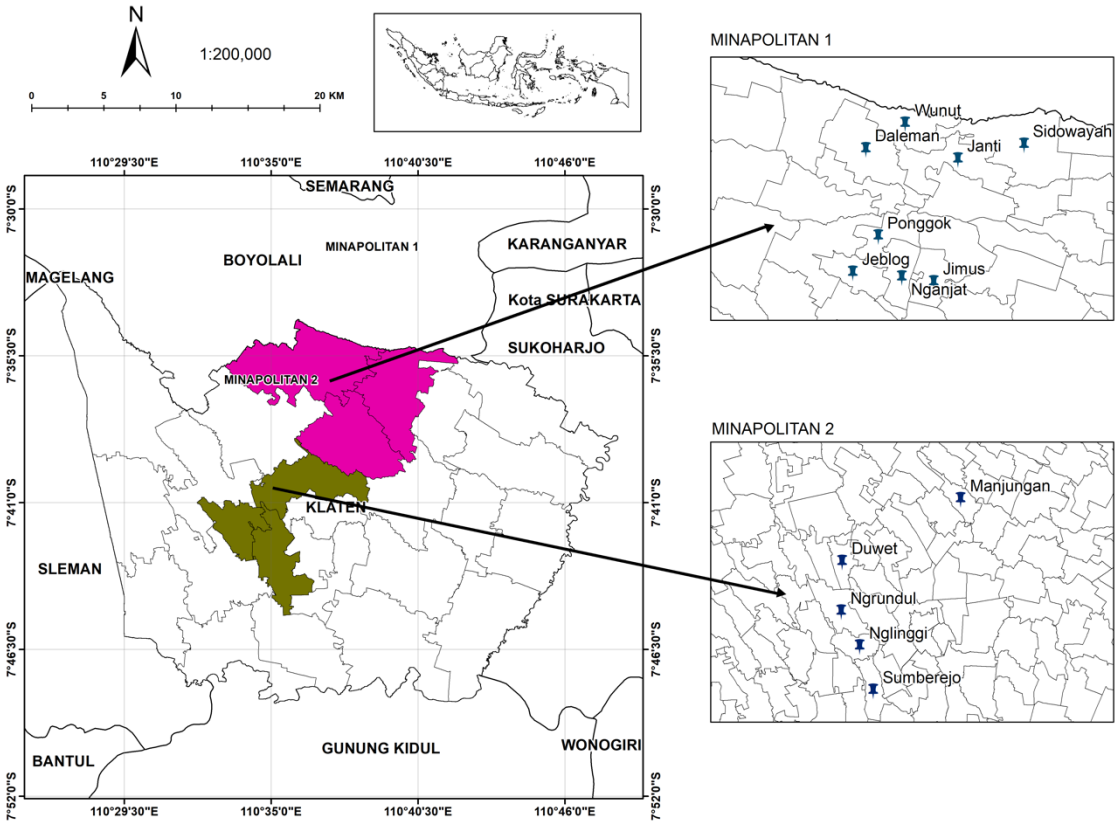

Figure 1. Map of research location.

The data analysis method in this study is quantitative, using a descriptive approach. To obtain research data, a combination of several data collection techniques was carried out, namely interviews, observation, and documentation studies. Interviews were conducted with Klaten Regency government stakeholders (Method I) and representatives of 81 tilapia fish farmers in the Minapolitan area (Method II). To obtain data on fish pond water quality and aquaculture waste, pond water samples were taken and water was quality laboratory tested (Method III). Meanwhile, observations were conducted at the pond and the surrounding environment to ascertion the field conditions (Method IV).

The results of interviews with fish farming respondents were processed into a distribution table containing their answers. Data processing software in the form of Microsoft Excel processes the data distribution tabulation into accumulated numbers and percentages. Meanwhile,

answers from interviews with stakeholders, field observations, and documentation studies were given a score of "3", "2" or "1" for each indicator in accordance with the matrix in the EAA technical guidelines.

The EAA value for each indicator is calculated after obtaining scores for 35 indicators. The calculation is calculated by multiplying the score by the weight of each indicator. The EAA value for each indicator is calculated using the formula:

Indicator value = Score X Weight (%)

The value of each indicator is then added up for each parameter and multiplied by the assessment weight of each principle. The assessment for the application of principle 1 is weighted at 40%, the application of principle 2 is 30%, and principle 3 is weighted at 30% (MMAF, 2019).

To see the position of the EAA results assessment in good, moderate or fair positions, a flag model conversion and visualization is carried out. The scale conversion value is calculated by calculating the minimum and maximum total values and then divided into 3 classes. The conversion value is calculated using a formula:

$$N = \frac{S_{max} - S_{min}}{3}$$

Where N is the conversion scale value; Smax is the maximum indicator if all indicator values are 3 and Smin is the minimum indicator value if all indicator values are 1. The conversion value and visualization model can be seen in Table 1.

Table 1. Conversion scale values and visualization models.

Conversion Scale Value	Flag Model	Information
1.00 – 1.67		Poor
1.68 – 2.33		Fair
2.34 – 3.00		Good

Following the EAA assessment, GAP analysis was then carried out by calculating the level of conformity to determine which parameters were priorities for improving the implementation of EAA in the Klaten district.

The results of the GAP analysis are presented in a spider diagram.

$$T_{ki} = \frac{\sum S_e}{\sum S_i}$$

Where: T_{ki} is the level of suitability; $\sum S_e$ is the existing parameter score; $\sum S_i$ is the ideal parameter value (Suprantoto, 2006).

RESULTS AND DISCUSSION

Fish farmer profile

The majority of tilapia farmers in Minapolitan are male and based on age, they are classified as productive workers. In the Minapolitan 1 (MP1) area, the youngest age is 39 years and the oldest is 71 years with the average age of fish farmers being 51 years. In the Minapolitan 2 (MP2) area, the youngest age for fish farmers is 56 years with an average age of 48 years. This demonstrate that fish farming activities can survive and be sustainable because the cultivators are of productive age (Nissa & Suadi, 2022).

The educational level of fish farmers in the Minapolitan area varies, namely from elementary school to bachelor's degrees. In MP1, the average education level of fish farmers is high school graduation with a score of 79% (Figure 2). Meanwhile, in MP2, the average education level of fish farmers is high school with a score of 90% (Figure 3). The high school education that most fish farmers have provides knowledge capital to be able to develop the quality of resources and businesses (Nissa & Suadi, 2022).

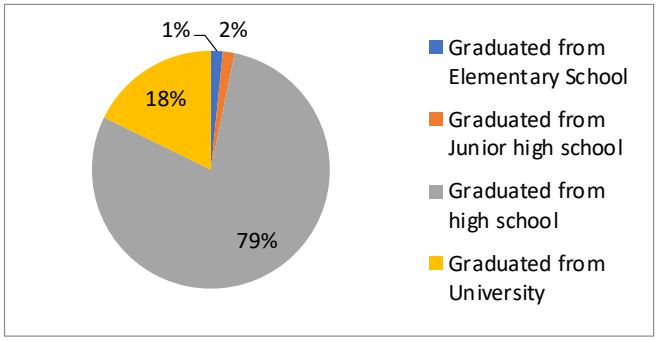

Figure 2. Education level of minapolitan 1 tilapia farmers.

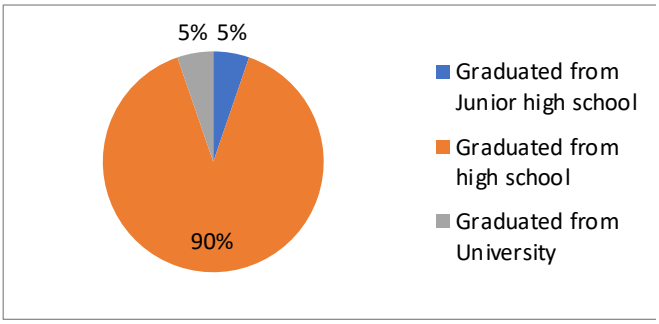

Figure 3. Education level of Minapolitan 2 tilapia farmers.

Principles of ecosystem sustainability

The principle of ecosystem sustainability consists of 3 constituent parameters, namely: 1) parameters for the suitability of the aquaculture area with the environmental carrying capacity; 2) the aquaculture area is managed sustainably; and 3) the role of environmental management in the aquaculture area. The results of the analysis of the principles of ecosystem sustainability can be seen in Table 2.

Table 2. Analysis of ecosystem sustainability principles.

Parameter	Portion	MP 1		MP 2	
		Score	Value	Score	Value
1. **Parameters of suitability of the aquaculture area**	**40%**		**1.20**		**1.00**
1.1. Indicators of conformity with spatial planning	10%	3	0.30	1	0.10
1.2. Indicators do not pollute the environment	10%	3	0.30	3	0.30
1.1.1. Sub indicator of adequate water quantity	5%	3	0.15	3	0.15
1.1.2. Water quality sub-indicators are met	5%	3	0.15	3	0.15
1.4. Indicator of proximity to the source of pollution	10%	3	0.30	3	0.30
2. **Parameters for sustainable management**	**25%**		**0.64**		**0.60**
1.1. Indicators of using environmentally friendly fish seeds	4%	1	0.04	1	0.04
1.2. Indicators of suitability of price, quantity and quality of fish seeds	4%	3	0.12	3	0.12
1.3. Indicators of suitability for use of fish feed	4%	2	0.08	1	0.04
1.4. Indicators of suitability for use of fish medicines	4%	3	0.12	3	0.12
1.5. Indicators for handling fish disease outbreaks	4%	3	0.12	3	0.12
1.6. Indicators of aquaculture land conversion	4%	3	0.12	3	0.12
1.7. Indicator of CBIB certification ownership	4%	1	0.04	1	0.04
3. **Parameters of the role of environmental management**	**35%**		**0.48**		**0.48**
1.1. Indicators of fulfillment of environmental requirements	12%	1	0.12	1	0.12
1.2. Indicators of environment monitoring management	12%	1	0.12	1	0.12
1.3. Indicators for biodiversity and habitat protection	12%	2	0.24	2	0.24
Total	**100%**		**2.32**		**2.08**

The parameters for suitability of aquaculture areas with environmental carrying capacity consist of 5 indicators presented in table 2 including 1) suitability of aquaculture areas with spatial planning/zoning, 2) aquaculture areas relatively do not pollute the environment, 3) water needs are met in quantity, 4) water needs are met in terms of quality, and 5) proximity of the aquaculture area to sources of pollution.

The Minapolitas 2 area's location does not align with the existing spatial layout. Based on the Klaten RTRW 2021-2041, South Klaten District is not classified as an area designated for aquaculture areas but is classified as an agricultural and urban residential area. Appropriate spatial planning and management provides many benefits and includes higher productivity and profits for investors, as well as more effective mitigation of environmental, economic and social risks (Aguilar *et al*., 2017).

Tilapia cultivation activities in Klaten Regency utilize water originating from springs, primary and secondary irrigation canals as a cultivation medium. So that the water requirements for tilapia cultivation are sufficient in quantity and good in quality (Table 3).

Table 3. Wastewater quality of Tilapia fish farming waste.

No	Parameter	Unit	Fishpond outlet channel (District)						Ref*
			Minapolitan 1			Minapolitan 2			
			Tulung	Polan harjo	Karang anom	Ngawen	Kebon arum	South Klaten	
1.	BOD	mg/l	0.9	1.7	1.7	8**	1	2.4	< 6
2.	COD	mg/	4.5	28.4	10.5	52**	14.1	38.8	< 40
3.	Organic substances	mg/l	21.8	44.24	29.7	49	29.7	44.24	< 50

4.	Phosphate	mg/l	0.38	0.78	0.64	0.4	0.4	0.29	< 1
5.	DO	mg/l	6.1	6.3	6.1	5.4	6	5.2	> 3
6.	Brightness	cm	>30	>30	>30	>30	>30	>30	>30

*. MMAF (2019).

Based on Table 3, it is found that 100% (MP1) and 88.9% (MP2) of the water quality test parameters are within the safe threshold limits of technical recommendations. The tilapia cultivation waste in the Minapolitan area relatively, does not pollute the environment (Table 4). It was found that 75% (MP1) and 87.5% (MP2) of the test parameters were within the refeence threshold for aquaculture waste discharge.

Table 4. Tilapia pond water quality.

No	Parameter	Unit	Tilapia pond water quality (district)						Ref*
			Minapolitan 1			Minapolitan 2			
			Tulung	Polan harjo	Karang anom	Ngawen	Kebon arum	South Klaten	
1.	Total Ammonia	mg/l	0.012	0.105**	0.025**	0.022**	<0.01	<0.010	<0.02
2.	Nitrite	mg/l	<0.031	0.071**	<0.031	<0.031	<0.031	0.067**	<0.06
3.	pH	-	6.9	7.3	7	7.6	6.9	7.6	6.5-8.6
4.	DO	mg/l	6.1	6	6.1	6.9	5.5	6.8	> 5
5.	Temperature	°C	24.9**	25.4	25.5	25.3	25.3	25.5	25-30
6.	Brightness	cm	>30	>30	>30	>30	>30	>30	>30

*. Government Regulations No. 21 of 2021.

The Minapolitan area has potential sources of pollution, but it has not had an impact on tilapia farming activities. Potential sources of pollution in the Minapolitan 1 area include waste from glass noodle making activities, waste from tourist activities, and household waste. Meanwhile, in the Minapolitan 2 area, there is livestock and household waste. The research results show that the Minapolitan area has potential sources of pollution, but it has not impacted the tilapia cultivation activities.

The parameters of the aquaculture area managed sustainably, consist of 7 indicators presented in table 6 including 1) use of environmentally friendly fish seeds, 2) suitability of price, quantity and quality of fish seeds, 3) suitability of use of fish food from the aspect of legality and method of administration, 4) suitability for the use of fish medicine from the aspect of legality and method of administration, 5) handling outbreaks of dangerous fish diseases, 6) land conversion or environmental modification for aquaculture purposes, and 7) ownership of a CBIB certificate.

The use of environmentally friendly fish seeds that are disease free and CPIB certified is still lacking. In the Minapolitan area, the Tilapia seeds cultivated come from various Fish Hatchery Unit (UPI) locations including Klaten, Salatiga, and Sleman. The research results showed that 11.29% of Tilapia breeders in the Minapolitan 1 area and 26.31% in the Minapolitan 2 area used certified Tilapia fish seeds. In terms of access to tilapia fish seeds, fish farmers in the Minapolitan area find it simple to get tilapia seeds all the time. Fish seeds are obtained by purchasing directly from UPI in the Klaten area, or by ordering from partners.

An outbreak of Tilapia fish disease has never been caused cropd failure. The fish deaths that occurred were during the seed acclimatization process due to differences in the temperature of the rearing media and during the rearing period due to seasonal changes (transitions), but did not result in crop failure. Ownership of CBIB certification is very low, found by 1.61% of fish cultivators in Minapolitan 1 and none in Minapolitan 2. Many of the CBIB certificates owned by cultivators have expired, and the validity period has not been extended. To increase CBIB ownership, there needs to be support from extension and related agencies for socialization, verification and control (Nugroho *et al*., 2016).

The parameters of the role of environmental management in aquaculture areas consist of 3 indicators including 1) fulfillment of environmental requirements (KLHS/Amdal and their implementation), 2) management of environmental monitoring, and 3) protection of biodiversity and habitat.

Fulfillment of environmental requirements in the form of implementation of NIB ownership (Business Identification Number) for Tilapia fish cultivators is very lacking. Only 3.23% (MP1) and 0% (MP2) of fish farmers have NIB. Apart from that, environmental monitoring activities around the area are considered insufficient. Environmental monitoring is needed to ensure that fish farming business activities are running well and sustainably. Monitoring activities can be carried out by local governments through institutions or bys certain SKPD appointed to carry out monitoring and evaluation (MMAF, 2019).

To maintain the role of ecosystems and environmental conditions in aquaculture areas, biodiversity and habitat must be protected. The Klaten Regency Government has implemented a biodiversity and habitat program, which involves restocking fish in public waters to sustain the ecosystem's role in the two Minapolitan areas. However, the selection of introduced and potentially invasive fish species such as tilapia and catfish will threaten the existence of local fish species in the waters (Dewantoro & Rachmatika, 2020).

Principles of welfare and equality

The principles of welfare and equality consist of 2 constituent parameters, namely: 1) social aspect parameters, and 2) economic aspect parameters. The results of the analysis of the principles of welfare and equality can be seen in Table 5.

Table 5. Analysis of the principles of welfare and equality.

Parameter	Portion	MP 1		MP 2	
		Score	Value	Score	Value
1. Parameters of social aspects	60%		1.17		1.17
1.1. Indicator of local employment absorption in aquaculture areas	7%	3	0.21	3	0.21
1.2. Indicators of workforce competency in fish cultivation units	7%	1	0.07	1	0.07
1.3. Indicators of the impact of aquaculture on increasing local community capacity	7%	2	0.14	2	0.14
1.4. Indicators of social security of fish farmers	5%	1	0.05	1	0.05
1.5. Indicators of social conflict	35%	2	0.70	2	0.70
1. Parameters for economic aspects	40%		1.00		0.90
1.1. Indicator of land status managed by fish farmers	5%	3	0.15	3	0.15
1.2. Indicators of asset accumulation by fish farmers (capital accumulation)	5%	1	0.05	1	0.05
1.3. Indicators of accessibility to capital according to needs	5%	3	0.15	3	0.15
1.4. Indicators of accessibility to the market	5%	3	0.15	3	0.15
1.5. Indicators of creating a perfectly competitive market (fair trade)	5%	3	0.15	3	0.15
1.6. Indicators of household income for fish farmers	5%	3	0.15	1	0.05
1.7. Indicator of saving habits	5%	1	0.05	1	0.05
1.8. Indicators of business profits compared to aquaculture production costs	5%	3	0.15	3	0.15
Total	100%		2.17		2.07

In terms of social aspect parameters, it consists of 5 indicators presented in table 5 including 1) absorption of local labor in aquaculture areas; 2) competency of labor in fish cultivation units; 3) impact of aquaculture on increasing the capacity of local communities; 4) social security for fish farmers; and 5) social conflict.

The results of the research show that 100% of aquaculture workers working in the Minapolitan area use local workers with 12.9% (MP1) and 10.53% (MP2) having technical competency certificates. The low ownership of training certificates is due to the lack of interest of fish farmers in taking part in training and aquaculture technical competency tests. The regional plan document did not explicitly include the Minapolitan aera as a location for enhancing the capacity of the Tilapia fish cultivitation sector. The social security protection program for fish farmers is poorly socialized and facilitated. Guidelines for conflict resolution can effectively resolve social conflicts. Conflict over water use with the agricultural sector is a conflict that arises in Minapolitan, Klaten Regency. This is similar to the conflict that occurred in the Minapolitan area of tilapia cultivation in Magelang Regency (Hikmah *et al*., 2023).

Economic aspect parameters, consisting of 8 indicators presented in table 5 include 1) status of land managed by fish cultivators; 2) accumulation of assets by fish cultivators (accumulation of capital); 3) accessibility to capital according to needs; 4) accessibility to markets; 5) creation of a perfectly competitive market (fair trade); 6) household income of fish farmers; 7) savings habits; and 8) business profits compared to aquaculture production costs.

The results of the research show that 100% of the tilapia cultivation land has the private property of fish cultivators and the property of the village government, which is leased to residents for fish cultivation. When it comes to asset accumulation, less than 10% of aquaculture profits are reinvested as capital for aquaculture businesses. Regarding access to marketing of their products, 100% of Tilapia fish farmers in the area find it easy to market their products to fish baskets/marketers. Fish farmers and fish marketers are satisfied with the current market. The income of tilapia farmers in MP1 (Rp. 2,465,000, -/pond/month) is above the Klaten Regency Regional Minimum Wage (UMR) (Rp. 2,244,012, -.). The income at MP 2 is IDR 849,750/pond/month. The difference in income received in the two areas is caused by differences in the stocking density of fish stocked in ponds. According to research by Erlin *et al*. (2020), the technical and managerial capabilities of tilapia farmers in the Minapolitan 1 area are quite good. Cultivators have technical and managerial expertise in tilapia cultivation. So that you always get profitable production results.

The saving habits are 11.29% (MP 1) and 0% (MP2). This is because the cultivator and his family have been using most of their business profit to cover their living expenses. Cultivators typically save gold jewelery, which is typically kept by the cultivator's wife. Fish farmer must have a habit of saving so that they have reserve funds when there are urgent business or household needs. Profitabil-

ity ratios are 1.25 (MP1) and 1.16 (MP2). This shows that the Tilapia fish farming business in the Minapolitan area is profitable and feasible.

Governance principles

Governance principles consist of 6 constituent parameters, namely: 1) institutional aspect parameters, 2) regulatory aspect parameters, 3) The results of the analysis of governance principles can be seen in Table 6.

Questions about formal institutions which clear authority to manage aquaculture areas and their effective role arise in terms of institutional parameters. In the Klaten

Table 6. Analysis of governance principles.

Parameter		Portion	MP 1		MP 2	
			Score	Value	Score	Value
1.	Parameters for institutional aspects	15%	1	0.15	1	0.15
2.	Parameters of regulatory aspects	15%		0.32		0.32
1.1.	Indicators of RTRW regulations and/or zoning for aquaculture areas	8%	3	0.24	3	0.24
1.2.	Indicators of fisheries business licensing regulations	8%	1	0.08	1	0.08
3.	Compliance/law enforcement parameters	25%	3	0.75	3	0.75
4.	Parameters for community participation	15%	3	0.45	3	0.45
5.	Parameters of government synergy	15%	3	0.45	3	0.45
6.	Monitoring and evaluation parameters	15%	1	0.15	1	0.15
Total		100%		2.27		2.27

Regency area, there is no formal institution with clear authority to manage aquaculture areas and their role effectively. In Klaten Regency Regional Regulation Number 10 of 2021, it is stated that to create an aquaculture area, it is mandatory to manage the area. In fact, the regional regulation includes an indication of a five-year program that plans aquaculture area management activities in 2022-2023. However, the aquaculture area management activities have yet to commence. The formation of a formal institution that manages aquaculture areas is based on technical instructions for implementing EAA and can be initiated by the local government consisting of the relevant SKPD and representatives of Pokdakan and confirmed in a Regent's decree.

Regulatory parameters, consisting of two indicators presented in table 11 include 1) RTRW and/or zoning regulations for aquaculture areas; and 2) fisheries business licensing regulations. The RTRW regulations (Klaten Regional Regulation No. 10 of 2021) have designated and listed the aquaculture area in Klaten Regency. Regarding fishing business licensing, the Klaten Regency government refers to Government Regulation Number 5 of 2021 concerning the implementation of risk-based business licensing. Proof of licensing is in the form of an NIB (Business Identification Number) as an official identity given to business entities or individual businesses in Indonesia, including in the maritime and fisheries sectors. As a business that uses water input that comes from outside the cultivation environment and has the potential to impact environmental pollution on wastewater produced by cultivation. There needs to be an effort to tie tilapia cultivation business activities in the Minapolitan area to pay attention to and maintain the ecosystem in the surrounding environment with the legality of business permits. Fish farmers own 3.235 (MP1) and 0% (MP2) of the NIB. As a business that uses water input that comes from outside the cultivation environment and has the potential to impact environmental pollution on wastewater produced by cultivation. There needs to be an effort to tie tilapia cultivation business activities in the Minapolitan area to pay attention to and maintain the ecosystem in the surrounding environment with the legality of business permits.

The compliance parameters ask questions about the occurance of violations and their handling. The Minapolitan area thoroughly processed and followed up on violatons, either through deliberation and consensus or through legal channels. Abuse of water is a violation that often invites conflict in the Minapolitan Klaten area. Often, water originating from springs or tertiary channels used to fill cultivation ponds is not returned to its original channel, namely the tertiary channel (borrowed water) to be reused for agricultural or fisheries purposes. This type of violation can be resolved through deliberation between the Pokdakan administrators and the village government.

Apart from that, it was stated that there was a violation of the business capital loan agreement in the form of money, seeds and fish feed to lenders such as banks, institutions and individuals. One of the parties involved in the tilapia cultivation businesss violated the agreement. This type of violation is resolved either through family discussion that align with the agreement, or by seizing the capital borrower's assets.

In the community participation parameters, questions about community satisfaction in determining the spatial layout for the aquaculture area were asked. Fish farmers expressed satisfaction with the spatial layout of aquaculture area in the Klaten Regency RTRW document. The spatial layout of the Minapolitan 1 and Minapolitan 2 areas as part of the aquaculture area has been compiled by the Klaten Regency regional government into a 2021-2041 RTRW document through a process that involves community participation. The intended participation includes participation in determining, utilizing space and controlling spatial planning. Forms of community participation in determining areas include preparation for drafting RTRW, determining the direction of area development, identifying area potential and formulating and determining aquaculture areas.

In the synergy parameters of Regional Government Work Units, questions are asked about regulations/policies related to mutual synergy and supporting aquaculture in Klaten Regency. Several regulations that support Tilapia cultivation activities in the Minapolitan area of Klaten Regency are:

The Regional Regulation Number 10 of 2021 about Klaten district pertains to the spatial planning of the Klaten Regency from 2021 to 2041.

Decree of the Regent of Klaten No. 523.3/428/2010 concerning the location for the development of the Minapolitan area "Nila Village" in Klaten Regency.

The Master Plan for Nilla Village, located in Klaten Regency, was created in 2010.

Final Report on Preparation of the Minapolitan Development Masterplan in Ngawen, Kebonarum and South Klaten sub-districts in 2016.

The monitoring and evaluation parameters pose questions about the monitoring and evaluation activities implemented in the management of aquaculture. According to the research results stated that there were no monitoring and evaluation activities for area management by regional authorities in Klaten Regency. This is due to the absence of an authority institution established by the regional government to carry out EAA activities in Klaten Regency. Monitoring activities currently carried out on tilapia cultivation activities in the Minapolitan area are still individualized by each SKPD and have not been carried out comprehensively regarding EAA parameters.

EAA status

The application of EAA with the principle of ecosystem sustainability in tilapia fish commodities in the Minapolitan 1 area received sufficient status with a score of 2.32 (77.33%). Meanwhile, Minapolitan 2 got a score of 2.08 (69.33%). The differences in the achievement of these values are caused by the gap in the suitability of the aquaculture area with spatial planning and zoning as well as the gap in the suitability of the use of fish food in terms of legality and method of administration. The Minapolitan 1 area's location in the RTRW of Klaten Regency leads to a higher score (score 3) compared to the Minapolitan 2 area (score 1). Apart from that, the use of fish food in terms of legality and method of administration in the Minapolitan 1 area is better (score 2) compared to the Minapolitan 2 area (score 1).

The applicaton of EAA, guided by the principles of welfare and equity, to the Tipalia commodity in the Minapolitan 1 area has achieved a sufficient status, receiving a score of 2.17 (73.33%). Meanwhile, Minapolitan 2 got a score of 2.07 (69%). The differences in achievement values are caused by gaps in fish cultivators household income indicators. In the Minapolitan 1 area, it was found that the income of tilapia farmers was IDR 2,465,000/pond/month. This income is above the Klaten Regency UMR of IDR 2,244,012, -. Meanwhile, the household income of tilapia cultivators in the Minapolitan 2 area is IDR 849,750/pond/month.

Table 7. Final assessment of EAA implementation in Klaten district.

No	Principle	Minapolitan 1		Minapolitan 2	
		Value	Total	Value	Total
1	Ecosystem sustainability (40%)	2.32	0.93	2.08	0.83
2	Welfare and equality (30 %)	2.17	0.65	2.07	0.62
3	Governance (30 %)	2.27	0.68	2.27	0.68
	Total		2.26		2.13

The application of EAA with governance principles to Tilapia commodities in the Minapolitan 1 and Minapolitan 2 areas of Klaten Regency yielded a value of 2.27 (75.67%). The similar values obtained in the two Minapolitan areas are due to similarities in the existing governance patterns of the Minapolitan area.

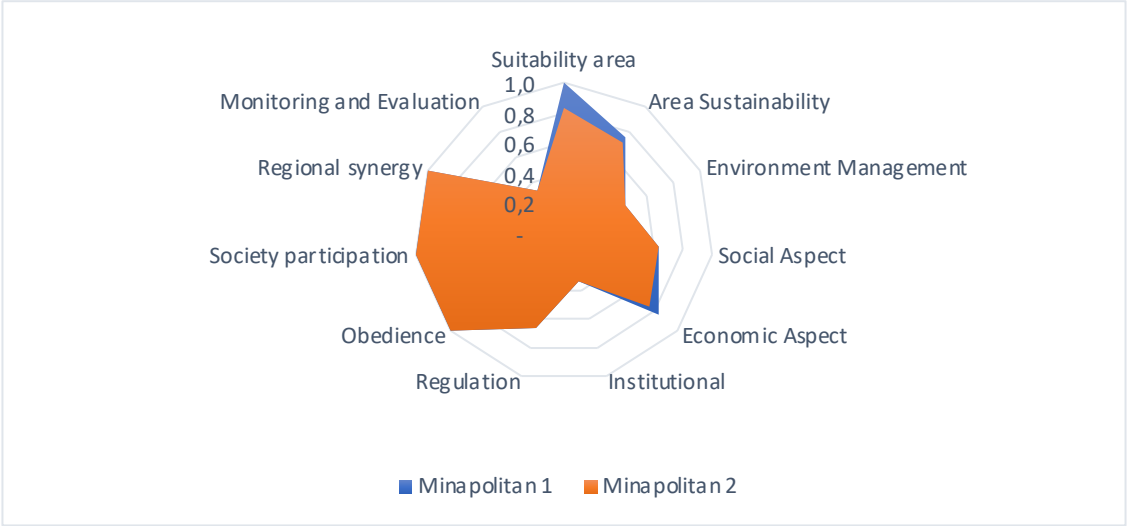

Figure 4. GAP analysis of EAA parameters in Klaten Regency.

Each principle is weighted to determine the EAA implementation value. The assessment for the application of the principles of ecosystem sustainability is weighted at 40%, the application of the principles of welfare and equity is 30% and the principles of governance are weighted at 30%. The final assessment of EAA implementation can be seen in Table 7.

Based on table 7, it is found that the application of EAA for Tilapia fish commodities in the Minapolitan area of Klaten Regency received a value of 2.26 for the Minapolitan 1 area and a value of 2.13 for the Minapolitan 2 area. Both areas received a yellow visualization marking which means the condition is "Fair". The assessment results of each parameter are then analyzed for the GAP between the current condition value and the expected ideal condition value and presented with a spider diagram in Figure 4.

Table 8. Recommendations for improving EAA implementation in Klaten Regency.

No	Parameter	Status	Recommendations for improvement
1.	Low ownership of business permits (NIB)	Poor	Socialization of Law No. 6 of 2023 concerning NIB ownership as a business legality
2.	The local government has not monitored the area properly	Poor	Environmental monitoring of the Minapolitan area is carried out periodically every year involving SKPD, fisheries instructors and fish farmers
3.	There is no formal institution to manage the Minapolitan area	Poor	Establishment of a formal institution with clear authority to manage the Minapolitan area
4.	There is no monitoring and evaluation of area management by area managers	Poor	Monitoring and evaluation is carried out by authority institutions regarding the management activities of the Minapolitan area

Based on the GAP analysis of EAA parameters, the three parameters with the lowest GAP are environmental management parameters (Tki 0.44), institutions (Tki 0.33), and evaluation monitoring (Tki 0.33). These are found in the two Minapolitan areas of Klaten Regency. Based on the GAP analysis of existing EAA parameters, intervention recommendations can be provided to improve area management in the two Minapolitan areas. Recommendations for improvement can be seen in Table 8.

In the parameters of the role of environmental management in aquaculture areas, there are 2 constituent indicators that have less value, namely the low ownership of NIB as proof of business legality and the area not being properly monitored by the regional government. To increase NIB ownership among tilapia farmers, it is necessary to socialize Law 6 of 2023 concerning NIB ownership as a legal business. Meanwhile, increasing area monitoring can be done by coordinating with fisheries policymakers in Klaten Regency to monitor the area periodically.

The institutional role in managing the Minapolitan area in Klaten Regency is also lacking. This is due to the lack of formal institutions with clear authority to manage aquaculture areas and an effective role in managing aquaculture areas. Institutions can be formed by involving local governments and fish farmers in the area. Coorporation between the local government and fish farmers determines the successful implementation of EAA for aquaculture area management. However, establishing this institution is likely to present numerous challanges. This is because many stakeholders have failed to pay attention to institutions in implementing EAA (Brugere *et al*., 2019).

Monitoring and evaluation activities for area management by area managers need to be carried out with the aim of monitoring and improving area management in order to achieve the expected status. Activities that can be carried out include monitoring the progress of implementing EAA, identifying and anticipating obstacles and potential obstacles that arise. Monitoring and evaluation activities can be carried out periodically at least once a year and reported in stages to the government.

CONCLUSION AND RECOMMENDATION

Conclusion

The management of aquaculture areas with Tilapia as a commodity in Klaten Regency based on the EAA indicator is in adequate condition with a score of 2.26 (scale 3) for the Minapolitan 1 area (Karangom, Tulung, and Polanharjo Districts) and 2.13 for the Minapolitan 2 area (Ngawen, Kebonarum, and South Klaten Districts).

Interventions that can be carried out by the regional government to improve the management of aquaculture areas with Tilapia as a commodity in the two Minapolitan areas of Klaten Regency based on the EAA assessment include institutional parameters, monitoring, and evaluation, as well as the role of environmental management in the area.

Recommendation

As one of the Tilapia fish producers in Central Java, the local government of Klaten Regency needs to ensure that Tilapia cultivation activities in the Minapolitan Klaten area can be profitable and sustainable. EAA as a tool for managing aquaculture areas, can be a reference for the local government of Klaten Regency in managing aquaculture.

Local government and tilapia farmers must work together to improve current EAA achievements. Improvements that can be made are by establishing formal institutions at the district level that are able to plan, implement and evaluate the implementation of EAA in the two Minapolitan Klaten regions.

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Each author's contribution to the manuscript's analysis technique, English grammar check, and proofreading.

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