



Analysis of Pond Revitalization and Land Suitability for Vaname Shrimp (*Litopenaeus vannamei*) and Milk Fish Cultivation Traditionally Policultural: A Case Study in Muara Kintap Village, Kintap District, Tanah Regency

Achmad Syamsu Hidayat^a, Erma Agusliani^a,
Frans Tony^{b*} and Rina Iskandar^c

^a Department of Fishery Agribusiness Program Study, Faculty of Fisheries and Marine Science, Universitas Lambung Mangkurat, South Kalimantan, Indonesia.

^b Department of Marine Science, Faculty of Fisheries and Marine Science, Lambung Mangkurat University, South Kalimantan, Indonesia.

^c Department of Fisheries, Faculty of Agriculture, Achmad Yani University, Banjarmasin, South Kalimantan, Indonesia.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/AJFAR/2023/v23i6618

Open Peer Review History:

This journal follows the Advanced Open Peer Review policy. Identity of the Reviewers, Editor(s) and additional Reviewers, peer review comments, different versions of the manuscript, comments of the editors, etc are available here: <https://www.sdiarticle5.com/review-history/103056>

Original Research Article

Received: 01/07/2023
Accepted: 10/07/2023
Published: 17/07/2023

ABSTRACT

Shrimp and milkfish are the main commodities of aquaculture in ponds, which have considerable development potential in almost all coastal areas in Indonesia. Based on the description above, to revitalize ponds in the village of Muara Kintap, Kintap District, the research aims to analyze the

*Corresponding author: Email: ftony@ulm.ac.id;

efforts to revitalize the aquaculture ponds of vannamei shrimp (*litopenaeus vannamei*) and milkfish in a polyculture manner based on water quality analysis in the village of Muara Kintap, Kintap District, Tanah Laut Regency, South Kalimantan Province. Implementation is planned for June 2023, with the location of the research being in the community pond area of Muara Kintap Village, Resistant Laut District, South Kalimantan Province. Business revitalization of vannamei shrimp (*litopenaeus vannamei*) and milkfish aquaculture ponds in polyculture based on water quality analysis in Muara Kintap Village, Kintap District, Tanah Laut Regency, Kalimantan, obtained an average R/C ratio for traditional vannamei shrimp farming business, which is worth 3.19, which means the aquaculture business Traditionally polyculture vannamei shrimp is efficient in the use of business costs, because every 1 unit of currency (Rp. 3.19) issued as the cost of the vannamei shrimp farming business will provide business revenue, and based on the land suitability analysis resulting from the interpolation of all parameters it can be concluded that at the research location it was stated that it was suitable to very suitable. The community of Muara Kintap village, Tanah Laut Regency, South Kalimantan Province.

Keywords: Polyculture; vannamei shrimp; milkfish; Muara Kintap; business; water quality.

1. INTRODUCTION

Muara Kintap Village is one of the villages in Kintap District, Tanah Laut Regency, South Kalimantan Province. This village is a coastal village so that some of its residents work as fishermen. The residents of Muara Kintap village are actually not originally from Kalimantan (Banjar tribe), but most of the population comes from the Bugis tribe. But cultural acculturation has been going very well here. Analysis of spatial use in the coastal fisheries development area of Muara Kintap village, Tanah Laut District, South Kalimantan according to Yunandar, 2007 that space utilization is dominated by ponds 36.67% (1640.59 hectares) and the smallest settlement is 2.28% (102.15 hectares). The economy of the Muara Kintap village study area is reflected in the structure of the livelihoods of its inhabitants which differ from one village to another, namely the dominant sub-sectors of work are fisheries/services (49.62%), livestock (30.12%), trade services (5.12%), and communication and transportation services (9.56%). Muara Kintap Village is the only Advanced Fishermen Village in South Kalimantan (Kalsel) that has received a Fisherman's Proficiency Certificate (SKN). This was revealed by the Regent of Tanah Laut (Tala) H.M. Sukamta when handing over SKN for fishermen from Muara Kintap Village in a series of Manunggal Tuntung Pandang (MTP) activities in Kintapura Village, Kintap District, Friday (10/2/2023).

Based on the results of Hidayat's research (2017) it shows that the condition of shrimp ponds in Tanah Laut Regency, South Kalimantan Province, is under very strong environmental pressure from various mining and plantation

activities in the vicinity so that shrimp farming cannot run productively. One of the obstacles for vannamei shrimp cultivators is that the seeds or fry that have been stocked have died. The cultivated vannamei shrimp died when they were still small because they could not adapt to the new environment. In addition, the vannamei shrimp seeds that had been sown in the cultivation container died due to stress during transportation from their place of origin to the new cultivation container. Other causes are also caused by water quality that does not meet the requirements for vannamei shrimp to survive. Factors that can affect water quality include unsuitable temperatures, low oxygen levels, unstable pH levels, high ammonia levels, water turbidity, and contamination by chemicals or pollutants. This condition is also influenced by erratic weather, causing fluctuations in water quality in ponds in the Kintap District. Waste from aquaculture inputs will increase with increasing shrimp biomass and shrimp culture age (Culberson and Piedrahita, 1996) [1]. So, to go through the desired shrimp farming cycle. So cultivators must understand the dynamics of fluctuations in water quality, as well as routinely control the condition of water quality parameters in ponds [2].

KKP is targeting national shrimp production of 2 million tons per year by 2024. Area-based shrimp pond development is carried out using ecological and economic considerations. In this way, it is hoped that not only will there be an increase in community welfare and local revenue, but also that ecosystem sustainability can be maintained. In addition to the development of area-based shrimp ponds, there is also a breakthrough in revitalizing traditional Indonesian shrimp ponds

which cover an area of 5,000 hectares throughout Indonesia. Based on KKP data via statistic.kkp.go.id, West Nusa Tenggara (NTB) Province has the highest production volume in 2020, namely 159,013.10 tons which opens the opportunity for NTB to become the main shrimp producer in Indonesia. NTB itself has a potential land area of 27,929.5 hectares with details of 10,237.5 hectares in Sumbawa; 4,998.5 hectares in Bima; 3,500 in East Lombok; and all districts in NTB own up to 4,700 hectares of land. But of the total land, only around 4,926.5 hectares have been utilized. The development of vaname shrimp production in NTB which continues to increase has encouraged KKP to make a breakthrough in NTB Province by realizing the construction of integrated shrimp ponds in Sumbawa NTB Regency which is planned to have an area of 528.15 ha with a total of 1,811 ponds. This modern shrimp pond area will be equipped with facilities and infrastructure such as management control headquarters, laboratories, employee mess, nursery pond, control office, and roads.

Shrimp and milkfish are the main commodities of aquaculture in ponds, which have considerable development potential in almost all coastal areas in Indonesia. Based on the description above, to revitalize ponds in the village of Muara Kintap, Kintap District, Tanah Laut Regency, it is deemed necessary to conduct a business analysis study of the revitalization of vannamei shrimp ponds (*litopenaeus vannamei*) based on water quality analysis in the Kintap sub-district, Tanah Laut district in order to determine land suitability and carrying capacity. waters for vanname shrimp and milkfish cultivation. The vannamei shrimp and milkfish commodities were chosen because they are one of the leading commodities in supporting the industrialization of aquaculture, because they have high economic value, high market demand (high demand product), these commodities are even currently the prima donna for exports. aquaculture products. The aim of this study was to analyze the revitalization of vannamei shrimp (*litopenaeus vannamei*) and milkfish aquaculture ponds in poly-culture based on water quality analysis in Muara Kintap Village, Kintap District, Tanah Laut Regency, South Kalimantan Province.

1.1 Research purposes

The purpose of this activity is:

1. Conducting a revitalization analysis of vannamei shrimp (*litopenaeus vannamei*)

and milkfish aquaculture ponds in a traditional polyculture manner based on an analysis of water quality in the ponds of the community of Muara Kintap Village, Kintap District, Tanah Laut Regency, South Kalimantan Province.

2. Analyzing the suitability of land for the revitalization of ponds in the community of Muara Kintap Village, Tanah Laut Regency, South Kalimantan Province.

2. RESEARCH METHODS

2.1 Schedule, Time and Place of Implementation

Implementation is planned for June 2023, with the location of the research being in the community pond area of Muara Kintap Village, Tanah Laut Regency, South Kalimantan Province.

2.2 Data Collection

The data used in this study are primary data and secondary data. Primary data is data obtained through direct surveys in the field, namely the biophysical and social environmental conditions of Muara Kintap Village, Tanah Laut District, South Kalimantan. Meanwhile, secondary data was obtained through a study of research reports, scientific publications, laws and regulations and regional publications. The data comes from government and private agencies that have relevance to the research objectives.

2.3 Data Analysis Technique

Data analysis techniques to analyze the advantages of vannamei shrimp farming using traditional polyculture are used, namely:

$$\pi = TR - TC$$

Information:

π = Profit

TR = Total Revenue

TC = Total Cost

Total revenue is all the results obtained from the sale of all production results. The formula is:

$$TR = P \times Q$$

Information:

P = Selling price /kg

Q = Production amount and output (Quantity)

Total costs are all costs incurred in one production cycle, generally consisting of fixed costs and variable costs. The formula is:

$$TC = FC + VC$$

Information:

FC = Fixed Cost

VC= Variabel Cost

The market opportunity criteria are as follows:

If $TR < TC$, then π decreases.

If $TR > TC$, then π increases.

2.4 Water Quality Measurement Techniques

A. Temperature Measurement

The temperature measurement is carried out in the water column using a water quality checker, as for the working procedure, namely by dipping the pen of the water quality checker into sea water then reading the results listed and recording the results. After the temperature measurement is complete, the pen tool is recalibrated from the water quality checker so that it is in normal conditions.

B. Measurement of dissolved oxygen or DO

The DO measurement is carried out in the water column using a water quality checker. The working procedure is to dip the pen from the water quality checker into sea water, then wait a few moments until the numbers on the monitor slow down, then read the results and record the results. After the Do measurement is complete, the pen tool is recalibrated from the water quality checker so that it is in normal condition.

C. Salinity Measurement

Water salinity measurements were carried out on the surface of the waters using a handrefractometer by dripping seawater on the blue prism. Then cover the blue prism with a glass cover and point the hand refractometer at the light source to find out the indicated salinity value. Then look at and observe the salinity value obtained then record the results on the note sheet. Prior to data collection, the blue prism was first calibrated with distilled water and then cleaned using a tissue.

D. Acidity (pH)

Measurement of the pH of the waters is used using a pH kit. Before using the pen from the pH

kit, it must first be calibrated using distilled water, then cleaned using a tissue. After that, dip it slowly into sea water, then read the results of the pH value and write it into a notebook sheet. After the pH measurement is complete, the pen pH kit is recalibrated so that it is in normal conditions.

E. Sampling and analysis of phosphate, nitrite, nitrate, TSS, BOD5 and organic matter

Taken at each predetermined observation station. Water sampling is carried out directly on the surface of the water using the provided sample bottle until it is completely filled. Water samples that have been taken as much as 1 liter are then marked and stored in a cool box, then the samples will be analyzed ex situ at the Water Quality Laboratory of the ULM Faculty of Fisheries and Marine Affairs to determine the content values of Phosphate, Nitrite, Nitrate, TSS, BOD5 and organic matter.

2.5 Data Analysis

Land suitability for aquaculture in this case is based on criteria adopted from the Fisheries Research Center (1992) and Poernomo [3]. Analysis of the suitability of pond areas is intended to determine the suitability of land and coastal waters (physical, chemical, and biological) for pond cultivation, carried out by measuring several environmental parameters which are ecological requirements for aquaculture development, namely substrate physics, water quality, and hydrooceanography [4]. The condition of the aquatic environment is a limiting factor for determining the suitability of cultivating land [5].

The carrying capacity of the waters is assessed from the water quality data that has been obtained from field measurements, then analyzed spatially. Data analysis in this study consisted of the stages of contouring and spatial modeling by deriving physical, chemical and biological parameters based on a geo-statistical model, which refers to Hartoko [6]. The results of the interpolation of each water quality variable are then arranged in the form of thematic maps. The matrix or criteria used in this study consists of 10 parameters, namely Temperature, Salinity, pH, DO, Nitrite, Nitrate, Organic Matter, TSS, Phosphate, , BOD5. The suitability level is divided into 3 classes, namely S3 class: Very suitable, S2 class: Appropriate and S1 class: Conditional Compliant.

3. RESULTS AND DISCUSSION

3.1 Business Analysis

The results of the analysis of the profit analysis of vannamei shrimp farming using the traditional polyculture method in Muara Kintap Village are

based on a profit analysis consisting of the total costs, which are all costs incurred in one production cycle to profits in the production cycle, with the cultivated land used, namely the cultivator's private property. The investment costs for vannamei shrimp cultivation in a traditional polyculture manner are in the Table 1.

Table 1. Investment Costs

No	Investment Cost	Vol	Unit	Unit price	Sum	UE (Th)	Shrinkage
1	Land preparation	2	Ha	2.500.000,-	5.000.000,-	10	Rp 500.000,-
Total							Rp 500.000,-

Primary data: 2023

Based on the investment costs obtained from the cost of depreciation and maintenance of cultivation facilities. The value of this investment cost is obtained from an average for vaname shrimp cultivation of Rp. 500,000.- From the depreciation cost data, it will be followed by calculating the fixed costs per year. These fixed costs consist of costs for depreciation and maintenance of cultivation facilities. The value of these fixed costs is obtained from the average cost incurred by cultivators of Rp. 500,000, - can be seen in Table 2.

Table 2. Fixed Costs

No.	Fixed cost	One year
1	Shrinkage	Rp 500.000,-
2	Facility maintenance	Rp 300.000,-
Total		Rp 800.000,-

Primary data: 2023

Variable costs consist of seed prices, feed prices, and medicines/vitamins. These variable costs are presented in the Table 3.

Table 3. Variable Costs

No.	Variable Cost	Vol	Unit	Unit price (Rp)	Production cost (Rp/production)
1	Fertilizer	4	Sack	Rp 500.000,-	Rp 2.000.000,-
2	Shrimp Seeds	20.000,-	pcs	Rp 250,-	Rp 5.000.000,-
3	Milkfish Seeds	2.000,-	pcs	Rp 250,-	Rp 500.000,-
Total					Rp 7.500.000,-

Based on the results of the research, it was obtained the results of a one-time variable cost of production, the average variable cost in traditional polyculture ponds incurred by cultivators was Rp. 7.500.000,- one time production. Based on the results of the analysis of fixed costs and variable costs of traditional polyculture vaname shrimp cultivation in Kintap District, the reception and profit of cultivators are presented in the Table 4.

Table 4. Total Operational Costs

No.	Cost	Price (Rp)
1	Fixed cost	Rp 800.000,-
2	Variable Cost	Rp 7.500.000,-
Total		Rp 8.300.000,-

Table 5. Revenue

Production	Vol (Kg)	Unit price (Rp)	Revenue/year (Rp/year)
Vaname shrimp	200	95.000,-	Rp 19.000.000,-
Milkfish	500	15.000,-	Rp 7.500.000,-
Total			Rp 26.500.000,-

Profits = Revenue – Total operating costs
 = Rp. 26.500.000,- – Rp. 8.300.000,-
 = Rp. 18.200.000,-

Based on the results of the profit/profit analysis that has been obtained from the research, then it is averaged, the net profit gain for vannamei shrimp farming in traditional polyculture ponds in Muara Kintap Village, Kintap District, is Rp. 18,200,000.00 per production. It is known that during the maintenance of vannamei shrimp there was around 75% death and milkfish had around 50% death. Vannamei shrimp ponds have a profit that is still above the UMP of South Kalimantan Province, namely Rp. 3,755,761.- per month, so that the business results are still able to meet the needs of the cultivator's family. The cost efficiency of vannamei shrimp farming is traditionally polyculture and is carried out through R/C ratio analysis. Where the R/C ratio is the comparison between the average total revenue and the average total cost. The greater the R/C ratio, the greater the profit the farmer will get. After the R/C ratio analysis was carried out, an analysis was needed to find out the difference in the cost efficiency of traditional polyculture vannamei shrimp farmers. The results of the analysis of the R/C ratio are in the Table 6.

The average R/C ratio of vannamei shrimp farming in a traditional polyculture manner with an average value of R/C ratio in vannamei shrimp farming is worth 1.43, which means that the vannamei shrimp farming business in a traditional polyculture manner is efficient in the use of business costs, because every 1 the unit of currency (Rp. 1.43) issued as the cost of the vannamei shrimp farming business will provide business revenue. According to Yuni., et al [7] the average income of vannamei shrimp farming using traditional polyculture is IDR 61,317,111.00/ha/cycle while the average income of vannamei shrimp farmers is IDR 727,773,104.00/ha/cycle. This shows that the cultivation of vannamei shrimp in traditional polyculture ponds and ponds is profitable and there is no significant difference between the average efficiency of pond vannamei shrimp cultivation and traditional polyculture ponds in Situbondo Regency with a significance value of 0.916.

The investment requirements for polyculture and traditional ponds are different. The most striking difference between polyculture and traditional investments is the water wheel. Traditional polyculture pond business only requires land and equipment. Waterwheels are needed in ponds because the stocking density of the two types of ponds is quite dense [8]. Policy recommendations for traditional polyculture ponds are very profitable economically when viewed from short-term business performance indicators, such as revenue, profit, revenue/cost ratio, and pay back period.

3.2 Water Quality Parameters

Water quality in aquaculture includes physical, chemical and biological factors of water that can affect aquaculture production. Shrimp are very sensitive to changes in water quality. Poor water quality can result in low survival rate, growth and reproduction of shrimp. Most of the water quality management is aimed at improving the chemical and biological conditions in the culture medium. Physical factors often cannot be controlled or depend on the selection of the appropriate location. Physical factors are very dependent on the geological and climatic conditions of a place [9].

The condition of pond water quality will play a role in the condition and performance of the shrimp cultivated [10]. Fluctuating water quality will make vaname shrimp easily experience stress due to abnormal conditions [11]. Shrimp that are stressed are very susceptible to disease and die, so that the mortality rate in aquaculture will increase [2]. Fluctuations in water quality parameters are dynamic, one of which is influenced by input factors and aquaculture waste. Waste from aquaculture inputs will increase as vannamei shrimp biomass increases and the age of vannamei shrimp culture increases [1].

The results of measuring water quality parameters at the research location of the planned revitalization of vannamei shrimp and milkfish ponds in Muara Kintap Village, Tanah Laut Regency, South Kalimantan Province can be seen in the Table 7.

Table 6. Average R/C ratio

No	Description	Polyculture	
1	Average Total Revenue	Rp. 26.500.000,-	Rp. 450.000.000,-
2	Average R/C ratio	3.19	1.43

Table 7. Water quality data

Parameter	Coordinate	115°15'24.70"E	115°16'8.07"E	115°16'9.89"E	115°16'3.19"E
		3°54'23.73"S	3°53'36.18"S	3°53'40.71"S	3°53'48.67"S
	Quality standards	ST1	ST 2	ST 3	ST 4
Salinity (ppm)		29	22	26	17
DO (mg/l)	> 5	6	6.9	6.5	7.9
Temp (C)	28-32	32.2	33.5	33.8	33.6
pH	7-8,5	7.12	7.18	6.89	7.37
TSS (mg/l)	80 mg/l	9	8	9	10
Nitrate (mg/l)	0,008 mg/l	0.02	0.01	0.01	0.01
Nitrite (mg/l)	0,06 mg/l	0.03	0.03	0.01	0.04
Phosphate (mg/l)	0,015 mg/l	0.82	0.07	0.07	0.03
Organic Matter	40 mg/l	5.4	4.5	4.8	5
BOD 5	20 mg/l	11.9	11.8	13.5	12.1

The Table 7 is the results of water quality measurements at 4 coordinate points, namely ST1:115°15'24.70"E, 3°54'23.73"S, ST2: 115°16'8.07"E, 3°53'36.18"S, ST3: 115°16'9.89"E, 3°53'40.71"S and ST4: 115°16'3.19"E, 3°53'48.67"S, with 10 water quality parameters namely salinity, DO or Dissolved Oxygen, temperature, pH, TSS (Total Suspended Solids), Nitrate, Nitrite, Phosphate, Organic matter and BOD 5 or Biochemical Oxygen Demand at 5 days).

The results of measuring the feasibility of water quality for the location of added vannamei shrimp at station I with the symbol ST1:115°15'24.70"E, 3°54'23.73"S, obtained water quality results including salinity, DO or Dissolved Oxygen, temperature, pH, TSS (Total Suspended Solids), Nitrate, Nitrite, Phosphate, Organic matter and BOD 5 or Biochemical Oxygen Demand at 5 days. The results of the Salinity measurement obtained a salinity value of 29 ppm. The DO or Dissolved Oxygen value at ST1 is 6 mg/l, the temperature value is 32.2 OC. The pH measurement results from Station 1 were 7.12, with TSS results of 9 mg/l, nitrate with a value of 0.02mg/l, and nitrite 0.03mg/l. The result of the phosphate measurement was 0.082mg/l, the organic matter value was 5.4 mg/l and the BOD 5 value at ST1 was 11.9 mg/l. A total of 10 water quality parameters for vannamei shrimp ponds at ST1: 115°15'24.70"E, 3°54'23.73"S, there are 2 parameters that do not meet water quality standards, namely nitrate and phosphate content which exceeds water quality standards.

The results of measuring the feasibility of water quality for the added location of vannamei shrimp at ST2 with coordinate points 115°16'8.07"E, 3°53'36.18"S obtained a salinity value of 22 ppm, DO value of 6.9 mg/l, temperature value of 33.5 OC, pH value 7.18, TSS value 8mg/l, nitrate

value 0.01 mg/l, nitrite value 0.03 mg/l, phosphate value 0.07 mg/l, organic matter value 4.5mg/l and BOD value 5 11.8mg/l. Total of 10 water quality parameters for vannamei shrimp ponds at ST2: 115°16'8.07"E, 3°53'36.18"S, there are 3 parameters that do not meet water quality standards, namely water temperature, nitrate and phosphate content which exceeds the quality standard water quality.

Subsequent measurements were made at ST3 with coordinates 115°16'9.89"E, 3°53'40.71"S obtained a salinity of 26 ppm, DO value of 6.5 mg/l, temperature value of 33.8 OC, pH value of 6.89, TSS value of 9 mg/l, the value of nitrate is 0.01mg/l, the value of nitrite is 0.01mg/l, the value of phosphate is 0.07mg/l and the value of organic matter is 4.8mg/l and the value of BOD 5 is 13.5 mg/l. A total of 10 water quality parameters for vannamei shrimp ponds at ST3: 115°16'9.89"E, 3°53'40.71"S, there are 4 parameters that do not meet water quality standards, namely water temperature, pH, nitrate and phosphate content that exceeds water quality standard.

The last measurement was carried out at station 4, namely ST4 with coordinates 115°16'3.19"E, 3°53'48.67"S, obtained a salinity value of 17 ppm, DO value of 7.9 mg/l, temperature value of 33.6 OC, pH value of 7.37, TSS value 10 mg/l, nitrate value 0.01 mg/l, nitrite value 0.04 mg/l, phosphate value 0.04 mg/l, organic matter value 5mg/l and BOD value 5 12.9mg/l. Total of 10 water quality parameters for vannamei shrimp ponds at ST3: 115°16'9.89"E, 3°53'40.71"S, there are 3 parameters that do not meet water quality standards, namely water temperature, nitrate and phosphate content which exceeds the quality standard water quality.

The feasibility of vaname shrimp ponds based on water quality analysis on the salinity parameter is

an important parameter in monitoring water quality, especially in aquatic environments such as the sea. However, significant fluctuations in salinity can affect marine organisms, especially those that cannot tolerate rapid changes in salinity [12]. One of the good water quality for vaname shrimp can be seen from the level of salinity in the good range for the growth of vannamei shrimp, which requires a salt content of 15 – 25 ppt so that their growth can be optimal. After more than 2 months of age, shrimp growth is relatively good at salinities between 5 – 30 ppt. After stocking the shrimp fry, the optimal level of salinity is in the range of 10 – 30 ppt [13] and the salinity level for growing Vaname Shrimp is in the range of 26 – 32 ppt [14].

According to Alyandri [15] the concentration of DO (Dissolved Oxygen) in water is below the specified quality standard, this may indicate a problem with the quality of the water. The presence of low DO can negatively impact aquatic organisms that require dissolved oxygen to survive. Low DO concentrations can indicate the presence of organic pollution or other contaminants in the water. The process of decomposing organic matter by microorganisms consumes oxygen, thereby reducing its availability for other organisms and reducing overall water quality. The concentration of DO (Dissolved Oxygen) in water is above the specified quality standard, this is generally considered a good thing for aquatic organisms. Adequate DO concentrations are important to support healthy aquatic life. The abundant presence of oxygen indicates an effective oxygenation process in the water, which means that the water is of good quality and free from significant organic pollution.

The temperature value observed, based on the research results, the temperature value is still in accordance with the life of the shrimp, where according to [16], that the optimal temperature for supporting the life of the Vaname Shrimp is around 27.2-32 °C, this statement is in accordance with the temperature value in the study conducted, it was >27 °C [14]. If the temperature is more than the optimum number, the metabolism in the shrimp's body takes place quickly, but if the ambient temperature is lower than the optimum temperature, the growth of the shrimp decreases with a decrease in appetite [17]. The high environmental temperature of the body temperature of aquatic organisms is also high so that the body metabolism of aquatic organisms is fast and vice versa at low

temperatures the metabolism of aquatic organisms is also low. This affects the appetite of aquatic organisms which will in turn affect fish growth and ultimately affect production (Hastningrum et al, 2020).

According to [18], the relationship between pH and the life of Vaname Shrimp is in the range of 6.1 –7.5 (moderate production), in the range of 7.6 –8.0 (Good enough for shrimp farming), in the range of 8.1 –8.7 (Good for shrimp maintenance), in the range 8.8 –9.5 (Production starts to decline). At low pH (high acidity), the dissolved oxygen content will decrease, resulting in decreased oxygen consumption, increased respiratory activity and decreased appetite. The opposite occurs in alkaline conditions.

TSS is solid particles in the form of colloids, sediments, silt, dust, powders, or other organic or inorganic materials. TSS confinement from ST1 to ST4 is still within normal quality standards. Normal TSS values may vary depending on the water source and specific environmental conditions. However, in general, water that is considered to have a normal TSS is water that has a low concentration of solid particles [19].

The maximum nitrite limit for growing Vaname Shrimp is at a value of ≤ 1 mg/l [14]. Nitrate and nitrite are the two main forms of oxidized nitrogen compounds found in waters. Both have a close relationship in the nitrogen cycle and can change each other through biochemical processes. Nitrate and nitrite are involved in the nitrification process, where ammonium (NH_4^+) is converted to nitrite by nitrite bacteria (Nitrosomonas), and then nitrite is oxidized to nitrate by nitrate bacteria (Nitrobacter). This process is an important part of the nitrogen cycle in aquatic ecosystems. One of the main causes of increased nitrate levels in waters is the presence of nitrogen-containing chemicals [20].

Phosphate in water (expressed as $\text{PO}_4\text{-P}$) is a phosphate compound dissolved in the form of phosphate ion (PO_4^{3-}). Phosphate is one of the main forms of the nutrient phosphorus (P) in waters. Phosphates in water can come from a variety of sources, including human and natural activities. Phosphate in water can come from various sources, such as agricultural activities (use of phosphate fertilizers), domestic waste, industrial waste, soil erosion, and organic decomposition. Human activities, especially agriculture and domestic/industrial waste, are the main causes of increased phosphate

Table 8. Parameter potential level values based on several references

No	Parameter	Tingkat Potensi			Ideal	Reference
		Not suitable (S1)	Suitable (S2)	Very suitable (S3)		
1	Salinity (ppm)	<10 or > 35	25 – 35	15 – 25	15-35	Aziz [23], SNI 7772 [24]
2	DO (mg/L)	<2,0	2,0 - 3,5	>3,5	>2,0	SNI 7772 [24], Ferreira et al- [25]
3	Temperature (C)	<18 atau >40	18-35	28-32	18-35	WWF [26], Nurjanah [27], Ferreira et al [25]
4	pH	<6,8 atau >8,6	6,8 – 7,6	7,6 – 8,6	6,8-8,6	Nitya et al [28]
5	TSS (mg/l)	250-300	200-250	<200	<250	Arifin et al. [29], KEPMEN LH NO. 51 2004, Utojo et al. [30]
6	Nitrate (mg/l)	>1	0,6-1	≤0,5	0,05-1	PERMEN KP Nomor 75 [31], Suwoyo & Tampangallo [32], Goldman & Horne [33]
7	Nitrite (mg/l)	>1	0,01 – 1	<0,01	0,05-1	PERMEN KP Nomor 75 [31], Suwoyo & Tampangallo [32], Goldman & Horne [33]
8	Phosphate (mg/l)	>5,0	>0,1-5,0	≥0,01-0,1	≥0,01-0,1	PERMEN KP Nomor 75 [31], Suwoyo & Tampangallo [32], Goldman & Horne [33]
9	Organic matter	>95	91-95	< 55-90	<55-90	PERMEN KP Nomor 75 [31], Suwoyo & Tampangallo [32], Goldman & Horne [33]
10	BOD 5	<3->25	20-25	3-20	3-25	Setyawan dkk 2021 dan SNI 01-7246-2006[34]

Table 9. Scoring weight table

No	Parameter	weight	Not Suitable (S1)		Suitable (S2)		Very Suitable (S3)	
			Score	Value	Score	Value	Score	Value
1	Salinity	0.182	1	0.182	2	0.364	3	0.545
2	Do	0.164	1	0.164	2	0.327	3	0.491
3	Temperature	0.145	1	0.145	2	0.291	3	0.436
4	Bod5	0.127	1	0.127	2	0.255	3	0.382
5	pH	0.109	1	0.109	2	0.218	3	0.327
6	Nitrate	0.091	1	0.091	2	0.182	3	0.273
7	Nitrite	0.073	1	0.073	2	0.145	3	0.218
8	Phosphate	0.055	1	0.055	2	0.109	3	0.164
9	Organic matter	0.036	1	0.036	2	0.073	3	0.109
10	Tss	0.018	1	0.018	2	0.036	3	0.055
Total		1.000		1		2		3

concentrations in water [21]. The recommended BOD for brackish water or sea water is below 5 mg/L (milligrams per liter) [22].

3.3 Land Suitability

Based on water quality parameter data and the results of the interpolation of each water quality variable consisting of Temperature, Salinity, pH, DO, Nitrite, Nitrate, Organic Matter, TSS, Phosphate, BOD5, then arranged in the form of matrix or criteria thematic maps used in this study were divided into 3 classes, namely class S1: Not suitable, class S2: Suitable and class S3: Very suitable.

As for the results of the interpolation of all water quality parameters, there are parameters that are

not suitable, namely phosphate which is found at ST 1 while at other stations it is Very Suitable as shown in the Fig. 1.

While the Salinity parameters (Fig. 2), temperature (Fig. 3) and Nitrite (Fig. 4), the value of the potential level is Suitable to Very Suitable as shown in the Figs. 2-4.

As for the other parameters, namely DI, BOD5, Nitrate, Organic Matter and TSS, they are Very Suitable, as shown in Fig. 5.

Based on the results of the interpolation of all these parameters it can be concluded that at the research location it was stated that at all stations it was stated as Suitable to Very Suitable in the Fig. 6.

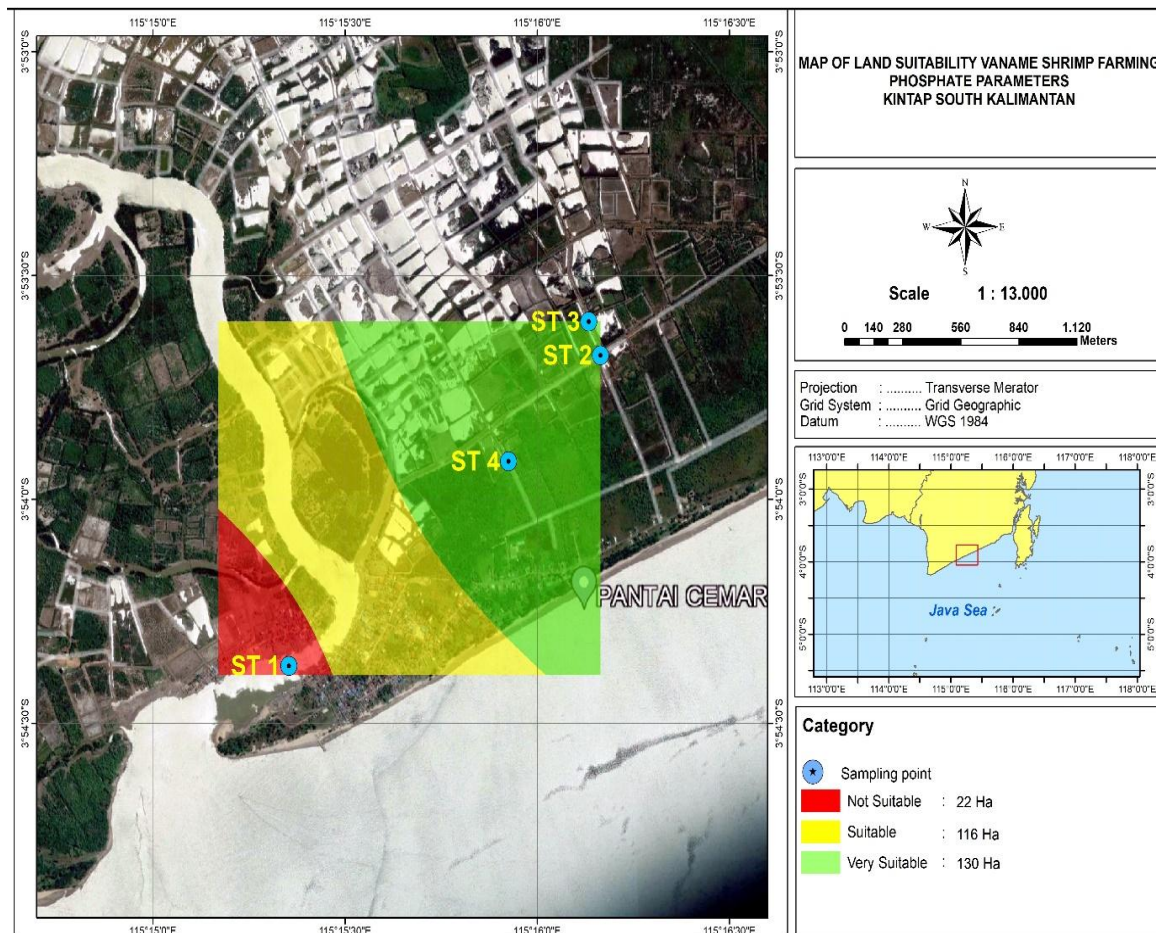


Fig. 1. Map of suitability of phosphate parameters at the location of the planned revitalization of vannamei shrimp (*litopenaeus vannamei*) and milkfish aquaculture in a traditional polyculture manner in Muara Kintap Village, Kintap District, Tanah Laut Regency, South Kalimantan Province

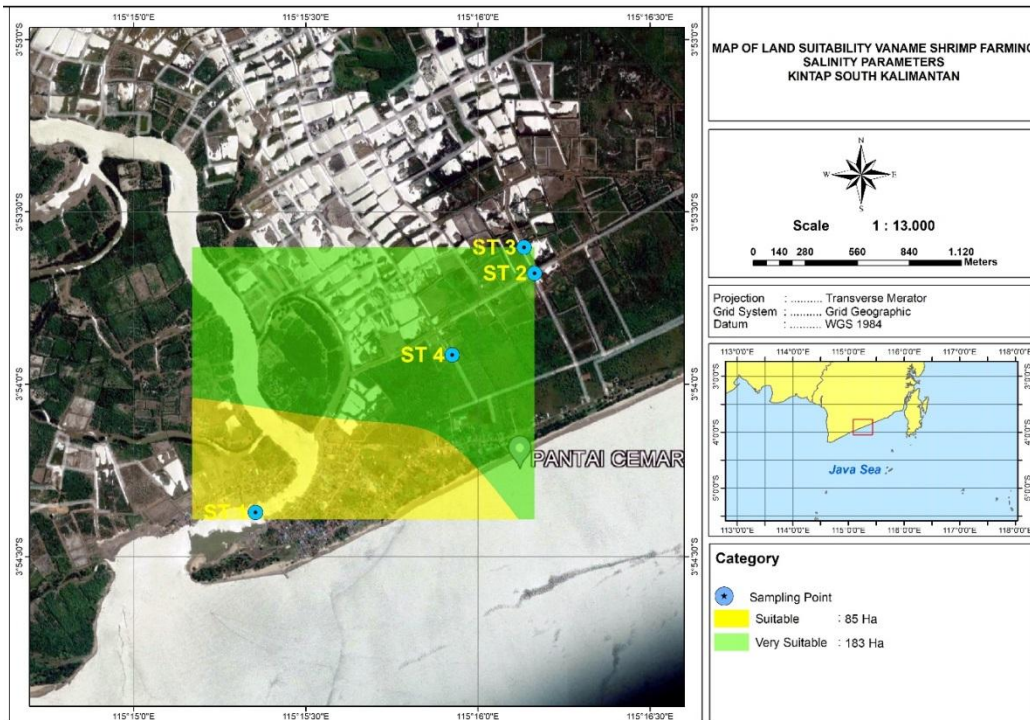


Fig. 2. Map of suitability of salinity parameters at the location of the planned revitalization of vannamei shrimp (*Litopenaeus vannamei*) and milkfish aquaculture in a traditional polyculture manner in Muara Kintap Village, Kintap District, Tanah Laut Regency, South Kalimantan Province

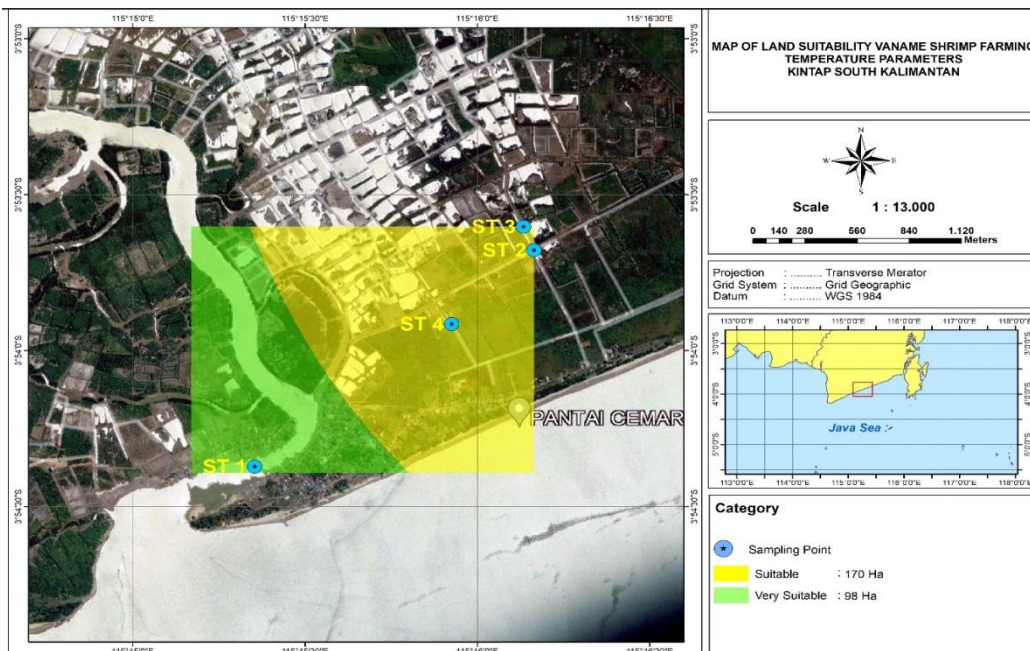


Fig. 3. Map of suitability of temperature parameters at the location of the planned revitalization of vannamei shrimp (*Litopenaeus vannamei*) and milkfish aquaculture in a traditional polyculture manner in Muara Kintap Village, Kintap District, Tanah Laut Regency, South Kalimantan Province

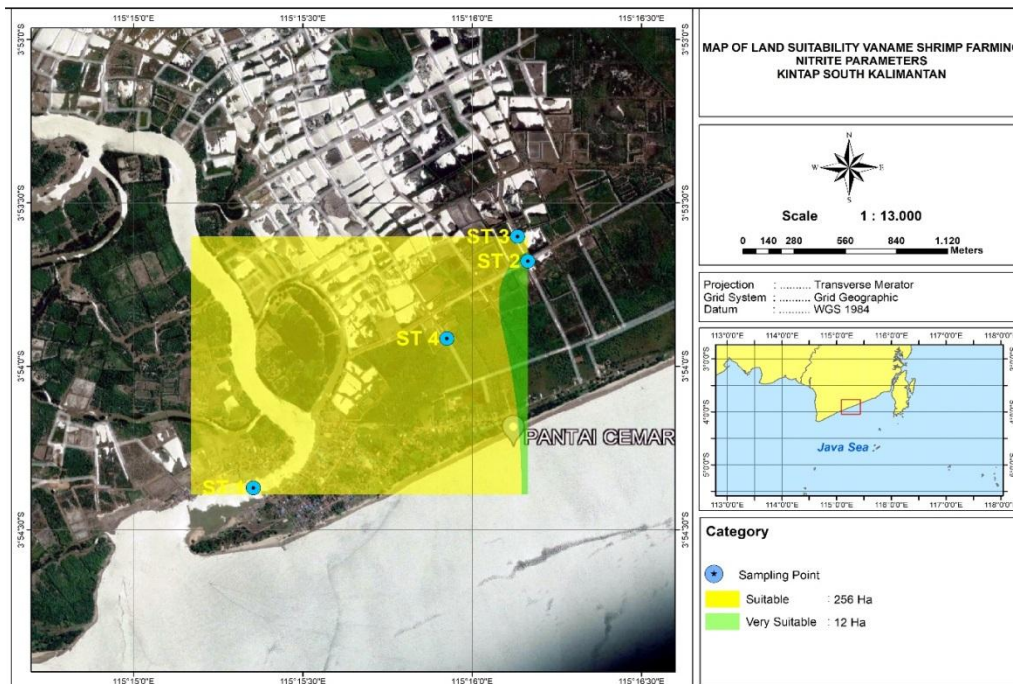


Fig. 4. Map of conformity of Nitrite parameters at the location of the planned revitalization of vannamei shrimp (*Litopenaeus vannamei*) and milkfish aquaculture in a traditional polyculture manner in Muara Kintap Village, Kintap District, Tanah Laut Regency, South Kalimantan Province

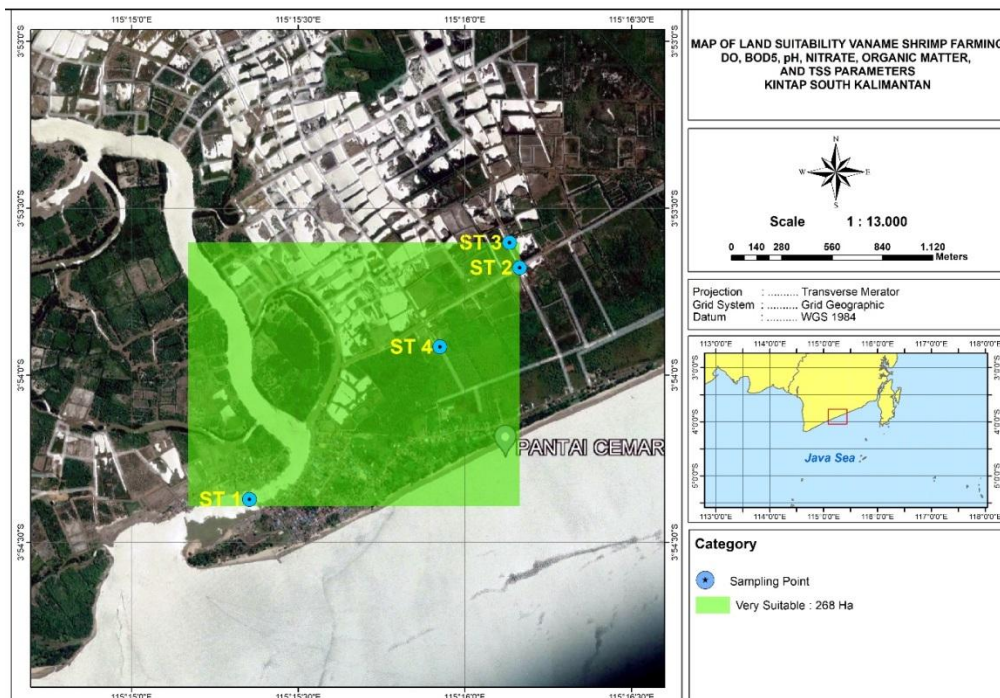


Fig. 5. Map of suitability of DO, BOD5, Natrate, Organic Matter and TSS parameters at the location of the planned revitalization of white shrimp (*Litopenaeus vannamei*) and milkfish aquaculture ponds in a traditional polyculture manner in Muara Kintap Village, Kintap District, Tanah Laut Regency, South Kalimantan Province

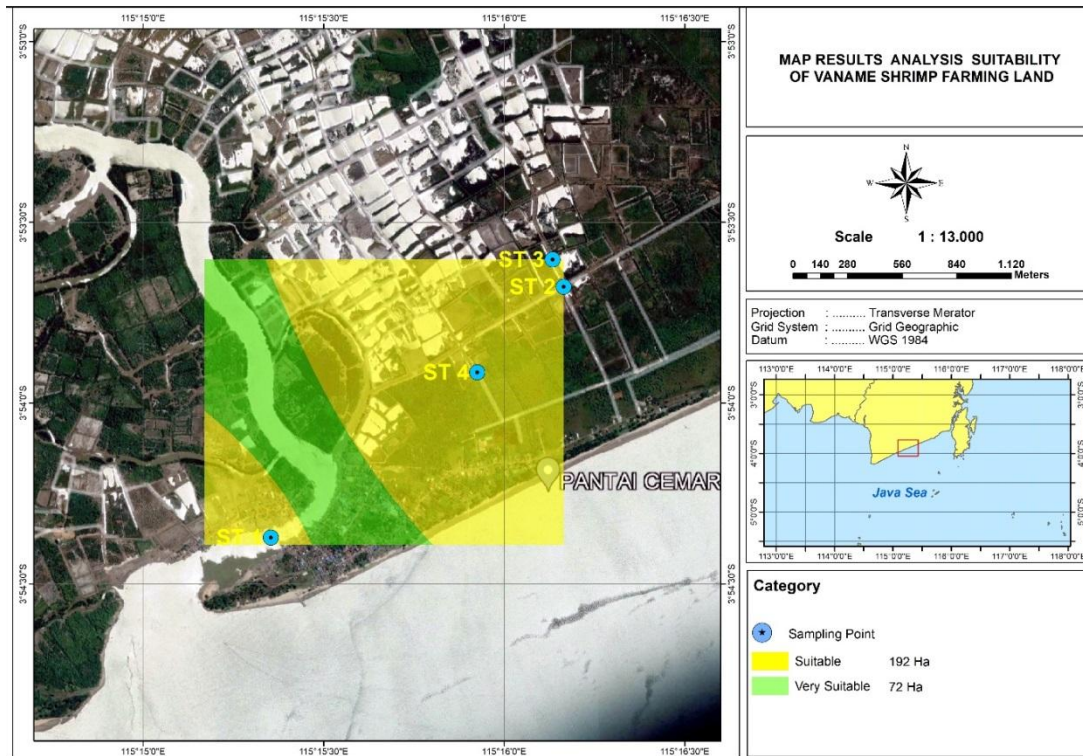


Fig. 6. Map of suitability of water quality parameters found in the location of the planned revitalization of vannamei shrimp (*litopenaeus vannamei*) and milkfish aquaculture in a traditional polyculture manner in Muara Kintap Village, Kintap District, Tanah Laut Regency, South Kalimantan Province

The results of the weight scoring of all parameters from all stations contained parameters that were not suitable for the research location, namely the temperature parameters at ST 2, ST 3, ST 4 and phosphates found at ST 1, but based on the interpolation results of all these parameters it can be concluded that at the research location it is stated that at all stations it is stated as Suitable to Very Suitable with the carrying capacity of each area is 192 Ha Suitable and 72 Ha Very Suitable [35-43].

4. CONCLUSION

1. Based on the analysis of the revitalization of vannamei shrimp (*litopenaeus vannamei*) and milkfish aquaculture ponds in a traditional polyculture based on an analysis of water quality in the ponds of the people of Muara Kintap Village, Kec. Kintap district. Land of the Sea Province. South Kalimantan based on the average R/C ratio of vannamei shrimp farming using traditional polyculture is efficient in the use of business costs.

2. Analysis of land suitability based on the results of the interpolation of all these parameters, it can be concluded that at the research location it was declared suitable to very suitable. Revitalization of vannamei shrimp (*litopenaeus vannamei*) and milkfish aquaculture ponds was carried out in a traditional polyculture manner by the people of Muara Kintap Village, Kab. Land of the Sea Province. South Kalimantan.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Brown TW, Boyd CE, Chappell JA. Organic Carbon and Dissolved Oxygen Budgets for a Commercial-Size, In-pond Raceway System. *Journal of The World Aquaculture Society*. 2015;46(5):539-548.
2. Edhy WA, Azhary K, Pribadi J, Chaerudin MK. White Shrimp Cultivation (*Litopenaeus*

- vannamei*. Boone, 1931). CV. Noble Beautiful. Jakarta; 2010.
3. Poernomo. Selection of Locations for Shrimp Ponds with an Environmental Insight. Center for Research and Development of Fisheries Agency for Research and Development of Agriculture. Jakarta; 1992.
 4. Fredinan Y. Study of the Suitability and Carrying Capacity of the Spatial-Based Pond Environment in the Coastal Area of North Aceh Regency, East Coast of Nanggroe Aceh Darusalam Province. *Journal of Indonesian Water and Fishery Sciences*. 2008; 15(2):157-163.
 5. Arifin T, Yulius, Arlyza IS. Patterns of Spatial Distribution and Characteristics of Dissolved Nitrate-Phosphate-Oxygen in Coastal Waters of Makassar. *Segara Journal*. 2011;7(2):88-96.
 6. Hartoko A. Dynamic Mapping Technology of Pelagic Fish Resources through Integrated Analysis of Oceanographic Characters and NOAA Satellite Data, Landsat_TM and SeaWIFS_GSFC in Indonesian Sea Waters. Office of the State Minister for Research and Technology, National Research Council, Jakarta; 2000.
 7. Kristina Yuni. Analysis of the Factors Influencing Production and Income of Vannamei Shrimp Aquaculture in Pasekan District, Indramayu Regency. Thesis, Bogor: Department of Resource and Environmental Economics, Faculty of Economics and Management, Bogor Agricultural University; 2014
 8. Nainggolan AI, Lesmana I, Utomo B, Usman S, Suryanti A. Study of the financial feasibility of vannamei shrimp (*Litopenaeus vannamei*) cultivation in Pantai Cermin District, Serdang Bedagai Regency, North Sumatra Province. *MarsIsland*. 2021;1(2):13—23.
 9. Boyd CE. Water Quality in Ponds for Aqua Culture. Alabama agriculture experiment station. Auburn Univ; 1990.
 10. Gao W, Tian L, Huang T, Yao M, Hu W, Xu Q. Effect of Salinity on The Growth Performance, Osmolarity Andmetabolism-Related Gene Expression in White Shrimp *Litopenaeus vannamei*. *Aquaculture Reports*. 2016;4:125-129.
 11. Ariadi H, Mahmudi M, Fadjar M. Correlation between the density of vibrio bacteria with *Oscillatoria* sp. abundant on intensive *Litopenaeus vannamei* shrimp ponds. *Research Journal Life Science*. 2019;6(2):114-129.
 12. Bange HW, Robinson C. The Oceanic Sink for Anthropogenic CO₂. In: Delille, B., & Harlay, J. (Eds.), *Coastal Marine Sciences: 1. Ocean and Coastal Studies*. Springer; 2011.
 13. Supono. *Low Salinity Vaname Shrimp Cultivation Solutions for Cultivation in Critical Lands*. 1st Edition. Science House. Yogyakarta; 2019.
 14. SNI. General Guidelines for Enlargement of Tiger Shrimp (*Penaeus monodon*) and Vaname Shrimp (*Litopenaeus vannamei*). Number 75. Minister of Maritime Affairs and Fisheries of the Republic of Indonesia. Jakarta; 2016.
 15. Alyandri FH, Mulya N, Sari RR, Nofrianti SI, Permana ES, Novendri F. Water Quality Analysis and Three-Point River Water Pollution Control Strategy in Padang City District. *Journal of Kapita Seleka Geography*. 2019;2(5):13–24.
 16. Yudiati E, Arifin, Riniatsih I. The Effect of Probiotic Application on the Survival Rate and Growth of Vannamei Shrimp (*Litopenaeus vannamei*) Broccoli, Population of Vibrio Bacteria, and Ammonia Content and Organic Materials of Culture Media. *Marine Science*. 2010;15 (3):153 -158.
 17. Supriatna, Mahmudia, M., MusaaM., Kusriana. Relationship between pH and Water Quality Parameters in Vannamei Shrimp (*Litopenaeus vannamei*) Ponds. *Journal of Fisheries and Marine Research*. 2020;4(3):368-374.
 18. Kordi MGH. *Sea Shrimp Cultivation*. Edition I. Lily Publisher. Yogyakarta; 2010.
 19. Rahadi B, Suharto B, Monica FY. Identification of the Pollutant Load Capacity and Water Quality of the Lesti River before the Construction of the Hotel *Journal of Natural Resources and Environment*. 2019;6(3):1–10.
 20. Rahman A, Jahanara I, Jolly YN. Assessment of physicochemical properties of water and their seasonal variation in an urban river in Bangladesh. *Water Science and Engineering*. 2021;14(2):139–148. Available: <https://doi.org/10.1016/j.wse.2021.06.006>
 21. Sabli TE, Zahrah S. Reduction of phosphate content in detergent wastewater using swamp bamboo system reduction of phosphate contents in waste water

- detergent using swamp bamboo system. Journal of Agricultural Dynamics. 2017;XXX:101–108.
Available:<https://journal.uir.ac.id/index.php/dinamipertanian/article/view/802/480>
22. Yudo S. Conditions of Ciliwung River Water Quality in the DKI Jakarta Region in View of Organic, Ammonia, Phosphate, Detergent and Coli Bacteria Parameters. Indonesian Air Journal. 2018;6(1). Available:<https://doi.org/10.29122/jai.v6i1.2452>
 23. Aziz R. Growth Performance and Survival Rate of Shrimp Vaname *Litopenaeus vannamei* at Salinities of 30 ppt, 10 ppt, 5 ppt and 0 ppt. Thesis. Department of Aquaculture, Aquatic Institute; 2010.
 24. SNI 7772. Semi-Intensive Growing of Vaname Shrimp (*Litopenaeus vannamei*) in Ponds. National Standardization Agency; 2013.
 25. Ferreira NC, Boneti CE, Seiffert WQ. Hydrological and Water Quality Indices as Management tools in Marine Shrimp Culture. Aquaculture. 2011;318:425-433.
 26. WWF. Semi-Intensive Pond Vannamei Shrimp Cultivation with Wastewater Treatment Plant (IPAL). WWF-Indonesia: South Jakarta; 2014.
 27. Nurjanah. Analysis of Pond Cultivation in Brebes Regency. Coastal Resource Management Master Program Thesis, Diponegoro University; 2009.
 28. Nitya JKP, Srideepu K, Hanuma RM, Siva RKV. Effect of water probiotic (Pro-W) on *Litopenaeus vannamei* culture ponds of Nellore, Andhra Pradesh, India. International Journal Of Environmental Sciences. 2016;6(5).
 29. Arifin Z, Andrat K, Subiyanto. Vaname shrimp (*Litopenaeus vannamei*) production techniques are simple. Ministry of Maritime Affairs and Fisheries. Center for Development of Brackish Ai Cultivation, Jepara. 2007;9.
 30. Utojo, Ahmad M, Rachmansyah, Hasnawi. Determining the Location of Sustainable Pond Aquaculture Development with the Application of Geographic Information Systems in South Lampung Regency. J. Ris. Aquaculture. 2010;4(3):407-423.
 31. Regulation of the Minister of Maritime Affairs and Fisheries Number 75/PERMEN-KP/2016 concerning General Guidelines for Growing Tiger Shrimp (*Penaeus monodon*) and Vaname Shrimp (*Litopenaeus vannamei*).
 32. Tampangallo BR, Suwoyo HS, Septiningsih E. The Effect of Using Windmills as Current Sources on the Performance of Vaname Shrimp (*Litopenaeus vannamei*) in Super Intensive Aquaculture Systems. Proceedings of the 2014 Aquaculture Technology Innovation Forum. 2014;353-361.
 33. Goldman CR, Horne AJ. Limnology (p. 576). New York: McGraw; 1994.
 34. SNI 01-7246. Vaname Shrimp Production (*Litopenaeus vannamei*) in Ponds with Intensive Technology. National Standardization Agency; 2006.
 35. Achmad S Hidayat. Problem analysis and development strategy of shrimp culture in Tanah Laut Regency, South Kalimantan Province, Indonesia. AACL Bioflux. 2017;10(4). <http://www.bioflux.com.ro/aac>
 36. Amri K, Iskandar K. Vannamei Shrimp Cultivation. PT. Garamedi Main Library. Jakarta; 2008.
 37. Hastutiningrum S, Muchlis, Astari NA. The Influence of Land Use on Water Quality and Pollution Load Capacity of the Yogyakarta Mataram Ditch. Technology Journal. 2020;12(2):189–194.
Available:<https://ejournal.akprind.ac.id/index.php/technoscintia/article/view/2809>
 38. Decree of the State Minister for the Environment Number: 115 of 2003 concerning Guidelines for Determining the Status of Water Quality, State Secretariat of the Republic of Indonesia, Jakarta.
 39. Royani S, Fitriana AS, Enarga ABP, Bagaskara HZ. Study of Cod and Bod in Water in the Final Processing Site (Tpa) of Kaliori Garbage, Banyumas Regency. Journal of Environmental Science & Technology. 2021;13(1):40–49.
Available:<https://doi.org/10.20885/jstl.vol13.iss1.art4>
 40. Seyawan, Arief Rahmat et al. Analysis of the Suitability of Source Water for Shrimp Cultivation in Purwodadi District, Purworejo Regency; 2021.
 41. Sulistinarto D, Adiwijaya DS. Guidelines for Simple and Semi-Simple Vaname Shrimp (*Litopenaeus vannamei*) Cultivation in Ponds. Directorate General of Aquaculture Fisheries Directorate of Production, Brackish Water Cultivation Center, Jakarta; 2008.
 42. Wibowo H. How to Choose Quality Vaname Shrimp Benur. Situbondo Brackish Water Seed Center. Situbondo; 2006.

43. Yunandar. Analysis of Space Utilization in the Muara Kintap Coastal Fishery Development Area, Tanah Laut Regency, South Kalimantan Province. Diponegoro University Semarang graduate program thesis; 2007.

© 2023 Hidayat et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<https://www.sdiarticle5.com/review-history/103056>