Utilization of idle ponds for semi intensive vannamei (*Litopenaeus vannamei*) cultivation integrated with red tilapia (*Oreochromis niloticus*), seaweed (*Gracilaria verrucosa*), and oysters (*Crassostrea sp*) in Mamuju, west Sulawesi

B Pantjara[*1] , E A Hendrajat[1] , R Reynalta[2], A Nawang[1] , A H Kristanto[3]
[*1] Research Center for Fishery, National Research and Innovation Agency
[2] Faculty of Fisheries and Marine Science, Mulawarman University
[3] Research Center for Applied Zoology, National Research and Innovation Agency

[*]Corresponding author: bpantjara@yahoo.com

Abstract. Shrimp farming failure is frequently constrained by low farm productivity. This is dueto a variety of issues, including high soil acidity, a lack of soil nutrients, high pyrite, iron levels,and organic matter. In general, alluvial ponds with low soil productivity predominate in coastalareas. As a result, shrimp farming in alluvial ponds necessitates careful management. The purpose of this research was to determine the effect of vannamei stocking density in conjunctionwith red tilapia, seaweed, and mangrove oysters on vannamei production. The studywas carriedout in Mamuju, West Sulawesi. The treatments in this study were differences in vannamei shrimp stocking density that were managed semi-intensively; specifically, A was 220,500 individuals per pond (60 individuals per m^2) and B was 118,500 individuals per pond (30 individuals per m^2). Each pond was also stocked with 2,200 red tilapia per pond, and biofilters such as seaweed and mangrove oysters were used. The study's findings revealed that in A, the survival rate and production of vannamei and red tilapia were 61.39±2.426 % (1,554±2.08 kg per pond) and 63.86±4.638 % (274.57±37.188 kg per pond), respectively, and in B, the survival rate and production of vannamei and red tilapia were 68.83±8.867% (957.56±67.660 kg per pond) and 253.28±33.372 kg per pond with a survival rate of 59.60±607.071%.

1. Introduction

Increased shrimp production from aquaculture in fisheries development is directed at meeting domestic and export demand [1]. However, the development of brackishwater pond cultivation for increased shrimp production must not harm the environment or the mangrove ecosystem. As a result, brackishwater pond development in existing ponds is prioritized, and new pond construction is discouraged. Some brackish water ponds in Mamuju, West Sulawesi whose land is classified as alluvial. There is pyrite in this pond, which is located on tidal land with low pH and nutrient content. The soil is occasionally found as acid soil and peat soil, or both, and some of the lands are intruded by saline water from the sea. Low soil pH, a high potential for mass levels, a lack of nutrient availability, and highly toxic compounds. Acid sulfate soils form when sulfide minerals, such as pyrite, and elemental sulfur in reduced sulfidic sediments oxidize upon exposure to air. If sulfide-bearing subaqueous soils are dredged and placed in a subaerial environment, sulfides will oxidize, creating sulfuric acid [2], [3], [4], [5].

This soil is less suitable for shrimp aquaculture because the ponds have a low pH and increase the solubility of toxic compounds when exposed to or oxidized. As a result, efforts must be made to increase soil productivity through soil remediation, commodity selection based on land conditions, andpond engineering [6]. Pond remediation involves reclaiming the bottom pond by soil drying to oxidizetoxic compounds and waterlogging in ponds and disposing of soaking water to reduce toxic compounds[7], [8], [9]. Furthermore, liming the pond bottom increases the activity of microorganisms that decompose organic matter, and aid in the nitrification process [7], [10]. The failure of shrimp farming in ponds is also caused by shrimp farmers' ignorance of the land's characteristics. Uncontrolled development of pond land as a result of being enticed by the high price of shrimp results in frequent shrimp harvest failures. Even though the increase is small, shrimp production in Indonesia is increasing. The reality on the ground is that shrimp farmers frequently face a slew of issues, includinga lack of quality seeds, deteriorating environmental conditions, high feed prices, and disease outbreaksin ponds. Unfavorable water conditions can promote the growth of bacteria and viruses, resulting in pathogens in shrimp. Shrimp mortality in aquaculture ponds occurs not only in Indonesia, but also in several other countries, including India, Korea, China, America, and others [11], [12], [13], [14]. Pondmanagement that is less than ideal during intensive shrimp farming, such as excessive and uncontrolledfeeding, contributes to decreased water quality, particularly high of organic waste, causing shrimp to beeasily stressed and susceptible to disease [15],[16], [17], [18].

Brackish water ponds that are less productive for shrimp farming due to limited land carrying capacity and inefficient pond use have the potential to become idle ponds. This type of pond, however, can be optimized through the use of appropriate cultivation technology. Extensive and extensive plus, polyculture, or semi-intensive that is integrated with various commodities, referring to the integrated multi trophic aquaculture (IMTA), are shrimp culture technology that can be developed in idle ponds [5],[19], [20], [21]. The presence of feed waste at the pond's bottom contributes to a significant source of organic matter and nutrients [10], [22]. Shellfish and seaweed are excellent biofilters and thus suitable for use in IMTA [22]. The IMTA is better for semi-intensive to intensive shrimp farming. Integrated cultivation benefits, such as IMTA, allow pond farmers to obtain more than one commodity, save land and water, increase land carrying capacity, improve environmental quality, reduce harvest failure risk, and increase the added value [22], [23]. Shrimp farming combined with milkfish, tilapia sp., seaweed, and mangrove oysters is expected to increase the productivity of idle ponds [5], [6], [24], [25], [26], [27]. The purpose of this study was to find out the influence of semi-intensive vannamei density integrated with red tilapia, seaweed, and mangrove oysters for the production of vannamei and red tilapia.

2. Materials and methods

2.1 Location

This study was carried out in a community-owned pond in Kaluku district, Mamuju Regency, West Sulawesi Province. The pond sizes used in treatments A and B were 3,675 m^2 and 3,950 m^2, respectively. This study activity includes interviews, site selection, soil analysis, and pond preparation,which includes repairing a leaky dyke, repairing irrigation, draining the pond bottom, rinsing, eradicating pests, liming, and fertilizing.

2.2 Pond preparation

To find out the initial pond condition, characterization of pond soil quality is carried out including, pH (pH_F dan pH_{FOX}), Total potential acidity (TPA), Total Actual Acidity (TAA), Total Sulfidic Acidity (TSA), organic matter (OM), pyrite (FeS_2), iron (Fe^{3+}), total nitrogen (N) and soil texture. The pond bottom is dried for approximately 7 days, and the soil redox is attempted to reach >30 mV. After that, continue by filling with water to a depth of 10-30 cm for 3 days with the goal of dissolving and oxidizing toxin compounds, and the soaking water is discarded. Pest control with saponins at a dose of 0.02 kg/m^2, liming the pond bottom with dolomite at a dose of 0.1 kg/m^2, and fertilizing with urea at a dose of 0.02 kg/m^2 and Super Posfat (SP-36) at a dose of 0.01 kg/m^2 to grow natural feed, particularly at thestart of cultivation. After fertilizing the soil, a gradual replenishment of water is carried out, with the first stage filled with water to a depth of 20-40 cm and left for 3 days aimed at dissolving fertilizer in the pond, and the second stage of the pond filled to a depth of 50-60 cm aims to grow natural feed, andafter 7 days filled water to a depth of 80-90 cm and left for up to 7 days so that natural feed (plankton) can grow optimally. While waiting for the growth of natural feed, a floating cage (hapa) installation is carried out for the red tilapia and seaweed distribution system longline.

2.3 Research design

The difference in stocking density of semi-intensive vannamei, namely A), the density of 60 individuals per m^2 (220,500 individuals per pond), and B), the density of 30 individuals per m^2 (118,500 individuals per pond), was used as the integrated shrimp culture treatment in this study, with each treatment having two replications (Table 1). The vanname shrimp seeds used in the study were post-larva 11 (PL11) in size. The red tilapia are raised in a hapa made of black net material.

Table 1. The pond size and stocking density of commodities used in integrated aquaculture, includingvannamei, red tilapia, mangrove oysters, and seaweed.

	Treatment	
Stocking density	A	B
A. Pond size (m^2)	3,675	3,950
B. Commodity stocking density		
- Vannamei (individual per pond)	220,500	118,500
- Red Tilapia (individual per pond)	2,200	2,200
- Mangrove oyster (individual per pond)	2,000	2,000
- Sea weed (kg per pond)	375	395

Remarck : A (density of 60 individuals/m^2); B (density of 30 individuals/m^2)

Each pond has up to 5 hapas, each measuring 5 m long, 4 m wide, and 1.2 m high, and the hapa in the pond should not be too close to each other. Vannamei (*Litopenaeus vannamei*) and red tilapia (*Oreochromis niloticus*) are distributed in ponds after natural food has grown. Red tilapia with an initial stocking size of 2-6 grams per individual (an average of 3.5 grams per individual) were stocked to A and B ponds, each as many as 2,200 fish per pond, equaling 440 fish per hapa, with each pond having up to 5 hapas. Meanwhile, in treatments A and B, seaweed (*Gracillaria verrucosa*) is spread at rates of 375 and 395 kg/pond, respectively. Seaweed seedlings are tied with ropes on bamboo poles. The distance between seaweed points is 25 cm, and one point is planted with up to 200 g tied to a 40-meter-long rope. Meanwhile, the shellfish chosen must be able to live and grow in brackish water conditions,such as mangrove oysters (*Crassostrea iredalei*). The oysters were stocked one week after the vannamei, at a density of oysters is 2,000 individuals per pond. Mangrove oysters are placed in the black net basket above the pond's soil bottom or hung on black waring baskets at a density of 400-500 individuals per basket. Oysters were placed at various points in each pond, and in this study, oysters were placed at five different points in the pond. In each pond, two paddlewheel aerators (1 HP) will be installed. Paddlewheel aerators are used to rear shrimp that are more than 45 days old or have been exposed to a lack of oxygen. In this study, the paddlewheel is only installed from 10 pm to 4 am. (6 hours). Every two weeks, the weight of shrimp and red tilapia was measured, and the feed dose was calculated at the same time. Feeding pellets at a dose of 3% of the bodyweight per day, feeding frequencyof twice a day, with a 50% in the morning and 50% in the afternoon.

2.4 Parameter measurement

The parameters in this study were growth, survival rate, soil and water quality. At the start of the study, soil quality was assessed using the parameters pH_F, pH_{Fox}, TPA, TAA, TSA, OM, FeS_2, Fe^{3+}, total N and soil texture were measured. A pH meter was used to measure soil pH (pH_F and pH_{FOX}), and the other soil analysis method refers to [4]. Water quality parameters such as pH, temperature, and oxygenwere measured in the field every day, while TOM, nitrite, nitrate, total ammonia nitrogen (TAN), and phosphate were measured every two weeks. The water quality analysis method is referred to [28[and [29]. Soil and water quality analysis were carried out in the soil laboratory and water Laboratory at the Research Institute for Coastal Aquaculture (RICA), Maros.

2.5 Data analysis

The data on the survival rate of vannamei and red tilapia, water quality parameters were tabulated and analysed descriptively. Meanwhile, growth and FCR were analysed using T-Test

3. Results

3.1 Pond soil quality

The study's findings revealed that the pond soil is an acid sulfate soil with the following characteristics: pH_F in A (5.80±0.056) and B (5.66±0.087); pH_{FOX} in A (3.71±0.042) and B (3.815±0.092). TPA in A (403.12±41.012 moles H^+/ton) and B (410.05±48.720 moles H^+/ton). TAA in A (30.8±3.253 moles H^+/ton) and B (25.85±0.778 moles H^+/ton). TSA in A (372.20±44,265 moles H^+/ton) and B (384.2±49.49 moles H^+/ton). In this study, pyrite on A can reach 1.70±0.140% and pyrite on B can reach 1.80±0.142%. Fe^{3+} on A (1,015±49.50 µg/g) and B (1,175±106.07 µg/g). Organic matter in A (5.80±0.848%) and B (5.95±0.495%). C organic matter in A (3.36±0.492%) and B (3.45±0.287%). Total N in A (0.444±0.0163%) and B (0.434.8± 0.0543%). CN ratio in A (7.57±0.831) and B (8,06±1,67%). Soil texture on ponds is Sandy clay loam with composition sand:clay: silt on A (42.5:32.5:25) and B (46.5:36.5:17).

3.2 Vannamei and red tilapia production

The absolute weight growth, survival rate, production and FCR of vanname and red tilapia are shown in Table 2.

Table 2. The weight, survival rate, FCR, and production of vannamei and red tilapia using integrated aquaculture in Mamuju Regency, South Sulawesi.

Variable	Treatment	
	A	B
Pond Area (m^2)	3,675±247.87	3,950±353.34
a. Vannamei		
Stock density (individuals per m^2)	60	30
(individuals per ponds)	220,500	157,500
Initial weight (g per individual)	0.1143	1.1143
Finally weight (g/per individual)	11.50^a±0.424	11.80^a±0.368
Survival Rate (%)	61.39±2.426	68.85±8.8671
Production (kg per pond)	1,554±2.08	957.5±67.66
(kg per m^2)	0.424±0.0030	0.244±0.0390
FCR	1.25^a±0.028	1.29^a±0.014
b. red tilapia		
Stock density (individuals per ponds)	2,200	2,200
(individuals per hapas)	440	440
Initial weight (g per individual)	3.2	3.2
Finally weight(g per individual)	195^a±14.14	193^a±2.83
Survival Rate (%)	63.86±4.638	59.60±7.071
Production (kg/pond)	274.57±37.188	253.28±33.372
(kg/hapa)	54.91±7.437	50.66±6.746
FCR	1.53^a±0.035	1.52^a±0.049

Remarck : A (density of 60 individuals/m^2); B (density of 30 individuals/m^2)

3.3 Water quality

Water quality during the study between treatments were seemed to vary (Figure 1-5). During the study, the oxygen content reached more than 3 ppm (3.2-5.8 mg/L) in both treatments A and B. Water quality measurements such as temperature and salinity remained within a vannamei tolerance range, namely the temperature ranged from 26.5-31.5ºC, and salinity reached 18.5-38 ppt. Meanwhile, dissolved oxygen (5.0-9.0 mg/L), temperature (28-31ºC).

Total organic matter (TOM) in treatments A and B ranged from 30 to 50 mg/L and was still within the tolerance for shrimp farming.

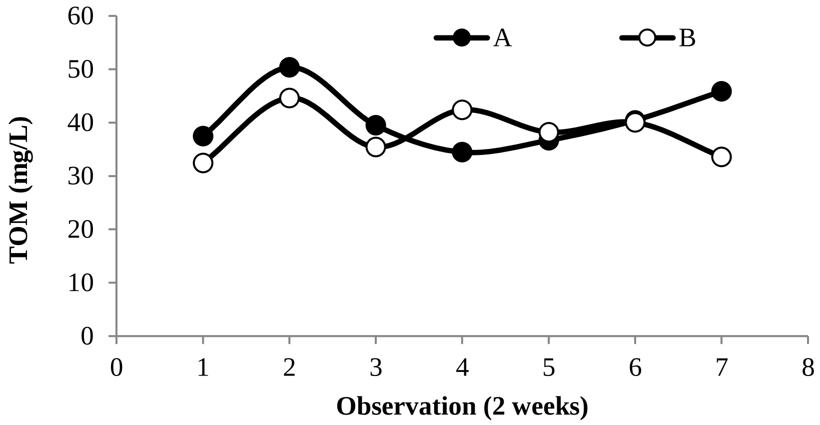

Figure 1. Fluctuations of total organic matter (TOM) in shrimp aquaculture ponds

Observations of TAN in the water media seem to fluctuate, in A can reaches the range of 0.0277-0.2034 mg/L, and B can reach the range of 0.027-0.1821 mg/L.

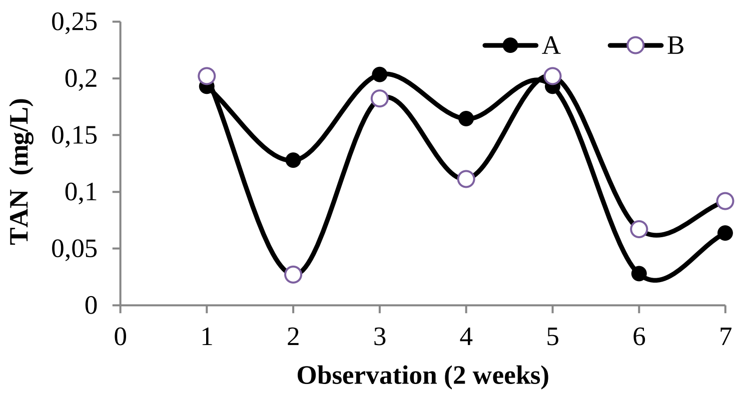

Figure 2. Fluctuations of Total Amonnia Nitrogen (TAN) in shrimp aquaculture ponds

During the study, nitrite levels in treatments A and B were 0.008-0.0328 mg/L and 0.006-0.0578 mg/L, respectively. Similarly, the nitrate while varying, is still relatively low.

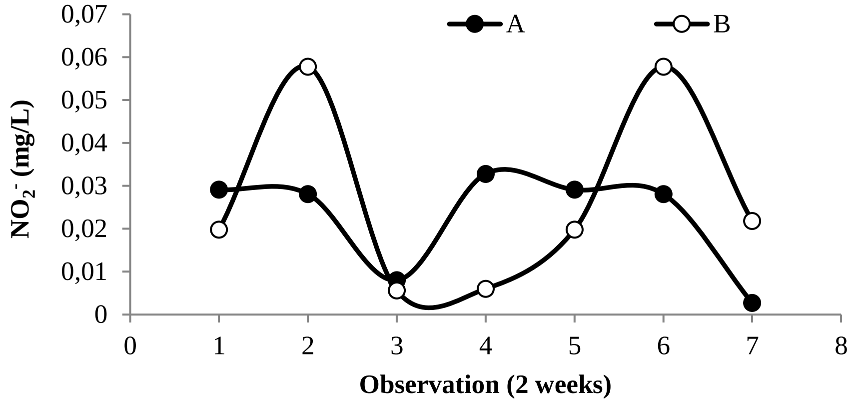

Figure 3. Fluctuations of nitrite (NO_2^-) in shrimp aquaculture ponds

Nitrate measurements in A ranged from 0.1992-0.3182 mg/L, while those in B ranged from 0.1312-0.2724 mg/L.

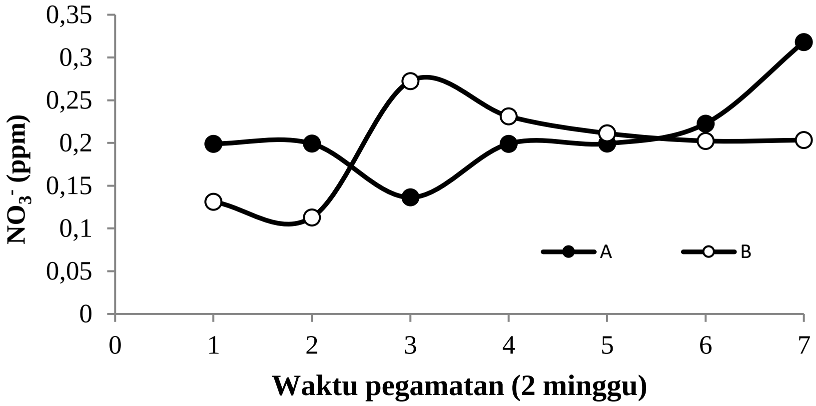

Figure 4. Fluctuations of nitrat (NO_3^-) in shrimp aquaculture ponds

Phosphate levelsvary across all treatments, with A reaching 0.1145-0.2273 mg/L and B can reaching 0.0342-0.4833 mg/L.

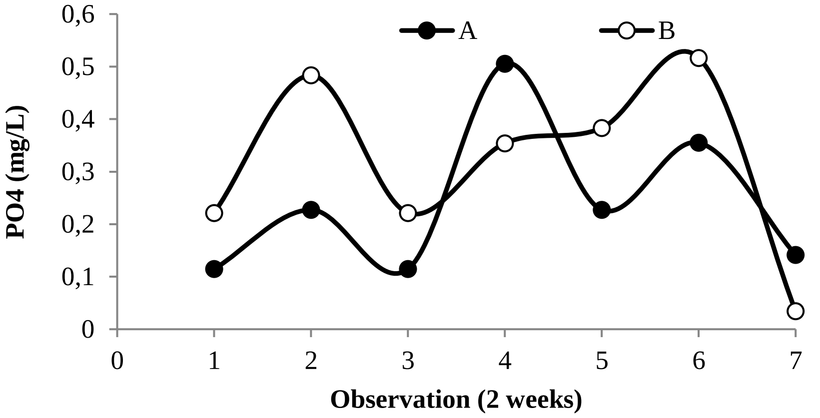

Figure 5. Fluctuations of phosphate (PO_4^{2-}) in shrimp aquaculture ponds

4 Discussion

4.1 Pond soil quality

The brackishwater pond soil, dominated by acid sulfate soil or occasionally associated with peat soil, and has been found to contain rust red pyrite (FeS_2) and jarosite ($KFe^{3+}3(OH)_6(SO_4)_2$ on the inside and top of the pale yellow dyke *Shrimp and red tilapia production.* Value of pH_F is the pH of soil measured in the field under water-saturated soil conditions, whereas pH_{FOX} is the pH of soil measured in the field after oxidation with hydrogen peroxide (H_2O_2) 30%. The difference between pH_F and pH_{FOX} represents the potential acidity of the soil based on its pH value of A (2.09±0.099) and B (2.13±0.163). Total Potential acidity (TPA) is often referred to as the buffer capacity of the soil against changes in pH. The higher the clay and organic matter content, the greater the soil buffer capacity. More lime is needed to raise the pH of the soil [30].

Total Actual Acidity (TAA) is the total amount of acidity of the soil that is freely available. This TAA consists of soluble acidity, interchangeable acidity, acidity from protonated varied charged particles, and acidity brought about by sulfate compounds. In the ASS system, the main mineral acid is sulfuric acid (H^+) which is produced from the oxidation of pyrite and measured by the TAA method. The presence of TAA in ASS pond is critical in pond management, however, it is hypothesized that TPA, within the TAA soil horizon is as equally important. Sulfuric potential acidity or Total sulfuric acidity (TSA) is calculated by the reduction of TPA from TAA. The source of acidity in acid sulfate soils is pyrite compounds, which oxidize and release hydrogen and sulfate ions, resulting in a decrease in pH. In this study, pyrite on A and B can reach less of 2%. Pyrite is formed in highly reductive anaerobic conditions; however, changes or disturbances such as drainage or tidal fluctuations can cause pyrite to oxidize. The oxidation of the mineral pyrite either directly or indirectly causes the increase in acidity in acid sulfate soils [6].

Organic matter in pond soil can have an impact on soil stability, oxygen consumption, nutrient sources, and habitat suitability from the pond's bottom. The amount of organic matter in the pond can affect its fertility, but too much can seriously the life and population of cultivated fish and shrimp [30]. According to [31], the ideal organic matter for shrimp cultivation is 6-9%. This CN ratio is relatively low, indicating that there is a carbon (C) and nitrogen (N) imbalance in the soil, which can lead to less available nutrients. The ideal CN ratio for soil is 15-20. Based on the texture of the soil, it can be determined that the pond soil has low fertility and often found low natural feed growth in the pond.

4.2 Vannamei and red tilapia production

Interviews with pond owners were informed that shrimp farmers have been cultivating vannamei using the traditional system with production ranging from 100-300 kg per ha and have experienced shrimp harvest failure (personal information). When the shrimp were 65 days old in this study, it was discovered that the ponds surrounding the study site had started to develop white spot syndrome virus (WSSV) diseases, and the water quality had deteriorated, as evidenced by the water's slightly cloudy and brownish color. Adding new water while keeping the existing water in the pond At 68 days, it appears that the shrimp have developed WSSV symptoms, and the disease has begun to spread throughout the site and attack the shrimp. Furthermore, due to a lack of water supply and an increase in salinity, seaweed did not grow optimally, and some of the oysters died. Dolomite is given at a dose of 5 mg/L every day for three days to prevent the rapid development of shrimp disease, with the goal of inhibiting diseases that affect shrimp culture production and stabilizing water quality. Vannamei harvest is done partially, because the pond can not be completely dry. Partial harvest first (72 days) at A was 1253.5 kg, partial harvest second (78 days) was 300.5 kg (total 1,554±2.08 kg per pond), and partial harvest first at B was 697.5 kg, harvest second was 260 kg (total harvest is 957.5±67.66 kg per pond). The production of red tilapia (84 days rearing) in A was 274.57±37,188 kg per pond with an FCR of 1.53±0.035 and B was 253.28±33,372 kg per pond with an FCR of 1.52±0.049. Meanwhile, *G. verrucosa* seaweed and mangrove oysters in this study have their main function as biofilters to filter nutrients N and P so that water quality is well maintained. At the end of the study, seaweed only increased from 367.5 kg (A) and 395 kg (B) to 650 kg (A) and 660 (B). The growth of seaweed in this study was relatively low, this was due to the condition of the pond water starting to turn cloudy and the salinity reaching 38 ppt.

4.3 *Feed nutrient and water quality*

In this study, commercial shrimp and red tilapia feed contained 30% and 26% protein, respectively. This means that 1 kg of shrimp and fish feed contains 310 grams and 260 grams of protein, respectively. Food is required as a source of energy for growth. According to [32], [33], 70-85% of the feed given to shrimp is used for growth and survival as well as excretion and feces, which returns to the culture environment, while the remainder of the feed that is not eaten also becomes organic waste. The availability of feed ingredients and microorganisms, as well as appropriate environmental factors, influence the rate of organic matter decomposition.

Based on the feed requirements for vannamei growth and survival in A and B, each treatment required several pellets of 1,911±6.45 kg and 1,245±48.7 kg, respectively, so the estimated amount of protein from the shrimp feed given was 592.5±2 kg in A and 386±27,27 kg in B. Organic waste from uneaten feed can dissolve and settle to the bottom of the pond, adding organic nutrients to the water. According to [34], [35], the majority of the waste from feed that enters the aquatic environment is in theform of N and P. Meanwhile, According to [22], the N and P content of oysters (*Crassostrea* sp.) is notdirectly absorbed but is first used for plankton growth. Plankton is also used by oysters for growth. Oysters consume food by absorbing and filtering it through their vibrating feathers (filter feeder). Seaweed growth in ponds plays a critical role, particularly in reducing excess N and P nutrients. The absorption of *Gracilaria* sp on P was less than optimal in this study. This is due to the high salinity ofwater in ponds, which can reach 40 ppt, whereas *Gracilaria* sp seaweed can grow optimally in the 15- 25 ppt range. *Gracilaria* sp. can be stressed at high salinity, affecting growth and even morphogenetic development. Furthermore, the high salinity of the seaweed shrinks due to the concentration difference between the fluid inside and outside the cell, forcing the Golgi bodies to balance until they become isotonic. This condition can affect the use of more energy, inhibiting the development of seaweed and visually reducing the callus size of the seaweed.

Organic matter from feed waste can degrade pond water quality. Residual organic waste of feed and excretion or shrimp metabolites during cultivation contributed to the increase in total ammonia nitrogen [35]. Organic waste from excretory feed can become nutrients after the nitrification process carried out by microbes to be converted into ammonia, nitrite, and nitrate, which then become nutrients that are utilized by seaweed and plankton growth. According to [28], [36], an ammonia content of less than 0.1 mg/L is still quite safe for shrimp life. The low nitrate content in these ponds is thought to be due to nitrate use by plankton and seaweed or other aquatic plants containing chlorophyll. Nitrate concentrations greater than 250 mg/L may affect shrimp life. The following information is obtained from a factor analysis of nutrient distribution that plays a role in determining the quality of pond water during cultivation: In treatment A, the analysis of factors with eigenvalues >1 explained that the quality of pond water was comprised of two main components, namely the first component, which affected TAN, NO_3^-, and TOM by 46.82%, and the second component, which affected PO_4^{2-} and NO_2^- by 31.25%. Meanwhile, treatment B with an obtained eigenvalue of >1 can explain that the quality of pondwater is comprised of two main components, namely the first component, which influences TOM, PO_4^{2},and TAN by 60.44%, and the second component, which influences NO_2^- and NO_3^- by 21.24%.

5 Conclusion

In idle ponds, semi-intensive and integrated vannamei cultivation can increase productivity. Pond productivity in Treatment A produces up to 1,554±2.08 kg per pond with a survival rate of 61.39±2,426 % and red tilapia up to 274.57±37.188 kg per pond with a survival rate of 63.86±4.638 %. Treatment B produces vannamei up to 957.56±67.660 kg per pond with a survival rate of 68.83±8.867% and red tilapia of 253.28±33.372 kg per pond with a survival rate of 59.60±607.071%.

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THE 3rd INTERNATIONAL CONFERENCE ON FISHERIES AND MARINE (ICFM-3)
FISHERIES AND MARINE SCIENCE FACULTY
KHAIRUN UNIVERSITY

Sekretariat : Building FPiK 2nd Floor Jalan Yusuf Abdulrahman, Kelurahan Gambesi
Kota Ternate Selatan Maluku Utara Kotak Pos 53 Ternate Kode Pos 97719
Telp.(0921) 3110907, Email: fpik@unkhair.ac.id

Ternate, 27 December 2022

Reff. No. : 055/ICFM-III/FPIK-U/KS/XII/2022

Subject : **Letter of Acceptance**

To : All Presenters and Authors

Dear,

Thank you for your participation in the **3rd International Conference on Fisheries and Marine 2022 (ICFM-3)**. On behalf the Organizing Committee and Scientific Committee, it is our pleasure to inform you that your scientific papers as attached have been accepted for publication after going through peer review process by professional experts in the related fields**.** All the paper**s** had been submitted to the IOP Publisher on 23rd August, 2022 for publishing in IOP Conference Series: Earth and Environmental Science, indexing by Scopus.

This letter is prepared to be used as necessary.

Best regards,
3rd ICFM Committee Chair,

Dr. Najamuddin, S.T., M.Si

THE 3rd INTERNATIONAL CONFERENCE
ON FISHERIES AND MARINE (ICFM-3)
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Telp.(0921) 3110907, Email: fpik@unkhair.ac.id

Attachment Letter Refference Number : 055/ICFM-III/FPIK-U/KS/XII/2022

LIST OF PAPERS HAD BEEN SUBMITTED TO THE IOP: EES PUBLISHING

No	Author	Subject Field	Title	Remark
1	Asep S Budiman et al	Oceanography	On detection of eddies in the South of Java using AMEDA	Submitted to Pubisher
2	Ikbal Marus et al	Marine Concervation	Analysis of the current condition of mangrove forest vegetation due to anthropogenic activities	Submitted to Pubisher
3	Cindy Rahmadhani Wirhardjo et al	Oceanography	Analysis of changes in the bottom profile of the waters surrounding the Kendari Bay Bridge in Southeast Sulawesi Province before and after its construction	Submitted to Pubisher
4	Tirtadanu et al	Capture Fisheries	Population distribution and management implications of some economical demersal fish in Arafura Sea	Submitted to Pubisher
5	Adi Purwandana	Oceanography	Internal solitary waves of the Ombai Strait, Indonesia	Submitted to Pubisher
6	Jeszy NA & Tarya	Oceanography	Spatio-temporal of macro and meso marine debris in Manado Bay, Sulawesi Utara	Submitted to Pubisher
7	Mochamad FA Ismail et al	Oceanography	The tropical eastern Indian Ocean marine heatwaves: Patterns and trends over 30 years	Submitted to Pubisher
8	Riesti Triyanti et al	Capture Fisheries	Risk mitigation of the utilization of fish aggregating devices (FADs) in the fishing business	Submitted to Pubisher

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Kota Ternate Selatan Maluku Utara Kotak Pos 53 Ternate Kode Pos 97719
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106	Zulhan A Harahap et al	Oceanography	Use of satellite data and drone mapping for observing sea level rise in North Maluku Province: A preliminary report	Submitted to Pubisher
107	Nurjanna Adam et al	Capture Fisheries	Tongkol fishing season prediction for North Maluku	Submitted to Pubisher
108	Dewi Syahidah & Leigh Owens	Marine Biotechnology	DNA extraction columns give false-positive PCRfor Cherax quadricarinatus Aquambidensovirus from Sf9 cells	Submitted to Pubisher
109	Anna Fauziah et al	Marine Concervation	Rehabilitation of coral reef ecosystem in northern waters of East Java	Submitted to Pubisher
110	Edward & Helfinalis	Marine Pollution	Review on heavy metals content in sediment of Makasar Straits (1999 2003 2004)	Submitted to Pubisher
111	Muhammad Irfan et al	Aquaculture	Effect of water depth on weight growth of seaweed Sargassum duplicatum using the net bag method	Submitted to Pubisher
112	Rachman Syah et al	Aquaculture	Application of Recirculation System in High-Density Vannamei Shrimp Culture for a Household Scale	Submitted to Pubisher
113	Brata Pantjara et al	Aquaculture	Utilization of Idle Ponds for Semi-Intensive Vannamei (Litopenaeus vannamei) Cultivation Integrated with Red Tilapia (Oreochromis niloticus), Seaweed (Gracilaria verrucosa), and Oysters (Crassostrea iredalei) in Mamuju, West Sulawesi	Submitted to Pubisher
114	Erna Ratnawati et al	Marine Concervation	Socio-Demographic Characteristics and Economic Analysis of Silvofishery Ponds in Tabalar District, Berau Regency, East Kalimantan Province	Submitted to Pubisher
115	Ruzkiah Asaf et al	Marine Technology	The Effect of Tidal Sea Water on Chlorophyll Concentration as a Source of Phytoplankton Nutrients to Support Floating Net Cage Cultivation Technology	Submitted to Pubisher

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116	Faishal Z Abdullah et al	Aquaculture	Agarolytic Bacterium, Bacillus sp. FRAgK1, Isolated from Gracilaria (Rhodophyta) Thallus as Probiotic Candidate for Abalone Culture	Submitted to Pubisher
117	M Hadziq Qulubi et al	Aquaculture	The Addition of Kepok Banana (Musa paradisiaca formatypica) Peel Wheat As Prebiotic of Sangkuriang Catfish (Clarias gariepinus) Performa Growth	Submitted to Pubisher
118	Asni Anwar et al	Aquaculture	Application of Bacillus sp. isolation result on improving growth performance of various cultivating organisms on marginal land	Submitted to Pubisher
119	Tumpak Sidabutar et al	Marine Concervation	Current status of harmful algal bloom events in Indonesian coastal waters	Submitted to Pubisher
120	Agus Setyawan	Aquaculture	Enhancing non-specific immune response of Litopenaeus vannamei (Boone 1931) by supplementation of Sargassum sp. alginic acid from Lampung waters	Submitted to Pubisher
121	Djamhuriyah S Said et al	Marine Concervation	Reproductive Aspects of endangered endemic fish Oryzias woworae Parenty & Hadyati, 2010 in Ex-situ Habitat	Submitted to Pubisher
122	Syahroma Husni Nasution and I Akhdiana	Marine Concervation	Length-weight relationship and condition factor of endemic fish Opudi (Telmatherina antoniae, Kottelat, 1991) in Lake Matano and Meopudi River, South Sulawesi, Indonesia	Submitted to Pubisher
123	Bayu Prayudha et al	Marine Technology	The application of AMMI (Automatic Mangrove Map and Index) to Monitor the Retrogressive Mangroves Chronologically in the Mahakam Delta, East Kalimantan, from 1988 to 2020	Submitted to Pubisher
124	Marsya J Rugebregt et al	Marine Concervation	Existing conditions of Lola Merah (Trochus niloticus) in Maluku: A Review	Submitted to Pubisher
125	Wahyu Budi Setyawan	Marine Concervation	Mangrove ecosystem in Inner Ambon Bay, Ambon Island, Indonesia: Current condition and what will happen if the sea level rises in the future	Submitted to Pubisher

LIST OF PRESENTER IN ROOM 3.1 (Aquaculture)

MODERATOR : Dr. Gamal M. Samadan, M.Si

NO	FULL NAME	INSTITUTION	PAPER TITLE
1	Deni Radona	Research Institute for Freshwater Aquaculture and Fisheries Extension	Growth, survival and physiological responses of domesticated Asian redtail catfish (Hemibragus nemurus Valenciennes, 1840) larvae reared at various temperatures
2	Tridjoko	Balai Besar Riset Budidaya Laut dan Penyuluhan Perikanan	Management of germplasm from selection results of humpback grouper and coral trout grouper
3	Agus Setyawan	faculty of Agriculture, University of Lampung	Enhancing nonspecific immune response of Litopenaeus vannamei (Boone 1931) by supplementation of Sargassum sp. alginic acid from Lampung waters
4	Andi Sahrijanna	BRPBAPPP	MONITORING OF WATER QUALITY AND PLANKTON COMPOSITION IN POLYCULTURE OF WINDU SHRIMP, AGILE TILAPIA AND SEAWEED (Gracilaria sp)
5	HIDAYAT SURYANTO SUWOYO	Research Institute for Coastal Aquaculture and Fisheries Extension	Application of Inorganic Fertilizer Combination with Various Kinds of Organic Fertilizer in Nursery Phase of White Shrimp (Litopenaeus vannamei)
6	Herlinah, S.Pi.MP.	Research Institute for Brackishwater Aquaculture and Fisheries Exstension	THE EFFECT OF HERBAL EXTRACT INJECTION ON THE SUCCESS OF PRE-MATING MOLT AND MATING OF IMMATURE FEMALE MUD CRAB (Scylla tranquebarica) REARED INDIVIDUALLY
7	SAHABUDDIN	Research Institute for Coastal Aquaculture and Fisheries Extension	Application of effective growing season patterns for cultivation Rice and tiger shrimp on brackishwater intruded land
8	Drs. Gunarto MS	Fisheries Research Center, National Research and Innovation Agency, Maros, 90512 South Sulawesi Indonesia	EFFECT OF DIFFERENT SALINITY LEVELS ON MEGALOPA Scylla tranquebarica (Fabricius, 1798) REARING TO THE CRABLET PRODUCTION
9	BRATA PANTJARA	Center of Fisheries Research, National Research and Innovation Agency	Utilization of Idle Ponds for Semi-Intensive Vannamei Cultivation Integrated with Red Tilapia, Seaweed, and Mangrove Oysters in Mamuju, West Sulawesi
10	bejo slamet	BRIN	Cage culture of scalloped spiny lobster, Panulirus homarus (Linnaeus 1758) in different location at Gilimanuk Bay, Bali, Indonesia
11	Endang Susianingsih	Research Institute For Coastal Aquaculter and Fisheries Extention	Used of Probiotics, Herbal Mangrove and Microalgae For Disease Prevention Alternative in Tiger Shrimp Culture