The Effect of Seaweed Stocking Density on the Growth of Vannamei Shrimps in Polyculture of Shrimp and Seaweed

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The Effect of Seaweed Stocking Density On the Growth of Vannamei Shrimp in Polyculture of Shrimp and Seaweed

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ABSTRACT

Istiyanto Samidjan, Yohannes Hutabarat, Diana Rachmawati, and Vivi Endar Herawati. 2019. The Effect of Seaweed Stocking Density On the Growth of Vannamei Shrimp in Polyculture of Shrimp and Seaweed. *Aquacultura Indonesiana*, 20 (2): 1-15. The research objective was to determine the growth of vannamei shrimp, seaweed, and phytoplankton abundance in the cultivation of vannamei shrimp and seaweed culture. The research method was a completely randomized design with 4 treatments and 3 replications namely T1 (10V + 10 cm RL): given 10 seeds / m^2 white shrimp and seaweed 10 cm spacing, T2 (10V + 20RL) = 10 seed / m^2 white shrimp and seaweed planting distance of 20 cm, T3 (10V + 30RL) = 10 seed / m^2 white shrimp and seaweed distance 30 cm, T4 (10V + 40RL) = given 10 seed / m^2 white shrimp vannamei and seaweed plant distance 40 cm, and observed abundance of plankton used sample collected (April-August 2018) from site (T1), (T2), (T3) and (T4) of this penculture pond. The weight of *Gracillaria* sp 150 g / to treatment with the long line system was placed around the plot of waring area of 1 m^2 in the pen culture pond area of 300 m^2. The treatment were T1 (10 post larvae 10 of white shrimp to add 150 gr seawed distance planting are 20 cm per m^2), T2(10 post larvae 10 of white shrimp to add 150 gr seaweed distance planting are 20 cm per m^2). T3(10 post larvae 10 of white shrimp to add 150 gr seaweed distance planting are 30 cm per m^2),T2 (10 post larvae 10 of white shrimp to add 150 gr seaweed distance planting are 20 cm per m^2), each with 3 replication and the stoking density of vannamei shrimp was 10 individual post larvae 10/m^2. Polyculture of vannamei shrimp and seaweed was carried out for five month, in pond measuring 300 m^2 each. Data collection included as follows absolute weight growth, survival, FCR, and water quality data (temperature, salinity, pH, O_2, NO_2, NH_3). Seaweed weight sampling, length and weight of individual shrimp, number of shrimp survive, and plankton density every weeks, and water quality were carried out every two weeks. Data were analyzed for variance and to find out the middle values between treatments, Tukey Test analysis was performed. The results showed that the presence of white shrimp and seaweed polyculture engineering at different plant distance had a significant effect ($P < 0.05$), on growth and survival and effected community structure and abundance of phytoplankton. The highest absolute weight growth in white shrimp (*L. vannamei* (g) on T4 (27.53 ± 0.04 g), white shrimp survival (90.25%), white shrimp of FCR (FCR = 1.19 ± 0.05^b), and also on seaweed *Gracillaria verocosa* on T4 has the highest growth of absolute weight of seaweed (*G.verocosa*) (g), namely 2905.05 ± 7.5^b, survival of T4 seaweed (93.33 ± 0.25% and abundance of phytoplankton.

Keywords: White shrimp; seaweed; polyculture; phytoplankton.

Introduction

The current condition of aquaculture on the north coast of Central Java (Pekalongan) and its environs many affected by sea water or exposed to sea abrasion so that many ponds are inundated by sea water and some are eroded by water until the ponds are inundated by sea water (Miroslav, *et al*, 2011, Marine and Fisheries Agency of Central Java Province, 2004 Yuvaraj, R. *Et al*.2015). Kandang Panjang Village, North Pekalongan Subdistrict, Central Java Province also has many ponds that have been affected by drowning and sinking. One solution is to find the right technology for vannamei shrimp cultivation by engineering vannamei shrimp polyculture technology and seaweed.

Technological innovation of vannamei shrimp and seaweed polyculture by regulating the spacing of seaweed and controlling fito plankton will increase the production of vannamei shrimp and seaweed. The findings of this enginering of polluting technology are needed to increase the growth and production of vannamei shrimp and seaweed. Current conditions indicate that the mortality of vannamei shrimp and seaweed which are maintained in high mortality polyculture reaches 80 to 90% (Istiyanto, *et al*. 2012, Endrawati *et al*. 2001. Suyono *et al*. (2010) suggests that to overcome the problem. This research can be carried out in relation to ponds which are subjected to sea abrasion, so that the floating ponds (*bero*) are not utilized. One of them is the application of culture technology based on culture pens to overcome the disaster of ponds affected by abrasion. Pekalongan city is partly affected by sea abrasion. can not be used for the cultivation of vannamei shrimp and seaweed. Pekalongan City is located in Central Java Province, where Central Java is very potential for the development of vannamei shrimp products, and seaweed with polyculture cultivation systems, because it has good freshwater and sea water resources, aquaculture ponds, *bero* ponds and unprocessed land for the cultivation of vannamei shrimp and seaweed (*Gracylaria* sp), it is still widely open. This is in accordance with the Central Java basic data information in figures (2018) in the Fisheries Sub-Sector covering business activities of Marine Fisheries and Inland Fisheries. In Inland Fisheries Activities Production generated from Fisheries activities in 2003 in Central Java reached 339 thousand tons with a value of down by 15.83 percent and 18.16 percent. The existing fishery production was dominated by marine fisheries of 236.24 thousand tons (around 74 percent of the total fishery production) with a value of 0.77 trillion rupiah. In 2003 the business of aquaculture and fisheries in public waters in Central Java both production and production values experienced an increase if compared to the previous year.

Polyculture research was developed again by Istiyanto *et al* (2015) on the hilink program in the city of Pekalongan with the concept of engineering polyculture-based cultivation technology with agrominapolitan systems to produce fisheries products sustainably clustered at certain locations so that their development is more focused and specific supported by marine tourism. this concept develops the concept of namely the concept of developing a small city as a center and supported by several surrounding rural areas with an economic driving sector from agriculture, fisheries. This theory is seen as a solution to attract urban agglomerations from the metropolitan area. But agropolitan was designed at a certain carrying capacity, with a small city size. After carrying capacity is exceeded, the agropolitan area becomes uneconomical and urbanization is expected to stop. In short, the agropolitan dimension at that time was imagined as a small town (the size of the population was around 10-25 thousand inhabitants), plus several sub-districts around it (on the commuting radius) with a distance of about 5-10 km from the city center. The main commodity to drive the regional economy is the agriculture / fisheries sector. Thus, an agropolitan area will have a population dimension of between 50 - 150 thousand people (Effendie, 1979, Istiyanto, 2001, Istiyanto, 2000, Istiyanto. 2008).

The aim of the study was to examine the effect of vannamei shrimp polyculture engineering, and seaweed at different spacing in an effort to improve the growth and survival of vannamei and seaweed shrimp and control the abundance of phytoplankton.

Research Methods

Material

The animal studied are vannamei shrimp type with initial weight of vannamei shrimp 1.79 ± 0.025 gr and *Gracillaria* sp. seaweed weighing 150 g / bunch. Artificial feed used with 35% protein content, amount of feed givenas much as 3% perbiomas per day. Engineering technology was manipulated to adjust the density of vannamei shrimp 10 individual fish / m^2, and different distance on seaweed (10 cm, 20 cm, 30 cm and 40 cm). The location was planted owned from April to August 2018).

Research methods

The experimental method used a completely randomized design with 4 treatments and 3 replications namely this method developed from the method (Istiyanto *et al*. 2018, Davis, 2011, Yang and itzsimmons. 2002) with experimental research using a completely randomized design with 4 treatments and 3 replications namely T1 (10V + 10 cm R): given 10 seeds / m^2 vannamei shrimp and seaweed 10 cm spacing, T2 (10V + 20RL) = 10 fish / m^2 vannamei shrimp and given seaweed 20 cm spacing, T3 (10V + 30RL) = 10 fish / m^2 vannamei shrimp and given seaweed with a spacing of 30 cm, T4 (10V + 40RL) = given 10 fish / m^2 vannamei shrimp and seaweed with a spacing of 40 cm), and also observed plankton abundance. Seaweed seed weight used by *Gracillaria* sp 150 g / bunch with plant spacing according to treatment with the long line system was placed around the plot of waring area of 1 m^2 in the pen culture pond area of 300 m^2.The data obtained are the data of absolute weight growth, survival, FCR, and water quality data (temperature, salinity, pH, O_2, NO_2, NH_3). Data were analyzed by analysis of variance (F test), and to determine the middle value between treatments, Tukey Test analysis was carried out.

The research location was in the pond owned by Mr. Miftahudin, the chairman of Pokdakan Muara Rejeki in the Kandang Panjang sub-district, Pekalongan City, Central Java, from April to August 2018.

Data obtained by absolute weight growth, survival, and FCR

Growth

a. Absolute weight growth

Absolute growth in this study can be calculated using the Steffens (1989) formula as follows:

$$W = W_t - W_0$$

Information :
W = Absolute Weight Growth (g)
W_0 = Weight of test animals at the beginning of the study (g)
W_t = Weight of test animals at the end of the study (g)

b. Feed Conversion Ratio (FCR)

Feed conversion can be calculated by the Tacon (1987) formula, namely:

$$FCR = \frac{F}{(Wt+d)-W0}$$

Information :
FCR = Food Conversion Ratio
Wt = white shrimp vannamei weight at the end of the study (g)
Wo = white srimp Vannamei weight at the beginning of the study (g)
F = The amount of food consumed (g)

c. Life

Life expectancy (SR) was calculated to determine the mortality rate of test animals during the study, survival can be calculated based on Effendi (1997) formula as follows:

$$SR = \frac{N_t}{N_0} \times 100\%$$

Information :
SR = Life (%)
N0 = Number of test animals at the beginning of the study (tail)
Nt = Number of test animals at the end of the study (tail)

d. Plankton abundance

Type of diversity index (H ')

Species diversity describes the wealth and distribution of collections of phytoplankton in a community. The diversity of species within a community expressed in one of the most common ways for marine ecological research is to use Shannon Wiener's richness index derived from information theory and aim to measure order and disorder (Smith, 1982, Krebs , 1989) namely:

$$\text{Shannon Index –Wiener: } H' = -\sum_{i=1}^{s} (\text{Log pi 2 pi})$$

That is :

Pi = Comparison between the number of types of individuals to i and the total number individual (ni / N)
s = number of species.

Shannon-Wiener diversity index values between 0 to ~ with the following criteria:
H '<3.2, small population diversity.
3.2 <H, <9.9 diversity of moderate population.
H '>9.9, large population diversity

Type similarity

Type uniformity is the composition of each type found in the community (Krebs, 1989). Type uniformity is obtained by comparing the diversity index with its maximum value, namely: Type similarity index (E), $E = H_1 / H_{1 max}$

where:

H_1 = Shannon-Wiener diversity index.
$H_{1\ max}$ = Log^2 s = maximum diversity index
S = number of species.

The uniformity value of a population ranges from 0-1 with the following criteria:
E <0.4 : Balance of small population.
0.4 <E <0.6 : Balance of moderate population .
E> 0.6 : Large population balance.

Dominance Type

This type of dominance is used to obtain information about the types of organisms that dominate a community in each habitat, because in the community not all types of organisms have an equally important role in determining the nature of the requirements of the community.

Results and Discussion

Research result

The results showed that the engineering of white shrimp vannamei and seaweed polyculture at different spacing significantly affected (P <0.05), on growth and survival and affected community structure and abundance of fito plankton. Furthermore, we obtained the absolute weight growth of Vannamei shrimp (*L. vannamei* (g) on T4 (10V + 40RL) = given 10 fish / m^2 vannamei shrimp and seaweed with a spacing of 40 cm was (27.53 ± 0.04 g), Vannamei shrimp life (90.25%), Vannamei shrimp FCR (FCR = 1.19 ± 0.05b), as well as seaweed *G.verocosa* on the highest T4 growth of absolute weight of seaweed (*G. verocosa*) (g), namely 2905.05 ± 7.5^b and survival rate T4 (93.33 ± 0.25% (Table 1)

Absolute weight growth of Vannamei shrimp

Based on the results of the research analyzed the diversity (F test), showed a very real effect (P <0.01) on absolute weight growth, this shows that the effect of feed given artificial feed with a protein content of 35% showed a very real effect, while based on the test Tukey'S showed a very significant difference. Growth of absolute weight in the highest vannamei shrimp was at T4 (white shrimp vannamei T4 (27.53 ± 0.04 g), (Table.1).

Absolute weight growth of seaweed

On the results of the research analyzed the diversity (F test), showed a very real effect (P <0.01) on the growth of absolute weight of seaweed, with the Tukey's test showed the difference in the middle value of T4-T3, T4-T2, T4-T1 is significantly different (P <0.05). Furthermore from Table.1, also shows that the cultivation system of vannamei shrimp polyculture with seaweed at different plant spacing with the highest absolute weight growth of *Gracillaria sp* T4 (10V + 40RL) 2905.05 ± 7.5b g seaweed (Table.1).

Survival rate of white shrimp vannamei

Based on the results of the study showed that the highest survival of vannamei shrimp in T4 treatment was (90.25 ± 0.25a%), (Table 1).

Furthermore, based on the results of the analysis of variance showed a very real effect (P <0.01) on the survival of vannamei shrimp.

Furthermore from Table .1 shows that the difference in density in vannamei shrimp and seaweed with polyculture cultivation system showed a very significant effect on the survival of vannamei shrimp (P <0.01), then Tukey's test showed a significant difference between treatment were T4-T3, T4-T2, T4-T1.

Survival rate of seaweed

Then from the results of research using polyculture technology with simultaneous maintenance of vannamei shrimp with seaweed at different plant spacing based on artificial feed and the role of seaweed as a biofilter system showed that the highest survival rate in T4 treatment was seaweed which was 93.33 ± 0.25. Furthermore, from the results of the study presented in Table 1, the analysis of the variance in the presence of vannamei shrimp polyculture with seaweed at different spacing showed a very significant effect on the survival of seaweed ($P < 0.01$). Furthermore, with the Tukey'S test showed significant differences between treatments T4-T3, T4-T2, T4-T1.

Food Conversion Ratio (FCR)

The results showed that the lowest food conversion ratio in T4 treatment was FCR (food conversion ratio), namely 1.15 ± 0.09^{b} ,Present the observation in each sampling period every week, the amount of feed given to each treatment,initial weight and weight of the harvest (Table.1). The results of the analysis of variance showed a very significant effect ($P < 0.01$) on feeconversionratio (FCR) on vanamei shrimp. 93.33 ± 0.25%.

The abundance of fitoplankton

Vaname shrimp polyculture with seaweed at different spacing can influence the abundance of fito plankton showing good community structure because of the H value, high diversity index, low dominance value and good compatibility value (see table. 2.3.). by observing phytoplankton in aquaculture systems of vaname shrimp and seaweed at different plant spacing producing 26 genera of plankton consisting of 10 genera of phyto plankton found 4 classes, namely Bacillariophyceae consisting of 8 genera, Chlorophyceae 1 genera, Cyanophyceae 1 genera and Dinophyceae 1 genera, both in treatments T1, T2, T3 and T4 (10V + 40RL) = given 10 fish / m^2vanamei shrimp and seaweed with a spacing of 40 cm), (Table 2.3)

Water quality of maintenance media in polyculture cultivation technology

Monitoring during the study showed that the water quality was feasible for polyculture cultivation of vaname shrimp and seaweed technology at different planting distances from the polyculture system (Table.4), because it uses a biofilter system by filtering water quality in the inlet and out let using seaweed (Table .4).

Table.1. Absolute weight growth of Vannamei shrimp (*L. vannamei* (g), seaweed (*Gracilariaverocosa*) (g, Survival of Vannamei shrimp (%) and seaweed and Vannamei shrimp FCR

t	Treatment			
	T1 (10V+10RL)	T2 (10V+20RL)	T3 (10V+30RL)	T4 (10V+40RL)
Absolute weight growth of Vannamei shrimp (*L. vannamei*) (g)	21.97±0.24[c]	22.91±0.10[b]	24.41±0.19[b]	27.53 ±0.04[a]
Absolute weight growth of seaweed (*Gracilaria verocosa*) (g)	2518.03±6.8[bc]	2715.03±6.6[b]	2817.03±8.7[bb]	2905.05±7.5[a]
Survival rate of white shrimp (%)	75.25±0.55[c]	85.25±1.95[b]	87.75±1.79[b]	90.25±0.25[a]
Survival rate of seaweed (%)	70.75±2.93[c]	80.25±1.15[b]	85.75±1.83[b]	93.33±0.25[a]
FCR white shrimp	3.15±0.05[a]	2.35±0.15[a]	1.87±0.85[b]	1.19±0.05[a]

Table. 2 Plankton genus consisting of phytoplankton observed during the study on vannamei shrimp and seaweed polyculture (*G verocosa*)

Treatment	phytoplankton type (genera)
T1 (10V+15RL)	Ceratium, Coscinodiscus, Baderistrum, Chaetoceros, Geotrichia, Navicula, Odontella, Oscillatoria, Pleurosigma,
T2 (10V+30RL)	Chaetoceros, Ceratium, Coscinodiscus, Baderistrum, Geotrichia, Navicula, Odontella, Oscillatoria,Thallasionema
T3 (10V+45RL)	Coscinodiscus, Geotrichia, Navicula, Baderistrum, Chaetoceros, Ceratium, Pleurosigma, Thallasionema
T4 (10V+60RL)	Baderistrum, Oscillatoria, Pleurosigma, Thallasionema Chaetoceros, Ceratium, Coscinodiscus, Geotrichia, Navicula,Odontella,

information :
4 treatments and 3 replications namely T1 (10V + 10 cm R): given 10 seeds / m^2 vannamei shrimp and seaweed 10 cm spacing, T2 (10V + 20RL) = 10 tails / m^2 vannamei shrimp and given seaweed plant spacing 20 cm, T3 (10V + 30RL) = 10 heads / m^2 vannamei shrimp and given seaweed with a spacing of 30 cm, T4 (10V + 40RL) = given 10 heads / m^2 vannamei shrimp and seaweed with a spacing of 40 cm),

Table.3. Number of individuals and genus as well as diversity index (H '), uniformity (E) and dominance (D) phytoplankton in the cultivation of Vannamei shrimp and seaweed polyculture (*Gracillariaverocosa*)

Treatment	Number of individuals (ind / L)	indeks		
		Diversity (H')	Similarity (E)	Dominance (D)
T1 (10V+15RL)	112	1.093	0.765	0.725
T2 (10V+30RL)	115	1.072	0.753	0.606
T3 (10V+45RL)	119	1.804	0.785	0.595
T4 (10V+60RL)	129	1.907	0.895	0.578
Rerata	118.75	1.469	0.7995	0.626

Table. 4. Water quality data resulting from the use of biofilter systems a spacing of 40 cm

Water Quality Parameter	Range	References
Oxygen disolved (mg/l)	5,25 – 6,75	>4 mg/l [a,b]
Temperature (^{0}C)	26,5 – 29,5	26,5 – 35 ^{0}C [c,d]
Salinity (ppt)	20.5 – 28,5	15 – 30[c,d]
pH	7.5 – 8,5	7,5 – 8,7 [c,d]
PO4-P (mg/L)	0.078-2.981	0.27-5.51[f]
BOT (mg/L)	32.075-49.75	
Ammonia (mg/l)	0.01– 0,15	<1 mg/l[c,d,e]
Transparency (À1 cm–1)	21	60–80[a, b,g]
N-O3 (mg L–1)	0.0–1.45	

Legend: (Nurjana.2007a, Kanazawa, 1985b, Kurmaly, 1995c, Kanazawa, 1985d, Boyd *et al.* 1982e)., F) Widjaya*et al*. 1994, Davis, J. 2011g.

Discussion

Based on the results of variance analysis showed that there was a very significant effect on the growth of absolute weights of vannamei shrimp (P <0.01), and with the Tukey's test showed a significant difference between the treatment of T4-T3, T4-T2, T4-T1. The difference in difference between the treatment of middle values shows that the application of vanamei shrimp and seaweed polyculture technology at different spacing can increase the different growth of vanamei shrimp and be able to increase growth and improve environmentally friendly farming environment. This is supported by the opinion of Istiyanto *et al* (2018), Hepher and Pragini (1981), Istiyanto (2008), Murachman, *et al*. (2010), Makwinja. And Kapute. (2015), Istiyanto, (2000) that with the application of artificial feed engineering enriched with probiotics, a dose of 10 ml / liter of artificial feed probiotics (positive properties) is sprayed on artificial feed (40% protein content) to increase the power of the farm to improve quality and vanamei shrimp production, sprayed on feed with 35% protein content and environmental improvement using system biofilter (on inlet and outlat given *Gracillaria* sp) with spacing between seaweed strands, able to improve the water quality environment and accelerate the growth of vannamei shrimp, because it is able to utilize feed well. This is consistent with the opinion of Istiyanto and Rachmawati (2018) Mangampa, and Burhanuddin. (2014), Hepher, (1988), Huet (1971), Furnichi, (1988), Akiyama, *et al* (1991), Bautista (1986), the Agency for the Assessment and Application Technologist (2007) .bahwa with shrimp polyculturevaname and milkfish can improve growth well, because both species do not compete in space, feed, and are able to grow both well by giving probiotic battery probiotics such as *Lactobacillus* sp, *Bacillus* sp. growing, artificial feed systems enriched with probiotics can help digestion. feed and absorb nutrients feed more efficiently and the role of seaweed synergistically acts as a good system biofilter.

This is also reinforced by the opinion of Huet (1971), Istiyanto*et al* (2012), Halver, (1980), Akegbejo and Samsons (1999 Boyd, *et al*. (1982), De Silva and Anderson (1995), Porchas, *et al*. (2010) suggested that physical growth occurs with changes in the number or size of cells making up body tissues, morphologically growth can be seen from changes in body shape, increase in cells and tissue, and weight. Growth will occur if the energy requirements for metabolism and maintenance of body tissues have been fulfilled according to fish needs (Hepher, 1988, Yuvaraj*et al*.2015) (see Table.1,).

Furthermore, from the difference in growth with the difference in the level of density of vannamei shrimp seeds and milkfish and seaweed seeds stocked with polyculture maintenance. This good growth is due to artificial feed which has a good nutritional content in the feed that is 35% protein content so that it will accelerate growth well. This shows that compared with other researchers at the same time maintenance is higher growth (Murachman, *et al*.2010, Mangampa and Burhanuddin. 2014).

There is a very real influence because of the use of artificial feed which contains high nutrient feed according to their needs and the role of seaweed as and the spacing of different seaweed and seaweed which has another role as a biofilter system by installing *Gracillaria* sp seaweed around the culture pen in the maintenance of vannamei shrimp with polyculture seaweed this can improve water quality and can improve the survival of vannamei shrimp (Istiyanto and Rachmawati, 2016, He and Liv. 1992, Kanazawa, 1985, Kurmaly, 1995, Nurjana, 2007, Steffens. 1989, Stickney, 1979, Yang. And Fitzsimmons. 2002, Davis, 2011, Xie, Jiang and Yang. 2011, Istiyanto*et al*. 2012) Good water quality in milkfish and vanamei shrimp polyculture cultivation could increase to 80-90%, these results lower when compared with the results of the study on T4 treatment (20 stocking density of milkfish and 20 Vana shrimp shrimp fries me / m2) with the result of survival 96.71 ± 0.85c%. This opinion is also strengthened by other researchers who maintain milkfish with vanamei shrimp polyculture system by Istiyanto*et al*. (2009,2016)

This shows that the influence of the environment is the use of Gracillariasp onmaintenance of polyculture and vannamei shrimp and seaweed at different spacing can improve water quality, because *Gracillaria s*p type seaweed is able to absorb suspended solids, organic waste, suspended solids so that the water quality is better and more feasible. The results showed that in polyculture with 10 fish / m^2 vanamei shrimp and seaweed with a spacing of 40 cm) (T4) produced the highest survival rate of 93.25 ± 0.57a%. This high survival rate is because the spacing of seaweed is very effective in increasing the best survival (Istiyanto. 2009, Reksono, *et al*. 2012, Nikolova, 2013, Yasin, 2013, Tacon. 1987. Amal, *et al*. 2008, Ibrahim. 2008, Aslam, *et al*. 2009, Dosu, *et al*. 2007).

The results of the analysis of variance with the difference in vannamei shrimp and seaweed at different plant spacing with the polyculture system had a very significant effect on FCR (P <0.01) and based on the tukey test showed significant differences between the middle values of T4-T3, T4-T2, T4-T1. Then with the difference in vannamei shrimp and seaweed polyculture systems, so that it will affect the difference in consuming food, which causes the FCR value is also different, it can be seen that the FCR value in the T4 treatment is lower 1.19 ± 0.05a meaning that the feed is more efficient, so by utilizing artificial feed given in T3, T2, T1 treatments.

This is consistent with the opinion of Istiyanto*et al*. (2010, 2012, Istiyanto and Rachmawati 2016), Tacon, 1987), Watanabe. 1988, Li, and Dong. 2000, Laxmappa, and Khrisna. 2015, Solomon, et. Al. 2010, Davis, 2011, Yasin, 2013, Jaspe, *et al*.2011, Kanazawa, 1985.

Xie, and H. Yang. 2011, Yang, and Fitzsimmons. 2002, Istiyanto & Rachmawati.2016), stated that the feed conversion ratio is a very important role to see whether the feed given is able to increase the growth of vanamei shrimp and seaweed with better growth or whether the feed is given more efficiently. Feed conversion value can also see how far the feed provided can improve growth better / faster growth

Discussion

Furthermore, the number of individuals obtained in the study is like an average of 118.75 ind / L, then it is seen that the number of species and individuals of fito plankton is relatively higher than that of vanamei shrimp and grass Gracillariaverocosa sea can affect the number of species and the number of individuals toplankton According to Hooker, *et al* (2018), Dolgov and Prokopchuk (2018), Elizondo-Patrone*et al*. (2015), Gamito *et al*. 2017) Karthik and Muthezhilan. (2015), Amin and Mansyur (2011) where the number of species and individuals of plankton is higher than the system of vanamei shrimp cultivation by utilizing biofloc in ponds, namely the number of genera, only 8 genera consisting of 6 genera of phytoplankton and 53 individuals. / L. This is supported by the opinion of José-Gilberto *et al*. (2018) Wang, *et al*. (2016), Yıldız, *et al*. (2017), Zhang-Kai, *et al*, (2015), Ansyur*et al*. (2010) the high percentage of phytoplankton obtained in this study is due to the continuous availability of nutrient elements through feed. The increase in the speed of the number of genus and individuals in this study is the provision of feeding and fertilizer.

Plankton monitoring includes observations of phytoplankton consisting of 10 phytoplankton genera which are dominated by Bacillariophyceae class, 6 genera and other genera from Chlorophyceae 1 genera class, Cyanophyceae 1 genera from Dinophyceae 1 genera. Based on observations of phytoplankton composition in accordance with the growth needs of vanamei shrimp and seaweed (*G.verocosa*) in the cultivation of polyculture systems in ponds. This can be seen from the habit of vanamei shrimp eating phyto plankton especially the Bacillariophyceae class (Abid, *et al*. 2008, Asencio, 201, Jabuschb, *et al*. 2018, Bborey, *et al*. 1982, Elloumi*et al*. 2006, Elloumi*et al*. 2009, Gracia and Gracia, 1985) said that natural food preferred by Vanamei shrimp compared to other classes (). Then from the observations during the study showed that the increase in the abundance of phytoplankton plankton caused by, among others, in the dry season the presence of planktonic genera could increase abundance of certain genera. So isin the rainy season can also increase the abundance of fito plankton genera. The fluctuations of the abundance of phyto plankton genera are influenced by several factors including temperature, pH, concentration of nutrients, light, weather, disease, predation of vaname shrimp and phyto plankton, competence between species, algae toxins (Boyd, 1980). Furthermore, based on observations of abundance of fito plankton, number of genera, and views of biological indices such as diversity, uniformity and dominance can be seen in Table 5.2. Based on the abundance of phyto plankton during the study showed abundance ranging from 107 to 1,264 ind / L has a relatively higher range between phytoplankton abundance in the study of vaname shrimp culture ponds with modular systems (Fabro, *et al* 2016, Gobler*et al*. 2012, Elloumi. *Et al*. 2010, Hemraj, *et al*. 2017, Amin and Tangko, 2010). Due to the low abundance of phito plankton in this study, it was caused at the same time to grow very dense, because nutrient elements are widely used by kleap (Koch *et al*. 2018, Kyu-Kwon H., *et al*. 2018, Legrand*et al*.2016, Odum, 1971, Meerssche, *et al*.2018, Melo-Magalhaes, *et al*. 2011, Nybakken 1992, Maugendre, *et al*. Gunarto, 2008). Based on the results of Selma's observations, research showed that the effect of adding feed on the cultivation of vaname shrimp polyculture system with *G. verocosa* seaweed in ponds had a significant effect (P <0.05).

The influence of vaname shrimp and seaweed polyculture affects the abundance and community structure of fito plankton because as a substitute feed, the role of fito plankton as a feed is shown by the lower abundance of phyto plankton in reducing feed intake than without reducing feed ration (Rajkumar. *Et al*. 2009 ,Nih-Tan S. *et al*.2016, Reynolds, 1989, Nobre*et al*. 2010, Mansyur*et al*. 2010). Yamada (1983) said that feed needed for natural food (fito plankton) and feed needed during enlargement of vaname shrimp and seaweed during maintenance can be predicted from the value of feed conversion ratio (FCR). Likewise the presence of natural food and other feed apart from the feed given will decrease the FCR value, is close to equal to or value 1. This value is due to the use of the type of feed other than artificial feed given artificial feed. The feed provided includes the presence of microorganisms available in ponds, plant material and detritus and flocculants (Table.2).

Based on Table .2. showed that the value of the diversity index in T1 treatment (10V + 10 RL): seed 10 tails / m2 vanamei shrimp and seaweed 10 plant spacing obtained the value of diversity (H '= 1.093), T2 (10V + 20RL) = 10 tails / m2 shrimp vanamei and given seaweed a spacing of 20 cm obtained diversity values (H '= 1,072), T3 (10V + 30RL) = 10 tails / m2 vanamei shrimp and given seaweed with a spacing of 30 cm found the value of diversity (H' = 1,804) and T4 (10V + 40RL) = given 10 heads / m2 of vanamei shrimp and seaweed with a spacing of 40 cm) with a variety of diversity (H '= 1,907). Then from the results of the diversity value on average H '= 1,469, indicating more than H'> 1, meaning that plankton conditions in pond waters are relatively good or the pond conditions are good enough. This value shows the condition of the community (plankton, vaname shrimp and seaweed) with the change in the pond waters environment is quite stable. This is in accordance with Basmi (2000) if the value of H 'diversity <1 then the biota community is declared unstable, if the value of H' ranges between 1-3 then the stability of the biota community is moderate, whereas if the diversity value is H '> 3 then the stability of the biota community concerned is in a very stable condition (prime condition). Furthermore, based on observations of the harmony of the biota, the value of the uniformity index (see table 2) shows that the result is the uniformity index at T1 treatment (10V + 10 RL): seed 10 tails / m2 vanamei shrimp and Seaweed spacing 10 obtained uniformity values (E = 0.765), T2 (10V + 20RL) = 10 tails / m2 vanamei shrimp and given seaweed 20 cm spacing obtained uniformity values (E = 0.606), T3 (10V + 30 RL) = 10 heads / m2 vanamei shrimp and given seaweed with a spacing of 30 cm found uniformity values (E = 0.785) and T4 (10V + 40RL) = given 10 heads / m2 vanamei shrimp and seaweed with a spacing of 40 cm) with supply harmony n (E = 0.895). Based on the value of the genus uniformity index, the average value of E = 0.7995, means that the uniformity of the genus fito plankton is relatively even or said the number of individuals in each genus is relatively the same, the difference is not significant or almost the same. This is supported by the opinion of Ali (1994) if the value of E> 0.75 shows a high uniformity value but vice versa if the value of E is <0.75, the uniformity value in the biota (genus plankton) is low (see Table.3).

Four treatments and 3 replications namely T1 (10V + 10 cm R): given 10 seeds / m^2 vanamei shrimp and seaweed 10 cm spacing, T2 (10V + 20RL) = 10 tails / m^2 vanamei shrimp and given seaweed plant spacing 20 cm, T3 (10V + 30RL) = 10 heads / m^2 vanamei shrimp and given seaweed with a spacing of 30 cm, T4 (10V + 40RL) = given 10 heads / m^2 vanamei shrimp and seaweed withThen from the results of observations (Table.3) the index value of plankton dominance in aquaculture of vaname shrimp and seaweed (*G_verocosa*) aquaculture at T1 (10V + 10 RL) treatment value D = 0.725, T2 dominance value (10V + 20RL, D value = 0.606, T3 (10V + 30RL value D = 00.595 and T4 (10V + 40RL) = dominance value D = 00.578. Based on the dominance value, the average dominance is D = 0.626, this shows the fito plankton community structure in pond waters with a polyculture system vanamei of phyto plankton. Furthermore, we obtained the absolute weight growth of Vannamei shrimp (L. vannamei (g) on T4 (27.53 ± 0.04

shrimp and seaweed (Gracillariaverocosa) there is no genus dominance or in other words there is no genus of phytoplankton that dominates the other genus in the extreme, according to Basmi (2000), plankton conditions in the pond waters suggest the dominance index ranges from 0-1, if approaching zero means that in the community structure of the biota, there is no genus that is dominantly dominating the other genus.

Based on Table .4. showed that with vaname shrimp and seaweed polyculture at different planting distances showed different influences on the quality of media maintenance of vaname shrimp and seaweed, in addition to the use of biofilter systems on water quality management media maintenance of vannamei shrimp and seaweed in polyculture systems produced water quality which is feasible for the maintenance of polyculture systems, and environmentally friendly, because it uses seaweed as a biofilter that is placed in the inlet and out let maintenance plot, and is able to increase survival in vaname shrimp 98.25% ± 2.25a and survival rate seaweed 93.25 ± 0.57a%. Water quality during the study showed dissolved oxygen (4.25 - 5.85 mg / l), temperature (25.5 - 29.5 oC), salinity (19.5 - 27.5 ppt), ammonia (0.02 - 0.15 mg / l). The water quality content shows the feasibility for the maintenance of milkfish and vannamei shrimp in accordance with the opinions (Nurjana. 2007, Kanazawa. 1985, Kurmaly 1985, Davis, 2011)

Conclusion

The results showed that the influence of vannamei shrimp polyculture engineering, and different spacing of seaweed had a very significant effect (P <0.01) on the growth and survival of vannamei shrimp and seaweed and was able to control phyrto plankton so that the community structure was good and well controlled abundance plankton.

The results showed that the engineering of vannamei shrimp and seaweed polyculture at different spacing significantly affected (P <0.05), on growth and survival and affected community structure and abundance

g), Vannamei shrimp life (90.25%), Vannamei shrimp FCR (FCR = 1.19 ± 0.05b), as well as seaweed *G.verocosa* on the highest T4 growth of absolute weight of seaweed (*G.verocosa*) (g), namely 2905.05 ± 7.5[b] and survival rate T4 (93.33 ± 0.25%.

Suggestion

Need for further research on polyculture engineering with environmental manipulation and artificial feed-based feed enriched with protease and vitamin C enzymes with biofilter based environment improvement system to regulate the stocking density of vannamei shrimp 20 tails / m^2 and seaweed spacing 30 cm, 60 cm, and 90 cm.

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