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Effect of different stocking density on the growth performances of white leg shrimp (*Litopenaeus vannamei*) and milkfish (*Chanos chanos*) in polyculture system

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ABSTRACT

Polyculture is a way of cultivating two or more types of organisms in the same container for the purpose of efficient use of land. The purpose of this study was to determine the effect of different stocking densities on the growth of white leg shrimp and milkfish by polyculture and to determine the stocking density that influences the growth of white shrimp and milkfish by polyculture in ponds. The study was designed using a completely randomized design (CRD), consisting of 3 treatments and 3 replications. The results showed that the specific growth rates in the three treatments, both white leg shrimp and milkfish varied. Similarly, the absolute weight growth between white leg shrimp and milkfish. Survival rate of white leg shrimp in treatment C, 85.56%, treatment B, 72.81%, and treatment A, 66.04%. While, the survival rate of milkfish in the three treatments was 100%. The feed conversion ratio in treatment A, 0.43, treatment C, 0.28, and treatment B, 0.17 grams. The different stocking densities of white leg shrimp and milkfish polycultures did not affect the absolute weight growth of white leg shrimp and their specific growth rate. However, there is an effect on the absolute weight growth of milkfish.

Introduction

A polyculture system is a method of keeping two or more species of organisms in the same container in order to maximize land utilization (Putri and Susilowati, 2013). Land-use efficiency and farmer revenue can both benefit from a polyculture agriculture system. Aquaculture technology has advanced to the point that shrimp may be raised in ponds alongside milkfish (Djumanto *et al*., 2018). The creation of polyculture shrimp farming with milkfish aims to boost shrimp and milkfish productivity while also streamlining the usage of ponds in the hopes of increasing the culture environment's quality (Anam 2007).

In some conditions, where output growth is constant, the use of polyculture farming techniques is projected to boost the carrying capacity of pond land. The effects of monoculture farming, when growers may only harvest one commodity at a time. However, with polyculture, crop yields will grow over time while using the same amount of land. This is extremely beneficial to farmers revenue (Syahid *et al*, 2006).

According to (Nurlaela *et al*., 2010; Samadan *et al*., 2018a,b), the higher the stocking density, the lower the growth, since there will be competition for space, dissolved oxygen, and feed, all of which will have an impact on growth. Meanwhile, (Widiastuti, 2009) the condition of the container, which is becoming thicker, might create stress and decrease fish appetite, resulting in slower growth. Furthermore, the accumulation of feed leftovers and fish excrement in

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the container might have an impact on the water quality (Wasielesky *et al.*, 2001). Fish lose their appetite when the water quality is poor. However, because water changes were performed on a regular basis, the water quality in this research was relatively consistent.

Increased stocking density will disturb the physiological processes and behavior of shrimp and fish in relation to space (Sookying *et al.*, 2011), thereby lowering their health and physiological conditions (Silva *et al.*, 2015). As a result of this process, food consumption has decreased (Napaumpaipom *et al.*, 2008), and growth and survival have decreased (Kumar *et al.*, 2015; Faisyal *et al.*, 2016). Meanwhile, if it's too low, space utilization isn't optimal, and productivity suffers as a result. Water quality, feed, and shrimp or fish size are all factors that influence stocking density. The purpose of this study was to see how different stocking densities influenced the growth of whitewashed white shrimp and milkfish maintained in polyculture in ponds, as well as which stocking density affected their growth.

Materials and Methods

Research preparation

This study took place in Porniti Village, Jailolo District, West Halmahera Regency, North Maluku Province, Indonesia, for 45 days. A net with a length of 1 m and a width of 1 m served as the experimental container. The test animals consisted of 270 individuals (PL_{15}) white leg shrimp and 30 fish density with 8-12 cm fish. Commercial pellet feed was utilized as the test feed for raising white leg shrimp and milkfish seeds.

Research Design

This study was carried out utilizing an experimental approach called Completely Randomized Design (CRD). Stocking density was the therapy that was investigated, and it consisted of three treatments that were repeated three times. Treatment A consisted of 50 white leg shrimp and 5 milkfish; treatment B consisted of 30 shrimp and 3 milkfish; and treatment C consisted of 10 shrimp and 2 individual milkfish. White leg shrimp and milkfish seeds are prepared and placed in a hapa-shaped rearing container. Maintenance was performed for 45 days with artificial feed administered five times each day. 5% of body weight should be fed (initial administration of 5 grams). Feeding took place at 7:00 p.m, 11:00 p.m, 15:00 p.m, 17:00 p.m, 21:00 p.m, and 1:00 a.m.

Parameter Measurement

The Hanna water checker was used to measure water quality parameters once a week. temperature, pH, salinity, and dissolved oxygen are all measured directly in the container. The specific growth rate (SGR), absolute weight growth, feed conversion (FCR), and survival were all measured (SR).

The specific growth rate (SGR) is calculated based on the formula (Changboo *et al.*, 2004). The absolute weight growth is calculated based on the formula (Effendie, 1997). Survival (SR) and Feed conversion ratio is calculated using the formula (Zonneveld *et al.*, 1991; Akbar and Fazli, 2023; Melanie *et al.*, 2023).

Data Analysis

The normality of all the measured variables' data was checked. The data was then evaluated using analysis of variance (ANOVA) with a confidence level of 95%. If the therapy had a significant impact, the *Least Significant Difference Test* (LSD) was performed (Zar, 1999). Stat-Cal software version 1.0 was used to analyze the data. The characteristics of water quality were descriptively assessed and provided in tabular form.

Results

During the experiment, the response of stocking density on growth and specific growth rate of white leg shrimp and milkfish indicated variations in each treatment.

Specific growth rate (SGR) of white leg shrimp and milkfish

The specific growth rate of white leg shrimp during the rearing period is presented in Figure 1 below.

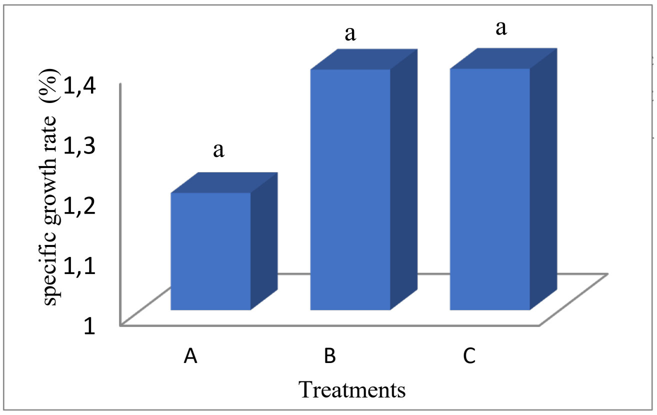

Figure 1. The specific growth rate of white leg shrimp

The growth of white leg shrimp in the three treatments varied during the study, as shown in Figure 1. Treatment C had the highest specific growth rate (1.399%), followed by treatment B (1.398%), and treatment A (1.398%). (1.193%). The particular growth rate of white leg shrimp was not significant, according to the findings of the analysis of variance (Table 1).

Table 1. Results of analysis of variance of specific growth rate of white leg shrimp

Variance	df	SS	MS	F_{stat}	F_{tab} (0.05)
Treatment	2	589.30	294.6502	3.473*	143253
Error	6	508.99	84.83307		
Total	8	1098.29			

*nonsignificance

Specific Growth Rate of Milkfish

The specific growth rate of milkfish during the rearing period is presented in Figure 2 below.

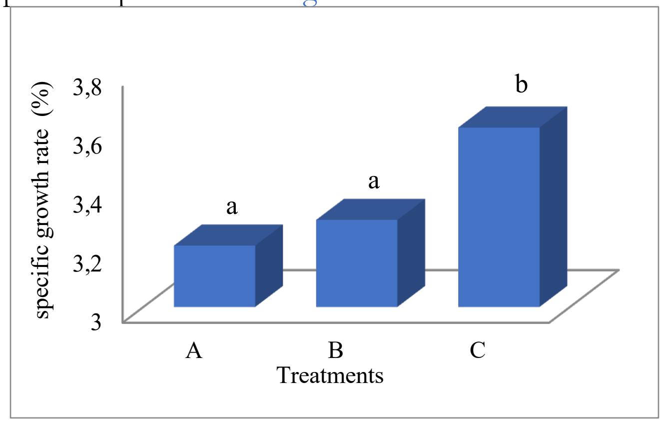

Figure 2. The average specific growth rate of milkfish

The specific growth rate of milkfish during the research varied, as shown in Figure 2. Treatment C had the highest specific growth rate (3.60%), followed by treatment B (3.29%), and treatment A (3.29%). (3.20%). The analysis of variance data for milkfish growth rate found a significant effect (Table 2).

Table 2. The results of the specific growth rate of milkfish

Variance	df	SS	MS	Fstat	Ftab (0.05)
Treatment	2	0.266	0.133	6.515**	5.143
Error	6	0.123	0.020		
Total	8	0.388			

*significance

Absolute Weight Gain of White Leg Shrimp

The absolute increase in weight of white leg shrimp during the trial under each treatment produced a wide range of findings (Figure 3).

Discussion

Discussion should be made comprehensively with comparing to other relevant studies, limitation and new findings of the study, and their implication to science in general. In the discussion, at least cite 7 references.

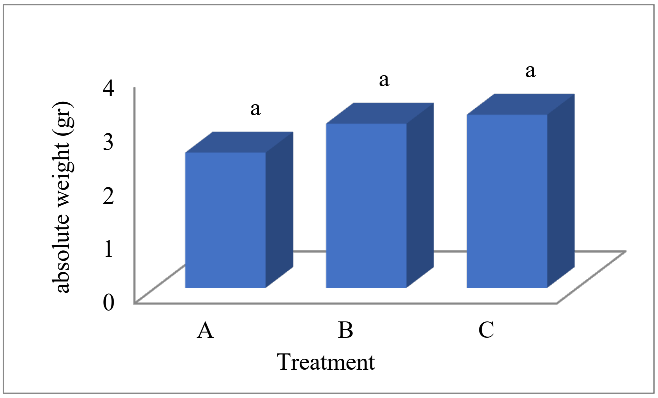

Figure 3. The average weight growth of white leg shrimp

The growth of white leg shrimp during the research varied in each treatment, as shown in Figure 3. Treatment C (3.21 g) had the largest proportion, followed by treatment B (3.04 g), while treatment A had the lowest concentration (2.51 g). The analysis of variance data for all treatments revealed no significant effect (Table 3).

Table 3. Results of analysis of variance in absolute weight of white leg shrimp

Variances	df	SS	MS	Fstat	Ftab(0.05)
Treatment	2	0.810	0.405	2.425*	5.143
Error	6	1.002	0.167		
Total	8	1.813			

*nonsignificance

Absolute Weight Growth of Milkfish

During the maintenance period, the absolute weight increases of milkfish varied depending on the treatment (Figure 4). Figure 4 illustrates the average absolute weight gain of milkfish during the course of this research work. Treatment C had the greatest weight (23.89 g), followed by treatment B (12.14 g), and treatment A had the lowest (9.49 g). The analysis of variance data for the influence of stocking density on milkfish growth revealed a significant effect (Table 4). Treatment C also shown to have a significant effect in a subsequent evaluation of the average effect of the three treatments.

Table 4. Results of analysis of absolute weight variance of milkfish

Variances	df	SS	MS	Fstat	Ftab (0.05)
Treatment	2	352.445	176.223	8.084**	5.143
Error	6	130.794	21.799		
Total	8	483.24			

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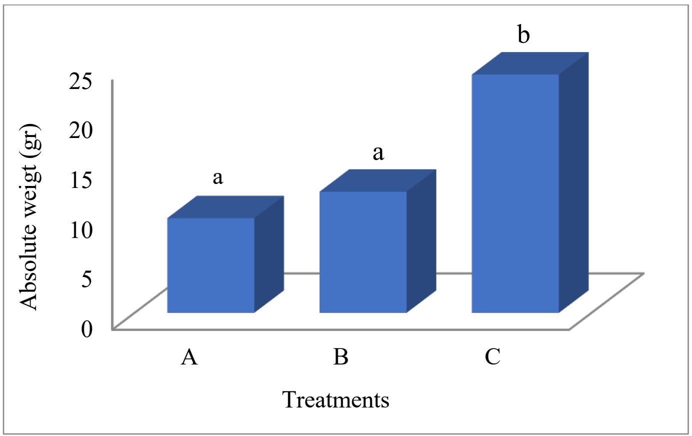

**very significance

Figure 4. The average absolute weight growth of milkfish

Survival (SR) White Leg Shrimp and Milkfish

The results of the measurement of the viability of white leg shrimp for each treatment during the rearing period varied (Figure 5). The survival rate of white leg shrimp in each treatment varied, as shown in Figure 5.

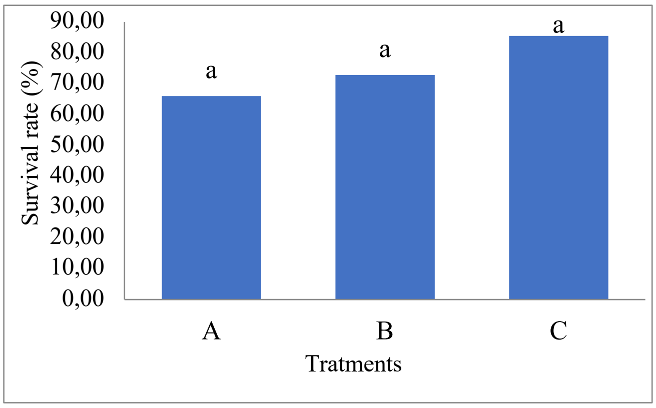

Figure 5. The average of survival rate of white leg shrimp

Treatment C had the highest survival percentage (85.56%), followed by treatment B (72.81%), and treatment A (71.81 %). The survival rate of white leg shrimp indicated no significant effect after the analysis of variance (Table 5).

Table 5. The analysis of variance in the survival rate of white leg shrimp

Variances	df	SS	MS	Fstat	Ftab (0.05)
Treatment	2	589.30	294.650	3.473*	5.143
Error	6	508.99	84.833		
Total	8	1098.29			

*nonsignificance

The three treatments had no difference in milkfish survival during rearing (Figure 6). Figure 6 demonstrates that the survival rate of milkfish in all three treatments was 100% throughout the research.

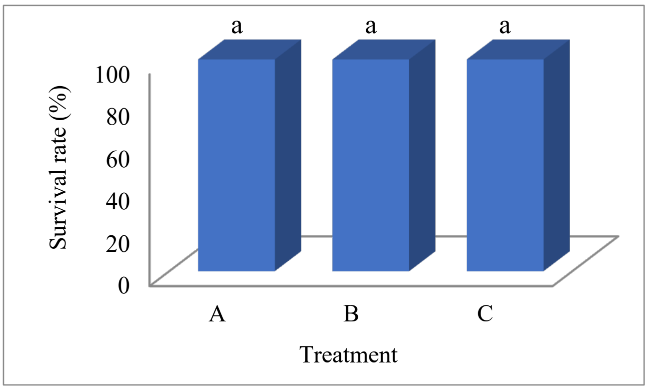

Figure 6. The average survival rate of milkfish

Feed Convertion Ratio (FCR)

The results of the feed conversion ratio (FCR) measure during maintenance showed that there were variations in each treatment (Figure 7) below.

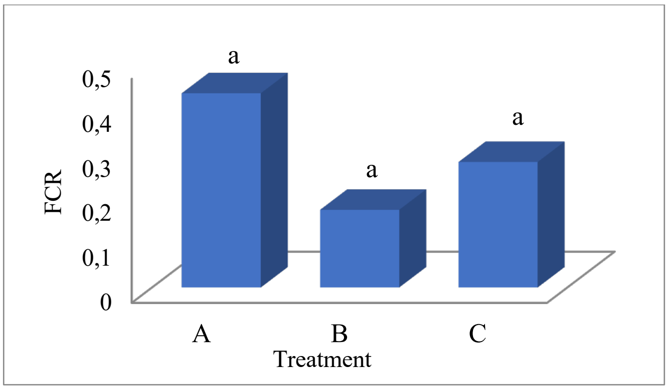

Figure 7. The average of feed conversion ratio during the study

Treatment A (0.433) had the highest feed conversion ratio of white shrimp and milkfish, followed by treatment C (0.28) and treatment B

(0.21). The feed conversion ratio was not significant, according to the findings of the analysis of variance (Table 6).

Table 6. Analysis of the variance feed conversion ratios

Variances	df	SS	MS	Fstat	Ftab (0.05)
Treatment	2	0.102	0.051	0.696*	5.143
Error	6	0.442	0.074		
Total	8	0.544			

*nonsignificance

Water Quality

During the research, the water quality measures in each treatment tended not to change. Temperature, salinity, pH, and DO values were consistent through all treatments (Table 7).

Table 7. Water quality during the study

Parameters	Treatment		
	A	B	C
Salinity (ppt)	16-25	16-25	16-25
Temperature (℃)	27-29	27-29	27-29
pH	7-8	7-8	7-8
O2 (ppm)	2-4	2-4	2-4

The health of white leg shrimp and fish is strongly affected by water quality. Low growth rates, survival rates, and feed conversion ratios can all be affected by poor water quality in rearing media, as well as an increase in dangerous bacteria. During the investigation, the water quality in the rearing area was still suitable for the growth of white shrimp and milkfish. The dissolved oxygen parameter, on the other hand, is in the low range.

Discussion

Between treatments, the specific growth rate of white shrimp and milkfish differed (Figures 2 and 3). Treatment C had the greatest specific growth rate of white shrimp, at 1.399 percent, followed by treatment B at 1.398%, and treatment A at 1.193%. The high density (50 fish) treatment appears to have a lower specific growth rate than the other stocking levels. The widespread use of the region and the feed given have a considerable impact on this, resulting in competition for cultivated species when feed is a limiting factor (Niazie *et al.,* 2013; Samadan *et al.,* 2018a, 2018b). However, there was no discernible effect of stocking density on the three treatments (Table 1). Growth and specific growth rate were negatively correlated with stocking density and declined as stocking density increased (Pervin *et al.*, 2012).

Milkfish growth rates in the three treatments were also different (Figure 2). Treatment C appears to have had the highest specific growth rate (3.60%). Treatment C demonstrated a substantial effect when compared to the other treatments, according to analysis of variance (Table 3). This is owing to the nature of milkfish, which clump together and reside in a water column with a big enough surface area due to low density, resulted in less competition (Mangampa *et al.,* 2008; Djumanto, *et al.,* 2018). The lower the growth rate per individual, the higher the fish density (Samadan *et al.,* 2018a,b). Because food is an external component that influences growth, low-density fish can better use food than fish with a higher density (Anam, 2007; Samadan *et al.,* 2018a). The capacity of fish to consume feed has an impact on their development. An excessively high fish population might enhance competition between fish and shrimp for feed, causing fish to underutilize it. According to (Sabariah and Sunarto, 2009) went on to say that the pace of growth is determined by the amount of feed consumed, the amount of protein in the meal, water quality, and other characteristics including genetics, age, endurance, and the fish's capacity to use the nutrition.

White shrimp and milkfish have different absolute weight growth rates (Figures 3 and 4). The absolute weight gain of white vaname shrimp, on the other hand, was not significant (Table 3). While milkfish absolute growth has a substantial impact (Table 4). This situation demonstrates that milkfish are more active than vaname shrimp. Several earlier research have shown that these two species may be raised in ponds at the same time (Istiyanto, 2001; Istiyanto *et al.,* 2012). According to (Mangampa *et al.,* 2008), the lower the growth rate per person, the higher the density of shrimp and fish. Milkfish do not exhibit cannibalistic qualities towards other fish, and milkfish are a species of fish that prefers to gather in small groups in search of food, therefore the lack of mobility space caused by stocking density has no direct impact on their survival. With white leg shrimp, however, stocking density has a direct impact on development and survival, as this shrimp is cannibalistic in nature (Tjoronge, 2005; Syahid *et al.,* 2006; Samadan *et al.,* 2018a,b).

The feed conversion ratio (FCR) for white shrimp and milkfish (Figure 8) varies considerably. The analysis of variance revealed that stocking density had no impact on feed conversion. Because the food is still regarded inadequate, it indicates that the usage of the feed provided is inefficient. According to

(Aslam *et al.,* 2009), discrepancies in FCR consumption and the development of fish and shrimp reared together would be influenced by the production of polyculture systems with various densities. Although (Tacon and de Silva, 1997; Istiyanto, 2001; Istiyanto *et al.,* 2012) claim that the feed conversion ratio is critical in determining whether the feed supplied can improve the growth of white leg shrimp and milkfish or if the feed is delivered more effectively. The feed conversion value may also be used to determine how far the provided feed can accelerate growth. The feed conversion value in the research is low, and it is assumed that the water quality, particularly dissolved oxygen, is poor, causing the body metabolism of cultured organisms to be less than ideal. Shrimp will encounter changes such as reduced appetite, slowing of the molting process, and disease susceptibility in ponds with poor water quality, according to (Effendi, 2003; Cahyono, 2009). The physiological processes in the body of the biota will function smoothly if the water quality is good (Perez *et al.,* 2012), allowing the biota to flourish and survive.

The health of shrimp and fish is heavily influenced by water quality (Boyd, 1998). Low growth rates, survival rates, and feed conversion ratios can all be affected by poor water quality in rearing media (Samadan *et al.,* 2023a), as well as an increase in dangerous bacteria (Samadan *et al.,* 2023b). During the observation, the water quality in the rearing area was still suitable for the growth of white shrimp and milkfish (Djumanto *et al*., 2018). The dissolved oxygen parameter, on the other hand, is in the low range.

Conclusion

The study's results indicate that varying stocking densities of white leg shrimp and milkfish have no effect on white leg shrimp absolute weight growth or the specific growth rate of whitefish and milkfish, but they do alter milkfish absolute weight growth.

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References

Akbar, S. A., R. R. Fazli. 2023. Meta-analysis: The effectiveness of artificial diets to increase survival rate of vannamei shrimp (*Litopenaeus vannamei*). *IOP Conference Series: Earth and Environmental Science*, 1221(1): 012066. IOP Publishing.

Anam, M. S. 2007. *Petunjuk Budidaya Polikultur Rumput Laut, Bandeng dan Udang di Tambak*. Kantor Ketahanan Pangan dan Penyuluhan Pertanian Kabupaten Pasuruan.

Aslam, A., G. S. Hossain, M. M. R. Biswas, S. K. Barman, K. Anisulhuq. 2009. Polyculture and integrated culture pattern of freshwater prawn in fresh to hyposaline water. *International Journal of Sustainable Crop Production*, 4(4): 23-27.

Boyd, C. E. 1998. *Water quality for pond aquaculture*. Department of Fisheries and Applied Aquaculture, Auburn University, Alabama, 39 p.

Cahyono, B. 2009. *Budidaya Biota Air Tawar*. Kanisius, Yogyakarta.

Changboo, Z., S. Du, W. Fang, G. Huo. 2004. Effects of Na/K ratio in seawater on growth and energy budget of juvenile *Litopenaeus vannamei*. *Aquaculture*, 234: 485-496.

Djumanto, U., Rustadi, B. Triyatmo. 2018. Utilization of wastewater from vannamei shrimp pond for rearing milkfish in Keburuhan Coast Purworejo Sub-District. *Aquacultura Indonesiana*, 19(1): 38-46.

Effendi, H. 2003. *Telaah Kualitas Air Bagi Pengelolaan Sumber Daya dan Lingkungan Perairan*. Kanisius, Yogyakarta, 258 pp.

Effendie, M. I. 1997. *Biologi Perikanan*. Yayasan Pustaka Nusa Tama, Jakarta, 112 p.

Faisyal, Y., S. Rejeki, L. L. Widowati. 2016. Pengaruh padat tebar terhadap pertumbuhan dan kelulushidupan ikan bandeng (*Chanos chanos*) di keramba jaring apung di perairan terabrasi Desa Kaliwlingi Kabupaten Brebes. *Journal of Aquaculture Management and Technology*, 5(1): 155-161.

Istiyanto, S. 2001. Pembesaran kepiting (*Scylla paramamosain*) di tambak dengan pakan yang diberikan sampah dalam dosis berbeda. *Makalah Seminar Nasional Crustacean 2001*. Pusat Kajian Ilmu Hayati Fakultas Perikanan dan Ilmu Kelautan IPB, Bogor.

Istiyanto, S., E. Arini, D. Rachmawati. 2012. Aplikasi ilmu dan teknologi terhadap kelompok usaha polikultur udang, ikan, dan rumput laut (*Gracillaria sp.*) berdasarkan filter biologis di Desa Mangkang Wetan Kecamatan Tugu, Semarang. *Research Report*. Universitas Diponegoro, Semarang.

Istiyanto, S., D. Rachmawati. 2016. Effect of artificial feed on the growth and survival of white shrimp (*Litopenaeus vannamei*) and milkfish (*Chanos chanos*) in application of innovative polyculture technology. *Jurnal Teknologi Science and Engineering*, 78(4).

Kumar, D. P., P. V. Krishna. 2015. Survival and growth performance of Pacific white shrimp *Litopenaeus vannamei* (Boone 1931) under different stocking densities. *IOSR Journal of Agriculture and Veterinary Science*, 8(5): 17-19.

Mangampa, Busran, M. Suswoyo. 2008. Optimalisasi padat tebar terhadap sintasan ikan bandeng dengan sistem aerasi di tambak. Jakarta.

Melanie, K., Z. Zilfira, S. A. Akbar. 2023. Effect of giving viterna plus supplements at different doses in feed on growth, survival rate, and feed conversion ratio of milkfish (*Chanos chanos*) seeds. *Arwana: Jurnal Ilmiah Program Studi Perairan*, 5(2): 162-168.

Napaumpaiporn, T., N. Chuchird, W. Taparhudee. 2013. Study on the efficiency of three different feeding techniques in the culture of Pacific shrimp (*Litopenaeus vannamei*). *Kasetsart University Fisheries Research Bulletin*, 37(2): 8-16.

Nurlaela, I., E. Tapahari, Sulatro. 2010. Pertumbuhan ikan patin nasutus (*Pangasius nasutus*) pada padat tebar yang berbeda. *Jurnal Lokal Riset Pemuliaan dan Pengembangan Budidaya Air Tawar*, Subang, 31-36.

Niazie, E. H. N., M. I. V. Taghizade, V. Zadmajid. 2013. Effects of density stress on growth indices and survival rate of goldfish (*Carassius auratus*). *Global Veterinaria*, 10(3): 365-371.

Perez-Velazquez, M., D. A. Davis, L. A. Roy, M. L. González-Félix. 2012. Effects of water temperature and Na+:K+ ratio on physiological and production parameters of *Litopenaeus vannamei* reared in low salinity water. *Aquaculture*, 342: 13-17.

Pervin, R., M. A. Wahab, K. Fatema, M. S. R. Khan. 2012. Effects of addition of mola at different densities on production of giant freshwater prawn. *Journal Bangladesh Agriculture University*, 10(1): 163-167.

Putri, S., Y. Susilowati. 2013. Pengaruh padat penebaran terhadap kelulushidupan dan pertumbuhan udang vanname (*Litopenaeus vannamei*) serta produksi biomasa rumput laut (*Gracillaria sp.*) pada budidaya polikultur. *Journal of Aquaculture Management and Technology*, 2(3): 12-19.

Sabariah, Sunarto. 2009. Pemberian pakan buatan dengan dosis yang berbeda terhadap pertumbuhan dan konsumsi pakan benih ikan semah dalam upaya domestikasi. *Jurnal Akuakultur Indonesia*, 8(1): 67-76.

Samadan, G. M., Rustadi, Djumanto, Murwantoko. 2018a. Production performance of whiteleg shrimp *Litopenaeus vannamei* at different stocking densities reared in sand ponds using plastic mulch. *AACL Bioflux*, 11(4): 1217-1221.

Samadan, G. M., Rustadi, Djumanto, Murwantoko. 2018b. Utilization of marginal sand land for culture of whiteleg shrimp (*Litopenaeus vannamei*) with different stocking density in coastal Purworejo Regency, Central Java. *Fish Aqua Journal*, 9: 257. DOI: 10.4172/2150-3508.1000257.

Samadan, G. M., F. Muchdar, I. Ridwan. 2023a. Effects of difference C/N ratio on water quality of whiteleg shrimp (*Litopenaeus vannamei*) cultivation. *Depik Jurnal Ilmu-Ilmu Perairan, Pesisir dan Perikanan*, 12(3): 415-420.

Samadan, G. M., F. Muchdar, F. Sriwati, M. N. Findra. 2023b. Pengaruh kombinasi pakan dan probiotik yang berbeda terhadap kinerja pertumbuhan udang galah (*Macrobrachium rosenbergii*) dan penurunan limbah N yang dipelihara dalam wadah terkontrol. *Juvenil*, 4(2): 75-83.

Silva, E., J. Silva, F. Ferreira, M. Soares, R. Soares, S. Peixoto. 2015. Influence of stocking density on the zootechnical performance of *Litopenaeus vannamei* during the nursery phase in a biofloc system. *Boletim Instituto Pesca*, 41(esp.): 777-783.

Sookying, D., F. S. D. Silva, D. A. Davis, T. R. Hanson. 2011. Effects of stocking density on the performance of Pacific white shrimp *Litopenaeus vannamei* cultured under pond and outdoor tank conditions using a high soybean meal diet. *Aquaculture*, 319: 232-239.

Syahid, M., A. Subhan, R. Armando. 2006. *Budidaya Bandeng Organik Secara Polikultur*. Penebar Swadaya, Jakarta, 64 p.

Tacon, A. J., S. S. de Silva. 1997. Feed preparation and feed management strategies within semi-intensive fish farming systems in the tropics. *Aquaculture*, 151: 379-404.

Tjoronge, M. 2005. Polikultur rumput laut *Gracillaria sp*. dan ikan bandeng *Chanos chanos* dengan padat penebaran yang berbeda. *Jurnal Penelitian Perikanan Indonesia*, 11(7).

Wasielesky, W. J., L. H. Poersch, L. Jensen, A. Bianchini. 2001. Effect of stocking density on pen reared pink shrimp *Farfantepenaeus paulensis* (Decapoda, Penaeidae). *Nauplius*, 9: 163-167.

Widiastuti, M. I. 2009. Pertumbuhan dan kelangsungan hidup (*Survival rate*) ikan mas (*Cyprinus carpio*) yang dipelihara dalam wadah terkontrol dengan padat penebaran yang berbeda. *Media Litbang Sulteng*, 2(2): 126-130.

Zar, J. 1999. *Biostatistical Analysis*. Prentice-Hall, Inc., New Jersey, 661 p.

Zonneveld, N., E. A. Huisman, J. H. Boon. 1991. *Prinsip-Prinsip Budidaya Ikan*. Gramedia Pustaka Utama, Jakarta, 318 pp.

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