International Journal of Life Science Research Archive

ISSN: 0799-6640 (Online)

Journal homepage: https://sciresjournals.com/ijlsra/

(RESEARCH ARTICLE)

Study of water quality in relation to the development of Vanamei shrimp (*Litopenaeus vannamei*) cultivation on the Siddo Coast, Barru Regency, Indonesia

Andi Puspa Sari Idris [1], Patang [2,*], Jamaluddin [2], Subariyanto [2], Marhayati [2] and Sulkifli Sulaeman [1]

[1] *Department of Aquaculture, Pangkep State Agricultural Polytechnic, Pangkeo, Indonesia.*
[2] *Department of Agricultural Technology, Universitas Negeri Makassar, Makassar, Indonesia.*

International Journal of Life Science Research Archive, 2024, 07(02), 034–042

Publication history: Received on 05 September 2024; revised on 12 October 2024; accepted on 14 October 2024

Article DOI: https://doi.org/10.53771/ijlsra.2024.7.2.0071

Abstract

Objective: The research aims to determine the quality of water on the Siddo coast of Barru Regency, Indonesia, in relation to the development of vanamei shrimp cultivation.

Material and method: The research was carried out in 3 locations, namely location 1 is located around Siddo Beach Bay and there is a mangrove forest around it, location 2 is a location close to the pier where fishermen moor their boats, and location 3 is a location in Toe Hamlet close to residential areas and community ponds. The water quality parameters measured are temperature, dissolved oxygen, pH, and salinity. The data obtained is then collected, processed, made into images, and analyzed using descriptive analysis.

Results: The research results showed that the water temperature was in the range of 29.73 to 30.33 ^{o}C; Dissolved oxygen is in the range of 3.72 to 6.22 ppm, with the lowest oxygen at location 3. Water pH is in the range of 6.67 to 7.33. Sea water salinity is in the range of 36.33-36.67 ppt.

Conclusion: The water quality of the research location is generally suitable for cultivating vanamei shrimp, except that the pH value of the water is still low or acidic and the salinity is still relatively high.

Keywords: Water Quality; Development; Vanamei Cultivation; Siddo Beach

1. Introduction

The coast is an area that is under heavy pressure both from activities originating from land and offshore. On the other hand, the coast is a buffer area for macroalgae ecosystems, coral reefs, and mangrove forests, so the pressure exerted can affect the quality of the aquatic environment where the ecosystem is located. Widespread land-based human activities in upstream regions are a possible source of contaminants that might degrade the aquatic environment in offshore and coastal waterways. Most pollutants produced by human activities on land are toxic and persistent in nature and are discharged into the environment below their half-life (Nalle et al., 2020). Although the shore has a lot of potential for natural resources, it is also highly susceptible to changes brought about by the surrounding region's land usage. Economic activities that convert coastal land from swamps and mangroves into industrial, tourism, and residential areas have caused quite severe abrasion and sedimentation processes (Bergen, 2002).

Coastal regions have strategic importance and promise as a means of facilitating a range of activities in the adjacent land areas. From an ecological perspective, marine waters serve as a natural habitat for a variety of marine biota, the survival of which depends on preservation. The rapid growth of industry, port activities, and the density of fishing

* Corresponding author: Patang

settlements and surrounding residents directly increase various kinds of activities that produce industrial waste and other domestic waste (Verawati, 2016). Coastal areas and small islands are very rich in potential natural resources that can be utilized for community welfare (Ayer et al., 2024). Coastal areas are important areas from various planning and management points of view. The transition between land and sea in coastal areas has formed diverse and highly productive ecosystems and provides extraordinary economic value to humans. In line with population growth and increased socio-economic development activities, the value of coastal areas continues to increase (Hamuna et al., 2018). Community activities are one part of the factors that have an influence on the presence of nutrients in water areas, thus having an impact on water quality (Sutarso et al., 2017). Coastal areas are areas that have the potential to develop fisheries commodities, including vanamei shrimp. To be able to develop this commodity, it needs to be supported by appropriate water quality.

Water quality is greatly influenced by activities that occur around these waters. Increasing water activity will gradually result in a decline in water quality both physically, chemically, and biologically, which will ultimately reduce the quality and quantity of coastal and marine resources (Wahyuningsih et al., 2021). The quality of sea water plays an important role in the seawater ecosystem itself and the environmental sustainability of living creatures on land (Verawati, 2016). A body of water's water quality can be assessed by taking measurements of its chemical and physical characteristics. Temperature is one example of a physical parameter; salinity, pH, dissolved oxygen, and heavy metals are examples of chemical parameters. Indicators of the fertility of waters include pH and dissolved oxygen levels; salinity plays a significant role in the distribution of marine biota; and temperature is one of the factors that controls chemical reactions and biological processes (Patty, 2013).

In aquaculture, it is important to maintain the carrying capacity of the environment to avoid crop failure (Latuconsina, 2020). Several water quality parameters that influence the growth and survival rate of shrimp include temperature, dissolved oxygen, pH, and water salinity (Supono, 2019). Vaname shrimp (Litopenaeus vannamei) is one of the leading commodities in aquaculture. This is because, apart from being competitively priced, the production system can also be carried out on a mass scale with high stocking densities (Mangampa and Suwono, 2016). Even though it is considered a superior variety, there must be attention paid to it, such as water quality, stocking density, and feeding. High stocking density means the amount of feed given will be large. Besides that, feed given and not consumed by shrimp can cause a decrease in water quality. Because shrimp retain about 16.3–40.87% of feed protein and the rest is excreted in the form of excreted feed residues and feces (Hari et al., 2004).

Aquaculture activities in coastal and marine areas are mostly fish farming activities, either shrimp farming, milkfish farming, or a mixture of both. Apart from that, there are also several other types of cultivation activities, such as cultivating seaweed, oysters, and fish in net cages (Bardach et al., 1972). Shrimp pond operations need to consider carrying capacity, land management, and location suitability in order to achieve the desired pond production. According to Mustafa et al. (2014), a number of parameters, including fresh water, the green belt, rainfall, tidal amplitude, elevation, beach bottom type, coastline type, currents, and soil quality, affect the carrying capacity of shrimp ponds. The right degree of cultivation technology—traditional, semi-intensive, or intensive—can be chosen based on this carrying capacity.

This research is very important because it can evaluate water quality conditions and evaluate the possibility of beach pollution from various activities carried out by communities around the coast. Water pollution can be caused by the entry of contaminants (pollutants), which can be in the form of gases, dissolved materials, and particulates. These pollutants enter water bodies through the atmosphere, soil, agricultural runoff, domestic waste, industrial waste, and others. Most of these polluting materials are foreign to nature and thus disrupt the functioning of aquatic ecosystems. Thus, the opportunity for pollution of the aquatic environment as a habitat for aquatic organisms is very large, resulting in a decrease in the productivity and quality of coastal aquatic ecosystems, including macroalgae ecosystems, coral reef ecosystems, and mangrove ecosystems (Nalle et al., 2020). According to Siahainenia (2001) in Damaianto and Masduqi (2014), various types of rubbish and pollutants will be found in the sea; this can certainly result in environmental degradation in coastal areas and the surrounding ecosystem.

2. Material and method

The research was carried out from July to September 2024 around the Siddo coast of Barru Regency using quantitative methods. The location selection consisted of 3 locations, namely location 1 is located around Siddo Beach Bay and around it there is a mangrove forest, location 2 is a location close to the pier where fishermen moor their boats, and location 3, namely the location in Toe Hamlet, close to residential areas and community ponds. The selection of the three locations was based on the possibility of developing shrimp cultivation, especially vanamei shrimp around the Siddo coast, Barru Regency. Water quality measurements were carried out 3 times in the period from July to September 2024, including measuring temperature, dissolved oxygen, pH, and salinity. Water quality measurements are carried out in the morning between 7 and 9 am. Temperature measurements were carried out using a mercury thermometer, dissolved oxygen measurements using a DO meter, pH measurements using a pH meter, and salinity measurements using a hand refractometer. The data obtained is then collected, processed, made into images and analyzed using descriptive analysis.

3. Results

Waters Temperature (°C)

Figure 1 shows that the average water temperature at the research location is highest at location 2, namely the location close to the pier where fishermen moor their boats, namely 30.33 °C, and the location with the lowest average temperature is at location 3, namely the location located In Toe Hamlet, close to residential areas and community ponds, the average temperature is 29.73 °C. In relation to the development of vanamei shrimp, the average water temperature around the research location is still in the appropriate category because it is in the range of 29.73 °C to 30.33 °C.

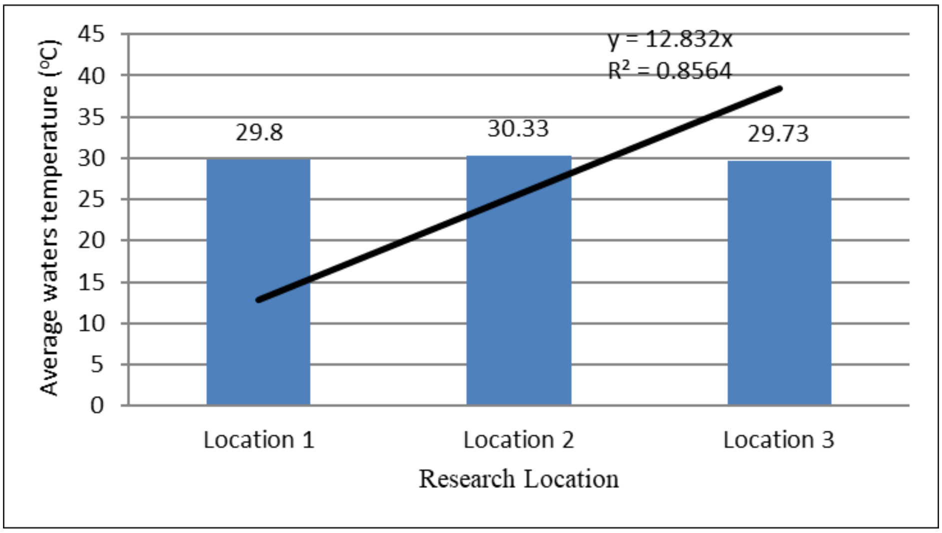

Figure 1 Research site waters temperature

3.1. Water Dissolved Oxygen (ppm)

Figure 2 shows that the value of dissolved oxygen in the waters at the research location is highest at location 2, namely the location close to the pier where fishermen moor their boats, namely an average of 6.44 ppm, and the location with the lowest average dissolved oxygen is location 3, namely the location at Toe Hamlet is close to residential areas and community ponds, namely 3.73 ppm. Thus, dissolved oxygen at the research location ranges from 3.73 ppm to 6.44 ppm. The dissolved oxygen values obtained during the research are still suitable for supporting shrimp life.

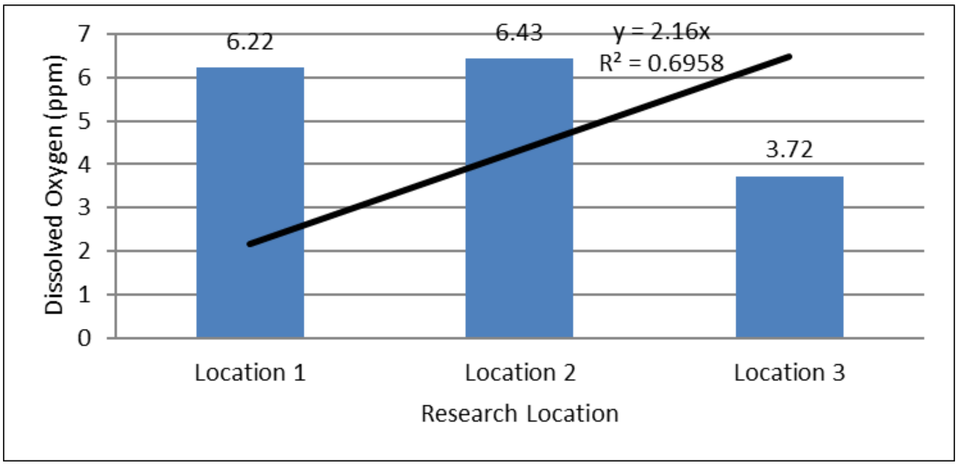

Figure 2 Average dissolved oxygen at the research location

3.2. Waters pH

Figure 3 shows that the average pH of the water at the research location during the research was highest at location 2, namely the location adjacent to the pier where fishermen moor their boats with a value of 7.33, while the location with the lowest average water pH was at location 1, namely located around the bay. Siddo Beach and the surrounding areas have mangrove forests with an average water pH value of 6.67. The low pH value of the water at location 1 is thought to be caused by the fact that there are many mangrove forests at that location. The relationship between the pH value of the water at the research location and the development of vanamei shrimp cultivation means that the pH of the pH of the water is still suitable for the life of vanamei shrimp.

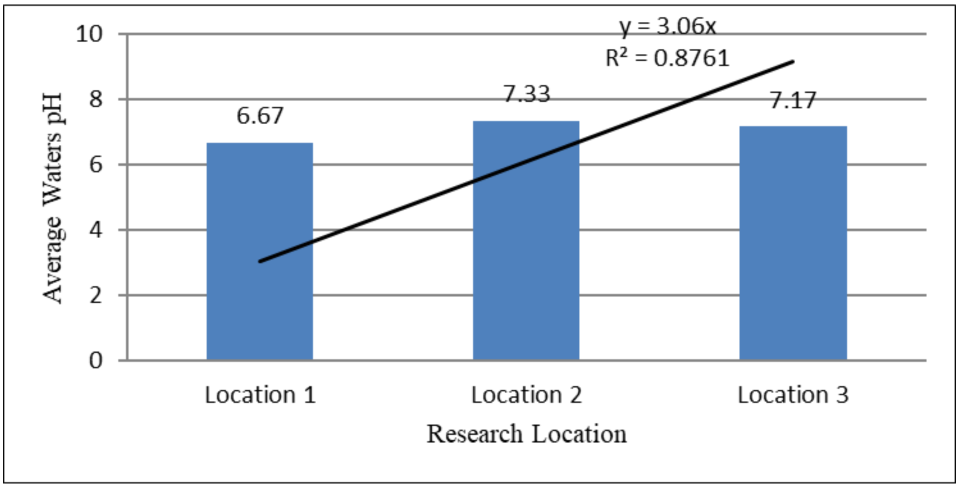

Figure 3 Average pH of waters at the research location

3.3. Waters salinity (ppt)

The figure shows that the average salinity of the waters at the research location is highest at location 3, namely the location in Toe Hamlet close to residential areas and community ponds, namely an average of 36.67 ppt, while the lowest average salinity values at the research location are 1 and 2. namely, location 1 is located around Siddo Beach Bay, and around it there is a mangrove forest, and location 2 is a location close to the pier where fishermen moor their boats, namely 36.33 ppt each. Thus, the average water salinity in the three locations is in the range of 36.33 to 36.67 ppt. The high salinity at the research location is thought to be because at the time of the research it was during the dry season, so the water exchange process during high tide and low tide was relatively low. Regarding the relationship between sea water salinity and the development of vanamei shrimp cultivation, it can be stated that water salinity is still relatively high; therefore, vanamei shrimp cultivation should be carried out at the beginning of the rainy season so that the water salinity does not reach an average salinity of 36 ppt.

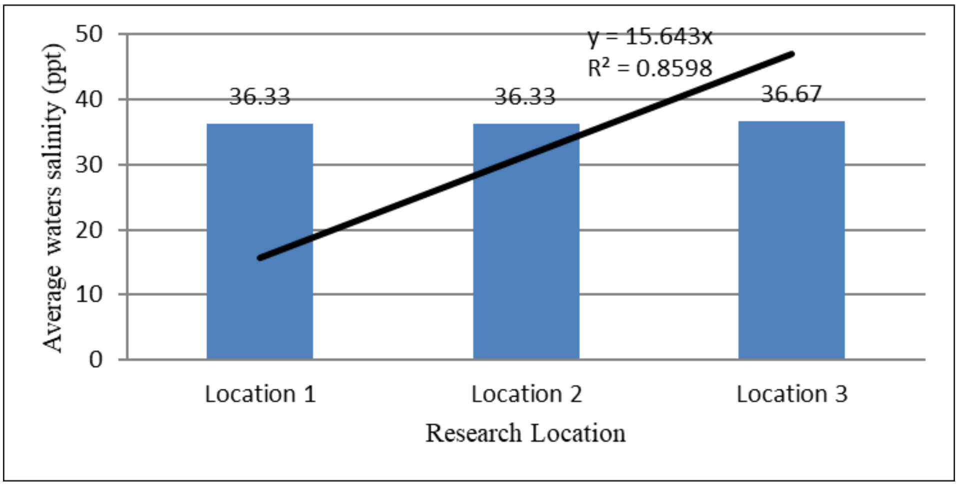

Figure 4 Average waters salinity at the research location

4. Discussion

4.1. Waters Temperature (°C)

Waters temperature is a very important factor for the life of organisms in waters (Hamuna et al., 2018). Temperature is one of the easiest external factors to research and determine. Metabolic activity and the distribution of aquatic organisms are greatly influenced by water temperature (Nontji, 2005). Temperature plays a very important role in controlling the condition of aquatic ecosystems. Temperature also greatly influences the life and growth of aquatic biota; the temperature in water bodies is influenced by season, latitude, time of day, air circulation, cloud cover, and water flow and depth (Effendi, 2000). Temperature affects metabolic activities and the reproduction of marine organisms (Haerudin, 2019). Temperature also greatly influences the life and growth of aquatic biota. Temperature in water bodies is influenced by season, latitude, time of day, air circulation, cloud cover, and water flow and depth. Water temperature plays a role in controlling the condition of aquatic ecosystems. Increasing temperature causes increased decomposition of organic material by microbes (Effendi, 2003).

Yudiati et al. (2010), stated that the optimal temperature to support the life of Vaname Shrimp is around 27.2-32.0 °C, this statement is in accordance with the temperature value in the study carried out, namely >27 °C (SNI. 2016). In general, surface water temperatures range between 28 – 31°C (Nontji, 2005). The temperature range of the measurement results is also still within the range of monthly sea surface temperature values in Jayapura waters which ranges between 25 – 31 °C with dominant temperatures ranging between 27 – 29 °C (Hamuna et al., 2015). Effendi (2003) states that the temperature value that meets water quality standards is around 27 – 30 °C with an average of 28 °C. An increase in water temperature also reduces the solubility of oxygen in water, increasing the toxicity of pollutants to aquatic organisms (Brown and Gratzek, 1980 in Widiadmoko, 2013). If the temperature is above the optimum number, metabolism in the shrimp's body is fast, but if the environmental temperature is lower than the optimal temperature, then shrimp growth decreases with decreased appetite (Supriatna et al., 2020).

Research results from Effendi (2003) show that an increase in temperature will cause stratification or layering of water, which will affect the mixing of water, which is very necessary for distributing oxygen, so that the layering of water in the base layer becomes non-anaerobic. An increase in temperature can cause stratification or layering of water. This stratification of water can affect the mixing of the water and is needed in order to distribute oxygen so that the layering of water in the base layer does not become anaerobic. Changes in surface temperature can affect physical, chemical, and biological processes in these waters (Kusumaningtyas et al., 2014).

4.2. Waters Dissolved Oxygen (ppm)

Dissolved oxygen is the total amount of oxygen present (dissolved) in water. Dissolved oxygen is needed by all living organisms for respiration, metabolic processes, or the exchange of substances, which then produce energy for growth and reproduction. Besides that, oxygen is also needed for the oxidation of organic and inorganic materials in aerobic processes. Generally, oxygen is found in the surface layer because oxygen from the nearby air can dissolve directly and diffuse into sea water (Hutabarat and Evans, 1984). An organism's need for dissolved oxygen varies relatively depending on the type, stage, and activity (Gemilang & Kusuma, 2017).

The minimum limit of dissolved oxygen for rearing Vaname Shrimp is in the range of >4 ppm (SNI, 2016). A dissolved oxygen concentration of 1–5 ppm will disrupt growth if it continues continuously; 5 ppm until saturation is very good for growth (Kordi, 2010). The solubility of oxygen in pond waters will increase as the environmental carrying capacity decreases (Wafi et al., 2021). Kurniaji et al. (2022) stated that dissolved oxygen levels during initial rearing tended to fluctuate because biomass in ponds continued to increase along with feeding and increasing shrimp weight.

Salmin (2005) states that the main source of oxygen in waters comes from the photosynthesis of organisms that live in those waters, apart from the diffusion process from free air. The dissolved oxygen content in a body of water is closely related to the level of pollution, type of waste, and the amount of organic material in the body of water. The concentration of dissolved oxygen in natural waters varies depending on temperature, salinity, water turbulence, and atmospheric pressure. The greater the temperature and altitude and the lower the atmospheric pressure, the smaller the dissolved oxygen concentration (Effendi, 2003).

4.3. Waters pH

The degree of acidity (pH) is the negative logarithm of the concentration of hydrogen ions released in a liquid and is an indicator of whether the water is good or bad. The pH of a body of water is one of the chemical parameters that is quite important in monitoring water stability (Simanjuntak, 2009). The degree of acidity (pH) is an important parameter in determining water quality. The pH value is a description of the amount or activity of hydrogen in water. In general, the pH value shows how acidic or alkaline a body of water is (Widigdo, 2001). Water conditions that are too alkaline or too acidic will be dangerous for the life of organisms because they will disrupt metabolic and respiration processes (Wahyuningsih et al., 2021).

According to Kordi (2010), the relationship between pH and the life of Vaname Shrimp is in the range 6.1–7.5 (medium production), 7.6–8.0 (good enough for shrimp cultivation), 8.1–8.7 (good for shrimp cultivation), and 8.8–9.5 (production starts to decline). At low pH (high acidity), the dissolved oxygen content will decrease; as a result, oxygen consumption decreases, respiratory activity increases, and appetite decreases. The opposite happens in alkaline conditions. The pH value that can still be tolerated for vanamei shrimp is 6.5–9 (Wyban and Sweeny, 1991), and for the rearing stage of vanamei shrimp, the optimal pH level is in the range of 7.5–8.5 (SNI, 2016). The ideal pH value for marine life organisms generally ranges from 7 to 8.5. Water conditions that are very acidic or very alkaline will disrupt the survival of organisms because they will cause disruption to metabolic and respiration processes (Barus, 2004). The pH increases towards the open sea. High and low pH can be caused by the large amount of organic material from land carried through water flows (Kusumaningtyas, 2014). Erari et al. (2012), who obtained the pH of the waters of Youtefa Bay, which ranged from 6.28–8.7 in the sea and 7.25–7.76 in the waters near the river mouth, and Silalahi et al. (2017), who found that the pH of Maruni Manokwari waters ranged from 7–8.3. According to Dojlido and Best (1993), the pH of sea water is relatively more stable and is usually in the range of 7.5 and 8.4, except near the coast. The ideal pH value for waters is 7–8.5. According to Simanjuntak (2009), water pH is an important chemical parameter in monitoring water stability. Odum (1971) states that a pH value between 6.5 and 8.0 is the safe limit for the pH of waters for the biota living in them.

4.4. Waters salinity (ppt)

Salinity describes the total solids in the water; salinity is expressed in units of g/kg (ppt). Terminology that is similar to salinity is chlorinity, which only includes chlorides, bromides, and ionides and has a smaller value than salinity (Verawati, 2016). Hutabarat and Evans (1984) stated that estuary areas are areas where salinity levels decrease due to the influence of incoming fresh water and also due to the occurrence of tides in that area. Variations in salinity in seawater will affect aquatic living organisms based on their ability to control specific gravity and variations in osmotic pressure.

According to SNI (2016), the salinity level for rearing Vaname Shrimp is in the range of 26–32 ppt. Furthermore, Supono (2019) stated that after spreading the shrimp fry, the optimal level of salinity is in the range of 10–30 ppt. Amansyah (2017) stated that to optimize salinity, new water can be added. Where salinity can be caused by the addition of rainwater and evaporation during the day (Ariadi, 2020). Low salinity can be caused by the supply of fresh water through river flows that empty into sea waters (Hamuna et al., 2018).

5. Conclusion

The conclusion from the research results is that the water temperature at the research location is still considered good and suitable for cultivating vanamei shrimp because it is in the range of 29.73 to 30.33 ^{o}C; dissolved oxygen is in the range of 3.72 to 6.22 ppm. The oxygen value of 3.72 is considered low for cultivating vanamei shrimp, and the lowest oxygen is at location 3. The pH of the waters is in the range of 6.67–7.33. The pH value of this water is also relatively low for vanamei shrimp cultivation. Seawater salinity is in the range of 36.33–36.67 ppt. The salinity value of this water is also still relatively high, which is thought to be because the salinity measurements were carried out during the dry season.

Compliance with ethical standards

Acknowledgments

This research was possible thanks to the facilities and technical support from the Director and head of the Pangkep State Agricultural Polytechnic research institute, and also supported by the chemistry and water laboratories of Pangkep State Agricultural Polytechnic

Disclosure of conflict of interest

In this research there is no conflict of interest. The all authors declare that they have no conflicts of interest related to this study.

References

[1] Amansyah, N. 2017. Water Quality Management Techniques for Raising Vaname Shrimp (*Litopenaeus vannamei*) in Intensive Ponds at PT. Satria Jaya, Southeast Sulawesi. Thesis. Pangkep State Agricultural Polytechnic.

[2] Ariadi, H. 2020. Dissolved Oxygen and Scientific Cycles in Intensive Ponds. Guepedia. Bogor

[3] Atmadja, W.S. & Sulistija. 1988. Several Aspects of Vegetation and Habitat of Benthic Marine Plants on Seribu Islands. Center for Oceanological Research and Development. LIPI. Jakarta.

[4] Ayer, P.I.L., I. Mishbach., E. Indrayani., & K. Rejauw. 2024. Analysis of Sea Water Quality and Environmental Sanitation on Beaches Based on Sulfide, Nitrate, Phosphate, Fecal Coli and Coliform Content in Hamadi Tourism Beach Waters. Saintifik: Journal of Matematika, Sains, & Pembelajarannya. 10(1), 115-119.

[5] Bardach, J. E., J. H. Ryther & W. O. McLarney. 1972. Aquaculture, the Farming and Husbandry of Freshwater and Marine Organism. John Wiley & Sons Inc., New York, London, Sydney, Toronto.

[6] Barus, T. A. 2004. Introduction to Limnology, Study of Land Water Ecosystems. Usu Press. Medan

[7] Bergen, D.G. 2002. Coastal and Marine Ecosystems and Natural Resources and Management Principles. Pusat Kajian Sumberdaya Pesisir dan Lautan Institut Pertanian Bogor. Bogor

[8] Damaianto, B., & Masduqi, A. 2014. Sea water pollution index for the north coast of Tuban Regency with metal parameters. Journal of Teknik Pomits, 13(1), 1-4.

[9] Dojlido, J.R., and Best, G.A. 1993. Chemistry of Water and Water Polution. England: Ellis Horwood Ltd.

[10] Effendi, H. 2000. Water Quality Assessment: For Resource and Environmental Management. Waters. Institut Pertanian Bogor: Bogor.

[11] Effendi, H. 2003. Water Quality Studies for Management of Aquatic Resources and Environment. Cetakan Kelima. Yogjakarta: Kanisius.

[12] Erari, S.S., Mangimbulude, J., & Lewerissa, K. 2012. Organic pollution in the coastal waters of Youtefa Bay Beach, Jayapura City, Papua. Proceedings of the 2012 Unesa National Chemistry Seminar, C327-C340. Surabaya

[13] Gemilang, W.A., & G. Kusumah. 2017. The status of the water pollution index for mangrove areas is based on a physico-chemical assessment on the coast of Brebes District, Central Java. Enviro Scienteae, 13(2), 171-180.

[14] Haerudin , A.M.P. 2019. Analysis of sea water quality standards for the development of marine tourism in the coastal waters of Labuhan Haji, East Lombok Regency. Geodika.;3(1):13-18.https://doi.org/10.29408/geodika.v3i1.1473

[15] Hamuna, B., Paulangan, Y.P., & Dimara, L. 2015. Study of sea surface temperature using Aqua MODIS satellite data in Jayapura waters, Papua. Depik, 4(3), 160- 167.

[16] Hamuna, B., R.H.R. Tanjung., Suwito., H.K. Maury., & Alianto. 2018. Study of Sea Water Quality and Pollution Index Based on Physico-Chemical Parameters in Depapre District Waters, Jayapura. Journal of Environmental Science. 16(1), 35-43.

[17] Hari, B., B.M. Kurup., J.T. Varghese., J.W. Schrama and M.C.J. Verdegem. 2004. Effects of Carbohidrat Addition on Production in Extensive Shrimp Culture Systems. Aquaculture. 241/ 179-194.

[18] Hutabarat, S., & Evans, S.M. 1984. Introduction to Oceanography. Jakarta: Universitas Indonesia Press.

[19] Kordi, M.G.H. 2010. Sea Shrimp Cultivation. Edition I. Lily Publisher. Yoyakarta

[20] Kurniaji, A., Yunarty, Budiyati, Renitasari, D.P., & Resa M. 2022. Water Quality Characteristics and Growth Performance of Vaname Shrimp Cultivation (*Litopenaeus vannamei*) Intensive Pattern. PENA Akuatika: Journal Ilmiah Perikanan & Kelautan. 21 (1): 75-88

[21] Kusumaningtyas, M.A., Bramawanto, R., Daulat, A., & Pranowo, W.S. 2014. Natuna waters quality in the transition season. Depik. 3(1), 10-20.

[22] Latuconsina, H. 2020. Tropical Aquatic Ecology: Basic Principles for Management of Aquatic Biological Resources. Cetakan ke-3. UGM Press. Yogyakarta.

[23] Mangampa, M. & Suwoyo, H.S. 2016. Intensive Technology Cultivation of Vaname Shrimp (*Litopenaeus vannamei*) Using Tokolan Seeds. Jurnal Riset Akuakultur. 5 (3): 351- 361.

[24] Mustafa. A., Hasnawi., Abbas. S., & Syamsu. A. A. 2014. Characteristics, Suitability and Management of Land for Cultivation in Ponds, Pohuwanto Regency, Gorontalo Province. J.Ris. Akuakultur. 9(I), 135-149.

[25] Nalle, T., P. Santoso.,& Suwari. 2020. Water Quality Study of Macroalgae Populations on the Coast of Kupang Bay, East Nusa Tenggara. JVIP, 1 (1), 23 – 34.

[26] Nonji, A. 2005. Archipelago Sea. Jakarta: Publisher Djambatan.

[27] Odum, Eugene P. 1971. Fundamentals of ecology. London (UK): W.B. Saunders.

[28] Patty, S. 2013. Distribusi Suhu, Salinitas Dan Oksigen Terlarut Di Perairan Kema, Sulawesi Utara. Jurnal Ilmiah Platax. 1:(3).

[29] Salmin. 2005. Dissolved oxygen (DO) and biological oxygen demand (BOD) are indicators for determining water quality. Oseana, 30(3), 21-26.

[30] Silalahi, H.N., Manaf, M., & Alianto. 2017. Status of sea water quality at Maruni Beach, Manokwari Regency. Journal Sumberdaya Akuatik Indopasifik, 1(1), 33-42.

[31] Simanjuntak, M. 2009. The relationship between chemical and physical environmental factors on the distribution of plankton in East Belitung waters, Bangka Belitung. Journal of Fisheries Sciences, 11(1), 31-45.

[32] SNI. 2016. General Guidelines for Rearing Tiger Prawns (*Penaeus monodon*) and Vaname Shrimp (*Litopenaeus vannamei*). Number 75. Minister of Maritime Affairs and Fisheries of the Republic of Indonesia. Jakarta

[33] Supono. 2019. Low Salinity Vaname Shrimp Cultivation Solutions for Cultivation on Critical Land. 1st Edition. Graha Ilmu. Yogyakarta

[34] Supriatna, Mahmudia, M., Musaa & M., Kusriania. 2020. Relationship between pH and water quality parameters in intensive ponds of vannamei shrimp (*Litopenaeus vannamei*). Journal of Fisheries and Marine Research. 4 (3): 368-374

[35] Sutarso, A., Gaol, L., Diansyah, G., Ida, A., & Purwiyanto, S. 2017. Analysis Of Sea Water Quality In The Southern Of Bangka Strait. Maspari. 2017;9(1), 9-16

[36] Verawati. 2016. Analysis of Sea Water Quality in Lampung Bay. Thesis. Civil Engineering Master's Postgraduate Program. Faculty of Engineering.. University of Lampung. Bandar lampung.

[37] Wafi, A., Ariadi, H., Muqsith, A., & Madusari, B.D. 2021. Business Feasibility of Intensive L. vannamei aname with Non-Partial System. ECSOFiM. 8 (2): 253-267.

[38] Wahyuningsih, N., Suharsono., & Z. Fitrian. 2021. Study of the quality of the water environment in Bontang City, East Borneo Province. Jurnal Riset Pembangunan. 4(1), 56-66

[39] Widiadmoko, W. 2013. Physical and Chemical Monitoring of Water Quality in Hurun Bay Waters. Balai Besar Pengembangan Budidaya Laut (BBPBL), Lampung. Politeknik Negeri Lampung. Bandar Lampung.

[40] Widigdo, B. 2001. Formulation of Ecobiological Criteria in Determining the Natural Potential of Coastal Areas for Pond Cultivation. Faculty of Fisheries and Marine Sciences. IPB. Bogor.

[41] Wyban, J.A, and J.N. Sweeney 1991. Intensive shrimp production technology. The Ocean Institute Honolulu, Hawai. 158 p

[42] Yudiati, E., Arifin. & Riniatsih, I. 2010. Effect of Probiotic Application on the Survival Rate and Growth of Vaname Shrimp Torch (*Litopenaeus vannamei*), Vibrio Bacterial Population, as well as the Ammonia Content and Organic Material of Cultivation Media. Marine Science. 15(3): 153 -158.