WATER QUALITY MANAGEMENT OF VANNAMEI SHRIMP *(Litopenaeus vannamei)* AT THE SOUTH AREA AND SEA FISHERIES CENTER PANGANDARAN

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ABSTRACT

Vannamei shrimp cultivation with intensive and super intensive patterns in Indonesia has so far developed and uses various types of ponds such as land ponds, cement ponds, and HDPE ponds. Although Vannamei shrimp cultivation has many advantages, if environmental conditions such as water quality are not by the standards for cultivation, it will certainly cause death and ultimately losses in the cultivation business. One technique to overcome this problem in vannamei shrimp farming is good water quality management. Because with good water quality management, can maintain water quality by standards for cultivation and can increase pond productivity. The purpose of this research is to analyze water quality including pH, water temperature, brightness, salinity, and ammonia for vannamei shrimp culture. Based on the results of research, the water quality in this aquaculture pond is still in the optimum range so that it supports the survival of vannamei shrimp.

Keywords: *cultivation, aquaculture, pond productivity*

1. INTRODUCTION

Shrimp is one of the shrimp that is easy to cultivate because it has many advantages (Fuady *et al*. 2013). In the application of simple to intensive technology in the cultivation of vannamei shrimp in the tropics, it has been shown that vannamei shrimp has advantages compared to other types of shrimp (Widodo *et al*. 2011). According to Poernomo (2004) in Widodo *et al*. (2011), Vannamei shrimp have faster growth, and can be cultivated with high stocking densities because they can utilize feed and space more efficiently, are euryhaline, and are more resistant to disease and environmental disturbances.

Vannamei shrimp cultivation with intensive and super intensive patterns in Indonesia has so far developed and uses various types of ponds such as land ponds, cement ponds, and HDPE ponds (Suriawan *et al*. 2019). According to Boyd (1990) in Sahrijanna and Sahabuddin (2014), intensive shrimp cultivation with a high enough amount of feed has an impact on increasing aquaculture waste originating from feed residues, feces, and shrimp metabolism which if disposed of directly will pollute the environment so that it can pollute the environment. surrounding cultivation environment.

Although Vannamei shrimp cultivation has many advantages, if environmental conditions such as water quality are not by the standards for cultivation, it will certainly cause death and ultimately losses in aquaculture (Fuady *et al*. 2013). One technique to overcome this problem is aquaculture. Vannames shrimp is good water quality management. Because with good water quality management, can maintain water quality by standards for cultivation and can increase pond productivity. Therefore, it is necessary to conduct this research to know and be able to analyze the water quality of vannamei aquaculture ponds at the Air Payat and

Marine Fisheries Center for the Southern Region of Pangandaran. The purpose of this research is to analyze water quality including pH, water temperature, brightness, salinity, and ammonia for vannamei shrimp culture.

2. MATERIALS AND METHOD

Methods Data collection methods include:

1. Primary
   Data Primary data in this field work practice is in the form of data from direct observations or observations, interviews, and active activities during the implementation of fieldwork practices.
2. Secondary Data in this fieldwork practice, is obtained from books, website addresses, journals, and research reports related to water quality.

The analytical method used in this research is the descriptive method. According to Siyoto and Sodik (2015), this descriptive research is related to the study of phenomena in more detail or distinguishing them from other phenomena. The descriptive method is a research method that seeks to describe and interpret the object as it is (Iskandar 2020). the descriptive method used was to analyze the results of water quality measurements at the Payat and Marine Fisheries Center for the Southern Region of Pangandaran which was then compared with the Indonesian National Standard (SNI) 01-7246 the year 2006. The tools and materials used in this research activity are presented in Table 1.

Table 1. Water quality measurement tools and material

No	Parameters	Tools	Material
1	Transparency	Secci disk	Water sample
2	Temperature	Thermometer	Water sample
3	pH	pH meter	Water sample
4	Salinity	Refractometer	Water sample
5	NH3	Standard color cart	Water sample

3. RESULTS

Penaeus vannamei is often also referred to as *Litopenaeus vannamei* which refers to the subgenus Litopenaeus. White shrimp or vannamei (*Litopenaeus vannamei*) has begun to be cultivated and has succeeded in increasing world shrimp production because the white shrimp mother has been successfully domesticated. World white shrimp production rose from around 100,000 mt (10% of world shrimp product) in 1998 to around 1,500,000 mt (75% of world shrimp product) in 2006 (Wyban 2007 in Supono 2017).

Classification of vaname shrimp according to Haliman and Dian (2006) in Lusiana (2019) is as follows:

Kingdom : Animalia
Subkingdom : Metazoa
Phylum : Arthropoda
Subphylum : Crustacea
Class : Malacostraca
Subclass : Eumalacostraca
Superorder : Eucarida
Order : Decapoda
Suborder : Dendrobrachiata
Family : Penaeidae
Genus : Litopenaeus
Species : Litopenaeus vannamei

Morphologically, vannamei shrimp has a characteristic body that is covered with books and the activity of changing the outer shell *(exoskeleton)* periodically, or so-called *molting* (Aidah 2020). Vannamei shrimp body parts function to eat, move, immerse themselves in the mud *(burrowing)*, support the gills, and sensor organs such as antennae and antennae (Aidah 2020). Vannamei shrimp has a body that is divided into

two parts, namely the head and body, the head *(cephalothorax)* and body parts protected by chitin or carapace. According to Aidah (2020), Vannamei shrimp have a body covered with skin protected by yellowish-white chitin with white feet.

On the head of the vannamei shrimp, there are antennae and antennae which are used as sensory organs, as well as the mandible, and maxillae. In addition, the head of the shrimp is equipped with 5 pairs of walking legs (periopod). The body and abdomen consist of 6 segments, each of which has a pair of swimming legs (pleopods), and on the sixth or last segment, there are 4 tails (uropods) and one telson which is pointed.

Water Quality Measurement Results Water
Temperature

Temperature is one of the most important factors for the life of organisms in waters, the easiest external factor to study and determine is the temperature (Hamuna *et al* 2018). The temperature difference in water is smaller and the changes that occur are also slower than in air (Odum 1996). Although the variation in water in water is not as large as in air, it is the main limiting factor for aquatic organisms that have a narrow tolerance. Temperature changes greatly affect aquatic life in the waters. Temperature is one of the important factors in water bodies. Temperature is one of the physical factors that affect the process of photosynthesis.

Based on the data obtained, it can be seen that temperature fluctuations occur in the vannamei shrimp rearing pond. The lowest temperature is obtained in the morning when the intensity of light entering the waters tends to be lower than in the afternoon because there is still sunlight intensity. The lowest temperature was obtained in the morning, which reached 26.3°C, and the highest was obtained in the afternoon, which was 30.7°C. Meanwhile, the average temperature in the morning and evening is 26.3-30.7°C. The temperature value obtained from this measurement is still in the optimal category for shrimp growth and survival. According to Liao & Muarai (1986) in Sahrijanna and Sahabuddin (2014), the success in shrimp culture temperature ranges from 20-30^{o}C. Water temperature can indirectly affect the life of aquatic organisms. The effect of water temperature can be through the solubility of oxygen in water, the higher the water temperature the lower the solubility of oxygen in the water and vice versa (Pasongli *et al*. 2015).

The highest temperature is when measurements are made in the afternoon, this will certainly cause a gradual increase in metabolic processes by aquatic organisms in these waters. This change will also have an impact on the use of dissolved oxygen in the waters resulting in reduced availability. It's just that during the day different conditions occur, where the rate of photosynthesis continues and even increases with increasing light intensity to a certain point and depth. This causes a high availability of dissolved oxygen (DO) and compensates for oxygen consumption which is affected by the increase in temperature in the vannamei shrimp rearing pond.

Many factors affect the high water temperature in a pond. These factors include sunlight and wind (Pasongli *et al*. 2015). Sunlight is one of the factors that can determine the size of the heating given by the sun to the surface or body of water. In addition to the sunlight factor, the wind factor can also affect changes in temperature on the surface of the water. The wind always moves hot and cold air, the wind will bring heat to cold areas and raise the temperature of the place visited, and vice versa (Pasongli *et al*. 2015).

pH

High and low pH in waters is influenced by fluctuations in O_2 and CO_2, Not all living things can withstand changes in pH values, nature provides a unique mechanism so that changes do not occur or occur slowly (Rukminasari *et al* 2014). The degree of Acidity or pH is a measure that shows the levels of acid and base in a solution, a neutral solution if pH = 7, while alkaline if pH> 7 and alkaline if pH <7 (Abduh 2018). Aquatic biota is sensitive to changes in pH values, the ideal pH value for life is between 7 - 8.5. The low pH value can cause a decrease in water quality which in turn will have an impact on the life of the biota in it.

The increase in pH levels increases along with the increase in dissolved oxygen content in the waters. The lowest pH is 7 while the highest pH is in the afternoon, reaching 9. It can be said that the increase in the pH value is not too significant. A decrease in CO_2 levels in the waters is due to an increase in the rate of photosynthesis during the day. It can be seen that the decrease in the pH value is caused by the decrease in CO_2 levels in the waters because CO_2 is an acidic reaction in the water In addition, there is a reciprocal relationship between CO_2 and the processes of photosynthesis and respiration. So the value of CO_2 usually increases during the night and decreases during the day the pH of the pond water in the vannamei shrimp culture is quite optimal. The standard for vaname shrimp culture ranges from 7.5 to 8.5 (Anonymous 2003 in Sahrijanna and Sahabuddin 2014).

Salinity

Salinity is the dissolved salt content in water, which describes the total solids in the water (Armis *et al*. 2017). Water salinity describes the salt content in water, the salt in question is a variety of ions dissolved in water including table salt (NaCl) (Armis *et al*. 2017).

The average salinity value of vannamei shrimp rearing ponds ranges from 11-18 ppt. According to Pasongli *et al*. (2015), many factors can affect the difference in the range of salinity values in pond waters, these factors are the pattern of water circulation, evaporation, rainfall, and river flow. The factor of high rainfall can also result in a mixing process of fresh water which is more dominant than seawater (Pasongli *et al*. 2015).

Transparency

Transparency is the level of transparency of water that can be observed visually using a *secchi disk*, by knowing the brightness of water we can determine the occurrence of assimilation processes in the water, the layer that is not cloudy, and the layer that is the most cloudy (Hamuna *et al* 2018). Light penetration is often blocked by water-soluble substances and limits the photosynthetic zone because aquatic habitats are limited by depth (Odum 1996). The presence of turbidity caused by suspended particles will result in differences in the growth potential of phytoplankton in a body of water (Alianto *et al* 2008).

The transparency of light in water can be determined by the amount of material that enters or is contained in the water (Sihombing *et al* 2013). The light penetration in the vannamei shrimp rearing pond has an average of about 15-65. According to Effendi (2003) that the brightness value is influenced by the time of measurement, suspended solids, weather conditions, turbidity, and also the accuracy of the person taking the measurement. The low light penetration will affect the photosynthesis process.

Ammonia (NH3)

Ammonia in water in the form of ammonia (NH3) and ammonium (NH4+), ammonia is not only toxic but also the most widely produced product of nitrogen metabolism, apart from the metabolism of feed, ammonia also comes from the decomposition of other organisms (Wahyuningsih and Gitarama 2020). Ammonia value is measured every two weeks, namely on November 14th, the high ammonia value is around 0.02. Meanwhile, on December 2, the ammonia value decreased to 0.01, this was due to storage in the vannamei shrimp rearing pond.

According to Ariadi et al. (2020), high ammonia values will have a negative effect on the growth rate of vaname shrimp. According to Sahrijanna and Sahabuddin (2014) that the main source of ammonia in ponds is the accumulation of organic matter from leftover feed and dead plankton. The protein content in the feed also strongly supports the accumulation of organic matter which will undergo ammonification and become ammonia.

Indonesian National Standards for Vannamei Shrimp Water Quality

Table 2. Indonesian National Standard for Vannamei Shrimp Water Quality

No	Parameters	Unit	Score
1	Transparency	cm	30-45
2	Temperature	^{o}C	28,5-31,5
3	pH	-	7,5-8,5
4	Salinity	ppt	15-25
5	NH3	mg/L	0,01

Source: Indonesian National Standard 01-7246 (2006)

According to Syafaat and Mansyur (2013), water quality measurements such as temperature, pH, salinity, dissolved oxygen, nitrate, nitrite, phosphate, total organic matter (BOT), and ammonia are important in the maintenance of vannamei shrimp. This is because it is related to the metabolic process of shrimp and activity in foraging for food so it is very influential on the growth and survival of vannamei shrimp (Syafaat and Mansyur 2013).

Based on Table 1, the SNI for vaname shrimp rearing temperature ranges from 28.5-31.5^{o}C. When compared with the results of temperature measurements in UPTD PAPLWS which has an average of 26.3-30.7 ^{o}C. Shrimp cultivation in UPTD PAPLWS is still considered feasible for shrimp farming. According to Pillay (1993) in Syafaat and Mansyur (2013) that shrimp can survive in a temperature range of 22-30^{o}C. According to Anonymous (2003) in Syafaat and Mansyur (2013) vannamei shrimp can live at a tolerance of

16-36 ^{o}C and optimal at a temperature of 28-31^{o}C. Water temperature is the second most important factor after dissolved oxygen, because water temperature affects the activity, behavior, eating habits, growth, and reproduction of all types of aquatic organisms (Syafaat and Mansyur 2013).

Salinity in vaname rearing ponds is 11-18 ppt while based on SNI 15-25. High temperatures will also cause the salinity of the waters to increase, because there has been thickening due to evaporation (Mangampa 2007 in Syafaat and Mansyur 2013). High and low salinity of the water is a factor that affects the growth rate of vannamei shrimp (Syafaat *et al*. 2010). According to the Indonesian National Standard, the optimum pH for shrimp growth is 7-8.5, while in the observation pond it is 7-9. The degree of acidity (pH) according to SNI is around 7.5-8.5, while in the observation pond it is around 7 and increases in the afternoon. According to Boyd (2001) in Syafaat and Mansyur (2013) ammonia diffuses from the pool water into the air, this can occur when the pH conditions are high and the wind blows over the pool surface. The degree of acidity (pH) can increase to 9-10 in the daily pH cycle, this is related to the uptake of carbon dioxide during the photosynthesis process (Pillay 1993 in Syafaat *et al*. 2010).

Ammonia in the observation pond has an average of 0.01-0.02 mg/L, ammonia in the pond is caused by the accumulation of feed residues and shrimp excrement which causes ammonia to increase. According to Mansyur and Suwoyo (2012), the toxicity of water quality changes does not work independently, meaning that even if the ammonia level exceeds the life threshold, changes in other parameters are still at an optimal level, it will not kill the shrimp. Ammonia levels began to affect the growth of vannamei shrimp, namely 50% at levels of 0.45 mg/L, while levels of 1.29 mg/L caused death (Mansyur and Suwoyo 2012).

The transparency of light based on SNI is 30-45 cm, and based on the measurement results it has an average of 15-65 cm. Light transparency describes the optical properties of water which can be determined based on the light absorbed and emitted by the materials contained in the water (Effendi 2003). Light is used by pigmented organisms to carry out photosynthesis. The value of light transparency is a condition that indicates the ability of light to penetrate the water layer at a certain depth (Mainassy 2015). According to Supriatna *et al*. (2020) that the range of good light transparency for shrimp rearing is 35-45 cm. Light transparency in ponds is highly dependent on the abundance of phytoplankton, zooplankton, and also particulate matter dissolved in water, low light transparency also results in a decrease in dissolved oxygen in the water (Supriatna *et al*. 2020).

4. CONCLUSIONS

The conclusions that can be drawn from this research are as follows:

1. The factor that causes water quality to fluctuate is the intensity of sunlight because it can affect the value of water temperature.
2. The average pH value in the rearing pond in the morning reached 7.7 and increased to 7.8 in the afternoon. Meanwhile, the Ammonia value of 0.015 mg/L was still within the tolerable limit of vannamei shrimp.
3. The water quality in this culture pond is still in the optimum range so that it supports the survival of vannamei shrimp.

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