Indonesian Journal of Aquaculture Medium

https://journal.unram.ac.id/index.php/jmai/index. E-ISSN : 2798-0553

VOLUME 2, NUMBER 2, DECEMBER 2022

Testing of Physical, Chemical and Biological Parameters on Seawater Lobster Cultivation in Ekas Beach, East Lombok Regency

Uji Parameter Fisika, Kimia Dan Biologi Pada Budidaya Lobster Air Laut Di Pantai Ekas Kabupaten Lombok Timur

Dwi Cahya Abdi Putra, Muhammad junaidi*, Dewi Putri Lestari

Aquaculture Study Program, Mataram University

Pendidikan Street Number 37, Mataram City, West NusaTenggara

*Coresponding author : m.junaidi@unram.ac.id

ABSTRACT

Lobster is one of the marine biota that has high economic value, as well as being one of the biota that can be developed through the cultivation process. The waters of Ekas Bay have the potential of marine resources that can be used as a place for lobster cultivation. This study aims to determine water quality with physical, chemical and biological parameters for lobster cultivation on the former coast of East Lombok Regency. The research was carried out in April 2022, located in the waters of Ekas Bay and the Lombok Marine Aquaculture Fisheries Laboratory Laboratory, West Sekotong, West Lombok Regency. Observations of the research were carried out in situ to observe water quality, as well as taking samples using a random sampling method of 8 points and then observing the content of nitrate, nitrite and plankton in the laboratory. The data that has been obtained is then analyzed descriptively by comparing the data with quality standards and ideal conditions for the development of sea crayfish aquaculture. The results showed that the water quality in Ekas Bay was generally in an ideal condition to be used as a lobster culture based on the appropriate quality standards of water quality for lobster cultivation. The water areas that are very suitable to be used as a place for lobster cultivation based on quality standards of water quality are the KJA 1, KJA 2, KJA 3 and Seagrass areas. The plankton species found consisted of *Amphisolenia* sp., *Coscinadiscus* sp., *Nitzchia* sp., *Moina* sp., *Planktoniella* sp., *Oithona* sp., *Synedra* sp. and *Navicula* sp.

ABSTRAK

Lobster merupakan salah satu biota laut yang memiliki nilai ekonomis yang tinggi, serta menjadi salah satu biota yang dapat dikembangkan melalui proses budidaya. Perairan Teluk Ekas memiliki potensi sumber daya laut yang dapat dijadikan sebagai tempat budidaya Lobster. Penelitian ini bertujuan untuk mengetahui kualitas air dengan parmeter fisika, kimia dan biologi untuk budidaya lobster di pantai ekas Kabupaten Lombok Timur. Penelitian dilaksanakan pada bulan April 2022, bertempat di perairan Teluk Ekas dan Laboratorium Balai Perikanan Budidaya Laut Lombok, Sekotong Barat Kabupaten Lombok Barat. Pengamatan penelitian dilaksanakan secara in situ untuk mengamati kualitas air, serta mengambil sampel dengan metode random sampling sebanyak 8 titik yang selanjutnya dilakukan pengamatan kandungan nitrat, nitrit serta plankton di Laboratorium. Data yang sudah diperoleh kemudian dianalisa secara deskriptif dengan cara membandingkan data tersebut dengan baku mutu dan kondisi ideal untuk pengembangan budidaya lobster air laut. Hasil penelitian menunjukkan bahwa kualitas perairan di Teluk Ekas secara umum berada pada kondisi yang ideal untuk dijadikan sebagai tempat budidaya Lobster berdasarkan standar baku mutu kelayakan kualitas air untuk budidaya lobster. Wilayah perairan yang sangat layak untuk dijadikan sebagai tempat budidaya Lobster berdasarkan standar baku mutu kelayakan kualitas air adalah wilayah KJA 1, KJA 2, KJA 3 serta wilayah Lamun. Spesies plankton yang ditemukan terdiri dari *Amphisolenia* sp., *Coscinadiscus* sp., *Nitzchia* sp., *Moina* sp., *Planktoniella* sp., *Oithona* sp., *Synedra* sp. dan *Navicula* sp.

Kata Kunci	*Lobster, In Situ, Kualitas Air*
Keywords	*Lobster, In Situ, Water Quality*
Tracebility	Tanggal diterima : 6/7/2022. Tanggal dipublikasi : 31/12/2022
Panduan Kutipan (APPA 7th)	Putra, D. C. A., Junaidi, M., & Lestari, D.P. (2022). Testing of Physical, Chemical and Biological Parameters on Seawater Lobster Cultivation in Ekas Beach, East Lombok Regency. *Indonesian Journal of Aquaculture Medium*, *2*(2), 166-176. http://doi.org/10.29303/mediaakuakultur.v2i2.1411

INTRODUCTION

Lobsters are animals that can live in a wide range of water parameters, are intolerant of low dissolved oxygen content even in turbid water. This lobster also has high economic value because it can be used as an alternative food for consumption or as an ornamental lobster. High nutritional content, easy marketing, does not require large areas of land and relatively small maintenance costs make this lobster attractive to many people for cultivation. In cultivating lobsters, it is the most important medium. Water conditions greatly influence the growth and development of lobsters. Good water quality will ensure good lobster growth and avoid various types of diseases so that it can produce quality lobsters (WWF, 2015).

In lobster cultivation, water is the most important medium. Water conditions greatly influence the growth and development of sea water lobsters. Good water quality will make lobsters grow well and avoid various types of diseases so that they can produce quality lobsters (WHO, 2004).

Several things that can affect water quality in seawater lobster cultivation are the acidity level (pH), temperature and water clarity (Roy, 2019). The water that will be used in cultivation should be protected from disease, pesticides or industrial waste (Stark et al., 2000). Good water quality can be seen from the clarity/turbidity level of the water. Turbid water can cause seawater lobsters to experience respiratory problems which can cause death (Kalih, 2016). Water acidity (pH) that is good for cultivating sea water lobsters ranges from 6 to 8 (Cuncun, 2006). This acidity can be maintained by total alkanity, not excessive amounts of plankton, cleanliness of the bottom of the pond and the use of appropriate pH buffers. The high acidity of sea water means that some of the water in the pool can be replaced periodically. While a good water temperature is between 24 to 32°C (Cuncun, 2006). In this type of ornamental lobster, the temperature will affect the brightness of the skin color. If the water temperature is lower or higher than the range mentioned, it will cause lobster growth to be slower and can cause death.

METODE PENELITIAN

Research sites

This research was carried out in April 2022 in the waters of Ekas Beach, Pemongkong Village, Jerowaru District, East Lombok Regency and at the Lombok Marine Aquaculture Center Laboratory, West Sekotong, West Lombok Regency, West Nusa Tenggara. Field research is carried out in situ in order to observe specified water quality parameters, including temperature, pH, brightness and turbidity. The parameters tested in the laboratory are to analyze the parameters of nitrate, nitrite and plankton content.

Research Tools and Materials

Table 1. Tools used in this research include:

No	Tools	Function
1	Currenmeter	To measure current speed
2	Batimetri	To measure depth
3	GPS Map	To determine location accuracy
4	Sechidisk	To measure brightness
7	pH meter	To measure pH
8	Refraktometer	To measure salinity
9	Termometer Alkohol	To measure temperature
10	Cool Box	Saving samples
11	Sample bottle	For water sample containers
12	Mikroskop Haemocytometer	To count the number of plankton cells
13	Plankton Net	To filter plankton

The materials used in this research include samples of sea water, Lugol and distilled water.

Research Parameters

The parameters that will be observed in this research are water quality which includes temperature, salinity, pH, dissolved oxygen (DO), brightness, turbidity, nitrate, nitrite and plankton.

a. Water temperature is measured in situ using a thermometer. Water temperature is measured using a thermometer. The thermometer is inserted into the water for approximately 2 minutes, then the temperature value is read while the thermometer is in the water so that the measured temperature value is not influenced by the air temperature.
b. Salinity measurement using a hand refractometer.
c. Measurement of the degree of acidity (pH) is carried out using a pH meter.
d. Measuring dissolved oxygen using a DO-Meter, Dip the DO-Meter into water > 50 cm in on condition (ON), Leave it for a few minutes until you can be sure that the indicator is not moving.
e. Brightness measurement using the Secchi disk tool. The Secchi Disk can be used by tying the Secchi Disk plate with a rope and then placing it in water. When the pattern on the Secchi Disk is no longer visible in the water at a certain depth, the results of the analysis of the level of water brightness are obtained. According to Pingki (2021), brightness can be calculated using the following formula.

$$K = \frac{d1 + d2}{2}$$

Note:

K : Brightness

d1 : The depth of the Secchi Disk when invisible

d2 : The depth of the Secchi Disk as it begins to appear again

Sampling Method

The method used in this research is a survey method, namely observation and taking research samples directly in the field which are then analyzed in the laboratory of the Lombok Marine Aquaculture Center, West Sekotong, West Lombok Regency and discussed descriptively based on literature related to the research.

Sampling was carried out using a simple random sampling method, where in this method the sample was determined from the number of fish cages in the research location. The coordinates of the research location have been determined using a GPS device (*Global Positioning Systemt*).

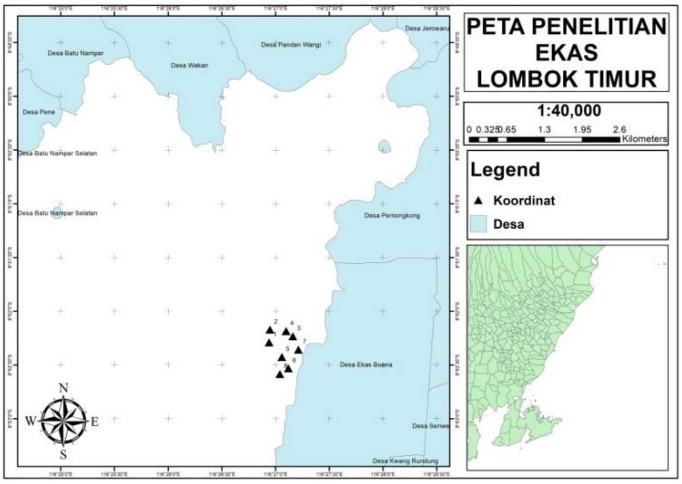


Figure 1. Map of Research Locations in Ekas Bay, East Lombok Regency and Distribution of Water Quality Observation Coordinate Points

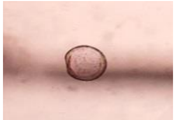
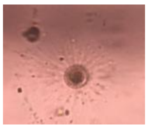
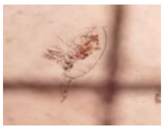
Note : 1. KJA 1	5. Mangrove 1
2. KJA 2	6. Settlement
3. Seagrass	7. estuary
4. KJA 3	8. Mangrove 2

Data Analysis

The data that has been obtained is then analyzed descriptively by comparing the data with quality standards and ideal conditions for developing seawater lobster cultivation. Next, further analysis is carried out to map water quality data. This analysis was carried out using the kriging interplotting technique (Siregar and Selamat, 2009). Includes physical, chemical and biological parameters as primary data and compared with secondary books and journals.

Distribution of plankton composition in the waters of Ekas Bay

Table 4. Observation results of plankton found in Ekas Bay

No	Spesies	Stasiun 1	Stasiun 2	Stasiun 3	Stasiun 4	Stasiun 5	Stasiun 6	Stasiun 7	Stasiun 8
1	 *Amphisolenia sp*	10	7	7	5	3	4	6	4
2	 *Coscinadiscus sp*	1	1	0	2	2	1	0	0
3	 *Nitzchia sp*	1	0	1	1	2	0	3	10
4	 *Moina sp*	2	1	1	0	0	1	0	0
5	 *Planktoniella sp*	4	1	4	5	1	2	3	1
6	 *Oithona sp*	0	1	1	0	0	0	0	0
7	 *Synedra sp*	0	0	2	0	0	0	0	1
8	 *Navicula sp*	0	0	0	1	0	1	0	0

RESULT AND DISCUSSION

Water Quality

Table 2. Summary of Observation and Laboratory Test Results

NO	Sampling Location	Observation Parameters							
		Temperature (℃)	DO (mg/l)	pH	Salinity (ppt)	Nitrate (NO_3_N)	Nitrite (NO_2_N)	Brightness (m)	Flow Speed (cm/s)
1	KJA 1	32,2	8,0	9,0	35,0	<0,01	0,005	10,2	38,0
2	KJA 2	32,3	8,0	8,0	36,0	<0,01	0,002	9,7	44,0
3	KJA 3	33,6	8,0	9,0	35,0	<0,01	0,07	10,1	40,0
4	Seagrass	33,3	8,0	8,5	34,0	<0,01	0,006	0,4	48,0
5	Mangrove 1	33,7	2,0	9,0	36,0	<0,01	<0,001	1,2	34,0
6	Mangrove 2	33,6	2,0	8,0	34,0	<0,01	<0,001	0,5	24,0
7	estuary	33,7	2,0	8,0	34,0	<0,01	<0,001	0,4	28,0
8	Settlement	32,1	8,0	8,5	35,0	<0,01	0,004	0,8	30,0
Average		33,1	5,8	8,5	34,8	<0,01	0,017	4,2	35,8

Description: KJA = Floating Net Cage

Table 3. Average Value and Feasibility Literature for Water Quality at the Research Location

Observation	Results Range	Average	References
Temperature (℃)	32,1 - 33,7	33,1	27-32 (FAO, 1989)
DO (mg/l)	2,0 - 8,0	5,8	>5 (MNLH, 2004)
pH	8,0 - 9,0	8,5	7,0-8,5 (Szuster and Albasri, 2010)
Salinity (PPT)	34,0 - 36,0	34,8	30-35 (Yogaswara *et al.*, 2016)
Nitrate (NO_3_N)	<0,01	<0,01	<0,5 mg/l (Makmur, 2010)
Nitrite (NO_2_N)	0,001 - 0,07	0,017	<0,1 mg/l (Makmur, 2010)
Brightness (m)	0,4 - 10,2	4,2	>3 (MNLH, 2004)
Flow Speed (cm/s)	24,0 - 48,0	35,8	5-100 (Rostika, 2020)

Based on the research results in Table 2, it can be seen that the water quality conditions at the sampling location are still suitable for use as a place for lobster cultivation based on the water quality feasibility literature. However, it was found that the Mangrove 1, Mangrove 2 and Muara locations had low dissolved oxygen values and were not suitable for cultivation of sea lobsters.

The DO value at Mangrove 1, Mangrove 2 and Muara locations is 2.0 mg/l each. This indicates that the three locations have low dissolved oxygen content so they are not suitable for sea lobster cultivation based on water quality literature. Based on the decr ee of the State Minister for the Environment (2004), the value of dissolved oxygen (DO) content to be able to support the needs of sea lobster cultivation must be greater than 5 mg/l. The low dissolved oxygen (DO) content values at the three locations are thought to be caused by the large amount of organic waste in them. (Hart, 2009) states that, one of the causes of low levels of dissolved oxygen content in waters is the large amount of organic waste originating from plant remains and other living creatures, so that it can result in the level of oxygen use by bacteria in breaking down organic substances into substances. inorganics will be higher.

Based on the results of observations and laboratory tests presented in Table 3, it can be seen that the water conditions of Ekas Bay in East Lombok Regency have an average temperature of 33.1, an average dissolved oxygen of 5.8 mg/l, an average pH water is 8.9, average salinity is 35.9 PPT, average nitrate content is <0.01, average nitrite content is 0.017, average brightness reaches 4.2 m and average current speed is 35.8 cm/s.

Based on the results of research that has been carried out, it can be seen that the temperature distribution in the waters of Ekas Bay ranges from 32.1 - 33.7 , with an average temperature of 33.1 . This fairly high temperature distribution value is caused by many factors, one of which is weather conditions. During the sampling process in the Ekas Bay area, the weather conditions at that time were very bright and allowed for the absorption of high intensity sunlight. According to Putri (2009), the more intense sunlight that reaches the sea surface, the higher the sea water temperature will be. This is in accordance with the statement (Effendi, 2003) which states that the temperature level that occurs in water areas is related to the level of heating ability carried out by sunlight, time and location conditions. Apart from that, Hutabarat (2000) also stated that the ability of water areas to absorb heat is much lower than land areas, but water areas have a higher ability to store heat. In general, the average temperature conditions in the Ekas Bay area have a temperature level that still allows it to be used as a place for cultivating lobsters.

Based on the results of research that has been carried out, it can be seen that the distribution of dissolved oxygen in the Ekas Bay area ranges between 2-8 mg/l, with an average value of 5.7 mg/l. The level of dissolved oxygen contained in a water area greatly influences the life processes of the biota that live in it. This is because if the dissolved oxygen content in a body of water is unable to meet the oxygen needs of the biota that live in it, it will result in disruption of the growth process and survival of that biota. According to (Kordi, 2010), states that one of the determining factors in the growth and development process of biota that live in waters is the level of oxygen content contained in it, if the dissolved oxygen content is not available in sufficient quantities it will result in growth and the development of the biota in it will be disrupted. Based on the research results obtained, the average value of dissolved oxygen content contained in the waters of Ekas Bay is at the optimum value to support the growth and development process of lobsters cultivated in KJA. This is supported by (Saparinto & Cahyo, 2014) who stated that the value of dissolved oxygen content needed to support the sea lobster cultivation process in KJA is >4 ppm.

Based on the results of observations that have been made, it can be seen that the distribution of pH values in the waters of Ekas Bay ranges between 8-9, with an average value of 8.5. This indicates that the pH value in the waters of Ekas Bay is at optimum conditions for carrying out the lobster cultivation process. This is in accordance with the opinion of (Saparinto & Cahyo, 2014), which states that to support the sustainability of the sea lobster cultivation process, water conditions with a pH range of 7.8-8.5 are needed. An optimum water pH value is very important to support the level of productivity of a water area in cultivating sea lobsters. Water that is in acidic conditions can threaten the survival of cultivated lobsters (Kordi, 2010). This is because low pH conditions will affect the level of dissolved oxygen contained in waters, and will result in the availability of oxygen for lobsters being reduced.

Based on the research results in Table 3, it can be seen that the salinity value found in the waters of Ekas Bay is around 34-36 ppt, with an average value of 34.8 ppt. This shows that the water conditions of Ekas Bay are still very supportive for being used as a place for lobster cultivation. This is because the salinity value in the waters of Ekas Bay is at optimum conditions to be used as a place for cultivating lobsters. According to (Chou & Lee, 2008), states that to be able to support the living needs of cultivated lobsters, a water salinity level of between 30-35 ppt is required.

The brightness value is a value that shows the ability of light to penetrate into waters. The level of brightness in a body of water is determined by various factors, one of which is the level of suspended and dissolved particles in the water. Based on the results of research that has been carried out, it can be seen that the average level of brightness in the waters of Ekas Bay is 4.2 m (Table 3). This indicates that the waters of Ekas Bay are at optimum conditions to support the lobster cultivation process. Based on the decree of the State Minister for the Environment (2004), a good level of brightness to support the living needs of cultivated sea lobsters is >3 m.

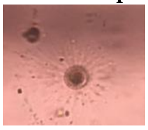
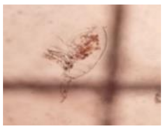
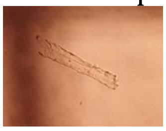
Based on the results of sample testing in the laboratory of the Lombok Marine Aquaculture Center, West Sekotong, West Lombok Regency (Table 3), it shows that the nitrate content in the waters of Ekas Bay is <0.01 mg/l. This indicates that the nitrate content at the sampling location in the waters of Ekas Bay is in suitable conditions to be used as a place for cultivating sea lobsters. According to Makmur et al (2010), the nitrate content suitable for cultivation is <0.05 mg/l. Nitrate is the main form of nitrogen in waters and is the main nutrient for algae and other aquatic plants. According to Bahri (2006), states that the nitrates found in water are very soluble and stable.

Nitrite is an intermediate form between nitrate and nitrogen gas through the denitrification process and between ammonia and nitrate (nitrification). According to Giri (2020), nitrite is unstable in the presence of oxygen. Based on the results of research on nitrite content in the waters of Ekas Bay, nitrite levels were found to range between 0.001-0.07 mg/l, with an average of 0.017 mg/l (Table 3). The results of observations of nitrite levels in the waters of Ekas Bay show that the nitrite content is still in a suitable condition to be used as a place for lobster cultivation. Makmur (2010), stated that the appropriate level of nitrite content to support lobster cultivation is <0.1 mg/l.

Distribution of plankton composition in the waters of Ekas Bay

Table 4. Observation results of plankton found in Ekas Bay

No	Spesies	Stasiun 1	Stasiun 2	Stasiun 3	Stasiun 4	Stasiun 5	Stasiun 6	Stasiun 7	Stasiun 8
1	 *Amphisolenia* sp.	10	7	7	5	3	4	6	4
2	 *Coscinadiscus* sp.	1	1	0	2	2	1	0	0
3	 *Nitzchia* sp.	1	0	1	1	2	0	3	10

4	 *Moina* sp.	2	1	1	0	0	1	0	0
5	 *Planktoniella* sp.	4	1	4	5	1	2	3	1
6	 *Oithona* sp.	0	1	1	0	0	0	0	0
7	 *Synedra* sp.	0	0	2	0	0	0	0	1
8	 *Navicula* sp.	0	0	0	1	0	1	0	0

Plankton is a microorganism that has chlorophyll which can function as a site for the photosynthesis process, so that it can produce its own energy. The distribution of plankton composition found in the waters of Ekas Bay is shown in Table 4.

Based on the plankton observation data presented in Table 4, it can be seen that the plankton found in Ekas Bay consists of Amphisolenia sp., Coscinadiscus sp., Nitzchia sp., Moina sp., Planktoniella sp., Oithona sp., Synedra sp. and Navicula sp.. Each species is spread across 8 sampling stations, with the largest number being the species Amphisolenia sp. as many as 46 cells/ml and the lowest species found was Oithona sp. and Navicula sp. each of which is 2 cells/ml.

Based on Table 4, it can be seen that the distribution of plankton in the waters of Ekas Bay is very diverse, consisting of the species Amphisolenia sp., Coscinadiscus sp., Nitzchia sp., Moina sp., Planktoniella sp., Oithona sp., Synedra sp. and Navicula sp.. The presence of plankton in lobster cultivation areas is very important in helping their growth and development. One type of plankton that acts as a primary producer in providing energy for living aquatic ecosystems is phytoplankton (Nindarwi, 2019). (Asriyana & Yuliana, 2012), stated that the presence of plankton in waters plays a very important role in maintaining the balance of the ecosystem within it.

Moina sp. is a type of zooplankton that is important as natural food because its size matches the mouth opening of fish larvae. Moina sp. has complete nutritional content and is easily digested in the intestines of marine biota. Its relatively small body size makes it easier for marine biota such as fish to consume it. Its nature of always moving actively will stimulate fish seeds/larvae to prey on them.

Oithona sp. is plankton which is usually used as a natural food for several types of marine biota such as grouper fish. Oithona sp is a type of copepod that is characterized by small protrusions on the first segment of the urosome. According to Santanumurti (2021), Oithona sp is a natural food that has quite high nutritional content, so it is very useful for meeting the food needs of cultivated marine biota.

Synedra sp. is one of the plankton that can be used as a bioindicator of the condition of waters. According to Isti'anah (2015), when the growth of Synedra sp is more dominant than other plankton in a body of water, it can indicate that there is pollution in that water. This is because, Synedra sp. is a type of plankton that is the size of a diatom, which allows it to survive in extreme conditions, because it has layered covering cells (Conradie, 2008). Apart from having a diatom form, Synedra sp. It is also able to survive in waters that have low nutrients. Venter (2003), stated that Synedra sp. has the ability to collect nutrients and then store them as reserves in the form of insoluble polymers, which can help them survive in waters that have low nutrients.

Navicula sp. is one of the microalgae found in sea water which can be used as feed for cultivating marine biota such as abalone. Microalgae include prokaryotic and eukaryotic organisms that have the potential to be used as raw materials for biofuel and natural food sources (Chisti, 2007). Apart from acting as food for abalone, Navicula *sp. It* can also be used as a source of nutrition in the process of seeding molluscs and crustaceans (Soemarjati, 2014).

The presence of plankton in waters apart from functioning to maintain the balance of the ecosystem, can also be a serious threat to the life of marine biota in it. Based on the research results in Table 3, it was found that one of the species that is poiso nous and has the potential to be a threat to the survival of marine biota is Nitzschia sp. Nitzschia sp is one of the species that causes Harmful Algae Bloom (HAB) and can cause Amnesic Shellfish Poisoning (ASP) which produces domoic acid poison (Lubis et al., 2019). According to Gurning et al. (2020), stated that Harmful Algae Bloom (HAB) will occur when plankton living in the surrounding waters are in very large numbers, namely > cells/l.

In general, the waters of Ekas Bay, East Lombok Regency have enormous potential in supporting the development of lobster cultivation. Physico-chemical characteristics such as temperature, pH, salinity, brightness, dissolved oxygen and current speed are still at optimum conditions based on the quality standard thresholds for lobster cultivation. Apart from that, the availability of marine biota such as plankton which is quite diverse can help maintain the balance of the ecosystem in the waters of Ekas Bay.

CONCLUSSION

Based on the research results, it can be concluded that the waters of Ekas Bay, East Lombok Regency have general water quality parameter values that are suitable for use as a place for cultivating sea lobsters based on water quality feasibility literature.

ACKNOWLEDGEMENT

Thank you to the supervisor who took the time to guide and provide input and motivation to the author during the thesis writing process. Thank you also to the author's parents who always pray for and provide endless support, as well as friends who have helped and supported the thesis writing process both morally and materially. Don't forget to also thank Mataram University, the Ekas Village Community, and the Lombok Marine Cultivation Fisheries Center Laboratory, West Sekotong, West Lombok Regency, West Nusa Tenggara who have agreed to support research activities.

REFERENCES

Asriyana, & Yuliana. (2012). *Produktivitas Perairan*. Jakarta (ID) : PT Bumi Aksara.

Chou, R., & Lee, H. B. (2008). Commercial Marine Fish Farming in Singapore. *Journal of Aquaculture Research*, 28(10), 767–776. https://doi.org/https://doi.org/10.1046/j.1365-2109.1997.00941.x.

Effendi, H. (2003). *Telaah Kualitas Air: Bagi Pengelolaan Sumber Daya Lingkungan Perairan*. Yogyakarta (ID) : Kanisius.

FAO. (1989). Food and Agricultural Organization. Site Selection Criteria for Marine Finfish Netcage Culture in Asia. *Rome FAO*. P 16.

Hart, G. (2009). Assessing the South-East Asian Tropical Lobster Supply and Major Market Demands. ACIAR Final Report. ACIAR Canberra.

Kalih. (2016). Keragaman Serta Distribusi Lobster Anggota Paniluridae dan Scyllaridae di Perairan Pantai Pulau Lombok. *Jurnal Oseanografi*, 2(2), 180–192.

Kordi, K., & Ghufran, H. (2010). Budidaya Perairan Buku Kedua. Yogyakarta (ID) : Citra Aditya.

Lubis, N. S., Siregar, S. H., & Nurrachmi, I. (2019). Struktur Komunitas Fitoplankton Berpotensi Sebagai Harmful Algal Bloom (HAB) Di Perairan Kota Pariaman Berbeda [skripsi]. Pekanbaru: Universitas Riau.

Rostika, R. (2020). Pentingnya Penentuan Lokasi Budidaya Lobster, Investor Wajib Tahu! http://perikanan.psdku.unpad.ac.id/ . [23 Mei 2022].

Roy. (2019). Hydro-Informatics Engineering (Ce) Water Quality Analysis: an Introduction. *International Research Journal of Engineering and Technology*, 6(1), 201–205.

Saparinto, & Cahyo. (2014). 33 *Bisnis Perikanan dengan Penghasilan Jutaan Rupiah Perbulan.* Jakarta (ID) : Penebar Swadaya.

Stark, J., Hanson, P., Goldstein, R., Fallon, J., & Fang, A. (2000). *Water Quality in the Upper Mississippi River Basin, Minnesota, Wisconsin, South Dakota, Iowa, and North Dakota*. United States : USGD.

WHO. (2004). *Guidelines for Drinking Water Quality.* WHO. WHO: Geneva.

WWF. (2015). *Perikanan Lobster Laut: Panduan Penangkapan dan Penanganan*. Jakarta Selatan (ID) : WWF Indonesia.

Yogaswara, G., Elis, I., & Setiyono, H. (2016). Pola Arus Permukaan di Perairan Pulau Tidung, Kepulauan Seribu, Provinsi DKI Jakarta pada Musim Peralihan (Maret-Mei). *Jurnal Oseanografi,* 5(2), 227–233.