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STUDY OF THE QUALITY OF THE WATER ENVIRONMENT FOR SEAWEED (*Eucheuma cottonii*) CULTIVATION ON LEMUKUTAN ISLAND, BENGKAYANG REGENCY

Studi Kualitas Lingkungan Perairan untuk Budidaya Rumput Laut (*Eucheuma cottonii*) di Pulau Lemukutan Kabupaten Bengkayang

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ABSTRACT

Bengkayang Regency is one of the potential areas for the development of seaweed cultivation in the waters of Lumukutan Island, seaweed cultivation cages are spread in the waters of Lemukutan Island located in the West Coast area which is very possible for the development of seaweed cultivation of the Euchema cottonii type. This study aims to determine the quality of the aquatic environment for seaweed cultivation, the suitability of water quality for seaweed cultivation Euchema cottonii on Lemukutan Island, Bengkayang Regency. The method used is a survey method consisting of 3 stations. Sampling with a direct measurement stage in the field, sampling was carried out for 3 months as much as 4 times in a period of 10 days, The results of this study The quality of the aquatic environment for seaweed cultivation that is in accordance with the Quality Standards, namely temperature parameters, depth is only found at station one, current speed, salinity, pH and DO, for the suitability of the quality of the aquatic environment of the cages for seaweed cultivation at stations one, two and three criteria are appropriate.

Keywords: Quality, Suitability of Seaweed Euchema cottonii

ABSTRAK

Kabupaten Bengkayang merupakan salah satu daerah potensial untuk pengembangan budidaya rumput laut di perairan Pulau Lumukutan, keramba budidaya rumput laut tersebar di Perairan Pulau Lemukutan terletak di daerah Pesisir Barat yang sangat memungkinkan untuk pengembangan budidaya rumput laut jenis *Euchema cottonii*. Penelitian ini bertujuan mengetahui kualitas lingkungan perairan untuk budidaya rumput laut, kesesuaian kualitas perairan untuk budidaya rumput laut *Euchema cottonii* di Pulau Lemukutan Kabupaten Bengkayang. Metode yang digunakan adalah metode survey yang terdiri dari 3 stasiun. Pengambilan sampel dengan tahap pengukuran langsung dilapangan, pengambilan sampel dilakukan selama 3 bulan sebanyak 4 kali dalam jangka waktu 10 hari, Hasil penelitian ini

Kualitas lingkungan perairan untuk budidaya rumput laut yang sesuai dengan Baku Mutu yaitu parameter suhu, kedalaman hanya terdapat di stasiun satu, kecepatan arus, salinitas, pH dan DO, untuk kesesuaian kualitas lingkungan perairan keramba untuk budidaya rumput laut pada stasiun satu, dua dan tiga kriteria sesuai.

Kata Kunci: Kualitas, Kesesuaian Rumput Laut *Euchema cottonii*

INTRODUCTION

Seaweed cages are spread throughout the waters of Lemukutan Island which is located in the West Coast region, making it possible to develop seaweed cultivation of the *Euchema cottonii* type. Bengkayang Regency is one of the locations that allows for the development of seaweed cultivation in the waters of Lumukutan Island. On Lemukutan Island, seaweed cultivation is currently centered in Teluk Cina, Teluk Melanau, and Teluk Surau which are close to residential areas. The aim is for these cultivation activities to be more controlled and maintained.

Seaweed is a low-level plant that does not have clear skeletal characteristics such as roots, stems, and leaves. Seaweed is a type of algae that can survive in salty environments. The largest part of seaweed included in the Thallophyta division is also called algae or seaweed. There are four classes known in the Thallophyta division, namely Chlorophyceae (green algae), Phaeophyceae (brown algae), Rhodophyceae (red algae), and Cyanophyceae (blue-green algae). Blue algae, green algae, red algae, and brown algae are exclusively found in marine and freshwater ecosystems (Ghufran, 2010).

Although seaweed cultivation on Lemukutan Island has been carried out for a long time, there has not been much research on the adequacy of water quality as a supporting requirement for its growth. The physical and chemical properties of water greatly affect seaweed production. If the requirements for seaweed growth are not met, the development of seaweed will be hampered and the quality of the product will decrease, which will ultimately affect the selling price and cause a fairly sharp decline.

One of the elements that greatly determines the success of seaweed cultivation is water quality. In seaweed cultivation, water quality is one of the requirements that needs to be considered. Therefore, *Eucheuma cottonii* seaweed requires water quality that supports its growth. The purpose of this study was to determine whether the aquatic environment is suitable for cultivating *Euchema cottonii* seaweed on Lemukutan Island, Bengkayang Regency.

METHODS

This research was conducted in March - May 2024 on Lemukutan Island, Bengkayang Regency, where there were *Eucheuma cottonii* seaweed cultivation activities.

Tools and Materials

The tools used during the study were a sechi disk, DO analyzer, rol meter, current board, refractometer, pH litmus paper, stopwatch, stationery and camera.

Research Implementation

Data collection was carried out for 3 months with a frequency of 10 days. Samples were obtained by direct measurement in the field, Measurement of aquatic environmental parameters was carried out at each station during the study, the parameters observed were brightness, temperature, depth, current speed, salinity, pH and DO.

Collection and Collection of Physical and Chemical Parameter Data

1. Temperature

A thermometer that is dipped directly into seawater is used by the temperature meter. Wait two to five minutes until the thermometer shows a stable number. Without removing the thermometer from the water, record the number listed on the scale.

2. Dissolved Oxygen (DO)

When using a DO meter to measure dissolved oxygen, first calibrate the instrument at zero scale. After dipping the probe tip into the sample, note the stable reading on the instrument.

3. Brightness

Using a Secchi disc, measure the brightness by dipping the instrument into the water until the black and white boundaries are no longer visible. Record the depth D1 and then slowly raise it until it is visible once again. Record the depth D2.

4. Water Depth

When measuring water depth, a roll meter is used to measure the length of a rope that has a weight tied to one end and is submerged in the water.

5. Current Speed

A current board and timer are used to measure the current speed. With the help of a stopwatch, determine how long it takes to release the current board into the water until the rope stretches.

6. pH

Litmus paper is used to measure pH. After the litmus paper is dipped into the water, the number on the pH table will be determined.

7. Salinity

Using a refractometer to measure salinity includes calibrating the prism glass with distilled water, cleaning it with tissue in one direction, dripping about three drops of sample water (seawater) onto it, covering it at a 45° angle to prevent air bubbles from forming on the main glass, pointing the refractometer towards the sun, and then observing and reading the scale on the right before recording the results.

Data Analysis

Quality Analysis

The research data will be analyzed descriptively. Descriptive statistics according to Sugiyono (2018) are statistics used to study data by characterizing or describing the data obtained in its original form, without further analysis or generalization. The results of measuring the physical and chemical parameters of water in the field will be compared with the Sea Water Quality Standards for marine biota based on PP (2021) and the physical and chemical quality standards of water used by experts in the field of seaweed cultivation which are presented in detail in Table 1, in order to study the quality of waters on Lemukutan Island, Bengkayang Regency.

Table 1. Water Quality Standard Parameters (Sea Water Quality Standards for Marine Biota and Quality Standards based on experts in the Field of Seaweed Cultivation)

No	Parameter	Quality Standards
1	Brightness	>3
2	Temperature	28 - 30
3	Depth	0.33 - 3
4	Current	5 - 50
5	Salinity	15 - 38
6	pH	7 – 8.5
7	DO	>5

Source: Government Regulation of the Republic of Indonesia Number 22 of 2021 Attachment VIII Concerning the Implementation of Environmental Protection and Management of Seawater Quality Standards.

In classifying the feasibility of seaweed cultivation, the use of parameter values is very important (Jailani *et al.*, 2015). The weight of each parameter is determined based on how much influence it has on the feasibility of the research location. Three very feasible values, two feasible values, and one unfeasible value are the scores given as part of the evaluation and weighting process. Weighting is used to determine the relative importance of each parameter, with a value of 3 indicating very important, 2 indicating significant, and 1 indicating unimportant (Ferdiansyah *et al.*, 2019). Table 2 presents the feasibility and weighting matrix. Parameters that have a stronger influence are given a greater weight than parameters that have a weaker influence (Neksidin *et al.*, 2013).

Table 2. Criteria for Suitability of Seaweed Cultivation Water Quality *Eucheuma cottonii*

No	Parameter	Class	Score	Weight
1.	Brightness (m)	>3	3	2
		1-3	2	
		<1	1	
2.	Temperature (˚C)	27 - < 30	3	3
		30 - 32	2	
		<27 - > 32	1	
3.	Depth (m)	3 - 5	3	3
		2 - <3 or > 5-10	2	
		< 2 and > 10	1	
4.	Current velocity (cm/s)	20-40	3	3
		10 – 20 or 40 - 50	2	
		<10 or >50	1	
5.	Salinity (ppt)	> 31 – 35	3	3
		29 - 31	2	
		<29 and > 35	1	
6.	pH	> 7 – 8.5	3	3
		6.5 - 7	2	
		< 6.5 and > 8.9	1	
7.	Dissolved oxygen (ppm)	> 7	3	3
		3 - 7	2	
		< 3	1	

Source: Modification (Nashrullah et al., 2021; Ferdiansyah et al., 2019; Al Mualam et al., 2022; Agustina et al., 2017; Hardiana et al., 2023).

Table 3. Criteria for Suitability of Water Quality Parameters for Cage Seaweed Cultivation *Eucheuma cottonii*

No	Value (score)	Criteria	Code
1	46.8 – 60	Very Appropriate	SS
2	33.4 – 46.7	Appropriate	S
3	20 – 33.3	Not Appropriate	TS

Source: Modification (Nashrullah et al., 2021; Ferdiansyah et al., 2019; Al Mualam et al., 2022; Agustina et al., 2017; Hardiana et al., 2023).

RESULTS

The purpose of this study was to evaluate the quality of waters used for seaweed production on Lemukutan Island, Bengkayang Regency. Three observation stations were used to measure the physical and chemical characteristics of the waters to assess the water quality in this study. The physical and chemical characteristics of the waters are one of the indicators of water quality that are recorded, and will be explained as follows: Source: Government Regulation of the Republic of Indonesia Number 22 of 2021 Attachment VIII concerning Management of Seawater Quality Standards and Implementation of Environmental Protection.

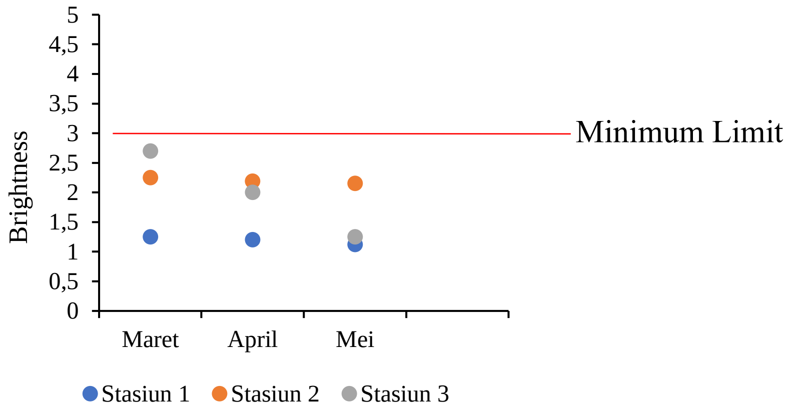

Figure 1. Brightness Parameter Graph

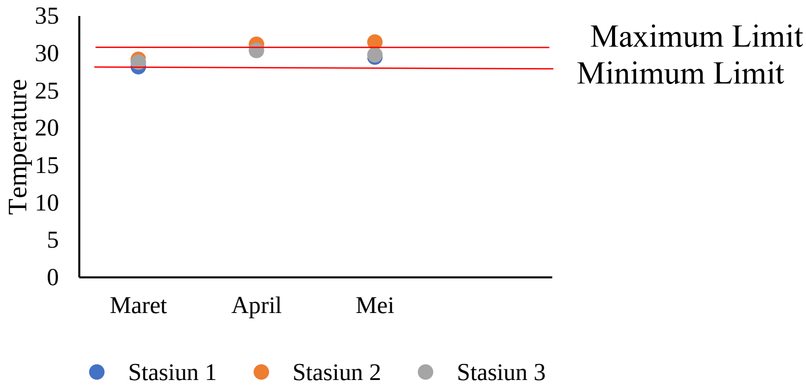

Figure 2. Temperature Parameter Graph

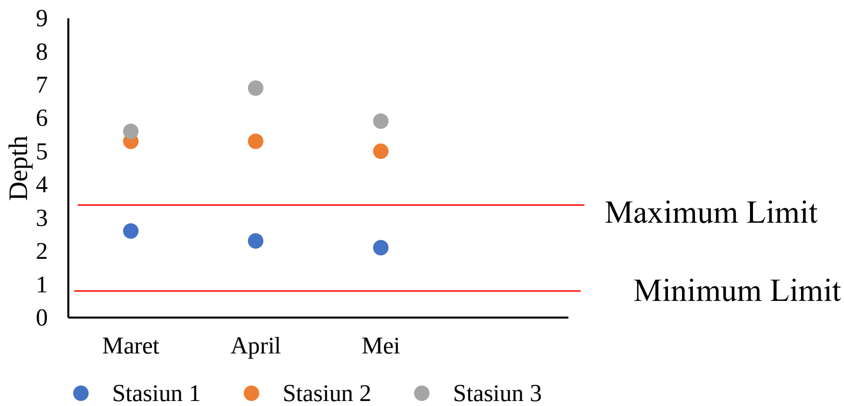

Figure 3. Depth Parameter Graph

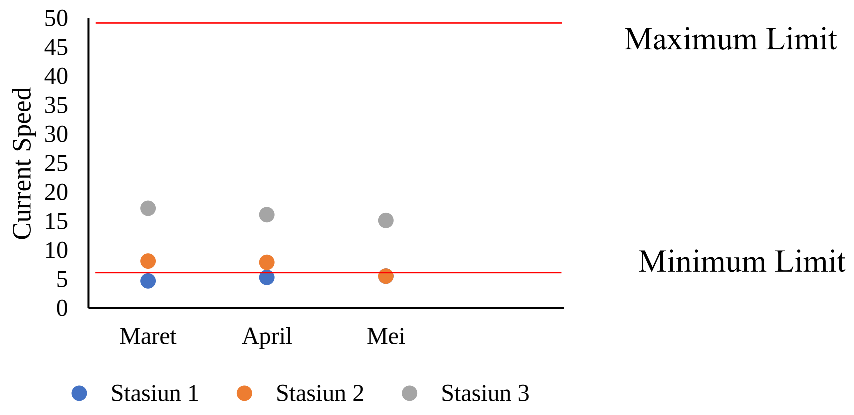

Figure 4. Current Speed Parameter Graph

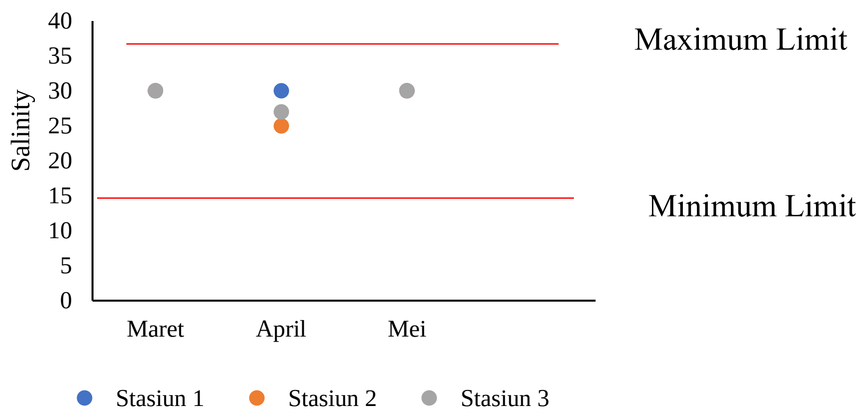

Figure 5. Salinity Parameter Graph

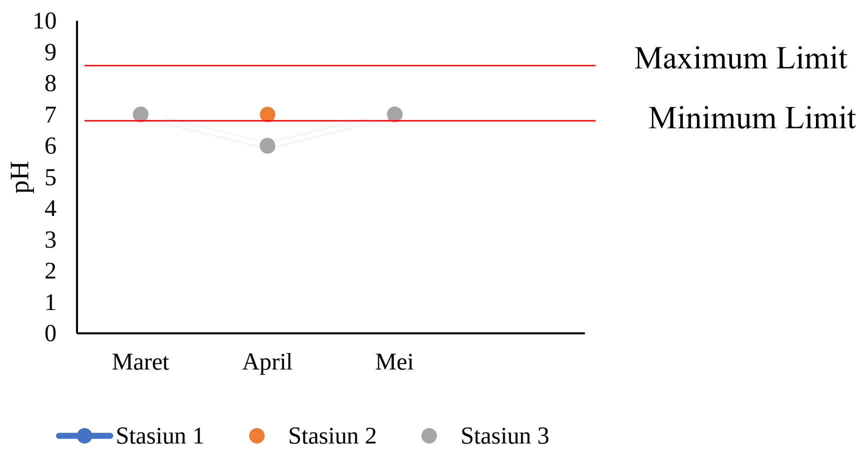

Figure 6. pH Parameter Graph

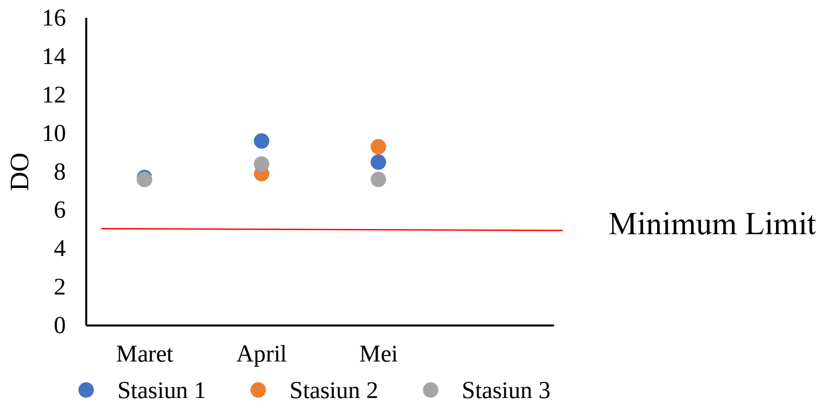

Figure 7. DO Parameter Graph

The results of the measurement of the suitability of water quality parameters in seaweed cages on Lemukutan Island for the period March-May are presented in Tables 4, 5, 6. Then the combined measurement results are presented in Table 7.

Table 4. Results of Water Suitability Measurement Data in March

No	Parameter	St 1	Sk	Bo	Ni	St 2	Sk	Bo	Ni	St 3	Sk	Bo	Ni
1	Brightness (m)	1.25	2	2	4	2.25	2	2	4	2.70	2	2	4
2	Temperature (˚C)	28.2	3	3	9	29.2	3	3	9	28.8	3	3	9
3	Depth (m)	2.6	2	3	6	5.3	2	3	6	5.6	2	3	6
4	Current (cm/s)	4.7	1	3	3	8.1	1	3	3	17.2	2	3	6
5	Salinity (ppt)	30	2	3	6	30	2	3	6	30	2	3	6
6	pH	7	2	3	6	7	2	3	6	7	2	3	6
7	DO (mg/L)	7.7	3	3	9	7.6	3	3	9	7.6	3	3	9
	Total				43				43				46
	Criteria				S				S				S

Description: St = Station, Sk = Score, Bo = Weight, Ni = Value, Bln = Month, S = Appropriate, SS = Very Appropriate

Table 5. Results of Water Suitability Measurement Data in April

No	Parameter	St 1	Sk	Bo	Ni	St 2	Sk	Bo	Ni	St 3	Sk	Bo	Ni
1	Brightness (m)	1.02	2	2	4	2.19	2	2	4	2	2	2	4
2	Temperature (˚C)	30.4	2	3	9	31.2	2	3	9	30.4	2	3	9
3	Depth (m)	2.3	2	3	6	5.3	2	3	6	6.9	2	3	6
4	Current (cm/s)	5.3	1	3	3	7.9	1	3	3	16.1	2	3	6
5	Salinity (ppt)	30	2	3	6	25	1	3	3	27	1	3	3
6	pH	6	1	3	3	7	2	3	6	6	1	3	3
7	DO (mg/L)	9.6	3	3	9	7.9	3	3	9	8.4	3	3	9
	Total				40				40				40
	Criteria				S				S				S

Description: St = Station, Sk = Score, Bo = Weight, Ni = Value, Bln = Month, S = Appropriate, SS = Very Appropriate

Table 6. Results of Water Suitability Measurement Data in May

No	Parameter	St 1	Sk	Bo	Ni	St 2	Sk	Bo	Ni	St 3	Sk	Bo	Ni
1	Brightness (m)	1.12	2	2	4	2.15	2	2	4	1.25	2	2	4
2	Temperature (˚C)	29.5	3	3	9	31.5	2	3	6	29.8	3	3	9
3	Depth (m)	2.1	2	3	6	5	3	3	9	5.9	2	3	6
4	Current (cm/s)	5.5	1	3	3	5.5	1	3	3	15.1	2	3	6
5	Salinity (ppt)	30	2	3	6	30	2	3	6	30	2	3	6
6	pH	7	2	3	6	7	2	3	6	7	2	3	6
7	DO (mg/L)	8.5	3	3	9	9.3	3	3	9	7.6	3	3	9
	Total				43				43				46
	Criteria				S				S				S

Description: St = Station, Sk = Score, Bo = Weight, Ni = Value, Bln = Month, S = Appropriate, SS = Very Appropriate

Table 7. Results of Combined Water Suitability Measurement Data

No	Parameter	Bln 3	Sk	Bo	Ni	Bln 4	Sk	Bo	Ni	Bln 5	Sk	Bo	Ni
1	Brightness (m)	2.06	2	2	4	1.76	2	2	4	1.50	2	2	4
2	Temperature (˚C)	28.7	3	3	9	30.6	2	3	6	30.2	2	3	6
3	Depth (m)	4.5	3	3	9	4.8	3	3	9	4.3	3	3	9
4	Current (cm/s)	10	2	3	6	9.7	1	3	3	8.7	1	3	3
5	Salinity (ppt)	30	2	3	6	27	1	3	3	30	2	3	6
6	pH	7	2	3	6	6.3	1	3	3	7	2	3	6
7	DO (mg/L)	7.6	3	3	9	8.6	3	3	9	8.4	3	3	9
	Total				47				37				43
	Criteria				S				S				S

Description: St = Station, Sk = Score, Bo = Weight, Ni = Value, Bln = Month, S = Appropriate, SS = Very Appropriate

The results of brightness measurements in March were 2.06 m, in April 1.76 m and in May 1.50 m. The temperature in March was 28.7˚C, in April 30.6˚C, and in May 30.2˚C. The depth results in March were 4.5 m, in April 4.8 m, and in May 4.3 m. The current speed in March was 10 cm/s, in April 9.7 cm/s and at station 3 8.7 cm/s. The salinity measured in March was 30 ppt, in April 27 ppt and in May 30 ppt. The results of pH measurements in March were 7, in April were 6.3 and in May were 7. The results of DO measurements in March were 7.6 mg/l, in April were 8.6 mg/l, and in May were 8.4 mg/l. The number of seaweed cage suitability in March was 47 SS (Very Suitable), in April was 37 S (Suitable) and in May was 43 S (Suitable).

DISCUSSION

1. Brightness

Both the suitability matrix for seaweed growth and the brightness values measured at each station did not meet the Quality Standards. The maximum amount of photosynthesis is supported by the brightness that reaches the bottom of the cage. According to the Directorate General of Culture and Culture (2006), the brightness value of waters greater than 45 cm is the ideal value for the growth and survival of aquatic organisms. Weather, measurement time, turbidity, and measurement accuracy all have a significant influence on the brightness value (Effendi, 2003). Due to the high concentration of dissolved and suspended organic matter, floating objects, and light intensity, the brightness value of the waters is usually produced by high turbidity. Mud is usually found in turbid waters to block sunlight from penetrating the water and disrupting the photosynthesis process. In addition, dirt can cover the surface of the thallus, causing it to rot and disintegrate. The growth and development of seaweed will be hampered by this condition. The location for cultivating *Eucheuma cottonii* must not be turbid, meaning that sunlight must reach the bottom of the cage, according to Zatnika (2009). Sunlight penetration and water clarity are closely related; high clarity is more than one meter. According to Nikhlani and Kusumaningrum (2021), water clarity of more than one meter is ideal for seaweed production. The development of seaweed is strongly supported by this high clarity value.

2. Temperature

The growth and development of seaweed is greatly influenced by temperature. Temperature affects the rate of photosynthesis to a certain extent. The rate of photosynthesis will increase according to the increase in temperature (Heryati in Indaryani et al., 2021). Based on Indrayani *et al.,* (2021), the range of good water temperatures for seaweed cultivation is 20-23˚C, while the optimum temperature of good waters for seaweed cultivation is 27-30˚C. According to Alamsyah (2016), the ideal temperature range for seaweed growth and development is between 22 and 27˚C. Aslan in Khasanah *et al.,* (2016), the water temperature suitable for seaweed cultivation ranges from 26-31˚C. Poor water temperatures can cause seaweed growth to be less than optimal. According to Khasanah, although this temperature is not fatal, it can inhibit seaweed growth. Increasing temperatures can cause seaweed thallus to turn pale yellow (Tarmizid *et al.*, 2022).

Seaweed must adapt to high temperatures because the water temperature in the cages varies greatly. Conditions like this will affect slow growth and cause organisms to shrink or become stunted. Although the ideal temperature range to maintain seaweed growth and development is between 22 and 27ºC, temperatures in this range at all stations are still relatively adequate for seaweed production (Amalia, 2013). Because observations were made during the day, when sunlight intensity is highest, the water temperature recorded at each location was relatively high. Due to the presence of mangrove forests, which can maintain temperature, sunlight can increase water temperature without reaching levels that can kill species. According to research by Mustafa et al. (2008), water temperatures between 25 and 30ºC are ideal for growing *Eucheuma cottonii* seaweed.

3. Current Speed

Tidal currents, wind, and waves can cause variations in current speed. Parenrengi et al. (2012) stated that a good current speed for seaweed cultivation is between 20 and 40 cm/s. In areas rich in nutrients, a slow current speed of around 10 cm/s can support good seaweed growth, while in areas poor in nutrients, a higher current speed is needed but not exceeding 40 cm/s. Kotiya *et al.*, (2011) stated that currents control the fertility of seaweed cultivation locations. Currents are important for seaweed growth, if they are too slow they will inhibit the absorption of nutrients in the waters. In addition, slow currents will affect the number of epiphytes that grow attached to seaweed, so that they will increase in number and can become competitors for nutrients (Arisandi, 2012).

The location of coral reefs, which is one of the causes of the weakening of the current, causes differences in current speed. This is because coral reefs form a natural barrier that holds back incoming ocean currents. Other estimates of current intensity variations at other times are the presence of turbulence and relatively open waters. According to Wibisono (2005), currents are caused by all tidal activity processes. Because the research period is short, local currents are caused by tidal variations. Because the research period is short, the currents that arise are local currents caused by tidal variations. In water, current speed is very important for various reasons, including mixing water masses, moving nutrients, and transporting oxygen (Akib *et al.*, 2015).

4. Depth

Seaweed can only grow in waters that are deep enough so that sunlight can reach the bottom because seaweed needs sunlight for photosynthesis. The average depth of all stations is still at a good level for the growth and development of *Eucheuma cottonii* seaweed culture because seaweed still receives very high levels of sunlight at that depth, allowing good photosynthesis. The right depth for seaweed growing in cages is between 60 and 80 cm, according to Darmi *et al.*, (2011), because the sun can still reach the bottom of the water at that depth. According to Susilowati *et al.*, (2012), depth affects how much light is absorbed by seaweed because it is related to the photosynthesis process, which produces food for algae growth (Nikhlani & Kusumaningrum, 2021). According to Khasanah *et al.*, (2016), 0.6–2.1 m is the ideal water depth for seaweed production.

5. Salinity

The results of this study are still within the salinity range that supports the establishment and development of *Eucheuma cottonii* seaweed cultivation in cages. *Eucheuma cottonii* seaweed grows best at salinities between 18 and 30 ppt, with an ideal range of 20 to 25 ppt. A number of variables, including water circulation, evaporation, rainfall, river flow, and variations in sampling time, affect salinity variations at each location. A key factor in the growth of *Eucheuma cottonii* seaweed is salinity. Because it can reduce salinity, the cultivation location is attempted far from fresh water sources, such as near river mouths (Anggadiredja, 2011). The salinity of Lemukutan Island waters is still suitable for seaweed production, as evidenced by measurements showing a range of 25–30 ppt. Salinity can affect the osmoregulation process in seaweed plants, and the stenohaline *Eucheuma cottonii* species is not resistant to extreme salinity changes. This supports Patang's statement (2010) that the ideal salinity range for seaweed growth is between 28 and 34 parts per thousand (ppt), with 33 ppt being the ideal range.

6. pH

Because pH, which stands for "potential hydrogen," has a significant impact on the life of aquatic plants and animals, it is often used as a benchmark to determine how good or bad a body of water is. *Eucheuma cottonii* grows best at a pH between 6 and 8, although 6.2 to 8.2 is generally acceptable. Considering the amount of water and land suitable for the growth of Eucheuma cottonii, this acidity level is still within the acceptable range. The rate of cell proliferation will slow down below this crucial threshold (Badruddin *et al.*, 2014).

The imbalance in measurement time contributes to variations in pH levels in the waters. Overall, the average pH value in the waters of the seaweed cultivation consumption zone is within the range that supports seaweed cultivation, while research findings show variations in pH at each sample location. According to Wibowo (2012), Eucheuma cottonii grows best at an acidity level (pH) of 7 to 9, with an ideal range of 7.3 to 8.2. According to Ramdhan et al. (2018), residents living near the coast often throw away alkaline waste such as soap and detergent so that the pH of the waters along the coast looks higher.

7. DO

An important component for aquatic life is dissolved oxygen. Dissolved oxygen will be high in waters due to local current circulation which increases dissolved oxygen levels (Ramdhan et al., 2018). The presence of oil layers on the sea surface, respiration (especially at night), increasing water temperatures, and the entry of easily digested organic waste into the marine ecosystem are factors that cause decreased oxygen levels in seawater. According to Irjenkanbud (2008), the dissolved oxygen levels to support seaweed cultivation efforts are 3.0 - 8.0 mg/L, but Basiroh et al. stated that the ideal dissolved oxygen range for seaweed cultivation is 2.0 - 4.0 mg/L. According to Risnawati *et al.*, (2018), Eucheuma cottonii requires

4.5-9.8 mg/L of dissolved oxygen to grow. The ideal acidity range for seaweed growth is between 6.0 and 9.0, according to Risnawati *et al.,* (2018). Water that is too acidic or alkaline can endanger the survival of organisms because it can cause respiratory and metabolic problems.

Suitability of Cages for *Eucheuma cottonii* Seaweed Cultivation

When compared with the values in the seaweed cultivation land suitability matrix table (Table 3), the physicochemical characteristics of Lemukutan Island waters are categorized as suitable for seaweed production. Brightness, temperature, depth, current velocity, salinity, pH, and DO are the seven parameters evaluated at each station. Clarity is an unsuitable parameter at all stations. In March, April, and May, the current velocity parameter at stations 1 and 2 is included in the Unsuitable group; however, at station 3, the current velocity parameter is included in the Suitable category. The current velocity parameter is considered unsuitable because at the time of data collection, the current flowing through the cultivation location was only 4.7 to 8.1 cm/s, which is far below the good location suitability value for seaweed growth. Seaweed growth is supported by all measured water quality metrics.

In April, the pH values recorded at stations 1 and 3 fell into the unsuitable range. The suitability values of the water locations obtained in this study reveal limiting characteristics that are less favorable for seaweed production, especially the parameters of pH, current velocity, and brightness. Since the cultivation location is in a bay area, where the inflow is relatively low, the current is a less suitable limiting element. In addition, fishing vessels often use these waters as a means of transit. This causes a lot of mud to stick to the seaweed thallus, which can inhibit growth because dirt prevents the seaweed from photosynthesizing. In situations like this, plants need to be shaken frequently in the water to free them from dirt particles (Wahyuningrum, 2001). For seaweed cultivation, a current of 20–40 cm/second is ideal (Aslan, 1998). The waters used for seaweed cultivation locations must be protected from ship traffic routes to prevent seaweed growth from being hampered. Based on the results of the study, each station studied still meets the requirements to be used as a seaweed cultivation location, ranging from suitable to less suitable.

The calculation of the land suitability matrix was then carried out based on field investigations by examining the dynamics of water quality parameters observed in the Lemukutan Island Aquatic Cages. The results were then compared with the ideal parameter range values at the land suitability class level. Four suitability codes—Very Suitable (SS), Suitable (S), and Not Suitable (TS)—are used to integrate several variables into each water quality change that is utilized as the suitability level at all sampling stations. The suitability of each observation station location on Lemukutan Island will be determined by calculating the value of the cage suitability matrix. In March, station 1 corresponds to a value of 43, station 2 corresponds to a value of 43, and station 3 corresponds to a value of 46, according to the calculation results of the water quality parameter suitability matrix for Eucheuma cottonii seaweed cultivation in cages on Lemukutan Island. Stations 1, 2, and 3 in April all correspond to a value of 40. In May, station 1 corresponds to a value of 43, station 2 corresponds to a value of 43, and station 3 corresponds to a value of 46. And with a value of 47 in March, the combined suitability data is Very Suitable; in April, it corresponds to a value of 37; and in May, according to the value of 47, and in May according to the value of 43 (Neksidin *et al.*, 2013).

CONCLUSION

Based on the results of research conducted in the waters of Lemukutan Island, Bengkayang Regency, the following conclusions can be drawn:

1. The quality of the water environment for seaweed cultivation that is in accordance with the Quality Standards, namely the parameters of Temperature, Depth, is only found at one station. Current speed is found at all stations. Salinity, pH and DO.

2. The suitability of the parameters of the quality of the cage waters for seaweed cultivation at all stations is Appropriate.

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