

## Suitability Analysis of *Eucheuma cottoni* Cultivation in the Coastal Area of Sabu Raijua

(Analisa Kesesuaian Lahan Budidaya *Eucheuma cottoni* di Pesisir Sabu Raijua)

Desy Amalia Hidayati\*<sup>1</sup>, Mutiara Rachmat Putri\*<sup>2</sup>, Iwan Pramesti Anwar<sup>2</sup>, Alifah Cahyani<sup>2</sup>, Fandy Hidayat<sup>2</sup>, Muhammad Iqbal Musthofa<sup>2</sup>, Agus Setiawan<sup>3</sup>

<sup>1</sup> Aquatic Resource Management, Faculty of Animal Husbandry Marine and Fisheries, Nusa Cendana University

<sup>2</sup> Oceanography, Faculty of Earth Science and Technology, Institut Teknologi Bandung

<sup>3</sup> Research Centre for Climate and Atmosphere, National Research and Innovation Agency

\*Corresponding author: [mutiara.putri@itb.ac.id](mailto:mutiara.putri@itb.ac.id)

Manuscript received: 19 April. 2026. Revision accepted: 27 June 2026

**Abstract.** The coastal region of Sabu Raijua exhibits significant potential for the development of seaweed aquaculture. In addition to favorable oceanographic conditions, local communities in the area possess valuable indigenous knowledge in the sustainable utilization of marine resources. This potential can be further enhanced through adaptive strategies that align with environmental conditions, such as selecting seaweed strains tolerant to salinity and managing cultivation periods based on seasonal variations. This study aims to assess the suitability of cultivating *Eucheuma cottonii* in the coastal area of Sabu Raijua, with an emphasis on oceanographic characteristics. Data were obtained through direct field measurement and water sampling conducted at several prospective cultivation sites. The observed parameters, included water depth, type of substrate, temperature, pH, salinity, and dissolved oxygen (DO), measured at 8 stations. The results indicate that the coastal waters of Sabu Raijua conducive to seaweed cultivation. However, station II and VIII were identified as less suitable due to their shallow depth and low dissolved oxygen concentration.

**Keyword:** Sabu Raijua, *Eucheuma cottoni*, seaweed cultivation, aquaculture development

**Abstrak.** Daerah pesisir Sabu Raijua memiliki potensi yang signifikan untuk pengembangan budidaya rumput laut. Selain memiliki kondisi oseanografi yang menguntungkan, masyarakat setempat memiliki pengetahuan lokal yang cukup untuk pemanfaatan sumber daya laut secara berkelanjutan. Potensi ini dapat ditingkatkan lebih lanjut melalui strategi adaptif yang sesuai dengan kondisi lingkungan, seperti memilih strain rumput laut yang toleran terhadap salinitas dan mengelola periode budidaya berdasarkan musim. Studi ini bertujuan untuk menilai kesesuaian budidaya *Eucheuma cottonii* di wilayah pesisir Sabu Raijua, dengan penekanan pada karakteristik oseanografi. Data diperoleh melalui pengukuran lapangan dan pengambilan sampel air yang dilakukan di beberapa lokasi budidaya prospektif. Parameter yang diamati meliputi kedalaman air, jenis substrat, suhu, pH, salinitas, dan oksigen terlarut (DO), yang diukur di 8 stasiun. Hasil menunjukkan bahwa perairan pesisir Sabu Raijua sesuai untuk budidaya rumput laut jenis *Eucheuma cottonii*. Namun, stasiun II dan VIII diidentifikasi kurang sesuai karena kedalamannya yang dangkal dan konsentrasi oksigen terlarut yang rendah.

**Kata Kunci:** Sabu Raijua, *Eucheuma cottoni*, budidaya rumput laut, pengembangan budidaya

### INTRODUCTION

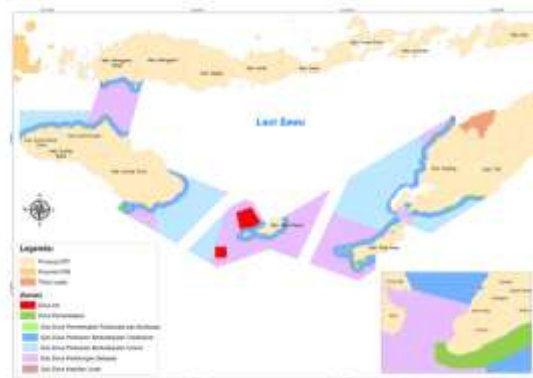
Located within the Coral Triangle, Indonesia is a leading commercial seaweed producer in the tropics and ranks second globally after China. Seaweed cultivation is seen as a viable alternative livelihood for coastal communities, helping to improve the socio-economic welfare of farming households (Mariño et al., 2019). Sabu Raijua Island is located in the Savu Sea Marine Protected Area (MPA), one of the most important Indonesia's conservation area. This MPA is located in East Nusa Tenggara and has 532 coral species, where 11 of them are endemic species. Due to its high and stable salinity over time, Sawu Sea is known as a place for seaweed cultivation, especially around the small islands (TNC, 2015). Seaweed is a profitable commodity in marine aquaculture and plays a crucial role in advancing the blue economy. As the global economy continues to evolve, Indonesia emerges as a key player in driving blue economic development. The country is among the top global producers of fresh seaweed, accounting for over 80% of total worldwide output, with an annual production volume of 9.78 million tons. *Eucheuma cottonii*, a highly valuable seaweed species, is primarily used to produce alkali-treated Cottonii chips (ATC) and is further processed into carrageenan powder.

Since the year 2000, the seaweed farming sector has grown rapidly, significantly benefiting the livelihoods of more than 250,000 coastal households in Indonesia. The cultivation of *Eucheuma cottonii* is widespread along the coastal regions of the Indonesian archipelago including in East Nusa Tenggara (Amir et al., 2024).

One of the key determinants of successful seaweed farming is the suitability of the cultivation site, which is primarily influenced by oceanographic conditions. The yield, quality, and sustainability of seaweed production are closely tied to factors such as water temperature, salinity, nutrient availability, and hydrodynamic patterns. Inappropriate site selection can significantly diminish production outcomes (Waluyo et al., 2019). Furthermore, seaweed cultivation practices should account for the environmental carrying capacity of the area to preserve water quality and ensure optimal conditions for seaweed growth.

## METHOD

This research was carried out in June 2025 at the seaweed cultivation area located in Bodae Village, East Sabu District, Sabu Raijua Regency, East Nusa Tenggara. This research was conducted in the Sawu Marine National Park (figure 1) covering eight different sampling stations (figure 2). Water quality assessment involved the collection of both physical and chemical parameters. In-situ measurements included: water depth, substrate type, salinity, temperature, pH, and dissolved oxygen levels.



Picture 1. Zoning of Sawu Sea National Park (Hidayati et al., 2015)



Picture 2. Location Research Map

### Area Suitability Analysis

Area suitability classification was conducted using a scoring-based matrix to evaluate limiting factors for seaweed cultivation (Imamshadiqin *et al.*, 2024). Each parameter was

categorized into three classes: suitable (score 3), less suitable (score 2), and unsuitable (score 1). Parameters with greater influence were assigned higher weights. The total suitability score, derived from the weighted sum of all parameters, determined the final classification. The maximum possible suitability score was 30 (maximum score × weight), while the minimum was 10 (minimum score × weight). Class intervals (Table 1) and suitability values (Table 2) were calculated using the formula:

$$I = \frac{N \max - N \min}{\sum k}$$

where:

- I = Class interval
- K = Number of area suitability classes desired
- N max = Maximum final value
- N min = Minimum final value

Table 1. Area suitability criteria for seaweed cultivation

Parameters	Score	Weight
Water depth (m)		
- 3-5	3	3
- 2 -<3 or >5-10	2	
- < 2 and >10	1	
Substrate type		
- Sand/coral fragments	3	2
- Silty sand	2	
- Mud	1	
Salinity (ppt)		
- 28-34	3	2
- 18-27 or 35-37	2	
- < 18 atau > 37	1	
Temperature (°C)		
- 24-30	3	1
- 20-24	2	
- <20 and >30	1	
pH		
- 6.5 – 8.5	3	1
- 4 – 6.5 & 8.5 – 9.5	2	
- < 4 & > 9.5	1	
Dissolved oxygen (mg/L)		
- > 6	3	1
- 4-6	2	
- < 4	1	

Source: Kepdirjen no 55 (2023); Noor (2015)

Table 2. Area suitability Classes

Score	Criteria
23.3 – 30	Suitable
16.5 – 23.2	Less suitable
≤ 16.4	Unsuitable

## RESULT AND DISCUSSION

The location of seaweed cultivation is a critical factor that significantly influences the success or failure of the cultivation process. Choosing the right site is essential, as environmental conditions directly affect the growth rate, yield, and quality of the seaweed. Poor site selection can lead to low productivity, vulnerability to disease, and lower-quality harvests,

making it one of the most important decisions in planning a seaweed farming. The results of observations for water quality parameters at all stations is given in Table 3.

Table 3. Water Quality Parameters

Parameters	Station							
	I	II	III	IV	V	VI	VII	VIII
Water depth (m)	2	1.9	1.9	2	2.4	2.9	2.6	1.9
Substrate type	Sand / coral fragments	Sand / coral fragments	Sand / coral fragments	Sand / coral fragments	Sand / coral fragments	Sand / coral fragments	Sand / coral fragments	Sand / coral fragments
Salinity (ppt)	22.2	29.7	29	29.4	30	29.8	29.5	29.2
Temperature (°C)	28.2	27.9	28	28,5	27.8	27.7	27.6	27.5
pH	7.9	8.04	8.04	8.04	8.01	7.97	7.94	8.05
Dissolved oxygen (mg/L)	10	5.8	7	8.1	6	7.4	5.5	5.3

Water depth is a factor in the success of seaweed cultivation because it is related to the intensity of light entering the water. Sunlight affects the level of photosynthesis. The selection of depths that facilitate the absorption of food and avoid damage due to direct sunlight (Hendri *et al.*, 2018). The observation location has a depth range of 1.9 - 2.9 meters. According to Kasnir (2023), the minimum depth for seaweed cultivation is 0.3 meters at the lowest tide, while the depth for optimal growth of seaweed ranges from 1-4 meters (Pong Masak *et al.*, 2020).

The findings of this study indicate that salinity levels remain within the suitable range for the successful cultivation of *Eucheuma cottonii* seaweed in cage systems. Salinity plays a critical role in the growth of *Eucheuma cottonii*, as it influences osmoregulation in the seaweed. The optimal salinity range for growth is 28–34 ppt (Sopia *et al.*, 2025). While extreme salinity levels (high or low) may not be lethal, they can hinder growth by causing talus blanching and detachment (Gultom *et al.*, 2019). Since seaweed is a stenohaline organism, it cannot tolerate significant salinity fluctuations, making stability a crucial factor (Sarjito *et al.*, 2022).

Additionally, the study recorded water temperatures between 22.2°C and 30°C, which fall within the ideal range for *Eucheuma cottonii* growth (Alamsyah, 2016). Temperature affects seaweed metabolism, with higher temperatures generally increasing metabolic rates (Waang *et al.*, 2024). However, excessively high temperatures can impair photosynthesis by degrading chlorophyll and reducing dissolved oxygen levels (Djalil *et al.*, 2021).

The dissolved oxygen (DO) in the water primarily comes from photosynthesis (Hirayama *et al.*, 2024). During the study, DO levels ranged from 5.3 to 10 mg/L, which is within the optimal range of 3–8 mg/L for seaweed growth (Serihollo *et al.*, 2021). Specifically, *Eucheuma cottonii* needs dissolved oxygen levels between 4.5 and 9.8 mg/L to grow (Risnawati *et al.*, 2018). Waters with a highly acidic pH below 4 or an alkaline pH above 8 are unsuitable for seaweed growth, although tolerance levels can vary among different species (Yulius *et al.*, 2017). Based on the result, pH range between 7.9 – 8.05. *Eucheuma cottonii* grows best at a pH between 6 and 8, although 6.2 to 8.2 is generally acceptable (Sopia *et al.*, 2025)

### Suitability of Waters for Seaweed Cultivation

Based on the results of the analysis of physical and chemical parameters of waters in Sabu Island (Table 4), shows that stations I, III, IV, V, VI, VII included in the category suitable for the cultivation of seaweed *E. cottoni*. While station II and station VIII of each parameter showed less suitable criteria for the cultivation of seaweed *E. cottoni*. This is due to the shallow depth and low dissolved oxygen concentration.

Table 4. Results of the analysis of the suitability of *Eucheuma cottoni*

Parameters	Station							
	I	II	III	IV	V	VI	VII	VIII
Water depth (m)	6	3	3	6	6	6	6	3
Substrate type	6	6	6	6	6	6	6	6
Salinity (ppt)	4	6	6	6	6	6	6	6
Temperature (°C)	3	3	3	3	3	3	3	3
pH	3	3	3	3	3	3	3	3
Dissolved oxygen (mg/L)	3	2	3	3	2	3	2	2
Total Score	25	23	24	27	26	27	26	23
Criteria	Suitable	Less Suitable	Suitable	Suitable	Suitable	Suitable	Suitable	Less Suitable

## CONCLUSIONS

Based on the results of the analysis it can be concluded that the coastal waters of Sabu Raijua Regency can be categorized as having suitability for seaweed cultivation except at station II and VIII due to shallow depth and low dissolved oxygen concentration.

## ACKNOWLEDGEMENT

This research is funded by ITB (Project ID DPMK.PM-8-26-2025)

## REFERENCE

- Alamsyah, R. (2016). Kesesuaian Parameter Kualitas Air Untuk Budidaya Rumput Laut di Desa Panaikang Kabupaten Sinjai. *Jurnal Agrominansia*, 1(2), 61-70.
- Amir, N., Mustajib, M. I., Gozan, M., & Chan, C. (2024). Development of a novel tray solar dryer for aquaculture product: Experimental study on drying kinetics and product quality in *Eucheuma cottonii* seaweed. *Solar Energy*, 273, 112503.
- Direktorat Jenderal Pengelolaan Ruang Laut. (2023). Keputusan Direktur Jenderal Pengelolaan Ruang Laut Nomor 55 Tahun 2023 tentang Pedoman Teknis Penghitungan Daya Dukung Kegiatan Pemanfaatan Kawasan Konservasi. Kementerian Kelautan dan Perikanan Republik Indonesia.
- Djalil, S., Subur, R., Rina, R., Sunarti, S., Abubakar, Y., Fadel, A.A., Susanto, A.N., & Sarni, S. (2021). Study of Composition and Composition of Macro Algae Habitat in the Intertidal Zone Water of Sibu Island, North Oba District Tidore Islands City North Maluku. *Jurnal Biologi Tropis*, 21(2): 403–411.
- Gultom, R.C., Dirgayusaa, I.G.N.P., & Puspitha, N.L.P.R. (2019). Perbandingan Laju Pertumbuhan Rumput Laut (*Eucheuma cottonii*) dengan Menggunakan Sistem Budidaya Ko-kultur dan Monokultur di Perairan Pantai Geger, Nusa Dua, Bali. *Journal of Marine Research and Technology*, 2(1): 10.
- Hendri, M., Rozirwan, R., Apri, R., & Handayani, Y. (2018). Intensification of seaweed cultivation *Eucheuma cottonii* with verticulture method in the water of Kelagian Island, Lampung Bay. *International Journal of Marine Science*, 8.
- Hidayat R, Widiyani D, Mayasari F, Simarangkir OR, Prabuning D, Aviandhika S, Fajariyanto Y, Purwanto. 2015. Prosedur Operasional Standar Monitoring Pemanfaatan Sumber daya Laut Taman Nasional Perairan Laut Sawu. Balai Kawasan Konservasi Perairan Nasional Kupang.

- Hirayama, S., Urata, K., Kusumoto, M., & Ikegami, Y. (2024). Producing Supersaturated Dissolved Oxygen Seawater by Photosynthesis of *Ulva* sp. and Its Applications. *Aquaculture Research*, 2024(1), 9411516.
- Imamshadiqin, I., Ritonga, G. H., Erlangga, E., Erniati, E., Imanullah, I., Syahrial, S., & Salmarika, S. (2024). Spatial distribution and habitat suitability of seaweed on West Simeulue Island, Aceh Province, Indonesia. *Journal of Marine Studies*, 1(2), 1202.
- Kasnir, M., Syarifuddin, S., & Nisaa, K. (2023). A study of water depth on the growth and productivity of seaweed *Kappaphycus alvarezii*. *Akuatikisile: Jurnal Akuakultur, Pesisir dan Pulau-Pulau Kecil*, 7(2), 139-143.
- Mariño, M., Breckwoldt, A., Teichberg, M., Kase, A., & Reuter, H. (2019). Livelihood aspects of seaweed farming in Rote Island, Indonesia. *Marine Policy*, 107, 103600.
- Noor, N. M. (2015). Analisis kesesuaian Perairan Ketapang, Lampung Selatan sebagai lahan budidaya rumput laut *Kappapycus alvarezii*. *Maspari Journal*, 7(2), 91-100.
- Pong-Masak, P. R., & Sarira, N. H. (2020). Effect of depth on the growth and carrageenan content of seaweed *Kappaphycus alvarezii* cultivated using verticulture method. In *E3S Web of Conferences* (Vol. 147, p. 01011). EDP Sciences.
- Risnawati, Kasim, M., & Haslianti. (2018). Studi Kualitas Air Kaitannya Dengan Pertumbuhan Rumput Laut (*Kappaphycus alvarezii*) Pada Rakit Jaring Apung di Perairan Pantai Lakeba, Kota Bau-Bau, Sulawesi Tenggara. *Jurnal Manajemen Sumber Daya Perairan*, 4(2), 155–164.
- Sarjito, S., Ammaria, H., Helmi, M., Prayitno, S. B., Nurdin, N., Setiawan, R. Y., ... & Wirasatriya, A. (2022). Identification of Potential Locations for *Kappaphycus alvarezii* Cultivation for Optimization of Seaweed Production Based on Geographic Information Systems in Spermonde Archipelago Waters, South Sulawesi, Indonesia. *ILMU KELAUTAN: Indonesian Journal of Marine Sciences*, 27(3), 253-266.
- Serihollo, L.G.G., Pratiwi, R., Kusuma, N.P.D., Amalo, P., & Suhono, L. (2021). Efektifitas Penambahan Jaring Kantong pada Budidaya Rumput Laut *Kappaphycus striatum* Sistem Tali Rawai. *Jurnal Bahari Papadak*, 2(2): 76–84.
- Sopia, V., Munir, A. M. S., & Hadinata, F. W. (2025). STUDY OF THE QUALITY OF THE WATER ENVIRONMENT FOR SEAWEED (*Eucheuma cottonii*) CULTIVATION ON LEMUKUTAN ISLAND, BENGKAYANG REGENCY. *Jurnal Perikanan Unram*, 15(2), 517-529.
- The Nature Conservancy. 2015. *Kajian Ekologi Cepat Sumberdaya Hayati Pesisir Taman Nasional Perairan Laut Sawu*. Jakarta. The Nature Conservancy. 151 hal
- Waang, D. C., Cokrowati, N., & Abidin, Z. (2024). The Effect of Different Substrates on Laboratory Scale Cultivation of *Sargassum cristaefolium*. *Journal of Coastal and Ocean Sciences*, 5(2), 107-113.
- Waluyo, W., Riani, E., & Arifin, T. (2019). Integrated Coastal Management Dynamic Models: A Case Study of Development Seaweed Cultivation in the Waters Luwu and Palopo Regency Bone Bay, South Sulawesi. *Journal of Marine Science*, 1(2).
- Yulius, Y., Prihantono, J., & Ramdhan, M. (2017). Pengelolaan budidaya Rumput Laut Berbasis Daya Dukung Lingkungan Perairan di Pesisir Kabupaten Dompu, Provinsi Busa Tenggara Barat. In *Seminar Nasional Geomatika*.