



## EVALUATION OF THE SUITABILITY OF MANGROVE RIVER COASTAL WATER FOR SEA CUCUMBER CULTIVATION

## EVALUASI KELAYAKAN AIR PESISIR SUNGAI BAKAU BAGI BUDIDAYA TERIPANG

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### Abstract

This study aimed to evaluate the suitability of the coastal waters of Sungai Bakau, Kumai District, as an alternative site for sea cucumber (*Holothuria scabra*) aquaculture. Water quality parameters, including temperature, salinity, and pH, were monitored, along with the growth performance of sea cucumbers in terms of body weight and length during the cultivation period. The results showed water temperatures ranging from 28–31°C, pH values between 8.3–8.7, and an average salinity of 20.5 ppt. Although the salinity was slightly below the optimal range (28–32 ppt), the sea cucumbers demonstrated positive growth. Final measurements indicated an increase in body weight from 10–20 grams to an average of 0.29 kg, and in body length up to 16.7 cm over approximately three months of cultivation. These findings suggest that the coastal waters of Sungai Bakau have potential for sea cucumber aquaculture development, with some adjustments needed to optimize salinity conditions.

**Keywords :** Sea cucumber, water quality, aquaculture, Sungai Bakau, *Holothuria scabra*

### Abstrak

Penelitian ini bertujuan untuk mengevaluasi kelayakan perairan pesisir Sungai Bakau, Kecamatan Kumai, sebagai lokasi alternatif budidaya teripang (*Holothuria scabra*). Parameter kualitas air yang diamati meliputi suhu, salinitas, dan pH, serta dilakukan pengukuran pertumbuhan teripang dari sisi berat dan panjang tubuh selama masa pemeliharaan. Hasil pengamatan menunjukkan bahwa suhu air berkisar antara 28–31°C, pH antara 8,3–8,7, dan salinitas rata-rata 20,5 ppt. Meskipun nilai salinitas berada sedikit di bawah kisaran ideal (28–32 ppt), teripang tetap menunjukkan pertumbuhan positif. Berat tubuh meningkat dari 10–20 gram menjadi rata-rata 0,29 kg, dan panjang tubuh mencapai 16,7 cm selama lebih kurang tiga bulan pemeliharaan. Hasil ini menunjukkan bahwa perairan pesisir Sungai Bakau memiliki



potensi untuk dikembangkan sebagai lokasi budidaya teripang dengan beberapa penyesuaian terhadap kondisi salinitas.

**Kata Kunci :** Teripang, kualitas air, budidaya, Sungai Bakau, *Holothuria scabra*

## 1. BACKGROUND

Kotawaringin Barat Regency has a coastline of  $\pm 156$  km and a public water area of around 10,800 ha, making it a potential area for developing the marine and fisheries sector. Unfortunately, this potential has not been optimally utilized, where the utilization of marine fisheries has only reached 36.14% of the total production potential (Kobar Fisheries and Marine Service, 2008). One of the commodities with high economic value that can be developed in this region is sea cucumber (*Holothuria scabra*), which is widely known in the international market for its high nutritional content and increasing export demand (Kurniawan et al., 2021).

Sea cucumber is a marine biota that lives on the seabed with an ideal habitat in the form of muddy sand substrates and seagrass beds. This animal is a detritivore, has a fairly fast growth rate, and is tolerant of environmental changes, so it is suitable for cultivation in calm shallow waters (Nuraini et al., 2020). Sea cucumber cultivation is also considered environmentally friendly because it does not require additional feed and can contribute to the restoration of the seabed ecosystem (Widiyastuti et al., 2021).

One of the challenges in developing sea cucumber cultivation is the limited location that meets the bioecological requirements to support optimal growth. Therefore, water quality evaluation is an important aspect before developing cultivation. Water quality parameters such as temperature, salinity, and pH are the main factors that affect the growth and survival of sea cucumbers (Sulistiyowati & Hartati, 2022).

The coastal area of the Bakau River in Kumai District is one of the potential locations that has not been widely utilized for sea cucumber cultivation. This study was conducted to observe the suitability of water quality in the area, especially in terms of temperature, salinity, and pH, as well as the biometric growth of sea cucumbers during the maintenance period. The purpose of this study was to evaluate the feasibility of the coastal waters of the Bakau River as an alternative location for sea cucumber cultivation in West Kotawaringin Regency.

## 2. RESEARCH METHOD

This research was conducted in Sungai Bakau Village, Kumai District, West Kotawaringin Regency, from July to September 2010. The location was selected based on bioecological considerations such as the availability of natural habitats that support sea cucumber life, as well as socio-economic considerations of the surrounding community that are considered to support the sustainability of cultivation activities. In addition, the location selection also refers to the provisions of applicable laws and regulations regarding the use of marine space and cultivation areas. This location is part of a coastal area that is relatively protected from large waves and has a basic water character in the form of muddy sand and seagrass ecosystems, which are ideal habitats for *Holothuria scabra*.

This study used floating net cages measuring  $10 \times 10$  meters as cultivation containers. The equipment used to measure water quality includes a Schidisk to measure turbidity, a pH meter for acidity, a salinometer for salinity, and a thermometer for water temperature. In addition, a ruler is used to measure the depth and dimensions of the cage. The sea cucumber seeds used are 10–20 grams in size. During the research period, direct observations were



conducted to measure water quality parameters (temperature, pH, salinity, and turbidity) and to monitor the biometric growth of sea cucumbers kept in cages. Observations were conducted periodically during the cultivation period.

The purpose of this observation was to evaluate the effect of environmental quality on sea cucumber growth. The data obtained were analyzed descriptively to describe the water conditions and dynamics of sea cucumber growth at the location. This analysis also aims to assess the relationship between environmental factors and cultivation performance, as well as to assess the extent to which the waters of the Bakau River meet the requirements as an alternative location for sustainable sea cucumber cultivation.

### 3. FINDINGS AND DISCUSSION

#### Findings

##### a. Temperature

The average water temperature at the research location ranged from 28°C to 31°C, both in the morning and evening. This temperature is still within the appropriate range for the cultivation of *Holothuria scabra*, which ideally grows at a temperature of 25–31°C (James et al., 1988). Stable temperature is very important because it affects the metabolism, appetite, and digestibility of sea cucumbers. An increase in temperature above this range can cause thermal stress, while temperatures that are too low will slow down the growth rate. Therefore, the water temperature of the Bakau River can be categorized as suitable and supportive for the sustainability of sea cucumber cultivation.

This finding is in line with research conducted by Yunita et al. (2020) in the coastal waters of Bangka Island, which reported that the optimal temperature for sea cucumber cultivation is in the range of 27–30°C, and in this range sea cucumber growth is faster and more efficient. Similar findings were also found by Setiawan and Mahendra (2022) who studied the cultivation of *H. scabra* in Ekas Bay, Lombok, where an average temperature of 29°C was proven to support biomass growth of up to 250 grams in 3 months. Thus, the temperature conditions in the Mangrove River are within the range of tropical ecosystems commonly used for sea cucumber cultivation in Indonesia. The results of morning temperature observations in °C for 3 months are shown in Figure 1 below.

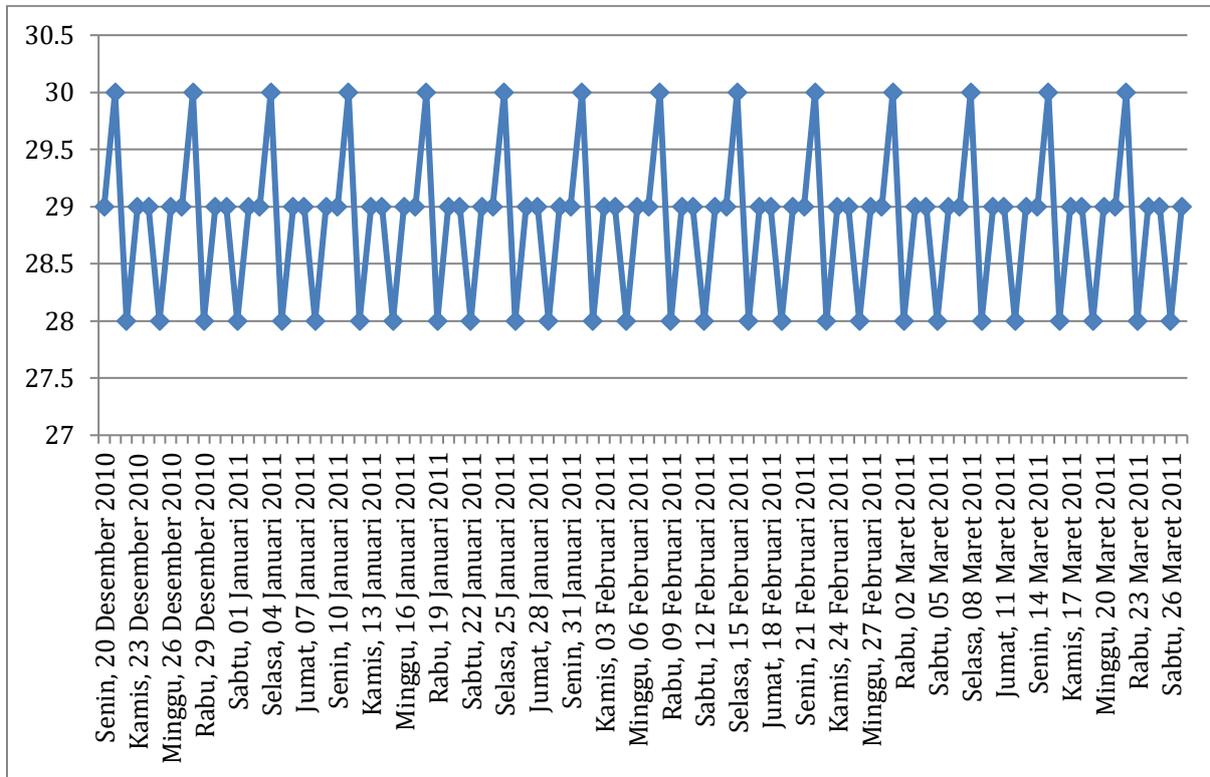


Figure 1. Results of Morning Temperature Observations (°C)

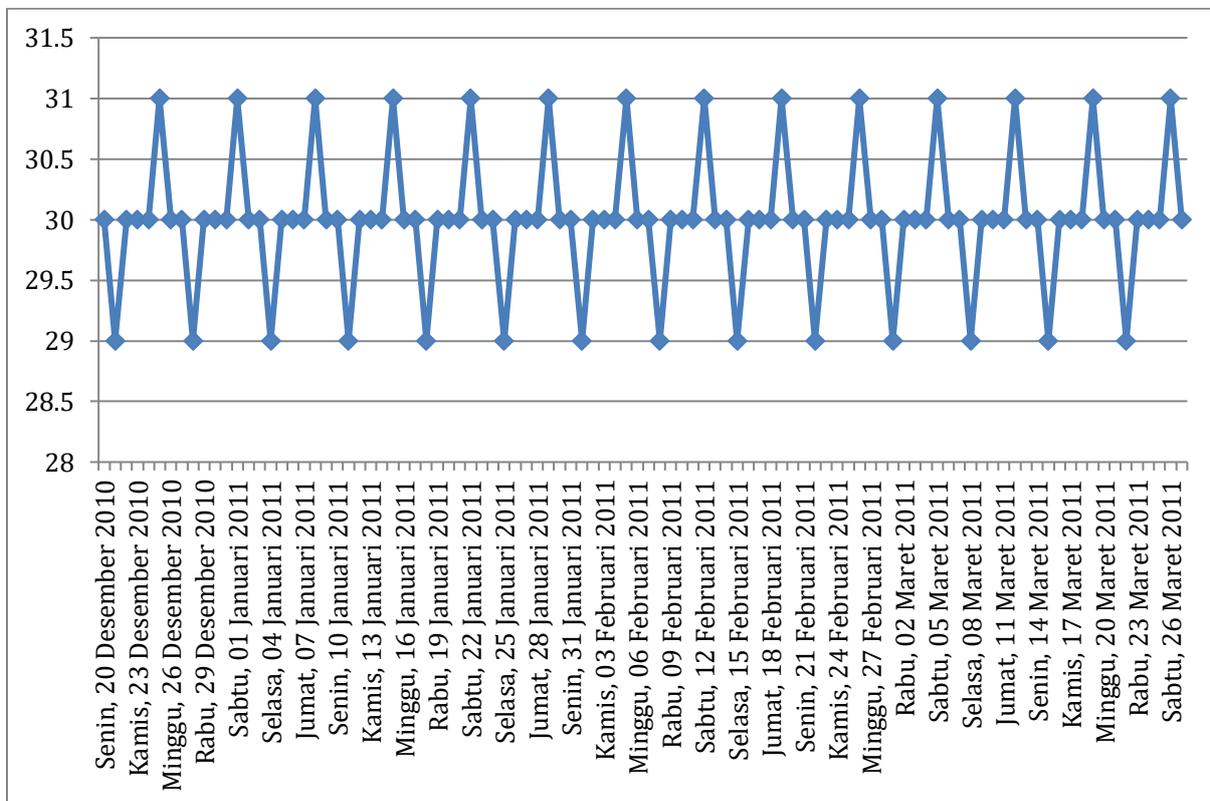


Figure 2. Results of Afternoon Temperature Observations (°C)



2. Salinity

Salinity is the level of salinity or dissolved salt content in water. Salinity can also refer to the salt content in the soil. From the literature we obtained, the salt content or salinity suitable for sea cucumber cultivation is 28–32 ppt. The average salinity obtained during the study was 20.5 ppt, which is below the optimal range for maximum sea cucumber growth (Darsono et al., 1994). However, the results of the study showed that *Holothuria scabra* could still grow well even though it was slightly below the ideal range. This indicates that this species has a lower tolerance to salinity.

This finding is in line with research by Putri et al. (2021) which showed that *H. scabra* can still survive and grow well in the salinity range of 20–25 ppt in the estuary waters of Banggai Regency. They also noted that although its growth was slightly slower than at optimal salinity, survival remained high. In addition, a study by Yudhistira and Kurniasari (2022) in Kendari Bay also found that sea cucumber adaptation to estuary salinity fluctuations allows cultivation to be carried out in semi-estuary waters with a minimum salinity of 19 ppt.

This condition proves that the Bakau River as an estuary area still has great potential to be developed as a location for sea cucumber cultivation, especially if supported by proper environmental management such as protection against excessive freshwater intrusion or increasing seawater circulation. The results of salinity observations at the demonstration plot location can be seen in Figure 3 below.

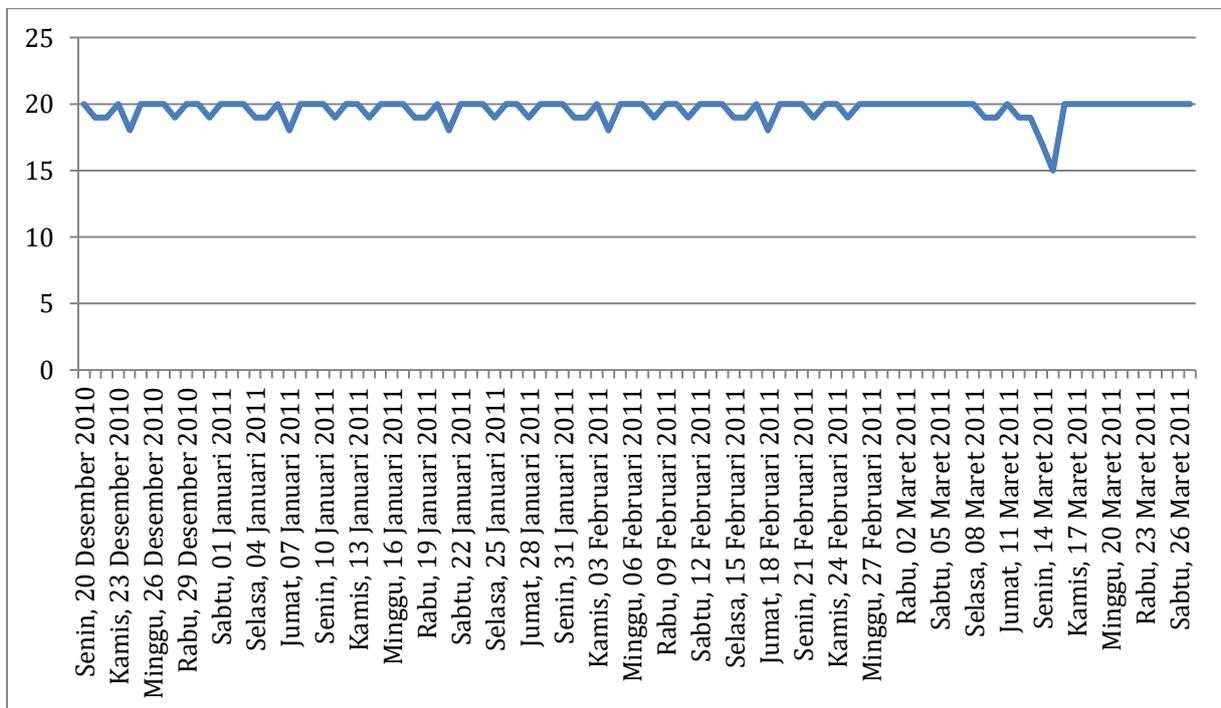


Figure 3. Salinity Observation Results (ppt)

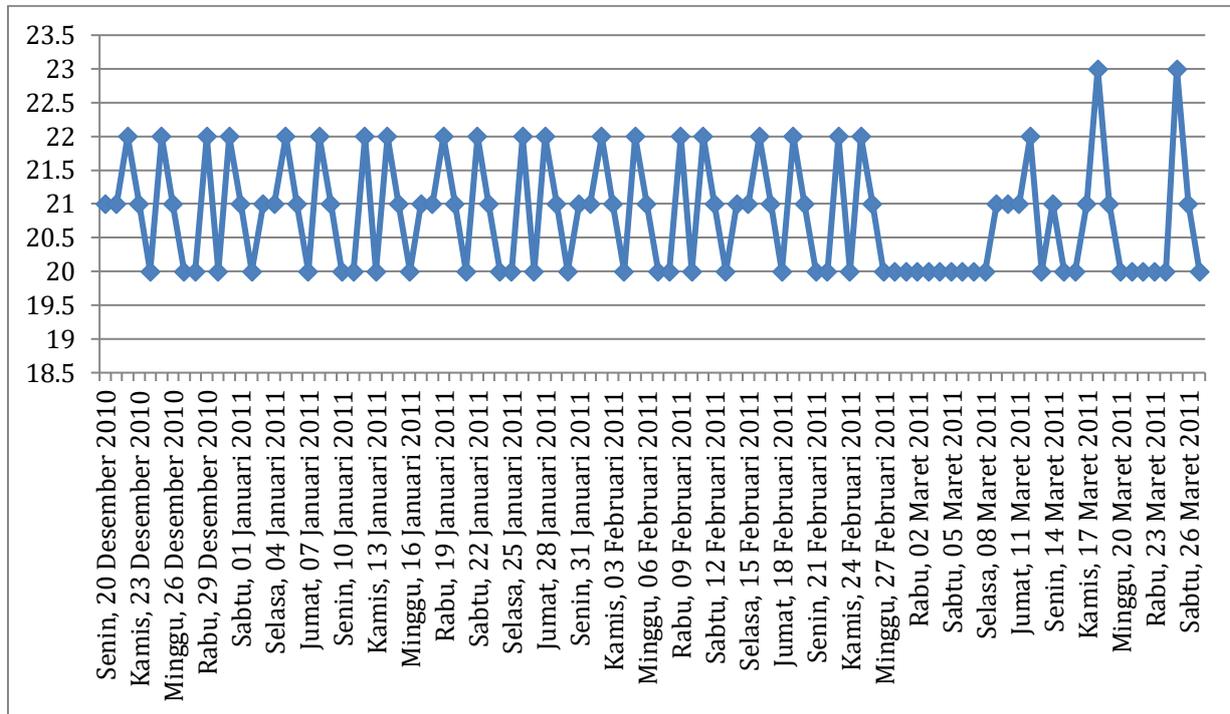


Figure 4. The average salinity obtained was 20.5 ppt.

### 3. pH

In sea cucumber cultivation, the ideal water pH ranges from 6.5 to 8.5. A pH that is too low can increase the solubility of toxic compounds such as ammonia and heavy metals that are harmful to cultivated organisms. In this study, the water pH ranged from an average of 8.5, both in the morning and evening. This value is still within the safe tolerance limit for the growth of *Holothuria scabra*.

These results are in line with the research of Sari et al. (2020) which reported that sea cucumbers showed optimal growth at pH 7.8–8.6 in the transitional waters of Seribu Island. They concluded that neutral to slightly alkaline pH encourages good metabolic processes and physiological performance for sea cucumbers. Another study by Rahmayani and Irawan (2021) in the waters of Karangsong, Indramayu, also found that *H. scabra* grew well at pH 8.3–8.5, which is closely related to the stability of shallow marine environmental parameters.

Thus, the pH conditions in the Mangrove River can be categorized as optimal, and also support the growth and survival of sea cucumbers during the maintenance period. The results of our observations of the pH in the river are as follows:

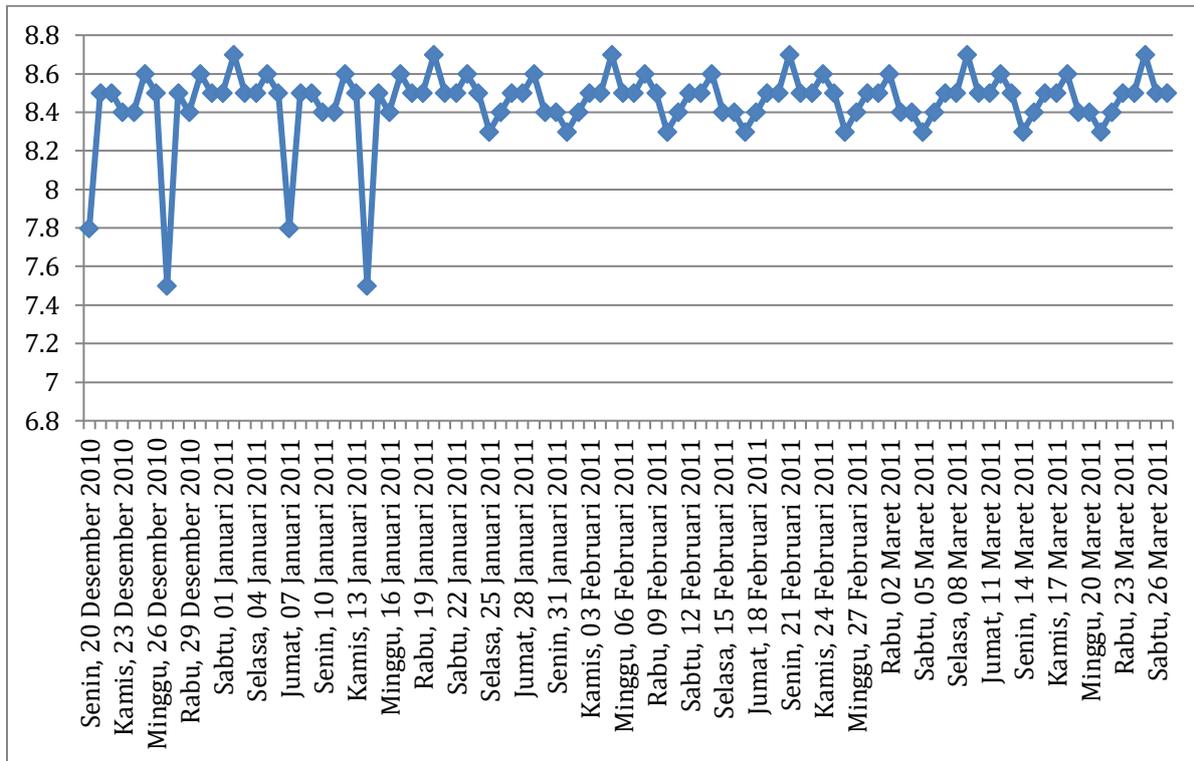


Figure 5. pH in the morning

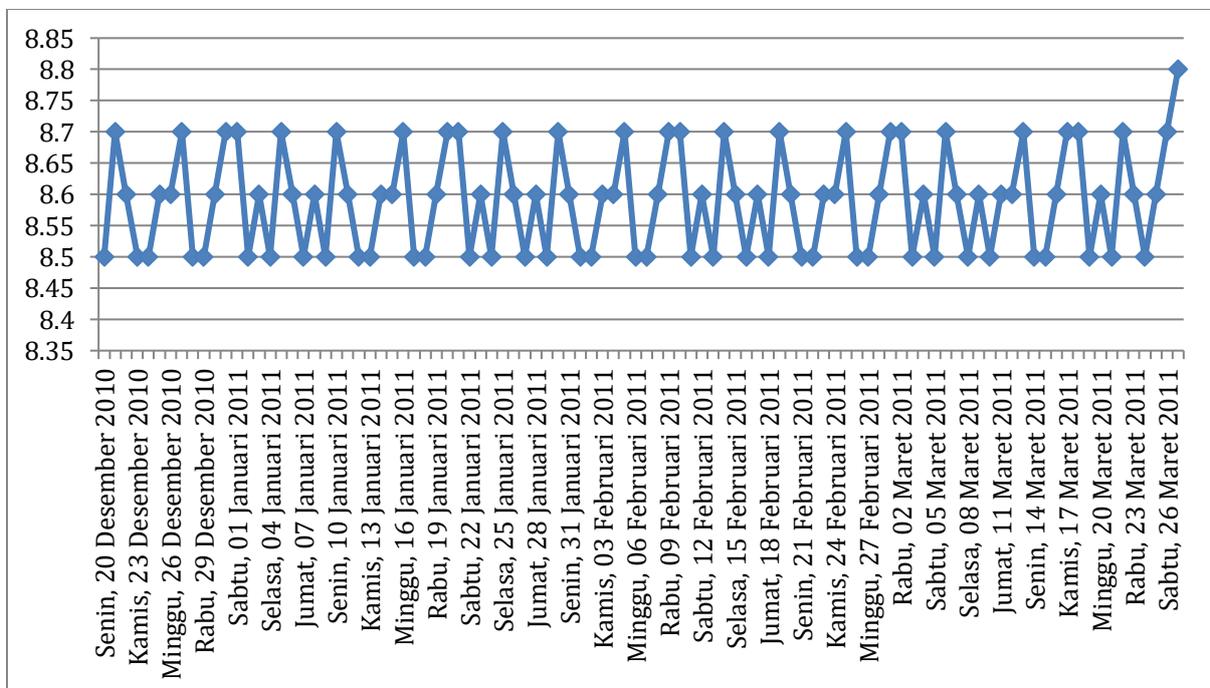


Figure 6. pH in the afternoon

4. Growth (weight and length)

Sea cucumber growth during the study was observed every two weeks, by measuring



body weight and length. The results of the observations showed an increase in weight from 10–20 grams to an average of 0.29 kg, and the final length reached 16.7 cm in about three months. This growth shows a positive response to the cultivation environment, even though the salinity is slightly below the ideal range.

This biomass growth is similar to the findings of Hamid et al. (2019) in the waters of Southeast Sulawesi, which showed that in semi-estuary environmental conditions, sea cucumbers were able to reach an average weight of 250–300 grams within three months. Meanwhile, Suhartini and Wulandari (2022) also recorded a length growth of 15–17 cm in *H. scabra* cultivated in floating net cages in tropical environmental conditions with good water circulation and muddy sand substrates.

Stable environmental factors such as temperature, pH, and water circulation, even with slight deviations in salinity, still provide profitable cultivation opportunities in the Bakau River area. This indicates that this location has great potential as a center for sea cucumber cultivation based on local ecosystems. The following is the growth of sea cucumbers in graphic form.

a. Body weight (Kg)

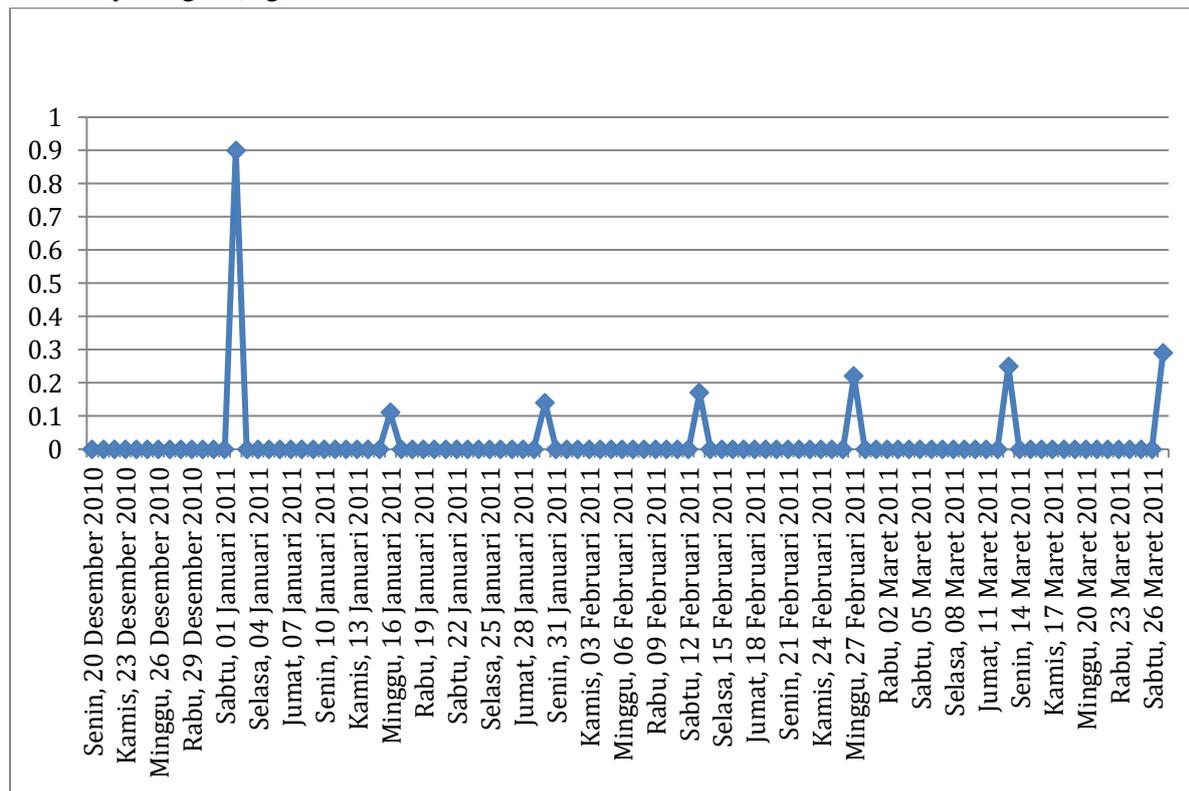


Figure 7. Sea cucumber body weight (Kg)



b. Body length

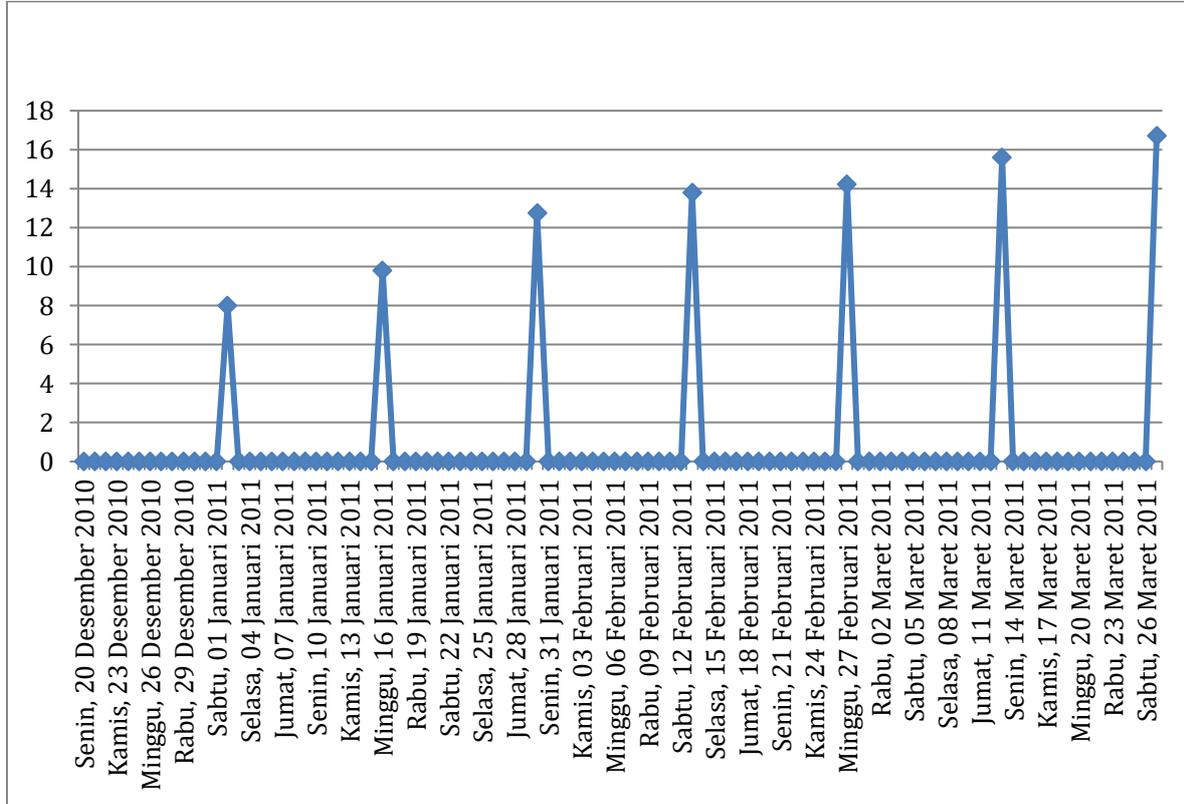


Figure 8. Sea cucumber body length (cm)

**Discussion**

The results of this study indicate that the coastal waters of Sungai Bakau offer environmental conditions that are generally suitable for sea cucumber (*Holothuria scabra*) aquaculture. Despite the observed salinity being slightly below the optimal range (average 20.5 ppt compared to the ideal 28–32 ppt), the temperature and pH remained within favorable ranges, with temperatures between 28–31°C and pH values averaging 8.5. These findings are consistent with previous research by Sari et al. (2020) and Rahmayani & Irawan (2021), which emphasize the critical role of temperature and pH stability in supporting physiological processes and survival rates of *H. scabra* in shallow coastal ecosystems.

The ability of *H. scabra* to maintain positive growth under suboptimal salinity conditions suggests a relatively high tolerance to estuarine environments, particularly in tropical regions like Sungai Bakau. This is in line with observations by Putri et al. (2021), who reported satisfactory growth performance in estuarine waters with salinity levels as low as 20 ppt. Additionally, the consistent growth in body weight (up to 0.29 kg) and length (16.7 cm) over three months confirms that despite deviations from ideal salinity, environmental factors such as substrate type, current flow, and ecological shelter (e.g., seagrass beds) may compensate and contribute to successful cultivation outcomes.

However, this study also highlights potential challenges in maximizing production efficiency under fluctuating or suboptimal salinity. Although *H. scabra* can adapt, prolonged exposure to lower salinity levels may affect reproduction, feed assimilation efficiency, or



disease resistance in long-term cycles. Therefore, future cultivation strategies in Sungai Bakau should consider integrated water management, such as periodic seawater exchange or selective breeding for salinity-tolerant strains. Monitoring other parameters like dissolved oxygen and ammonia would also strengthen environmental assessments.

In practical terms, the results reinforce the feasibility of establishing sea cucumber farming initiatives in underutilized coastal zones of Central Kalimantan. With proper site management and minimal environmental manipulation, these areas can serve as alternative sources of sustainable marine aquaculture. Moreover, the compatibility of *H. scabra* with local environmental conditions could be leveraged to promote community-based aquaculture programs, contributing to both economic uplift and coastal ecosystem restoration efforts.

#### 4. CONCLUSION

In general, sea cucumber cultivation is carried out in coastal waters in the tidal zone, considering the availability of land that is still quite extensive and environmental conditions that support it. However, sea cucumber cultivation is also possible to be carried out in seawater ponds or ponds by meeting certain technical requirements. Coastal waters that have a natural sea cucumber seed population tend to be more suitable for cultivation activities, although locations that do not have natural seed sources can still be utilized as long as the environmental parameters meet the requirements. The ideal cultivation location is protected from strong currents, large waves, and strong winds, because these conditions can damage cultivation facilities and complicate management activities. The recommended water depth is in the range of 0.5 to 1 meter at the lowest ebb, and does not exceed 2 meters at the highest tide. In addition, the ideal waterbed should have a gentle slope, composed of sand, coral fragments, mud, and overgrown with seagrass and seaweed. The presence of seagrass, seaweed, and coral structures not only act as natural protection from environmental disturbances, but also function as a place to trap food that supports optimal sea cucumber growth.

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