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PHYSICAL AND CHEMICAL ANALYSIS OF BINTAN STRAIT WATERS, PENGUJAN VILLAGE, BINTAN REGENCY FOR CANTANG GROUPER CULTIVATION

Analisis Fisika Kimia Perairan Selat Bintan, Desa Pengujan, Kabupaten Bintan Untuk Budidaya Ikan Kerapu Cantang

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ABSTRACT

The cultivation of cantang grouper (*Epinephelus fuscoguttatus* × *Epinephelus lanceolatus*) in the Bintan Strait using floating net cages (KJA) and fixed net cages (KJT) requires support from water physicochemical parameter data. The study was conducted at five observation points using a purposive sampling approach. Measurements of temperature, salinity, DO, pH, current, and depth were carried out directly (in situ). The observation results showed a temperature range of 27.3–31.8°C, DO > 5 mg/L, and salinity of 29–31 ppt, which are within the standard range for grouper cultivation. The current velocity parameters are moderate at 0.09–0.59 m/s and pH 8.6–8.9, which is slightly higher than the standard. Based on the data, the deepest point depth at low tide is only 3.0–3.4 m, so it is quite limited for KJA but does not affect KJT. Careful consideration is needed to cultivate cantang grouper in the Bintan Strait waters, especially in determining steps to overcome pH and currents that do not meet standard criteria.

Key words: Aquatic Chemistry Physics, Bintan Strait, Cantang Grouper, Pengujan Village

ABSTRAK

Budidaya ikan kerapu cantang (*Epinephelus fuscoguttatus* × *Epinephelus lanceolatus*) di Perairan Selat Bintan menggunakan Karamba Jaring Apung (KJA) dan Karamba Jaring Tancap (KJT) perlu didukung data parameter fisika kimia perairan. Penelitian dilakukan di lima titik

pengamatan dengan pendekatan *purposive sampling*. Pengukuran nilai suhu, salinitas, DO, pH, arus dan kedalaman dilakukan secara langsung (*in situ*). Hasil pengamatan menunjukkan suhu berkisar 27.3 – 31.8°C, DO > 5 mg/L, dan salinitas 29-31 ppt dimana nilai tersebut masuk dalam kisaran standar baku pembesaran ikan kerapu. Parameter kecepatan arus cukup laju 0.09 – 0.59 m/detik dan pH 8.6 – 8.9 yang sedikit lebih tinggi dari standar baku. Berdasarkan data kedalaman titik terdalam saat surut hanya 3.0 – 3,4 m sehingga cukup terbatas untuk KJA tetapi tidak berpengaruh untuk KJT. Perlu pertimbangan yang matang untuk melakukan budidaya kerapu cantang di Perairan Selat Bintan terutama penentuan langkah untuk mengatasi pH dan arus yang belum masuk kriteria standar baku.

Kata Kunci: Selat Bintan, Desa Pengujan, Fisika Kimia Perairan, Kerapu Cantang

INTRODUCTION

Perairan The Bintan Strait waters lie between Pengujan Island and Bintan Island. Administratively, these waters fall within the Teluk Bintan District. Pengujan Village comprises three hamlets along the coast of the Bintan Strait: Hamlet I on Pengujan Island, and Hamlets II and III on Bintan Island. A bridge spanning the Bintan Strait connects the three hamlets. Pengujan Village is one of 51 villages/sub-districts with significant fisheries potential in Bintan Regency (Kurniawan *et al*., 2024).

These waters enjoy a strategic location, protected from large waves and strong winds, and minimal shipping traffic. This advantage favors the placement of floating net cages (KJA) and fixed net cages (KJT). Capture fisheries continue to dominate the community's livelihoods, compared to aquaculture. The gonggong snail (*Strombus sp*.) is the most sought-after capture fishery commodity by the people of Pengujan Village (Fadilla *et al*., 2021). Based on direct field observations, the growing aquaculture activity in this area is the nursery of cantang grouper (*Epinephelus fuscoguttatus* × *Epinephelus lanceolatus*) in Household-Scale Hatcheries (HSRT). The nursery of cantang grouper has a short maintenance period, thus minimizing business risk (Astari *et al*., 2023). For fisheries processing, the community often dries sand sea cucumbers. The use of water bodies for aquaculture activities in floating net cages (KJA) and floating net cages (KJT) is still relatively minimal. The only active floating net cage unit belongs to the Fish Seed Center (BBI), which is the Regional Technical Implementation Unit (UPTD) of the Riau Islands Province Maritime Affairs and Fisheries Service, and belongs to a fish farmer group. There are three other locations in the waters where floating net cages are located, but fish farming activities are no longer active. Meanwhile, the active sea cucumber (KJT) units serve as containers for sea cucumber (*Triang Cucumber*) cultivation, and only four sea cucumber (KJT) locations have been observed along the Bintan Strait.

Grouper is a marine fish commonly cultivated by fish farmers in the Riau Islands, alongside white snapper and pomfret. Raising grouper in floating cages (KJA) and floating cages (KJT) is a common method for farmers. The main markets for floating grouper from the Riau Islands are Singapore, Malaysia, and Hong Kong. In fact, the Riau Islands (Kepri) is a major supplier of live grouper to Hong Kong. Foreign vessels legally enter the sea to large holding facilities in Natuna and the Anambas Islands (Husin *et al*., 2023). According to Sirait and Rahmawati (2026), live fish sales from Natuna to Hong Kong reached 1.2 billion rupiah, dominated by grouper.

Considering the grouper market and the potential of the Bintan Strait, such as protected waters, geographical location relative to export markets, and easy and close access to seed supplies from HSRT and BBI (Sa'adah and Suyoto, 2024), the utilization of water bodies for floating net cages (KJA) or floating net cages (KJT) should be more optimal in these waters. This utilization must of course still take into account environmental carrying capacity and regional spatial planning. To complement this potential, researchers conducted a physical and

chemical study of the waters in the Bintan Strait. Fish growth is greatly influenced by water quality conditions, with parameters such as salinity, temperature, pH, and DO (dissolved oxygen) being the main parameters of the physical and chemical properties of marine waters for grouper cultivation (Saselah *et al*., 2025; Febrianti, 2024; Husin *et al*., 2023). This data is needed to assess the suitability of water quality for grouper cultivation using floating net cages (KJA) or floating net cages (KJT) in the Bintan Strait.

RESEARCH METHODS

This research was conducted in March 2026. The observation locations consisted of five observation points with a purposive sampling approach in the Bintan Strait Waters, Pengujan Village, Bintan Regency, Riau Islands. The observation points for the physical and chemical parameters of the waters can be seen in Table 1 and Figure 1. Observations were carried out at three depths: the surface, middle, and bottom of the waters.

Table 1. Coordinate points for observing the physical and chemical parameters of the Bintan Strait waters, Pengujan Village

No.	Observation Point Name	Coordinate
1	Location 1	1°00'34.80"N 104°22'01.58"E
2	Location 2	0°59'52.78"N 104°22'04.08"E
3	Location 3	1°00'02.59"N 104°22'16.12"E
4	Location 4	0°59'59.80"N 104°22'02.37"E
5	Location 5	1°00'10.58"N 104°22'20.62"E

The tools used in this study included a Van Dorn Water Sampler tube, a current meter, a refractometer, a pH meter, a Dissolved Oxygen (DO) meter, a Garmin GPSMAP 580, and a boat. The materials used included distilled water, tissue, and nylon rope. The physicochemical parameters of the waters observed included salinity, DO, pH, temperature, current, and depth. Observations were conducted directly (in situ) at predetermined observation points. Location 1 was the waters that were completely dry at the lowest tide, and locations 2-5 experienced only changes in water depth at the lowest tide.

The data obtained from the physicochemical parameters of the waters in the Bintan Strait were tabulated using Microsoft Excel and presented in tabular form. The data were analyzed descriptively by comparing them with the Indonesian National Standard (SNI) water quality standards for cantang grouper cultivation using floating net cages (KJA).

Figure 1. Observation location points for the physical and chemical parameters of the Bintan Strait waters, Pengujan Village (Source: Google Maps, 2026)

RESULTS

The results obtained from observations of the physical and chemical parameters of the waters at the five observation points in the Bintan Strait can be seen in Table 1 below. Observations were carried out at different depths (surface, middle, and bottom).

Table 2. Physical and chemical parameter values of the Bintan Strait waters, Pengujan Village

Parameters	Observation Points	Depth			Standard RSNI3 9254:2024
		Surface	Middle	Base	
Physics	Location 1				
Temperature (°C)	Location 2	28.8	28.8	27.3	
	Location 3	31.4	31.3	31.3	
Current (m/s)	Location 4	30.8	30.4	30.2	28 – 32
	Location 5	30.0	30.6	30.4	
Chemistry	Location 1	31.8	31.0	30.7	
DO (mg/L)	Location 2	0.2	0.18	0.09	
Salinity (ppt)	Location 3	0.4	0.49	0.14	
	Location 4	0.48	0.51	0.47	0.05 - 0.25
	Location 5	0.46	0.38	0.33	
		0.59	0.46	0.39	
Parameters	Location 1				
	Location 2	4.8	4.8	4.6	
Physics	Location 3	5.8	6.1	5.9	
Temperature (°C)	Location 4	5.9	5.9	5.6	minimum 5
	Location 5	7.5	7.3	7.1	
Current (m/s)		8.1	7.2	7.0	
	Location 1	31	31	31	
Chemistry	Location 2	30	29	29	
DO (mg/L)	Location 3	30	30	30	28 - 33
	Location 4	30	30	30	

Salinity (ppt)	Location 5	29	29	29	
	Location 1	8.80	8.70	8.70	
	Location 2	8.80	8.70	8.70	
	Location 3	8.75	8.76	8.75	7.5 - 8.5
	Location 4	8.60	8.78	8.90	
	Location 5	8.66	8.61	8.63	

Temperature changes from the surface to the bottom of the waters are not significantly different. The lowest water temperature was at location 1, at the bottom, at 27.3°C. Compared to the quality standard, almost all temperature values were within the optimal range. Current values in these waters were quite high at locations 2-5 compared to the standard, with only location 1 remaining within the standard range of 0.09-0.20 m/s. Salinity was fairly uniform and within the optimal standard range of 29-31 ppt. Only location 1 did not meet the DO standard criteria, below 5 mg/L. The pH values at each observation location were fairly uniform but slightly above the specified standard range, reaching 8.9 at location 4, at the bottom, with the highest pH value compared to the other locations.

The depth data in the Bintan Strait waters presented in Figure 2 represents water depth at low tide. The boat, equipped with a Garmin 580 GPSMAP, navigated along the Bintan Strait waters following the established tracking line. Determination of the tracking line is also based on purposive sampling.

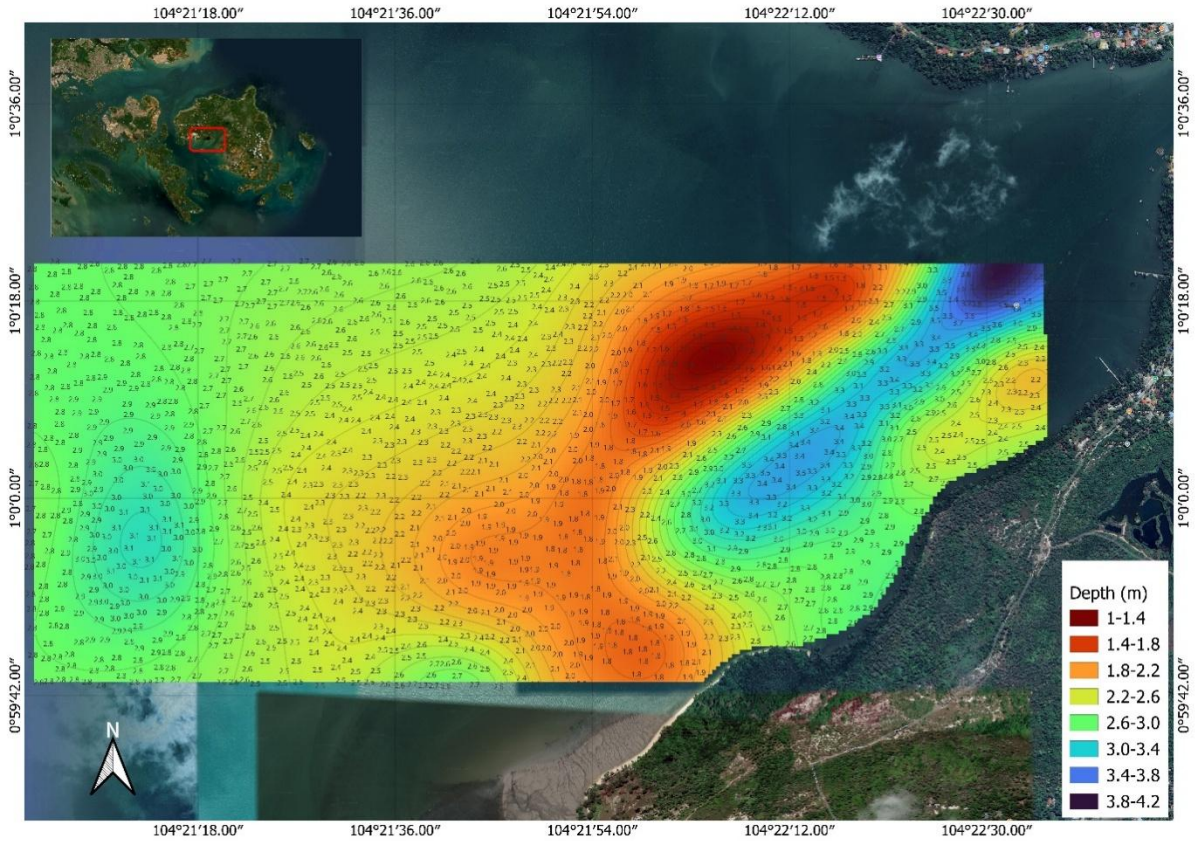

Figure 2. Depth of the waters of the Bintan Strait, Pengujan Village at low tide

DISCUSSION

The cantang grouper is a hybrid fish resulting from a cross between a male kertang grouper and a female tiger grouper. Although hybrid fish possess superior characteristics, their growth is also influenced by environmental conditions. Cantang grouper cultivation using floating net cages (KJA) will encounter open water conditions that affect business results. Water quality parameters such as salinity, temperature, DO, pH, and current influence the physiological condition, growth, and survival of cantang grouper (Ningrum *et al*., 2025; BPAP Situbondo, 2016).

Fish are poikilothermic organisms where water temperature will affect their body temperature which will impact their metabolic processes. This will also affect the level of feed consumption and ultimately will affect the calculation of the feed conversion ratio (FCR) which is one of the analysis of the calculation of the business costs of fish farming activities. The water temperature of the Bintan Strait is still within the standard range for the maintenance of cantang grouper in KJA, namely 28.8 - 31.8°C, there is only one observation point, namely at location 1 of the bottom of the waters where the temperature value is below the standard, namely 27.3°C. The maintenance of cantang grouper in KJA, the Batam Marine Aquaculture Center (BPBL) recorded temperatures ranging from ±28.5°C where the harvest time is around 6 to 8 months with a weight of 600 - 800 grams per fish (Febrianti, 2024).

Currents in ocean waters can be caused by tides and wind. Current conditions in the Bintan Strait are quite fast, exceeding standards, with a maximum value of 0.59 m/s. The narrow structure of the strait between Bintan Island and Pengujan Island contributes to the current speed. The alternating tidal patterns in the Bintan Strait also influence current conditions (Sari *et al*., 2021). Currents play a crucial role in the marine fish farming environment. Currents can clean the marine fish cage environment of accumulated toxic fish metabolic waste, such as ammonia (Bangun *et al*., 2024). Currents also affect the DO levels within the marine fish cages, provided the nets are regularly cleaned of attached organisms to maintain good water circulation through the nets. Furthermore, nets covered with attached organisms can obstruct the net structure and be carried away by the current, disrupting the movement of fish within.

DO levels in the water can affect fish appetite and are related to cellular respiration, which produces energy. The location with the lowest DO value was at location 1, while other observation points had DO values >5 mg/L and met the standard. This can be attributed to current conditions, which were also lowest at location 1 compared to other observation points. Water currents affect DO values (Wilmansyah *et al*., 2019; Mustafa *et al*., 2019). DO conditions also influence the density of fish that can be stocked in a rearing tank (Saselah *et al*., 2025).

Water salinity affects fish osmoregulation. Although cantang grouper are euryhaline fish capable of adapting to a wide salinity range, it still affects the portion of metabolic energy devoted to osmoregulation. In a study by Wijayanto *et al*. (2023), 12-gram cantang grouper fry still performed well when reared at 7 ppt salinity for 40 days, with a 100% survival rate. The salinity of the Bintan Strait waters ranges from 29 to 31 ppt and is fairly uniform across all observation locations, meeting the standard criteria for cantang grouper cultivation (RSNI3 9254:2024).

The pH value in the Bintan Strait waters is slightly higher than the specified standard range of 7.5 to 8.5, while observations indicate a pH range of 8.6 to 8.9. In some waters where cantang grouper is grown in floating net cages (KJA), such as Kuala Cangkoi in Aceh, the pH range is 7 to 8 (Zulfahmi *et al*., 2023) and the Sangihe Islands in North Sulawesi, the pH range is 7.5 to 8.2 (Saselah *et al*., 2025). According to research by Trianzah and Adi (2023), the pH in the cantang grouper nursery business unit at UD. The Situbondo Sea Garuda was recorded at a pH of 7. While the difference is not significant, it is still important to consider because high pH can increase the toxicity of free ammonia in the water. Therefore, measures to reduce

ammonia accumulation in the cultivation environment should be implemented. For example, polyculture with sea cucumbers or seaweed, which can utilize organic matter left over from fish metabolism.

The appropriate depth for placing marine cages (KJA) in the Bintan Strait waters is quite limited. Depth data collected during low tide indicates that locations 2-5 still have a depth range of 3-3.4 m. However, this condition is less than ideal for KJA using a 3 m net height because at low tide, the bottom of the net will be directly on the water floor. At low tide, the ideal distance between the bottom of the net and the water floor is 1 m (WWF Indonesia, 2011). However, this condition does not significantly impact fish farming activities using KJT containers.

CONCLUSION

The physical and chemical conditions in the Bintan Strait waters indicate a moderate current velocity of 0.09–0.59 m/s and a pH of 8.6–8.9, slightly above the standard. This requires careful consideration before conducting cantang grouper cultivation activities using floating net cages (KJA) or floating net cages (KJT). For temperature, DO, and salinity parameters, the Bintan Strait waters meet the criteria in accordance with the standard for grouper cultivation based on RSNI3 9254:2024.

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