

Occurrence of Jellyfish (*Rhopilema hispidum* and *Crambione mastigophora*) in Banyuasin Estuarine Waters Related to Environmental Conditions

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ABSTRACT

Estuarine ecosystems are transitional waters characterized by high productivity and dynamic environmental conditions. In recent years, jellyfish occurrence has increasingly been reported in several coastal areas, including the Banyuasin estuary, South Sumatra. This study aimed to analyze the relationship between oceanographic parameters and jellyfish occurrence in Banyuasin estuarine waters. The research used a survey method through direct field observations conducted during seven fishing trips. Environmental parameters measured included temperature, salinity, dissolved oxygen (DO), pH, current velocity, water transparency, and depth. Total catch biomass was also recorded. Data were analyzed descriptively and using Principal Component Analysis (PCA). The results showed average environmental conditions of temperature 29.41°C, salinity 22.36 ppt, DO 6.43 mg/L, pH 6.95, current velocity 0.39 m/s, water transparency 25.56 cm, and depth 1.96 m. The total catch was dominated by shrimp at 865.50 kg (52.23%), followed by jellyfish at 541.50 kg (32.67%), fish at 208.35 kg (12.57%), and crabs at 41.90 kg (2.53%). PCA results showed that depth, water transparency, temperature, salinity, DO, and current velocity were associated with jellyfish occurrence in Banyuasin estuarine waters. These findings indicate that oceanographic conditions play an important role in supporting jellyfish occurrence and may serve as baseline information for monitoring environmental changes and managing estuarine ecosystems sustainably.

Keywords: Jellyfish occurrence, Estuarine waters, Oceanographic parameters, PCA, Banyuasin estuary

INTRODUCTION

Estuarine ecosystems are transitional areas between land and sea characterized by high biological productivity and playing an important role in maintaining the ecological balance of coastal areas (Chilton *et al.*, 2021). Estuarine waters are characterized by dynamic environmental conditions due to the influence of tides, river discharge, and anthropogenic activities in coastal regions (Pein *et al.*, 2021). These characteristics cause environmental parameters such as temperature, salinity,

dissolved oxygen (DO), currents, and turbidity to fluctuate considerably, thereby affecting the distribution and abundance of aquatic organisms, including gelatinous organisms such as jellyfish (Estuary *et al.*, 2020). In recent years, the increasing occurrence of jellyfish in coastal and estuarine waters has become an important issue in marine ecology (Chaparro *et al.*, 2022)

Jellyfish blooms are characterized by increases in jellyfish abundance and biomass over a certain period, leading to the dominance of gelatinous organisms in

aquatic ecosystems. Several studies have reported that increasing water temperature, salinity changes, eutrophication, habitat degradation, and anthropogenic pressures in coastal areas may trigger jellyfish blooms (Estuary *et al.*, 2020 ; Rowley *et al.*, 2023). In addition to environmental factors, reduced natural predators and the high tolerance of jellyfish to extreme environmental conditions are also suspected to contribute to the increasing dominance of these organisms in estuarine waters (Hee *et al.*, 2023).

Increasing jellyfish abundance has been reported in various regions worldwide and has affected both ecosystems and human activities. Jellyfish blooms are known to disrupt fisheries by clogging fishing gear, reducing catch quality, and altering aquatic food webs through predation on zooplankton, fish eggs, and fish larvae. Furthermore, the dominance of gelatinous organisms is often associated with environmental degradation and imbalance in coastal ecosystems (Bosch-belmar *et al.*, 2021).

A similar phenomenon has also been observed in several coastal areas of Indonesia, including the estuarine waters of South Sumatra. Based on field observations in Banyuasin waters, high jellyfish occurrence and biomass were found in shallow estuarine waters. These conditions are related to environmental characteristics that support the development of gelatinous organisms, such as warm water temperature, high turbidity, fluctuating salinity, and high estuarine productivity (Bosch-belmar *et al.*, 2021). Estuarine environments that are relatively calm and rich in organic matter are known to support plankton growth as the primary food source for jellyfish.

Previous studies have primarily focused on jellyfish bloom phenomena in open coastal and offshore waters, while

studies examining the relationship between environmental parameters and jellyfish occurrence in tropical estuarine ecosystems, particularly the Banyuasin estuary, remain limited. In addition, information regarding the relationship between estuarine oceanographic conditions and jellyfish biomass in South Sumatra waters is still scarce. This lack of information has resulted in limited baseline data concerning environmental conditions that support jellyfish occurrence in the Banyuasin estuarine waters. Therefore, this study is important as preliminary information for understanding the relationship between environmental conditions and the occurrence of gelatinous organisms in estuarine ecosystems.

This study aimed to analyze the relationship between environmental parameters and the occurrence and biomass of jellyfish in the Banyuasin estuarine waters. The analysis of the relationship between oceanographic conditions and jellyfish occurrence is expected to provide information regarding the dominant environmental factors influencing the distribution of these organisms. The results of this study are also expected to provide baseline information for monitoring environmental changes in coastal and estuarine ecosystems and to support sustainable aquatic ecosystem management.

MATERIAL AND METHOD

This study employed a survey method through direct field observations (*in situ*) in the Banyuasin estuarine waters, South Sumatra Province, from August to September 2025.. The study was conducted during seven fishing trips at 37 observation stations located in the estuarine area of Banyuasin. Sampling stations were determined using a purposive sampling method based on

fishing activities and the operational areas of local fishermen.

Trips 1, 2, 3, 5, 6, and 7 were conducted in fishing grounds operated by fishermen using push-net fishing gear, while trip 4 was conducted in a non-push-net fishing area. The study area was located between coordinates 104°49'20"–104°56'20" E and 2°9'20"–2°18'20" S.

Jellyfish sampling was carried out by following fishermen operating push-net fishing gear at each fishing location. During the fishing operation, the net was deployed and towed for several minutes before being lifted onto the boat. Jellyfish samples obtained from the catch were collected and brought to the Laboratory of Biological Resource Exploration for identification based on morphological characteristics. The total biomass of jellyfish catches at each station was recorded and combined into each fishing trip.

Water samples were collected using a water sampler, and environmental parameters were measured directly in the field (*in situ*). The parameters measured included temperature using a thermometer, salinity using a refractometer, dissolved oxygen (DO) using a DO meter, pH using a pH meter, water transparency using a Secchi disk, current velocity using the floating drag

method, and depth using a GPS Map sounder.

The data obtained were analyzed descriptively to describe environmental conditions and the occurrence of jellyfish in the study area. Furthermore, the relationship between jellyfish biomass and environmental parameters was analyzed using Principal Component Analysis (PCA) to determine the dominant environmental factors influencing jellyfish occurrence in the Banyuasin estuarine waters.

RESULT AND DISCUSSION

Environmental Parameters at the Study Site

Based on the measurement results of environmental parameters, the average water temperature was 29.41°C, salinity was 22.36 ppt, dissolved oxygen (DO) was 6.43 mg/L, pH was 6.95, current velocity was 0.39 m/s, water transparency was 25.56 cm, and depth was 1.96 m. These conditions indicate that the study area is a shallow estuarine environment characterized by warm water temperature, fluctuating salinity, and relatively high turbidity levels, which may support the occurrence of gelatinous organisms such as jellyfish. The environmental parameter data are presented in Table 1.

Table 1. Environmental Parameters at the Study Site

Trip	Temperatur (°C)	Salinitas (ppt)	Do m/l	pH	Current velocity (m/s)	Water Transparency (cm)	Depth (m)
1	28,50	22,20	6,44	6,77	0,37	31,20	1,32
2	30,00	22,15	6,15	7,25	0,43	33,75	1,05
3	30,07	21,64	6,23	7,12	0,35	27,60	2,63
4	30,23	21,6	6,35	7,06	0,37	25,76	2,60
5	30,10	24,38	6,24	7,18	0,40	20,10	1,58
6	28,12	20,37	6,79	6,62	0,42	20,00	2,06
7	28,84	24,21	6,79	6,63	0,41	20,52	2,48
Maxs	30,23	24,38	6,79	6,62	0,43	33,75	2,63
Min	28,12	20,37	6,15	7,25	0,35	20,00	1,05
Average	29,41	22,36	6,43	6,95	0,39	25,56	1,96
STDEV	0,89	1,45	0,26	0,27	0,03	5,62	0,65

Note: Water quality standards for marine aquatic biota refer to the Government Regulation of the Republic of Indonesia No. 22 of 2021 (temperature, DO, pH, salinity, and water transparency). Current velocity was categorized as moderate according to (Saputro *et al.*, 2023)

A temperature of 29.41°C indicates that the study area is characterized by warm waters and remains within the optimal range for jellyfish growth in tropical regions. Water temperature is one of the primary environmental factors influencing jellyfish growth, reproduction, distribution, and blooming events in coastal and estuarine ecosystems. Elevated temperatures can accelerate metabolic processes, polyp development, and reproductive cycles, thereby increasing the biomass of gelatinous organisms in aquatic environments. Furthermore, warm water conditions can enhance plankton productivity, providing an abundant food source that supports jellyfish occurrence and development in estuarine waters..

In tropical estuarine ecosystems, relatively warm and stable temperature conditions are often associated with high aquatic productivity and increased abundance of both zooplankton and phytoplankton. These environmental conditions can create favorable habitats for the growth and development of various jellyfish species, particularly those with a high tolerance to environmental fluctuations and changing

habitat conditions. (Cabrerizo *et al.*, 2021).

Several studies have demonstrated that increasing sea temperatures contribute to higher intensity and frequency of jellyfish blooms in various regions worldwide, as elevated temperatures can extend reproductive periods and enhance jellyfish survival rates. Furthermore, warm water conditions influence the spatial distribution of gelatinous organisms, which tend to follow water masses that provide favorable environmental conditions for their growth and persistence (Cabrerizo *et al.*, 2021; Angel and Fern, 2021). Other studies have also reported that shallow semi-enclosed waters characterized by relatively high temperatures and high biological productivity have a greater potential for increased jellyfish biomass compared to open-water environments (Cabrerizo *et al.*, 2021).

The average salinity value of 22.36 ppt reflects the typical characteristics of estuarine waters influenced by the mixing of seawater and freshwater. Fluctuating salinity conditions are known to affect the distribution of gelatinous organisms.

Several estuarine jellyfish species have high tolerance to salinity changes, allowing them to survive under dynamic environmental conditions (Jaspers *et al.*, 2021)

Several estuarine jellyfish species are known to exhibit a high tolerance to salinity fluctuations, enabling them to survive and thrive under highly variable environmental conditions. This adaptation allows jellyfish to maintain their metabolic, respiratory, and reproductive processes across a broad range of salinity levels, giving them a greater ecological advantage compared to many other aquatic organisms (Cabrerizo *et al.*, 2021). Studies have shown that salinity is one of the primary environmental factors regulating the population dynamics of estuarine jellyfish. Extreme fluctuations in salinity can significantly influence the distribution, abundance, and survival rates of the medusa stage in estuarine waters (Warnken, 2021).

Furthermore, moderately variable estuarine salinity conditions can support high plankton productivity, providing an important food source for jellyfish. The combination of high physiological tolerance and sufficient food availability enables gelatinous organisms to thrive more successfully in estuarine environments than many other aquatic organisms (Tee *et al.*, 2021). These findings suggest that the salinity characteristics of the Banyuasin waters constitute one of the environmental factors supporting the occurrence and relatively high biomass of jellyfish in the study area.

The dissolved oxygen (DO) concentration of 6.43 mg/L indicates that the dissolved oxygen conditions were still suitable for aquatic organisms. Relatively high DO values may support metabolic activity, respiration, and the growth of plankton and other aquatic organisms. These conditions indicate that the water

quality in the study area was still capable of supporting the biological productivity of the estuarine ecosystem.

In estuarine ecosystems, dissolved oxygen (DO) concentrations are influenced by phytoplankton photosynthesis (Laining, 2015), water mass mixing, temperature, currents, and organic matter input from terrestrial areas. Waters with sufficient DO generally indicate good primary productivity, which can increase food availability for gelatinous organisms such as jellyfish. In addition, high plankton productivity in estuarine waters may support increased biomass of aquatic organisms in shallow coastal areas (Lai *et al.*, 2024). Several studies have also shown that jellyfish have relatively high tolerance to low DO conditions compared to many other aquatic organisms, allowing them to survive in fluctuating estuarine environments (Polyps *et al.*, 2021). These adaptations provide ecological advantages for jellyfish to survive and develop in waters with highly dynamic environmental conditions. Therefore, the relatively good DO conditions in the Banyuasin waters are suspected to support the presence and occurrence of gelatinous organisms in the study area.

A pH value of 6.95 indicates near-neutral water conditions that remain suitable for supporting aquatic life. In estuarine ecosystems, pH is generally influenced by freshwater input, organic matter availability, and tidal dynamics. Although pH is not considered a primary factor driving jellyfish blooms, relatively stable pH conditions can contribute to the persistence and survival of gelatinous organisms in estuarine environments (Arossa *et al.*, 2021).

The average current velocity of 0.39 m/s was categorized as moderate. Relatively calm to moderate currents may support the accumulation of plankton and gelatinous organisms in shallow estuarine

waters. In addition, currents play an important role in the spatial distribution of jellyfish because these organisms tend to follow water mass movement (Guo *et al.*, 2023)

Water transparency of 25.56 cm indicates relatively high turbidity levels. High turbidity in estuarine waters is generally caused by sediment and organic matter input from rivers. These conditions may increase plankton productivity and support food availability for jellyfish (Baliarsingh *et al.*, 2020).

Several studies have shown that estuarine waters with high turbidity levels tend to have greater potential for increasing jellyfish biomass (Syazwan *et al.*, 2025). Turbid water conditions may also provide ecological advantages for certain jellyfish species because these organisms have high tolerance to fluctuating environmental conditions compared to many other aquatic organisms (Caputo *et al.*, 2018). Therefore, the high turbidity in the Banyuasin waters is suspected to be one of the environmental factors supporting jellyfish occurrence in the study area.

Fisheries Catch Results During Seven Fishing Trips

Based on the total catch during the study, shrimp were the dominant commodity with a biomass of 865.50 kg, followed by jellyfish at 541.50 kg, fish at 208.35 kg, and crabs at 41.90 kg. Although shrimp remained the main target catch of fishermen, the relatively high jellyfish biomass indicates the occurrence of gelatinous organisms in large quantities in the Banyuasin estuarine waters. The high jellyfish biomass also indicates that gelatinous organisms were relatively dominant compared to most other catch components. The dominance of gelatinous organisms in coastal and estuarine waters is often associated with environmental conditions that support jellyfish development and the high tolerance of these organisms to environmental changes (Bosch-Belmar *et al.*, 2021). Overall catch data are presented in Table 2

Ecologically, the occurrence of jellyfish with high biomass in estuarine waters is often associated with environmental conditions that support the development of gelatinous organisms, such as warm water temperatures, fluctuating salinity, high water productivity, and relatively calm current conditions (Togatorop *et al.*, 2025).

Table 2. Total Catch Biomass

No	Famili	Spesies	Common name	Trip (kg)							Total Catch Weight (kg)
				1	2	3	4	5	6	7	
1	<i>Penaeidae</i>	<i>Penaeus merguensis</i>	Udang burung	7,5	5	8	4	4,5	5,9	7,7	42,6
2	<i>Penaeidae</i>	<i>Metapenaeus monoceros</i>	Udang tb	43	48	55	48	23,2	37,6	47,9	302,7
3	<i>Penaeidae</i>	<i>Mierspenaeopsis sculptilis</i>	Udang cat	18	52	65	49	11,1	21,1	26,8	243
4	<i>Penaeidae</i>	<i>Metapenaeus lysianassa</i>	Udang krosok	38	46	48	43		27	35,8	237,8
5	<i>Squillidae</i>	<i>Harpisquilla raphidea</i>	Udang petak	8,5	7	9	6	6,1		2,8	39,4
6	<i>Sciaenidae</i>	<i>Johnius carouna</i>	Ikan gulama	12	11	7	8	0,9	1	2,2	42,1
7	<i>Paralichthyidae</i>	<i>Pseudorhombus arsius</i>	Ikan sebelah	6	7	8	6	2,2	5,7	3,2	38,1
8	<i>Cynoglossidae</i>	<i>Cynoglossus lingua</i>	Ikan lidah	7	7	7	8	3,6	2,4	2	37
9	<i>Synbranchidae</i>	<i>Monopterus albus</i>	Belut biasa	14	11	12	8	1	1,9	1,2	49,1
10	<i>Congridae</i>	<i>Conger cinereus</i>	Belut Besi	11	8	8	6	3,75	3	2,3	42,05
11	<i>Rhizostomatidae</i>	<i>Rhopilema hispidum</i>	Ubur-ubur nipar	17	55	65	50	6,5	65	30	288,5
12	<i>Catostylidae</i>	<i>Crambione mastigophora</i>	Ubur-ubur manggis	55	20	50	48	31	11	38	253
13	<i>Portunidae</i>	<i>Charybdis hellerii</i>	Kepiting ragi	4	3	5	4		1,3	5,3	22,6
14	<i>Portunidae</i>	<i>Portunus pelagicus</i>	Kepiting rajungan	2,5	3	4	2	1,8	2,2	3,8	19,3
Total Catch Weight											1657,25

Estuarine environments rich in organic matter and plankton may also increase food availability for jellyfish, thereby supporting the accumulation of their biomass in shallow waters (Latifa *et al.*, 2022). These conditions indicate that Banyuasin waters possess habitat characteristics suitable for jellyfish development.

The relatively high dominance of jellyfish biomass compared to fish and crab catches may serve as an early

indication of changes in the community structure of estuarine waters. Jellyfish blooms or dominance are known to affect capture fisheries activities and the balance of aquatic food webs due to strong competition and predation on zooplankton, fish eggs, and fish larvae, (Rahmah and Zakaria, 2017). The percentage comparison between jellyfish and other non-target catches showed a significant difference, as presented in Figure 1.

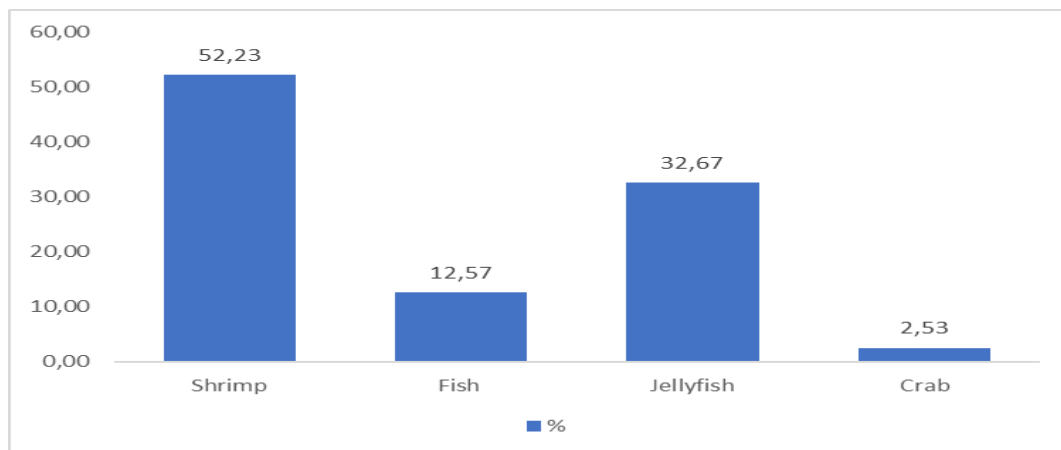


Figure 1. Total Catch Weight (%)

Principal Component Analysis (PCA) Relationship Between Environmental Parameters and Jellyfish Occurrence

The PCA analysis presented in Figure 2 based on the biplot showed a

cumulative eigenvalue percentage of 65.89%, with the F1 and F2 axes contributing 38.06% and 27.83%, respectively.

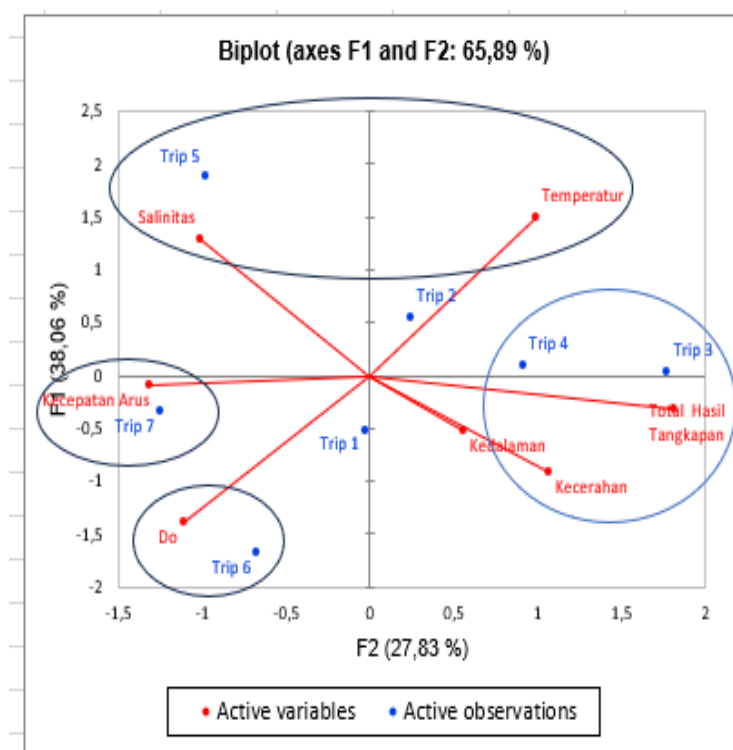


Figure 2. PCA Analysis of the Relationship Between Environmental Parameters and Jellyfish Occurrence

On the positive side of F1 (F1+), Trip 3 and Trip 4 were characterized by the variables total catch, depth, and water transparency. These conditions indicate a positive relationship among variables, where increasing depth and water

transparency were associated with higher total catches during these trips.

The greater water depth observed during Trip 3 and Trip 4 may have provided more stable habitat conditions for aquatic organisms, including jellyfish

and other catch components. Water transparency values ranging from 20.00–33.75 cm indicate relatively turbid conditions, which are common characteristics of estuarine waters due to high sediment and organic matter input from land. These conditions may still support plankton productivity as a food source for aquatic organisms, including gelatinous organisms such as jellyfish. In addition, high organic matter content and estuarine productivity were suspected to contribute to the relatively high total catches recorded during both observation trips (Heronimus, 2024).

The relationship between water transparency and total catch indicates that estuarine water conditions play an important role in the distribution of aquatic organisms at the study site. The relatively low transparency values indicate high water turbidity caused by sediment and organic matter input from land, which is a common characteristic of estuarine environments. These conditions may still support plankton productivity as a food source for aquatic organisms, including gelatinous organisms such as jellyfish. (Paiki *et al.*, 2018). In addition, oceanographic parameters such as depth and water transparency are known to influence the spatial distribution of gelatinous organisms, which tend to follow water mass conditions and food availability in estuarine waters.

On the negative side of F1 (F1–), Trip 7 was characterized by the current velocity variable. These conditions indicate a relatively strong relationship between Trip 7 and increased current velocity at the study site. This suggests that the hydrodynamic conditions during Trip 7 were more strongly influenced by water mass movement compared to the other trips.

Current velocity is known to play an important role in the distribution of aquatic organisms, including gelatinous organisms such as jellyfish. Currents may

influence the distribution pattern of plankton as the primary food source for jellyfish and also affect the movement of organisms following water mass circulation. In estuarine waters, stronger current conditions may cause organisms to become more dispersed, resulting in lower jellyfish biomass accumulation compared to relatively calm waters.

In addition, current dynamics in estuarine waters are influenced by tidal activity and river discharge, causing environmental conditions to become more fluctuating. The relationship between Trip 7 and current velocity in the PCA indicates that hydrodynamic parameters are among the environmental factors influencing variations in water conditions during the observation period.

On the positive side of F2 (F2+), the characteristic variables were salinity and temperature. These conditions indicate a positive relationship between Trip 5 and higher water temperature and salinity values at the observation site. This suggests that the oceanographic characteristics during Trip 5 were more strongly influenced by warmer water conditions and relatively higher salinity compared to the other trips.

Temperature and salinity are important environmental parameters influencing the distribution of aquatic organisms, including gelatinous organisms such as jellyfish. Warm water temperatures are known to increase the metabolic activity, growth, and reproduction of jellyfish, while salinity affects the physiological tolerance of organisms to estuarine environmental conditions. Several jellyfish species are known to develop well in estuarine areas characterized by relatively high salinity fluctuations. (Andriyani *et al.*, 2019).

The relationship between Trip 5 and the temperature and salinity variables indicates that these oceanographic conditions were factors supporting the occurrence of gelatinous organisms at the

study site. In tropical estuarine waters, the combination of warm temperatures and moderate to high salinity is often associated with increased water productivity and the availability of plankton as the primary food source for jellyfish, thereby serving as characteristic factors of the observation area. (Purba, 2020).

On the negative side of F2 (F2-), Trip 5 was characterized by the dissolved oxygen (DO) variable. These conditions indicate a relationship between Trip 5 and dissolved oxygen concentration at the study site. The relatively high DO values indicate that the water conditions were still suitable for supporting aquatic organisms, including plankton and gelatinous organisms such as jellyfish.

Dissolved oxygen is one of the important parameters in estuarine ecosystems because it plays a significant role in the respiration and metabolic processes of aquatic organisms. High DO concentrations are generally associated with phytoplankton photosynthetic activity, water mass mixing, and relatively good water conditions. In estuarine waters, DO concentrations are also influenced by temperature, currents, and organic matter input from land. (Simanjuntak, 2012).

The relationship between Trip 5 and dissolved oxygen (DO) in the PCA results indicates that dissolved oxygen was one of the environmental factors influencing water characteristics at the observation site. Favorable DO conditions were also suspected to support plankton productivity as a food source for gelatinous organisms in the Banyuasin estuarine waters.

Based on the PCA results, the F1 axis had a greater contribution than the F2 axis, indicating that it was the most dominant environmental factor influencing water conditions during the study. The dominant variables on F1+ included total catch, depth, and water

transparency, while F1- was mainly characterized by current velocity. These results indicate that physical water characteristics and hydrodynamic conditions were the primary factors affecting environmental variation in the Banyuasin estuary. Meanwhile, the dominant parameters on the F2 axis included temperature, salinity, and dissolved oxygen (DO), reflecting the influence of oceanographic conditions and water quality on the presence of gelatinous organisms such as jellyfish.

The PCA results showed a positive relationship between depth, water transparency, and total catch on the F1+ axis, where increasing depth and transparency tended to be associated with higher total catches during trips 3 and 4. In contrast, current velocity on F1- showed an opposite relationship to the variables on F1+, indicating that stronger currents may reduce organism accumulation due to more dynamic water mass movement.

On the F2+ axis, temperature and salinity showed a positive relationship with trip 5, indicating that warmer temperatures and relatively higher salinity were associated with the water characteristics at that location. Meanwhile, dissolved oxygen (DO) on F2- showed an opposite relationship to temperature and salinity, reflecting differences in water quality conditions among the observation sites.

Ecologically, the PCA results indicate that estuarine oceanographic conditions play an important role in influencing the distribution and occurrence of jellyfish in Banyuasin waters. Depth and water transparency, which were associated with higher catches, suggest that relatively stable habitat conditions can support the productivity of aquatic organisms. In contrast, current velocity influences the distribution of gelatinous organisms because jellyfish tend to follow water

mass movement and food availability.

In addition, relatively high temperature and salinity indicate environmental conditions that support the physiological tolerance, metabolism, and growth of jellyfish. Overall, the PCA results demonstrate that physical factors, hydrodynamic conditions, and water quality play important roles in controlling environmental variation and jellyfish occurrence in the Banyuasin estuary.

CONCLUSION

Based on the results of this study, the Banyuasin estuarine waters exhibited oceanographic conditions that support jellyfish occurrence, characterized by warm temperatures, fluctuating salinity, suitable dissolved oxygen (DO) levels, and moderate current velocity. The relatively high jellyfish biomass indicated the occurrence of gelatinous organisms in the study area. PCA results showed that depth, water transparency, temperature, salinity, DO, and current velocity were important environmental parameters influencing water condition variability and jellyfish occurrence in the Banyuasin estuary.

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