Zooplankton community structure in Cengkok Coastal Water and it’s around, Teluk Banten

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Abstract. Cengkok coastal waters of Banten Bay are one of the waters that have many anthropogenic, industrial, and aquaculture activities. Zooplankton would like to become a bioindicator for the water’s condition. This study aimed to analyze the biodiversity and structure of the zooplankton community in waters. The study was carried out, from May to September 2019 at five stations. Data analysis calculating the value of composition, abundance, similarity index, biological index, and PCA. Based on the study obtained, the zooplankton consisted of 17 classes and 47 genera. Based on location and time, respectively, the average composition of Malacostraca (47.2% and 49.8%) and Ciliata (40.6% and 37%). Based on location and time observation, the average diversity index (H’) was (0.8-1.6) and (1.2-1.6); evenness index was (0.7-0.8) and (0.6-0.9); and index dominance was (0.3-0.6) and (0.3-0.4) respectively. The PCA results divided into 3 groups and the results of the similarity index showed the zooplankton abundance had the highest similarity value at Stations 3 and 5 (0.829) and based on water parameters showed that the highest similarity is 0.98. Based on the community structure index, it is found that the condition of the zooplankton structure community in Cengkok coastal waters (Banten Bay) was medium stressed.

Keywords: Banten Bay; community structure; zooplankton

1. Introduction
Banten Bay is a part of Serang Regency, Banten Province in Indonesia. The waters of Banten Bay receive input from several small rivers that flow into the Bay, namely the Cibeureum River, Cibanten River, and Cikadueun River [1]. Banten Bay is fairly fertile irrigation with a variety of fishery catches that are also abundant, namely fish, clams, crabs, and shrimp. One of the coastal of Banten Bay is Cengkok Coastal Waters, Cengkok Coastal waters are located at 06°01'433'' S and 106°10'514 '' E which are in fishing ground and pound areas [2]. The coastal waters are dominated by mud substrate which causes the waters to have a brown color with muddy substrate characteristics derived from sediments carried by seawater or freshwater to coastal areas. This is consistent with Nybakken [3] mentioned that most estuary areas that carry suspended particles are mostly organic. The substrate is rich in material organic which is a source of nutrition for coastal organisms including zooplankton. In addition to natural
factors, Cengkok Coastal Waters gets nutrient input from anthropogenic influences from various human activities. Also, the presence of some industrial activities around the coast further adds to the pressure on the coast of Banten Bay. Some streams that flow into Banten Bay cause a lot of nutrient input or nutrient enrichment compounds in the region.

Plankton is an important biological component in the food chain in waters, but it can also be used as an indicator of aquatic biology that can be used to determine ecological conditions in waters [4]. Zooplankton plankton acts as a primary herbivore consumer. Plankton can be used as a bioindicator of water because it’s distribution pattern follows the condition of the aquatic environment and the concentration of nutrients contained in these waters [5]. Several studies on zooplankton were carried out in several estuaries and coastal waters in Indonesia including in the Jakarta Bay Waters [6], in the Majakerta River estuary [7], in Jayapura Coastal Waters [8], in marine waters of South East Java, Bali, and Lombok [9]. However, information on zooplankton in Cengkok coastal waters of Banten Bay has never been reported. This study aimed to obtain the diversity and community structure of zooplankton, including abundance, diversity, evenness, and dominance index in the Cengkok Coastal waters of Banten Bay. The results of this study are expected to be able to provide information about the water condition of Banten Bay. The data is expected to be used for the management and utilization of the Cengkok coastal waters management.

2. Methods

2.1. Time and location
A sampling of zooplankton was carried out once every month for five months from May to September 2019 in Cengkok Coastal Waters, Banten Bay (figure 1), at five stations that represented ecological water conditions, namely Station 1 at the river body, Station 2 at the estuary, Station 3, 4, and 5 at the sea. Sample analysis was conducted at the Biology Macro Laboratory 1 (Department of Aquatic Resources Management) and the Marine Bioprospecting Laboratory (Department of Marine Science and Technology) Faculty of Fisheries and Marine Science of Bogor Agricultural University.

![Figure 1. Study sites of zooplankton diversity and community structure in Cengkok Coastal Waters of Banten Bay.](image)
2.2. **Sampling method**

Water samples were taken using a purposive sampling method at five stations by filtering 100 liters of water using plankton net 53µ taken at each station from the river body towards the sea at the surface waters. The results of the filter that are 75 ml were poured into plastic sample bottles. Preservation of samples using 1% Lugol and place it in a cool box.

2.3. **Laboratory analysis**

Laboratory analysis was carried out to identify zooplankton used a microscope and plankton identification book [10]. Before analyzing the sample volume was measured after filtering using a measuring cup. The sample was inserted into the Sedgewick Rafter using a pipette, then identify the census survey method using a microscope.

2.4. **Data analysis**

2.4.1. **Abundance.** Zooplankton abundance was calculated using the survey census method which is expressed in individuals per liter using the equation [11].

\[
F = \frac{A \times C \times 1000}{B \times D \times E} \times N
\]

Note:
- A = Area of the glass cover
- B = Field of View studied
- C = Filtered sample volume
- D = Sample volume
- E = Volume of the sample taken
- F = Number of individuals per liter
- N = Number of organisms obtained

Water parameters are one of the important things for the biodiversity of zooplankton and there are some waters parameter we must measure to support our research (table 1).

| No | Parameters               | Unit   | Location   |
|----|--------------------------|--------|------------|
| 1  | Biology                  | Zooplankton | ind/l     |
| 2  | Physics                  | Temperature | °C       |
|    |                          | Transparency | m       |
|    |                          | Turbidity     | NTU     |
| 3  | Chemistry                | Salinity     | %        |
|    |                          | pH            | In situ   |
|    |                          | Dissolved Oxygen (DO) | Ppm |
|    |                          | Nitrate       | Ppm       |
|    |                          | Phosphate     | Ppm       |

2.4.2. **Diversity Index (H').** The diversity index was calculated using the Shannon-Wiener equation [12].

\[
H' = - \sum_{i=1}^{s} p_i \ln p_i
\]

Note:
- \(H'\) = Diversity Index
- \(p_i = n_i / N\)
- \(N = \) The sum of all individuals
2.4.3. Evenness Index (E). The evenness index serves to determine the type of population that dominates and the distribution of the number of individuals in each species [12].

\[ E = \frac{H'}{H'M_{\text{maks}}} \]  

Note:
- \( E \) = Evenness index
- \( H'M_{\text{maks}} = \ln S \)
- \( S = \) Number of species of biota

2.4.4. Dominance Index (C). The dominance index was calculated using the Simpson dominance index equation [12].

\[ C = \sum_{i=1}^{n} \left( \frac{n_i}{N} \right)^2 \]

Note:
- \( C \) = Simpson dominance index
- \( n_i \) = Number of individual types \( i \)
- \( N \) = Total number of individual \( i \)-th types

2.4.5. Index Similarity. Zooplankton species composition data were presented descriptively an Bray Curtis index to determine the grouping of species between observation stations [4].

\[ I_b = 1 + \sum_{j=1}^{n} \frac{|A_{ij} - B_{ik}|}{|A_{ij} + B_{ik}|} \]

Information:
- \( I_c \) = Bray-Curtis Index similarity value
- \( A_{ij} \) = The value of the \( i \)-th parameter data at the \( j \)-th station
- \( B_{ik} \) = Value of the \( i \)-th parameter data at the \( k \)-th station
- \( S \) = Number of taxa

2.4.6. Principle Component Analysis. Principle component analysis (PCA) is a method used for grouping plankton based on physical and chemical parameters of waters. PCA is used to determine the relationship between plankton abundance and water parameters in the Cengkok coastal waters of Banten Bay.

3. Result

The composition of zooplankton species in Cengkok Coastal waters, Banten Bay from observations at five stations for five months (May-September 2019) can be seen in table 2, figure 2, and figure 3. During the five-month and five stations, we found 17 classes of zooplankton. The zooplankton species composition consisted of Appendicularia, Bivalvia, Ciliata, Heterobranchia, Hexanauplia, Hydrozoa, Malacostraca, Oligotrichae, Olitrichae, Polychaeta, Rhizopoda, Rotifera, Sagittoidae, Sarcodina, Sticholonchea, Thaaliacea, and Urochordata. Based on the location and time of observation, it was found that the classes Malacostraca and Ciliata had the most composition (table 2). The most zooplankton compositions were Malacostraca and Ciliata, both classes of zooplankton were found in many waters. Based on the calculation of composition, the types of zooplankton that exist at each station and the observation time were Nauplius, Calanus of the class Crustacean, and Tintinopspis of the class Ciliata. Zooplankton have lower abundance values which were almost evenly distributed at each station but the highest abundance at Station 3 (19,649 ind/l), and the lowest one at Station 4 (11,053 ind/l) (figure 4 and figure 5). Based on the observation time, the abundance of zooplankton was fluctuating, but the amount was not so much different. The lowest abundance was in July (3,115 ind/l), and there was a significant increase in September in which the total abundance of zooplankton was (32,994 ind/l).
Table 2. Classes and Genera of zooplankton found in Cengkok Coastal Waters of Banten Bay.

| Class          | Genera                  |
|----------------|-------------------------|
| Appendicularia | Oikopleura              |
| Bivalvia       | Larva                   |
| Ciliata        | Amphiporella            |
|                | Acanthostomella         |
|                | Codonellopsis           |
| Heterobranchia | Creseis                 |
| Hexanauplia    | Corycaeus               |
| Hydrozoa       | Diphyes                 |
| Malacostraca   | Acartia                 |
|                | Balanus                 |
|                | Calanus                 |
|                | Candacia                |
|                | Cyclops                 |
|                | Cotocoelamus            |
| Oligotricha    | Helicostomella          |
| Oliotricha     | Salpingella             |
| Polychaeta     | Larva                   |
| Rhizopoda      | Arcella                 |
| Rotifera       | Brachionus              |
|                | Keratella               |
| Sagittoidea    | Sagitta                 |
| Sarcodina      | Globigerina             |
| Sticholonecha  | Sticholpnche            |
| Thaliacea      | Thalia                  |
| Urochordata    | Oikopleura              |

Figure 2. Composition of zooplankton based on observation location in Cengkok coastal waters, Banten Bay.
**Figure 3.** Composition of zooplankton based on observation time in Cengkok coastal waters, Banten Bay.

**Figure 4.** Zooplankton abundance based on location in Cengkok coastal waters, Banten Bay.

**Figure 5.** Zooplankton abundance based on time in Cengkok coastal waters, Banten Bay.
3.1. Zooplankton community structure

The zooplankton diversity index based on the location of the station was various, the lowest value was at Station 2 (0.8) and the highest one was at Station 5 (1.6) (figure 6). The diversity index at each station was classified as medium, except at Station 2 which the diversity index was in a low category. Zooplankton had a stable evenness index (E) value, there was no significant fluctuation with a range of values from 0.7 to 0.8 (figure 7). The lowest E value with a value of 0.7. The E value at Station 1 was 0.8, Station 3 was to 0.8 at Station 4 was 0.8, and Station 5 was 0.8. This value indicates a moderate even distribution of zooplankton. Based on figure 10, the zooplankton evenness index in Cengkok Coastal waters was in the medium to the high category because it’s value was close to 1. Dominance index with the highest value was found in Station 2 which was 0.8 while Station 1, 3, 4 and 5 has a low dominance value that was 0.3 at Station 1, at Station 3 was 0.3 and 0.3 at Station 4 and 0.3 at Station 5 (figure 8). The dominance index was classified as a low dominance index except at Station 2 which had the highest (C) value. Based on the dominance index obtained from the observation location, the zooplankton in Cengkok Coastal waters were not dominated by one species in a community.

Figure 6. Value of diversity index of zooplankton in Cengkok Coastal Waters, Banten Bay based on observation station.

Figure 7. Value of evenness index of zooplankton in Cengkok Coastal Waters, Banten Bay based on observation station.
Figure 8. Value of dominance index of zooplankton in Cengkok Coastal Waters, Banten Bay based on observation station.

Figure 9. Value of diversity index of zooplankton in Cengkok Coastal Waters, Banten Bay based on observation time.

Figure 10. Value of evenness index of zooplankton in Cengkok Coastal Waters, Banten Bay based on observation time.
The zooplankton diversity index based on the time of observation shows fluctuating results. In May it was 1.5 and increased in June to 1.6 (figure 9). Since July there was a decrease until September and the lowest value was in two months in August and September of 1.2. Evenness index values obtained decreased from May to September, but with a range of values that were not so far away. In May the highest value was 0.9 and decreased in June until August to 0.8 decreased in September which was 0.6 respectively (figure 10). Based on the time of the study for five months, the zooplankton evenness index value was moderate to the high category because the value was close to 1. The value of dominance index (C) based on the time of the study increased from May to September, with the lowest one in May and June which were 0.3 and 0.4 in July-September (figure 11). Dominance index values obtained based on time of observation were categorized in the low category based on Odum [13].

### 3.2. Environment

Water parameters are one of the important factors for organisms in the waters. Data of water parameters in the Cengkok Coastal Waters, Banten Bay during May-September is presented in table 3.

#### Table 3. Values of physical and chemical parameters of the waters based on the location of data collection in Cengkok Coastal Waters, Banten Bay.

| Parameters | Units | Station 1 | Station 2 | Station 3 | Station 4 | Station 5 |
|------------|-------|-----------|-----------|-----------|-----------|-----------|
| Physic     |       |           |           |           |           |           |
| Temperature | °C    | 31.5±1.1  | 32.1±0.5  | 30.8±0.6  | 32.4±0.5  | 31.2±1    |
| Transparency | %    | 23.2±4.6  | 22.2±8.04 | 117.2±16.68 | 78±22.95  | 144.4±36.45 |
| Turbidity  | NTU   | 58.4±31.2 | 67.4±65.5 | 7.26±4.69  | 58.36±101.7 | 7.34±6.75 |
| Chemistry  |       |           |           |           |           |           |
| Salinity   | %     | 14±13.8   | 22.6±10.19 | 33.6±2.07 | 29.0±3.7  | 31.6±3.0  |
| pH         |       | 6.94±0.15 | 7.34±0.42 | 7.26±0.32  | 7.18±0.3  | 7.42±0.46 |
| DO         | Mg/l  | 5.68±1.35 | 5.3±0.99  | 6.36±1.54  | 6.44±1.09 | 6.66±1.12 |
| Nitrate    | Ppm   | 0.71±0.9  | 0.47±0.49 | 0.08±0.09  | 0.27±0.37 | 0.11±0.1  |
| Phosphate  | Ppm   | 0.35±0.26 | 0.19±0.1  | 0.13±0.12  | 0.15±0.14 | 0.12±0.11 |
Based on observations, the temperature value in Cengkok Coastal waters ranged from 30.8-32.4 °C. Transparency is a physical factor that affects the productivity of waters that are used for photosynthesis activity by producing organisms in the waters. Based on the results of observations the average transparency value in Cengkok Coastal waters ranged 22.2-144.4 (%). Based on the location of observation, the lowest transparency value was found at Station 2 which is located in a river basin area with a muddy substrate and increasing to Station 5 which was in areas more towards the sea with a value of 144.4 (%). The turbidity value at Cengkok Coastal Waters, Banten Bay based on the observation location, the highest turbidity value was at Station 2 in the estuary area of the Cengkok River with a value of 67.4 NTU and the lowest value was at Station 3 which was 7.26 NTU and Station 5 was 7.34 NTU because the station was included in the sea waters that have moved away river mouth area. Salinity is one of the physical parameters of water that affects the presence of organisms in the water. Cengkok Coastal waters are estuarine that receive water from the Cengkok River. The salinity value in Cengkok Coastal waters based on the location of observation, salinity values obtained were increasingly towards the sea. The lowest salinity value was at Station 1 (14 %o) and the highest one was at Station 3 (33.6 %o). The highest average pH in Cengkok Coastal waters based on the observation location, the lowest average pH value was at Station 1 was 6.9 and the highest value was at Station 5 was 7.42. Dissolved oxygen (DO) is oxygen in water sourced from air or diffusion exchanges and also from the photosynthesis of aquatic organisms. Dissolved oxygen (DO) is needed by aquatic organisms for the benefit of the oxidation of nutrients that enter the body [14]. Research at Cengkok Coastal waters, Banten Bay generates a dissolved oxygen (DO) value obtained from observations based on stations ranged from 5.3-6.66 Ppm. Based on the observation location, the average nitrate value in Cengkok Coastal waters for 5 months in May-September ranged 0.08 to 0.71 ppm. The highest nitrate value was at Station 1 and tended to decrease towards the sea at Station 5 with the lowest value of 0.08 ppm. Phosphate content in Cengkok Coastal waters of Banten Bay ranged 0.12 to 0.35 ppm. The lowest one was 0.12 ppm in Station 5 and the highest one was 0.35 ppm in Station 1. Based on the location of data collection at 5 stations, the average phosphate value tends to decrease further towards the sea.

Figure 12 shows PCA results showing the tendency of water parameters with an abundance of zooplankton divided into 3 groups. Group 1 consists of Station 1 and zooplankton abundance, namely Olitricea, Rotifera, Rhizopoda, Thalicea which are influenced by nitrate and phosphate, group 2 consists of Stations 2 and 4 and zooplankton abundance consists of Ciliata, Heterobranchs, Hydrozoa, and Thalicea which are influenced by temperature and turbidity. Group 3 consists of Stations 3 and 5 consisting of an abundance of Appendicularia, Bivalvia, Hexanauplia, Malacostraca, Oligotrichacea, Polychaeta, Sarcodina, Stcholonchea, and Urochordata influenced by salinity, pH, DO, and transparency.

Station grouping based on the Bray-Curtis index was calculated based on zooplankton abundance data. The grouping produces Fi is a dendrogram similarity based on the Bray Curtis index on zooplankton abundance with the highest similarity value at Stations 3 and 5 was 0.829 while the furthest similarity is found at Station 4 namely 0.689 at Station 3 and 0.785 at Station 5 (figure 12). Station 1 has the closest similarity to Station 2 was 0.784. Dendograms produced in zooplankton abundance obtained 2 zones, namely Zone 1 consisting of Stations 1 and 2, Zone 2 consisting of Stations 3, 5, and 4. The station grouping based on the water parameters presented on figure 13 shows the results of dendograms are divided into 2 zones divided by stations. Group 1 consists of Stations 3 and 5 which have a value of 0.93 similarity, and Group 2 consists of Stations 2 and 4 of that have a value of similarity 0.8 while Station 1 has the proximity of Stations 2 and 4 with a value of 0.93.
4. Discussion
Malacostraca is a subphylum of Crustaceans while Ciliata is a class of Protozoa. Zooplankton types of Crustaceans, Protozoa, and Rotifers are types of zooplankton that eat phytoplankton directly. Also, zooplankton can eat organic or suspended material [13]. The results of the study conducted Widyarini [7] stated that the composition of zooplankton found in the Majakerta River of Protozoa (10 genera), Crustacea (4 genera, 1 stadia nauplius), and Rotifera (4 genera). The number of nauplius and calanus stages indicates that Cengkok Coastal Waters of Banten Bay are waters that have fishery potential due to fish food sources from crustaceans which have the most abundance. Plankton abundance in the waters can be influenced by several limiting factors including
temperature, salinity, and nutrients. The abundance of plankton abundance can also be affected by wind, therefore the abundance of zooplankton based on the station with the highest abundance at Station while Station 5 is a Station located in the direction of the sea and far from the estuary which it can be stated the influence of nutrient runoff will be lower causing the abundance of zooplankton at Station 5 was lower. But the abundance of plankton in the ocean far from land runoff can have high abundance if stirring or upwelling occurs in these waters.

The abundance of zooplankton experienced a significant increase in September, the abundance of zooplankton increased seems due to a large amount of food available which resulted in a decrease in abundance from phytoplankton, the high abundance value of zooplankton in September is since this month is the dry season, so that the sunlight optimally and will cause an increase in the productivity of phytoplankton which is the main food of zooplankton and causes zooplankton to have high abundance in September. This is consistent with Nybakken [15] which stated that the abundance of zooplankton can be influenced by several factors including the abundance of phytoplankton, currents, and predators. Based on Basmi [16] zooplankton has a lower level of productivity than phytoplankton, therefore the abundance of zooplankton will increase after the peak productivity of phytoplankton. The range of zooplankton abundance based on stations and observation was categorized in the low category, which is salinity the value produced in previous studies at the mouth of the Majakarta River [7] with an abundance value in the range of 7,147-29,025 ind/l, other than that based on the results of research at the estuary of the Serang River, of Yogyakarta [18] described the abundance value of zooplankton based on the time of the study ranged from 6,704-36,427 ind/l, and based on the location of the research station ranged from 10,952-31,669 ind/l, namely 10,952 ind/l above the waters while 31,669 ind/l at the bottom of the waters. Research Junaidi et al. [17] in the waters of North Lombok Regency of West Nusa Tenggara Province show that the most common genus was from the crustacean class, 6 genera namely Balanus, Nauplius, Cyllops, Cypridina, Canthocamptus, and Daphnia. Phylum Protozoa were Anthropod Cliaphora Holosticha, favella, and Sacculina, respectively Crustacean classes generally have a higher composition because they are euryhaline or have the ability to migrate to river mouths [18]. Plankton is closely related to the condition of the aquatic environment itself, namely the physical and chemical parameters of the waters, therefore supporting water parameter data was presented. The results of measurements of water parameters in situ based on the location and time of observation in Cengkok Coastal waters of Banten Bay-produced data presented in Tables 3 and 4. The temperature has a positive correlation to plankton abundance and is one of the parameters that affects the distribution of aquatic organisms [19, 20].

The data is following the temperature range of tropical waters such as in Indonesian waters. Based on MENLH No. 51 of 2004 [21] the quality standard for marine life is 28-32 °C. Based Nonji [22] stated that generally, the surface temperature in Indonesia waters ranged 28-31 °C. Temperature range in the waters of Cengkok Coastal waters of Banten Bay was still in good range and suitable for the development of zooplankton [23]. Transparency is a state of low sunlight penetration in waters due to the presence of suspended particles in the waters. The pH value in Cengkok Coastal waters is optimal for the presence of microorganisms in these waters. The optimal pH value for aquatic organisms ranges from 7-8.5 if the pH value is too acidic it will affect the life of the microorganisms and interfere with its metabolism and respiration [24]. pH range suitable for the life of organisms in the range of the water of 6-9. Dissolved Oxygen (DO) is one of the important factors in water that can be utilized for the photosynthesis process. The values of Dissolved oxygen (DO) in the Cengkok Coastal waters of Banten Bay were still in good condition for the life of plankton, based on MENLH No. 51 [21] the values of Dissolved oxygen (DO) was still within the standard ranged of MENLH. Zooplankton has an association with the condition of the water. It can be seen from figure 14, which is the result of PCA (Principle Component Analysis) which explains the relation of zooplankton to the water conditions in the waters of Cengkok Coastal waters of Banten Bay. The water condition was divided into 3 groups, namely group 1 consisting of Station 1, which was influenced by nitrates and phosphate close to the zooplankton of the classes Oliitricha, Rottiera, Thalaichea, and Rhizopoda. Nitrates and phosphate are the essential nutrients that marine organisms need to perform primary productivity, nutrient cycles, and food nets [25]. Station 1 is located in the river body, so it gets a lot of domestic waste runoff source from Nitrogen and Phosphorus. That affects the presence of phytoplankton as a primary consumer, which phytoplankton and then zooplankton follow the existence of phytoplankton as its prey. Group 2 is Stations 2 and 4, in group 2 zooplankton Sagittoidea, Hydrozoa, Heterobranchia, and Ciliata have close to temperature and turbidity. Temperature and turbidity are one of the important components of the existence of plankton in the waters because the temperature can observe the growth, metabolism, and productivity of marine organisms, as well as the incidence of increasingly higher particles on a water, it will affect the intensity of the
incoming sunlight which was it will cause the disruption of biological activities of microorganisms in the water. Group 3 consists of Stations 3 and 5, Appendicularia zooplankton, Bivalvia, Hexanauplia, Malacostraca, Oligotrichia, Polychaeta, Sarcodina, Sticholonechea, Urochordacea close to salinity, pH, and transparency. The PCA result indicates that each water parameters zone will affect some species of zooplankton and water parameters can affect other types of zooplankton.

5. Conclusion
Based on the data obtained, for five-month from May to September the number of zooplankton classes consists of 17 classes, and the highest composition was the Malacostraca. Based on the research Station, the diversity index of zooplankton was 0.7-1.6 and the evenness index was 0.7-0.8 and the dominance index was 0.3-0.6. Based on research time index diversity of zooplankton was 1.1-1.6 the evenness index was 0.7-0.9, and the index domination was 0.3-0.4. Cengkok coastal waters in Teluk Banten are influenced by various anthropogenic activities that can change the oceanographic conditions in these waters, causing the water conditions to be under moderate pressure and affecting the zooplankton community structure to become unstable.

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