Diet and feeding strategy of the common silver-biddy, *Gerres oyena* (Forsskål 1775) in the seagrass beds of Karang Congkak Island, Kepulauan Seribu National Park

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Abstract. Diet and feeding ecology studies are a principal tool to understand the functional role of fish within their habitat. Like most coastal habitats, seagrass meadow provides food and refuge for many biotas. Karang Congkak Island is a small uninhabited island situated in the northern part of the Kepulauan Seribu National Park and surrounded by a seagrass ecosystem. The current study aims to analyze diet composition changes and trophic attributes of the common silver-biddy, *Gerres oyena*, in the seagrass ecosystem of the Karang Congkak Island. The research was carried out monthly from March to September 2018 by towing the beach seine net. Data analysis includes diet composition, niche breadth, and feeding strategy. During the study period, 1,196 individuals of *G. oyena* were captured, and most of them were juveniles. Fifty-nine types of prey were documented and arranged into six groups, namely phytoplankton, algae, zooplankton, zoobenthos, crustaceans, and unidentified material. *G. oyena* shows an ontogenetic change, from zooplanktivore to crustacivore and zoobenthivore. Moreover, this species has a TROPH value ranging from 3.00-3.31 and is categorized as omnivorous that tend to feed on animals. The interpretation of prey-specific abundance and niche breadth confirms that this species developed specialized and generalized feeding strategies.

1. Introduction
The seagrass ecosystem is a crucial shallow coastal ecosystem because of its ecological role as a nursery habitat for juvenile fish that has economic and ecological value [1][2][3]. The complexity of seagrass meadows harbors the high diversity of fish species and other aquatic organisms [4]. Its ecological services include the nursery roles that provide habitats for shelter to avoid predators and provide a variety of food organisms [5]. Most coral reef fish juveniles migrate from their adult habitats to take advantage of the ecological services of seagrasses to reach a particular phase and migrate back to coral reef ecosystems [6]. The process when reef fish will settle in their nursery habitat until they reach a specific size and return to their natural habitat can be called ontogenetic habitat shifting [7].

The occurrence of ontogenetic habitat changes can also coincide with an ontogenetic shift in the fish diet. According to [8], food determines the distribution of a species in a particular ecosystem. The
ontogenetic change of food is influenced strongly by the growth of fish [7]. Small fish generally utilize prey by adjusting to the morphology of the mouth, digestive tract, and swimming ability. In contrast, large fish will prey on organisms with higher protein composition to meet their energetic needs before returning to their natural habitat and joining the adult fish population. In herbivorous fish, the change of food type is visible between juveniles and adults from omnivores which tend to eat animals to become herbivores. In contrast, omnivorous and herbivorous fish tend to switch from small prey to large prey [1].

One of the coral reef fish with economic value is the common silver-biddy (Gerres oyena). The adult size of this fish is inhabiting coral ecosystems [9]. The findings of [10] in March-September 2018 and [11] in November 2018 – March 2019 revealed that G. oyena was mainly found in the seagrass ecosystem of Karang Congkak Island in their juvenile phase. Therefore, G. oyena can be categorized as temporary residents in the seagrass ecosystem of Coral Congkak Island. According to [12], temporary residents are fish that stay only in part of their life phase before returning to their adult habitat. The movement of fish from one habitat to another proves that there is an interconnection of seagrass ecosystems with adjacent shallow coastal ecosystems [13].

Although The Karang Congkak Island is not intended for either recreational or habitation, the effect of some activities in the surrounding island seems to bring the litters dan debris trapped and scattered within the Karang Congkak Island because this island is surrounded by lagoons and coral reef [14]. Mostly marine litter and debris are as hed and moved from one place to another by the current [15]. The effect of the anthropological disturbance on the role of the seagrass ecosystem of Karang Congkak Island as the nursery habitat for Gerres oyena and any other aquatic organisms has not yet been analyzed. Hence, this study aimed to determine the diet and feeding ecology of G. oyena during their occurrence in the seagrass beds of Congkak Coral Island as basic information for nursery habitat management.

2. Materials and Methods

2.1. Study site and sample collecting
This research was conducted in the seagrass beds of Karang Congkak Island, Kepulauan Seribu, DKI Jakarta (Figure 2), covering four zones: east, south, west, and west north of Karang Congkak Island. Six months of sampling were performed from March to September 2018 with a once-a-month sampling frequency. Fish and environmental variables’ sampling were performed in the morning at high tide towards low tide, although seagrass coverages observation were only carried once in April 2018.

Fish samples from each zone were caught using a beach trawl with dimensions of 10 m x 1 m with a mesh size of 3 mm. The trawl is pulled by two people on both sides from the furthest distance of seagrass vegetation towards the coast as far as ± 30 m by the swept area method. Firstly, the caught fish were preserved in 10% formalin solution, then washed with water, and preserved back in 80% ethanol solution [11].

The physical, chemical, and biological conditions of the seagrass ecosystem of Karang Congkak Island were measured and observed in each fish sampling zone. The percentage of seagrass cover obtained in this study was compared with the percentage of mixed type seagrass cover (Cymodocea sp./Halodule sp./Thalassia sp.) based on [16]. The chemical and biological parameters of these waters are presented in Table 1.
Table 1. Environmental variables

| No | Parameters                     | Unit    | Tools         |
|----|--------------------------------|---------|---------------|
|    | **Physics**                   |         |               |
| 1  | Temperature                   | °C      | Thermometer   |
| 2  | Turbidity                     | NTU     | Turbidimeter  |
|    | **Chemistry**                 |         |               |
| 1  | Dissolved Oxygen              | mgL⁻¹   | DO meter      |
| 2  | Salinity                      | ‰       | Hydrometer    |
|    | **Biology**                   |         |               |
| 1  | Percentage of seagrass’s coverage | seagrass% | transect quadrat |

2.2. Laboratory analysis

The preserved fish were identified to the lowest taxon based on books and identification guides [17][18][19] and were measured in length and weighed. The collected fish were measured to obtain standard (mm) and total length (TL) and also weighed (g). Thirty *G. oyena* samples were taken each month to be dissected, and their digestive tract was taken. The digestive tract of fish containing food was preserved using 4% formalin, and food organisms were identified based on [20][21][22]. Fish composition based on developmental stage was classified into juvenile and adult. The fish were categorized as juvenile if their total length (TL) does not exceed the length at the first time gonadal maturity (Lm), which refers to [23].
2.3. Data analysis

2.3.1. Diet composition
The fish diet was analyzed using the index of preponderance based on the following formula by [24].

\[ IP = \frac{v_i \times o_i}{\sum (v_i \times o_i)} \times 100 \]  \hspace{1cm} (1)

Where IP=Index of preponderance; \( v_i \)=volumetric frequency percentage \( o_i \)= occurrence frequency percentage, \( i = 1,2\ldots n \) food item
2.3.2. Trophic level
Measurement level Fish trophic level can be performed using the TrophLab software. The trophic level of each fish can be determined by the formula according to [25] as follows:
\[ \text{Troph}_i = 1 + \sum_{j=1}^{G} D_{ij} \times \text{Troph}_j \]  
(2)

Where \( \text{Troph}_i \) = Trophic level of species (i), \( \text{Troph}_j \) = Trophic level of prey (j), \( D_{ij} \) = fraction of each (j) in the diet of (i); \( G \) = total number of prey

2.3.3. Feeding strategy
Feeding Strategies of fish were obtained by linking a specific percentage of the abundance of food organisms (\( P_i \)) and the percentage frequency of occurrence (\( O_i \)) using charts Costello by [26] as shown in Figure 2. Fish is categorized as a specialist if the plot is distributed above the graph (\( P_i >50\% \)); otherwise, if it is distributed below, the plot indicates the fish is a generalist. The organisms located at the top right of the plot are essential because they have \( P_i >50\% \) and \( O_i >50\% \).

![Figure 2. Feeding strategy plot modified from Costello by [26]](image)

2.3.4. Diet breadth
Fish niche breadth is a trophic parameter that can describe the selection of food resources that fish can utilize. Niches comprehensive measurement performed using a standardized index Levin’s as follows:
\[ B_i = \frac{1}{(n-1)} \left( \frac{1}{\sum P_{ij}} - 1 \right) \]
(3)

Where \( B_i \) = standardized index of niche breadth, \( P_{ij} \) = proportion of diet of predator i on prey j, \( n \) = total number of food items. The value of \( B_i \) can be said to be narrow if it is less than 0.4 (\( B_i <0.4 \)), moderate if it is at 0.4-0.6 (\( 0.4 <B_i<0.6 \)) and broad if it has a value above 0.6 (\( B_i > 0.6 \)).
2.4. Statistical analysis
MANOVA was used to determine whether there are differences in the water condition variables based on month and location ($\alpha$: 0.05). The standard lengths of fish were grouped into certain length classes and analyzed using ANOVA to determine the difference between the length classes ($\alpha$: 0.05). Percentage IP each organism was classified using cluster analysis and then analyzed by using ANOSIM to determine the similarity of the diet composition according to month and length-classes.

3. Results and Discussion

3.1. General catch and specimens
The number of *G. oyena* captured during the study amounted to 1196; the amount was mainly at the juvenile stage (99.75%). There were only three fish (0.25%) at the adult stage. The range of total size of fish caught during the study was 13-105 mm. The difference in the size of the *G. oyena* at the juvenile and adult stages is shown in Figures 3(a) and 3(b). The number of fish dissected to observe the digestive tract was 132 fish, with details as shown in Table 2.

![Figure 3](image)

**Figure 3.** The different stages of *Gerres* *oyena* (a) juvenile (b) adult

The classification of fish based on length class forms eight-length classes as in Table 3, which shows the decreasing frequency of fish and the increasing fish size. The analysis of variance on the length class group showed a significant difference between the classes with a $P_{0.00} < 0.05$.

| Table 2. Number of total and dissected fish |
|--------------------------------------------|
| Number of Fish                             |
| Months          | Mar  | April | May  | July | Aug  | Sept | Total |
| Total Catch         | 425  | 498   | 221  | 38   | 11   | 1    | 1196  |
| Dissected Specimen | 30   | 30    | 30   | 30   | 11   | 1    | 132   |
| Range of Standard Length (mm)              | 13-30| 14-65 | 19-49| 13-105| 13-44| 86   | -     |

The high proportion of juveniles of *G. oyena* in the seagrass ecosystem of Coral Congkak Island proves that the seagrass ecosystem is a nursery habitat for this species [27][28]. The juvenile of *G. oyena* and other reef fish migrate to seagrass ecosystems to protect themselves from predation by predator in their natural habitat [29]. In addition to shelter, reef fish also use the seagrass ecosystem as a place to find food with the availability of various epifauna attached to seagrass leaves [4]. Therefore, the composition of fish in the seagrass ecosystem is generally dominated by the fish juvenile.

The size of the *G. oyena* caught in the seagrass ecosystem of Karang Congkak Island is relatively smaller when compared to the *G. oyena* caught in the Mayangan Waters by [30] measuring from 95 - 165 mm that is performed in mangrove ecosystem, while in the waters of Tondonggeu Waters, Abeli District, Kendari City, [31] which sampling occurred in the coral reef ecosystem, measuring from 60-185 mm. The difference in the size of the fish caught in this study with those two results is because the sampling was performed in different locations. Hence, those phenomena can also explain that the seagrass ecosystem is a nursery habitat for juvenile fish, including *G. oyena* [32][33].
Table 3. Length-classes of 132 dissected specimens of *G. oyena* for stomach content analysis

| No. | Length-classes (mm) | Frequency |
|-----|---------------------|-----------|
| 1   | 13-24               | 53        |
| 2   | 25-36               | 56        |
| 3   | 37-48               | 11        |
| 4   | 47-58               | 3         |
| 5   | 59-70               | 5         |
| 6   | 71-82               | 1         |
| 7   | 83-94               | 1         |
| 8   | 95-106              | 2         |
| TOTAL|                    | 132       |

3.2. Environmental variables

The results of multivariate analysis of several environmental parameters (Table 4) showed differences in dissolved oxygen and temperature according to month, but there was no difference based on location (P<0.05). Furthermore, other parameters did not show any difference between month and location.

Table 4. Summary of multivariate analysis of variances for environmental variables based on month and Location

| Environmental Parameters       | P-Months | P-Location |
|-------------------------------|----------|------------|
| Dissolved Oxygen (mg/L)       | 0.011*   | 0.392      |
| Temperature (°C)              | 0.000*   | 0.968      |
| Turbidity (NTU)               | 0.509    | 0.215      |
| Salinity (°)                  | 0.682    | 0.604      |
| Seagrass Coverages (%)        | 0.168    | 0.414      |

* Significant (P<0.05)

3.3. Diet composition and ontogenetic diet shifting

The results of the analysis of the contents of the digestive tract of 132 *G. oyena* showed that 59 food organisms could be grouped into five food groups: phytoplankton, zooplankton, zoobenthos, crustaceans and unidentified material (Appendix A.) The type of food with an immense preponderance index value based on month or length class was copepods, especially the harpacticoid (IP: 1.19 – 98.67), followed by polychaeta, nematodes, early stages of bivalves, and gastropods larvae [34]. The variety of food items found is also related to seagrass leaves which provide various types of food such as epiphytic organisms, algae, fungi, protozoa, sponges, bryozoans, hydroids, and ascidians [35].

*G. oyena* from the seagrass ecosystem of Coral Congkak Island has the main food component in the form of harpacticoid copepods, which is similar to the results of research [36] in tropical waters, Thailand. In comparison, the results of [37] in the eastern Johor Strait and [38] in the seagrass ecosystem of Zostera marina, Aburatsubo waters, Japan, that the most common types of copepods found in the digestive tract of *G. oyena* are calanoid and cyclopoid. Although harpacticoid are zooplankton associated with seagrass leaves [39], the seagrass species Zostera marina not found in Indonesian waters [40] can trigger the different types of copepods. The research results on the composition of fish food in seagrass ecosystems of *Enhalus acoroides*, *Thalassia hemprichii*, *Syringodium isoetifolium*, *Cymodocea rotundata* species are copepods of the Harpacticoid species [41]. This difference in food types can occur because fish from the Gerreidae group are generally benthic feeders that can utilize various foods such as copepods, amphipods, mysis, polychaeta, and other invertebrates and detritus [42].

Observations of the diet type that carried out monthly (Figure 3) show that the composition of the main diet of *G.oyena* is copepods which decrease towards September. On the other hand, zoobenthos (IP: 49.59) and crustaceans (50.49) are increased. This is confirmed by the cluster analysis results in
Figure (3), which shows the similarity of food composition between March and August, separated from September. Changes in fish food generally happen, one of which can occur due to environmental factors [43]. Seasons can affect the availability and suitability of food, such as the results of research [44] on the composition of macroinvertebrates in the seagrass ecosystem area of the tropics of Australia can change temporally. During the study, changes in the aquatic environment were indicated by differences in dissolved oxygen concentrations and different temperatures between months, which were thought to be related to the season at the time of fish sampling.

Ontogenetic changes in fish diet are also closely related to the phenomenon of migration from the nursery to their natural habitat for spawning [45][46]. *G. oyena* has a spawning season every six months or has two spawning peaks [47]. Spawning occurred in March and between October – December [48]. This was indicated by a decrease in the proportion of zooplankton in the diet (Figure 3), which indicated that *G. oyena* in the Congkak coral island seagrass ecosystem was preparing to migrate to their adult habitat by doing ontogenetic changes in food.

![Dendrogram clustering based on the index of preponderance relation to months](image)

**Figure 4.** Dendrogram clustering based on the index of preponderance relation to months

The dendrogram analysis of fish length classes based on the composition of their diet showed the formation of two groups of length class size group I (SL: 13-70 mm) and group II (SL: 71-122 mm). Fish in the 13-70 mm length class generally feed on zooplankton. The proportion of zooplankton in the larger length class of 70-106 mm began to decrease and was replaced by an increasing proportion of zoobenthos and crustaceans. The results of the similarity analysis (ANOVA) of group I and group II showed a significant difference in the composition of fish food between groups (P-Value: 0.0162).

The ontogenetic change in diet was shown by smaller fish (groups 13-70 mm) consuming more copepods, while larger fish (71-106 mm) using crustaceans and benthic invertebrates. A similar pattern is also found in observations by [37] of fish *G. oyena* in polluted waters in Singapore; small fish (< 2 cm) predominantly eat zooplankton while larger fish (> 4 cm) predominantly eat Polychaeta. However, [36] found that the *G. oyena* did not perform any changes in food based on fish size or season in tropical seagrass ecosystems, Thailand. The differences can happen because changes in fish size can trigger food changes in fish [49][50].

The largemouth of bigger fish is due to catch and consume a larger prey [45][51]. Fish body size has a positive correlation with prey size [46]. Larger fish will prey on suitable organisms to meet their energetic needs [52], so they will seek larger food. According to [49], ontogenetic food changes in reef
fish generally occur when they migrate back to the coral ecosystem. For example, reef fish juveniles from the Haemulidae, Lutjanidae, and Lethrinidae groups that inhabit seagrass ecosystems will move to coral ecosystems to find larger prey such as crustaceans [53].

Figure 5. Dendrogram clustering based on the index of preponderance relation to length-classes

3.4. Trophic level
The trophic level (TROPH) of *G. oyena* based on month (Figure 5a and 5b) or length class size (Figure 3b) ranges from 3-3.26, which means there is only a slight change in trophic value. The highest trophic level was observed in September (3.31), and based on the length class, the highest trophic value class is in the 97-110 mm fish size class. The analysis of the trophic level values based on the length size group showed differences between groups (P-value <0.05).

Figure 6. The trophic level of *G. oyena* according to (a) months and (b) length-classes

Observations based on size class showed a trophic increase along with the increase in fish length, which was 97-10 m (TROPH: 3.26) and 109-122 mm (TROPH: 3.18). The changes in the composition of fish food are marked by an increase in the proportion of larger prey in the form of crustaceans and zoobenthic. The trophic level will be higher in line with body size [52].

The *G. oyena* obtained from the seagrass ecosystem of Karang Congkak Island either by month or by length class were categorized as omnivores that tend to eat prey in the form of animals because they occupied the TROPH that ranges from 3-3.31. [54] stated that fish in this trophic range utilize a
variety of food types. This is also reflected in the type variety of food used, especially by small *G. oyena* (Appendix A) because the trophic level is strongly influenced by the presence of food, feeding habits, and niche breadth [55]. Hence, the trophic level of fish will change during the ontogeny process [56].

### 3.5. Feeding strategy

*G. oyena* shows a mixed feeding strategy between a generalist and a specialist (Figure 6). Some fish only use specialist strategy against certain prey, Cumacea (O: 3.78%; P: 57.03%) and *Metridia* (O: 12%; P: 86.12%). Based on the plots in Figures 6 and 7a, Harpacticoids (O: 93.19%; P: 56.06%) can be categorized as an essential food for *G. oyena*, tiny ones. Small-sized *G. oyena* develops a generalist strategy, but some fish in this size class develop a specialist strategy with the prey item of *Metridia* (Calanoid copepods). The size class II group developed a generalist strategy with an essential diet of crustacean fragments found in all the fish observed (Figure 8b).

![Figure 7. Amunsend plot for the feeding strategy of *G. oyena* in the seagrass beds of Karang Congkak Island, based on the month. Only the plots with the upper 50% of prey-specific abundance were labeled. Har (Harpacticoid copepods), Cum (Cumacea), Met (*Metridia* sp.)](image)

Some of juvenile-sized *G. oyena* developed a specialist strategy that prey Cumacea and *Metridia*. The same finding was happened to fish *U. tragula* in its juvenile stage in Kendari Bay. They also developed specialist and generalist strategies because of their limited mobility, so they only use food that fits their mouth opening [57]. Fish that develop generalist strategies can utilize various foods even with a low percentage of abundance [58]. The range trophic indicates that most of the juveniles of *G. oyena* use different organisms as food and is called opportunistic feeder [26].
The *G. oyena* in the size class II group also tended to develop generalist strategy indicated by the abundance of food organisms (P_i) below 50%. Larger fish will have a broader spectrum of food because the morphological structure used in the foraging process can determine the type of food [8]. However, compared with the size of class I, the number of food organisms diminishes size classes, indicating specialist fish.

### 3.6. Niche breadth

The Niche breadth value calculated based on the month, showing the value of B_i: 0.03 to 0.15 and categorized as having a narrow (low) niche segment value. The value of niche breadth grouped by size class in general also shows a low value of niche area (<0.4), only at sizes 47-58mm (B_i: 0.4) and 71-82 mm (B_i: 0.62), which have medium to high niche breadth values.

A broad niche breadth indicates that the species is generalist, and vice versa if it has a low niche breadth, it means the species is specialist [59]. The fish diet strategy combined with the niche breadth index can overview better interpretation of fish niche [55]. Figures 6 and 7 show that the *G. oyena*...
occupied the seagrass ecosystem of Karang Congkak Island developed a mixed diet strategy, as evidenced by the fluctuations of niche value in Figure 8. The value of standardized niche breadth tends to increase monthly with a range of 0.03-0.15, and fish length with that ranged between 0.03-0.62.

The size class II group had a broad niche but tended to develop specialist strategy due to the reduced number of food organisms found, as shown in Figure 7b. Based on the Amunsend plot, as much as 50.4% (O. G. oyena) in size class II developed a specialist strategy that fed on isopods. Therefore this G. oyena has a narrow and broad niche breadth.

Overall, the changes in the diet of fish that generally happened in fishes also occurred in this study. The diet's ontogenetic revealed in fish with different sizes (length), although the shift relation to months showed no significant differences. The smaller fish feed on mostly zooplankton (Harpacticoid copepods), while the larger fish are found to have crustaceans as the primary diet item. Small and large G. oyena develop a mixed feeding strategy with narrow to broad niche breadth. In addition, the trophic level value G. oyena shows a rational value with the diet composition of an omnivore that prey on small animals.

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APPENDIX A. The diet composition’s shift of 132 *G. oyena* (IP) collected from the seagrass beds of Karang Congkak Island on relating to months and length-classes

| No | Diet Groups | Diet items | Index of Preponderance |
|----|-------------|------------|------------------------|
|    |             |            | Months                 | Length-Classes (mm) |
|    |             |            | Mar | Apr | May | Jul | Aug | Sep | 13-24 | 25-36 | 47-58 | 59-70 | 71-82 | 83-94 | 95-106 |
| 1  | Phytoplankton | Pleurosigma sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 2  |             | Nitzchia sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 3  |             | Amphora sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 4  |             | Amphipora sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 5  |             | Navicula sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 6  |             | Diploneis sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 7  |             | Cocconeis sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 8  |             | Roichosphaenia sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 9  |             | Triceratium sp. | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 10 |             | Consinodicus sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 11 |             | Climacospheria sp. | 0.00 | 0.00 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.71 | 0.00 | 11.76 | 0.00 |
| 12 | Algae       |             | 0.00 | 0.00 | 0.91 | 0.09 | 0.06 | 0.00 | 0.28 | 0.00 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 13 | Zooplankton | Harpacticoidae | 82.60 | 83.23 | 59.84 | 74.72 | 1.19 | 2.41 | 64.15 | 75.21 | 29.44 | 44.74 | 98.67 | 9.80 | 2.41 | 3.37 |
| 14 |             | Miracia sp. | 0.98 | 0.04 | 2.55 | 0.00 | 0.01 | 0.00 | 0.43 | 0.26 | 0.01 | 1.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| 15 |             | Clytemnestra sp. | 1.12 | 0.34 | 0.77 | 0.00 | 0.00 | 0.00 | 0.51 | 0.31 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 16 |             | Peltidium sp. | 0.00 | 0.03 | 0.05 | 0.00 | 0.01 | 0.00 | 0.00 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 17 |             | Poecelidium sp. | 0.03 | 0.45 | 0.60 | 0.86 | 0.03 | 0.00 | 0.28 | 0.35 | 0.82 | 1.37 | 0.00 | 0.00 | 0.00 | 0.00 |
| 18 |             | Philipiponte sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 19 |             | Metis sp. | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 20 |             | Schizopera sp. | 0.00 | 1.17 | 6.58 | 0.00 | 0.00 | 0.00 | 0.68 | 1.60 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 21 |             | Tegastes sp. | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 22 |             | Euterpina sp. | 0.91 | 0.08 | 0.05 | 0.00 | 0.00 | 0.00 | 0.29 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 23 |             | Tigrions sp. | 0.00 | 0.09 | 1.39 | 0.00 | 0.00 | 0.00 | 0.04 | 0.27 | 0.00 | 3.19 | 0.00 | 0.00 | 0.00 | 0.00 |
| 24 |             | Tisbe sp. | 0.00 | 0.00 | 2.33 | 0.00 | 0.00 | 0.00 | 0.04 | 0.29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 25 |             | Cyclopoidea sp. | 4.71 | 0.00 | 1.39 | 0.02 | 0.00 | 0.00 | 0.31 | 1.51 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 26 |             | Corycaeus sp. | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Group             | Species          | Percentage | Count | Percentage | Count | Percentage | Count | Percentage | Count | Percentage | Count | Percentage | Count | Percentage | Count |
|-------------------|------------------|------------|-------|------------|-------|------------|-------|------------|-------|------------|-------|------------|-------|------------|-------|------------|-------|
| Sapphirina        | 2.20             | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       |
| Oncaea            | 2.20             | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       |
| Metridia          | 2.20             | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       |
| Calanus           | 2.20             | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       |
| Frag. Copepods    | 2.20             | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       |
| Conchoecia        | 2.20             | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       |
| Larva insekta     | 2.20             | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       |
| Nematoda          | 2.20             | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       |
| Polychaeta        | 2.20             | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       |
| Foraminifera      | 2.20             | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       |
| Spiroloculina     | 2.20             | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       | 2.00  | 0.00       |
|   | Frag. Crustacea |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|---|----------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|   |                | 3.03 | 0.08 | 0.07 | 8.58 | 0.76 | 34.97 | 1.60 | 0.53 | 2.05 | 12.31 | 0.32 | 29.41 | 34.97 | 21.04 |
|   | Unidentified Material | 0.00 | 0.00 | 0.00 | 0.00 | 0.62 | 0.00 | 0.06 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
|   | TOTAL          | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |