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A Case Study To Understand The Feeding Strategy Of Some Selected Estuarine Copepods In Response To Mixed Phytoplankton Diet

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Abstract----A preliminary study was performed to understand the feeding preference of some selected estuarine copepod species and their response to mixed phytoplankton diet. Acartia erythraea Giesbrecht, Paracalanus indicus Wolfenden, Oithona brevicornis Giesbrecht, Microsetella rosea Dana, Microsetella norwegica Boeck were selected for the feeding experimental trials. During the course of the study, all the selected species were fed with mixed microphytoplankton assemblage comprising centric diatom, pennate diatom and dinoflagellates. It was observed showed that all the selected species had higher feed preference for centric diatom than its pennate counterparts. Of the total feed consumed during the experimental process A. erythrae consumed 71% of the centric diatom, 27% pennate diatom and remaining 2% as dinoflagellates. Similar results were observed in case P. indicus (69% Centric; 31% Pennate), O. brevicornis (60% Centric; 38% Pennate and 2% Dinoflagellate), M. rosea (81% Centric Diatom; 19% Pennate Diatom) and M. norwegica (71% Centric Diatom; 29% Pennate Diatom) respectively.
Keywords--Feeding preference, Copepod, Centric Diatom, Pennate diatom, Dinoflagellates.

I. INTRODUCTION

Feeding is the most important route for transferring energy from lower to higher trophic level within plankton communities and higher trophic levels. Microalgae, in the planktonic and benthic form, are the most important primary producers in aquatic ecosystem. Mesozooplanktons, most notably copepods, are one of the chief primary consumers of that environment (Panwar and Mallik, 2016). They form the dominant metazoan group and are abundant in freshwater, brackishwater and marine environment (Humes, 1994). Many notable works have been done to understand the feeding strategy of copepods, their order of feed preference specially when fed with specific phytoplankton diet. Mention can be made of studies carried out by workers like Frost (1972), Landry (1981), Isari et al. (2013) etc. who have revealed that the feeding strategy of the copepod may change when there is abundance in phytoplankton assemblage in their diet (Wyckmans et. al. 2007). Copepods have an ability to discriminate between particles of different quality (Donaghay and Small, 1979) and are known to be selective feeders. Their feeding strategy does play an important role to determine the influence along the pelagic food web (Kiorboe, 2011). Works conducted by Alldredge (1981), Paffenhöfer and Van Sant (1985) etc. state that copepods identify their prey by mechanoreception in either passive mode or active mode of feeding. Generally it has been observed that the copepods opt for passive feeding when the cells are smaller in size and shift to active mode of feeding when the cells are larger in size (Frost, 1972). Therefore, to quantify the feeding behaviour remains a key factor to understand the studies of phytoplankton-copepod trophic interactions (Båmstedt et al., 2000). Several methods are commonly used in the feeding studies of mesozooplankton including gut fluorescence, food removal, radiotracers, digestive enzyme activity, faecal pellet production rate, and direct cinematographic observation (Båmstedt et al., 2000). Some copepods species also ingest detritus in spite of the presence of phytoplankton, which presumably contains dead phytoplankton cells and faecal matters (Turner et al., 2004). As a result, many conceptual and quantitative models of planktonic food-web structure now include not only the potential for copepods to transfer materials and energy along the traditional planktonic chain, but also to form a trophic link between protozoan and metazoan food webs (Sherr et al., 1986; Stoecker and Capuzzo, 1990; Gifford, 1991; Sanders and Wickham, 1993; Tett and Wilson, 2000; Halvorsen et al., 2001).

Not every species of zooplankton consume every available phytoplanktonic species for their sustenance and as with every other animal on earth they have their specific and at times unique affinity for a handful of species that they find delectable or easy to digest. Thus the generalized energy transfer model needs to be remodeled since nothing is straightforward in the aquatic ecosystem as it was once thought to be. Experimental attempts such as the one concerned here aim on enlightening such murky areas. Apart

from this, many commercially significant fin and shell fish species take zooplankton as their food source and the quality of the food items ingested by that zooplankton in turn modify the health of the consumers at higher trophic levels. If the food preference of certain zooplankton species is established then many aquaculture industries benefit from the knowledge by providing the most preferred food to their zooplankton fish feed so that in return they can expect to get higher biomass enrichment with relatively lower wastage of time and resources. Hence, the present endeavor is not only valuable from an ecological point of view but also economically important and only further studies such as these will reveal more about the intricate network between two of the most fundamental units of an aquatic ecosystem i.e. the primary producers and consumers.

II. MATERIAL AND METHOD

A. Physiography of Study Area

Sundarban (21°31'E and 22°30'N; 88°10'E and 89°51'E) which means 'beautiful forest' is the largest uninterrupted delta patch in the Ganga-Brahmaputra estuary. The total land area today is 4,143 square kilometres (1,600 sq. miles), including exposed mudflats with a total area of 42 square kilometres (16 sq. miles); the remaining water area of 1,874 square kilometres (724 sq. miles) encompasses rivers, small streams and canals. Rivers in the Sundarbans are confluence zones of salt water and freshwater resulting in the formation of transition zone between the freshwater of the Hooghly and the seawater of the Bay of Bengal. The Sundarban Biosphere reserve occupies an area of about 2585 sq kms of which 1330 sq km is in the relatively undisturbed core area and around 1255 sq km considered as the buffer zone.

Sunderban area observes three distinct seasons viz. premonsoon (March-June), monsoon (July-October) and postmonsoon (November-February). Annual average rainfall ranges from 1900-2100 mm. The average maximum and minimum wind velocities range from 16.7- 20 kmh^{-1} (April-June) and 10.7- 11.8 kmh^{-1} during months of December to February. Sunderban is a tide dominated area where tides are characteristically semi-diurnal with slight diurnal inequality. The flood and ebb currents fluctuate with seasons. The Hooghly River is main offshoot of river Ganga and it carries with itself a huge amount of sediment load that has resulted in the transformation of the deltaic region into irregular marshy coastal habitat. The tidal dominance is experienced upto 250 km i.e. from the mouth to upstream of the river. Being a well mixed estuary, it experiences intense tidal and wave actions with a meso-macrotidal setting (2.5 – 7 m tidal amplitude) (Mukhopadhyay et. al 2006; Biswas et.al 2004)

Figure 1 denotes the respective sampling stations chosen for the study. Six sampling stations viz. Kachuberia (21°52.72'N; 88°8.15'E), Chemaguri (21°38'N; 88°08'E), Gangasagar (21°80' N; 88°10'E), Namkhana (21°46'N; 88°14'E), Frasergunj (21°35'55.33"N; 88°14'48.53"E) and Bakkhali (21.5633°N and 88.2594°E) were selected based on their physiochemical parameters mainly focusing on lower stretch of Hoogly estuary along with surrounding anthropogenically disturbed marine and coastal ecosystems beginning with greater freshwater influenced ecosystems near estuary head to gradually brackish water regions at the tide dominated estuary mouth. Kachuberia and Namkhana represented the regions with considerable freshwater influence. Bakkhali and Gangasagar represented the marine dominated regions. Sampling sites at Fraserganj and Chemaguri represented brackishwater environment. The selection of stations was based on the pretext of observing the responses of the biotic communities which are constantly influenced by the ever changing stoichiometry of the ambient media.

B. Sample Collection

Sampling was performed with the help of country boats at offshore area away from the coast to avoid turbulence and resuspension of the sediments. Air temperature and water temperature was recorded using field thermometer at the sampling site itself. Water samples were collected with the help of Niskin Water Sampler for the estimation of nutrients (mainly nitrate, phosphate and Silicate). The analysis of the nutrients, dissolved oxygen was performed following the standard procedures proposed by Grasshoff et al. (1983). Salinity was recorded on field with the help of Refractometer and then cross checked in the laboratory following argentometric method (Strickland and Parsons, 1972). pH was recorded on field using portable digital pH meter calibrated at pH buffer 7 using buffer solution. The mesozooplankton sampling was mainly performed by using zooplankton net of mesh size (65 µM) to avoid the collection of phytoplankton concentrate. The sampling was mainly performed preferably at dawn or dusk as the chances to find greater number of copepod was higher. The net was operated at the starboard side to avoid resuspension and clogging of the net mesh due to sediments. The chief gear used for the entire period of the study was country boats. The net was deployed for around 30 mins. After the collection, the mesozooplankton concentrate was transferred to 100 ml Tarsons polyethylene containers. For long term storage of samples, the newly modified combined preservative concentration (2% Formalin + 2.5% Lugol's iodine) (Mukherjee *et al.*, 2014) was employed so that various ecological measurement can be performed on them without

compromising on their natural dimensions, a change induced at times by the preservatives themselves. The primary equipment used for the detection purposes were Olympus brightfield microscope and Nikon phase contrast microscopes. The enumeration was performed with the help of Sedgwick rafter counter chamber. For the identification of Mesozooplankton (copepods) species renowned identification guide of Kasturirangan (1963), Al-Yamani *et. al* (2011) were considered. Phytoplankton samplings were performed using the phytoplankton net made of bolting silk (no. 30) with a mesh size of 20 µm. The identification of the phytoplankton species was accomplished with help of validly published renowned literatures (Al-Kandari *et al.,* 2009; Hasle and Syvertsen, 1997; Desikachary, 1986-89).

Live phytoplankton samples and live copepod species were collected by the earlier mentioned process. The phytoplankton concentrate and the live zooplankton samples were then immediately transferred to laboratory. Live phytoplankton concentrate was kept in dark at 18°C – 20° C to ensure no photosynthetic activity shall occur. Natural seawater was filtered through 0.45 micron Millipore filter paper and live copepod samples were isolated species wise under Leica stereoscopic microscope. The live copepod samples were then transferred to the natural filtered seawater and kept under starvation for 24 hours in dark at controlled temperature in B.O.D. incubator. Aeration was provided to keep the live copepods stress free. On the following day, 1 ml of an aliquot of phytoplankton concentrate was transferred to a beaker where the feed preference of the selected copepod species will be studied. Prior to that, the mixed microphytoplankton assemblage present in 1 ml of the sample was enumerated and was taken as the initial count and left for 24 hours under low aeration for the copepods to feed upon. The next day, the copepod species were removed carefully and the solution as filtered. The residue was taken in a small petridish with little ambient seawater and final count was noted down.

C. Statistical Analysis

The statistical analyses for the concerned work were performed with the use of Microsoft Excel 2007.

III. RESULTS

Feeding experiment to understand the feeding strategy of selected copepod species when fed with natural mixed phytoplankton diet were performed using *Acartia erythraea, Paracalanus indicus, Oithona brevicornis, Microsetella rosea* and *Microsetella norvegica* as subject species. The main aim of the study was to observe feeding pattern of the chosen species and to understand their food preferences. *Acartia erythraea* and *Paracalanus indicus* represented the calanoid group. *Microsetella rosea* and *Microsetella norvegica* represented the harpacticoid group whereas *Oithona brevicornis* represented the cyclopoid copepods. The results obtained from the experimental trials provided a preliminary idea about their feeding habit with respect to the mixed phytoplankton concentrate that was used for feeding the copepods. The experimental data has been provided in the form of tables and figures in support of the results obtained during the research work.

Table 1 represents the background parameter of the study sites that were chosen during course of the study. The experimental set up was maintained according to the environmental conditions of the study sites. All the experiments were performed at room temperature.

Table 2 represents the feeding response of *Acartia erythraea*, a calanoid copepod species was chosen as the subject for the study. The phytoplankton diet that was to be used as feed was at first enumerated. In this experiment, 1 ml of the phytoplankton concentrate provided consisted of mixed population of centric and pennate diatoms and dinoflagellates. Figure 2 and 3 represents the percentage of feed utilization and the feed preference of *Acartia erythraea*. From the observations made, it appeared that *Acartia erythraea* a seemed to prefer centric diatom than pennate diatom which may shed light on its foraging behaviour. 71 % of the total feed consumed by *A. erythraea* represented the centric diatom, 27 % being that of pennate counterpart and remaining 2 % constituted the dinoflagellates.

Microsetella rosea was chosen as the next subject species for the feed preference experiment. Table 3 represents the mixed phytoplankton diet that was fed to *Microsetella rosea* to observe the feeding strategy of the species. Figure 4 and 5 represents the percentage of feed utilization by *Microsetella rosea* and the diatom species consumed as preferential feed respectively. Results showed that *Microsetella rosea* had a preference to centric diatoms representing 81% of the consumed feed size. Pennate diatoms recorded only 19% of the consumed phytoplankton size.

In another feeding experimental trial, *Oithona brevicornis*, a cyclopoid copepod species was chosen to understand its feeding strategy. Table 4 shows the results obtained by feeding mixed microphytoplankton assemblage to *Oithona brevicornis*. Figure 6 and 7 represents the percentage of feed utilization by *O. brevicornis* and feed preference among the consumed microphytoplankton population size. Of the total feed uptake by *Oithona brevicornis*, centric diatoms represented 60%, pennate diatoms constituted 38%

and dinoflagellates represented 2% of the feed.

Table 5 represents the mixed phytoplankton diet that was fed to *Microsetella norvegica*. Figure 8 and 9 represents the percentage of feed utilization and feed preference of *Microsetella norvegica.* Centric diatoms were among the most preferred phytoplankton group by *Microsetella norvegica* in terms of percentage (71%) of feed preference. Pennate diatoms also constituted about 29% of the preferred diet of *M. norvegica* which was considerably higher than its earlier counterpart *M. rosea*.

Table 6 shows the composition of the mixed phytoplankton diet that was provided to understand the feeding pattern of *Paracalanus indicus*, a calanoid copepod species. *Paracalanus indicus* is a predominant estuarine calanoid copepod. Figure 10 shows the percentage of feed utilization by *P. indicus* provided during the experimental setup. Figure 11 gives us the feed preference among the consumed microphytoplankton. It is clear that P. indicus had greater preference to centric diatoms than that pennate counterparts and dinoflagellates. Of the total feed utilized by *P. indicus,* centric diatoms constituted 69%, pennate counterparts represented 31% of the feed consumed.

IV. DISCUSSION

Selective feeding strategy on specific diets of phytoplankton population has been performed by many workers like De Mott 1989; Irigoien et al., 2009; Sommer et al., 2000 to understand the copepod feeding strategy. However, the effect of mixed phytoplankton diet on the feeding strategy of copepod species has been less studied. Due to the congenial environmental parameters, the aggregation of diverse phytoplankton community assemblage is observed in the estuary and thus serves as a feeding ground for copepod species. Authors have suggested that feeding habits do change in case of abundance in feed resource (Wyckmans et al. 2007). In the course of the study, it was observed that in most cases, the selected species showed preference towards centric diatoms other than pennate counterparts. This can be explained by the fact that due to large surface area, centric diatoms generally prefer the surface ambient water, whereas pennate diatoms are mostly benthic and are known to form benthic mat. Since copepods capture their prey by mostly foraging mechanism and mechanoreception, it may be suggested that copepods generally have preference towards centric diatoms than pennate counterparts.

The phytoplankton diet was mainly comprised of mixed microphytoplankton community which included centric diatom, pennate diatom and dinoflagellates as it is observed in the estuarine condition. Centric diatom and pennate diatom were the predominant microphytoplankton fed to the selected copepod species. *Acartia erythraea* (Calanoida), *Paracalanus indicus* (Calanoida), *Oithona brevicornis* (Cyclopoida), *Microsetella rosea* and *Microsetella norvegica* (Harpacticoida) all preferred centric diatom than pennate counterparts. Feeding experiments on *A. erythraea* reflected that this calanoid copepod is a suspension feeder, mostly feeding on the diatoms with the help of filter feeding, foraging mechanism and mechanoreception. They are omnivorous in their feeding habit (Turner, 2004). Similar studies have been performed by Teixeira et al. (2010) where the feeding of *Thalassiosira weissflogii* and *Chaetoceros muelleri* increased the rates of egg production in *Acartia tonsa* suggesting that copepod may also feed in order to fulfill its nutritional requirement. The prey switching behaviour depending on the availability of the food has been also suggested by Kiorboe et al. (1996). The feeding strategy of a copepod species mainly depends on availability, accessibility and the effectiveness to catch prey (Wainwright, 1994; Hughes, 1980; Charnov, 1976). The nutritional demand and the requirement of energy of the species also is an important criteria for the selectivity of prey. An interesting observation was also recorded during the course of study among the congeneric species *Microsetella rosea* and *Microsetella norvegica* where latter showed significant preference to pennate diatom although the percentage of preference to centric diatoms was considerably higher in both the cases. Harpacticoid copepods mostly prefer a benthic habitat living close to the substratum. Since pennate diatoms are mostly known as benthic mat formers, grazing of Harpacticoid copepods on pennate diatoms can be an obvious result. This can be supported by the works of Wyckmans et al. (2007), Sellner (1976) and Nilsson (1987). *Oithona brevicornis* showed omnivorous feeding preference and maximum feed utilization as suggested by Turner (2004). *Paracalanus indicus* showed high affinity towards centric diatom than pennate diatoms suggesting that they are mostly suspension feeders capturing prey with mechanoreception and since centric diatoms have larger surface area compared to that pennate diatom which mainly prefer benthic habitat, centric counterparts remain mostly in suspension. Hence, the preference for centric counterparts could be explained for *Paracalanus indicus*.

V. CONCLUSION

The main aim of the study was to understand the feeding strategy of certain selected copepod species. It is known to us that no two species exhibit similar kind of feeding preference. Different species have differential feeding habit. In a dynamic environment like estuary where conditions are always changing, the feeding strategy of the copepods may not be same. On the contrary, it can state that when food resources are abundant, copepods may tend to shift their normal feeding diet. The results that have come up from the

study might not be highly conclusive but can provide us with an idea about the preferable feed choice of a particular species. There are certain avenues which can be sought after in future where studies can be undertaken to see whether feed preference depends on size fractionation of microphytoplankton or not. Specific diatoms can be cultured to understand the feeding preferences more clearly and can be tallied with feeding of natural phytoplankton diet. Moreover, further studies can be done to understand which specific diatom species on being fed to a particular copepod species may result in greater increase in the biomass. Moreover, the prey switching behaviour of copepods in presence abundant feed resource is also an aspect to lookout for.

VI. ACKNOWLEDGEMENT

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FIGURES

Figure 1: The map is depicting the zones selected as the sites of collection during the field trip. The sites were chosen owing to their varied physico-chemical and biotic nature viz. Kachuberia (Stn.1) with relatively greater influence from freshwater; Namkhana (Stn.2) and Chemaguri (Stn.3) serving as ideal brackish water regimes, with Gangasagar (Stn.4) having an almost marine facade and the sites with highest marine influence were Frasergunj (Stn.5) and Bakkhali (Stn. 6).

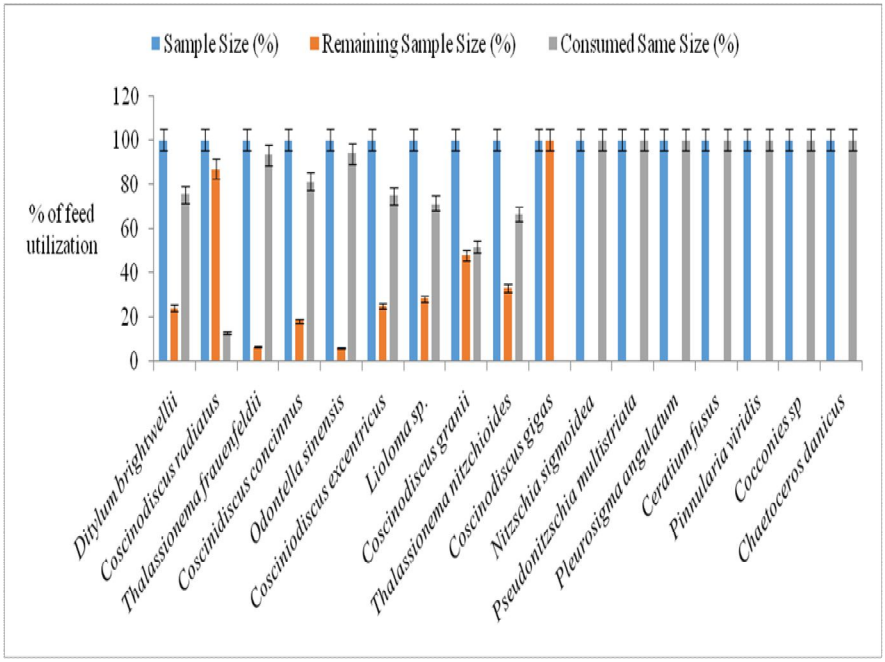

Figure 2: The present figure shows the percentage of feed utilization of by Acartia erythraea recorded during the feed experimental trial.

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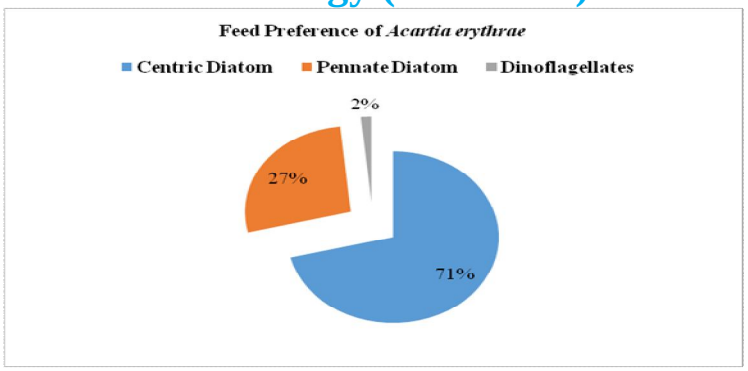

Figure 3: The present figure shows the preference of feed by Acartia erythrae among the consumed microphytoplankton cell structure community

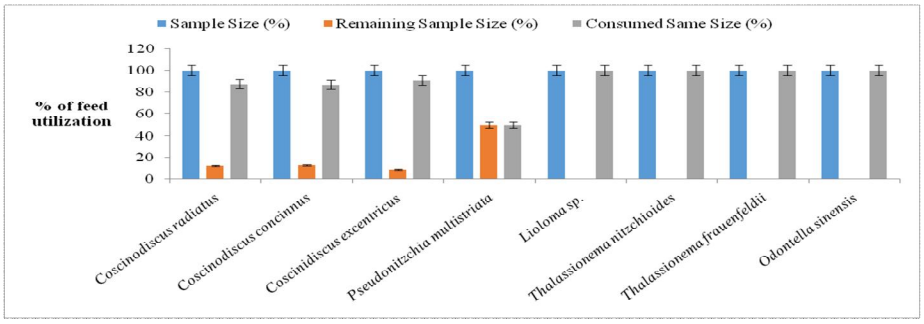

Figure 4: The present figure shows the percentage of feed utilization of by Microsetella rosea recorded during the feed experimental trial.

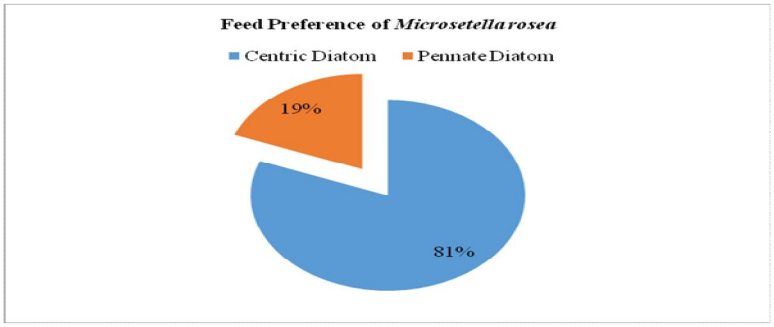

Figure 5: The present figure shows the preference of feed by Microsetella rosea among the consumed microphytoplankton cell structure community

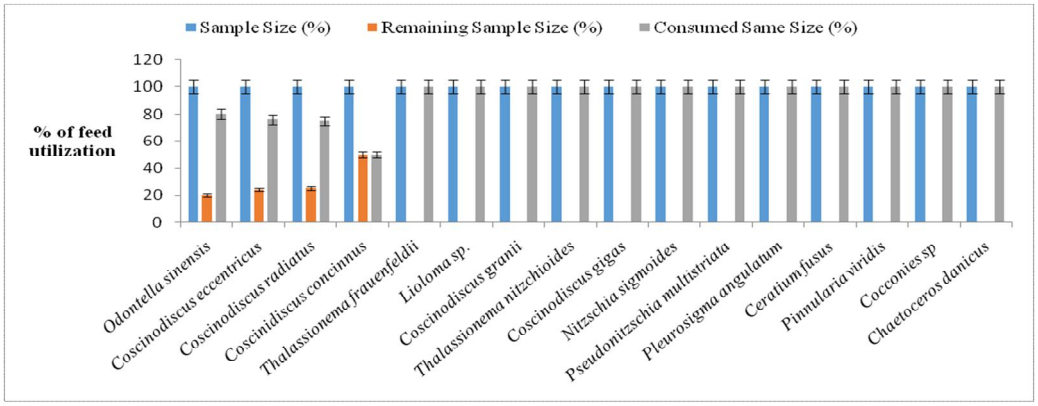

Figure 6: The present figure shows the percentage of feed utilization of by Oithona brevicornis recorded during the feed experimental trial.

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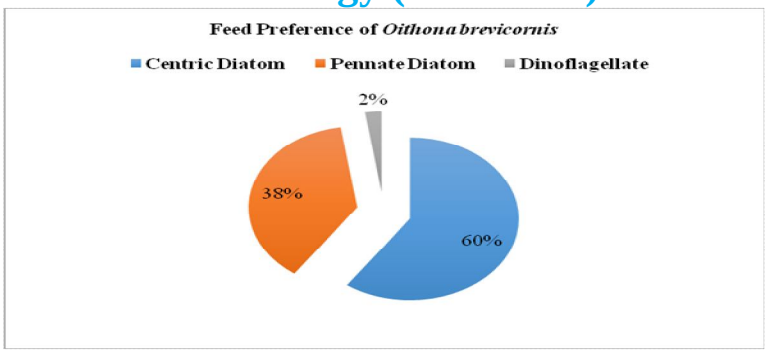

Figure 7: The present figure shows the preference of feed by Oithona brevicornis among the consumed microphytoplankton cell structure community

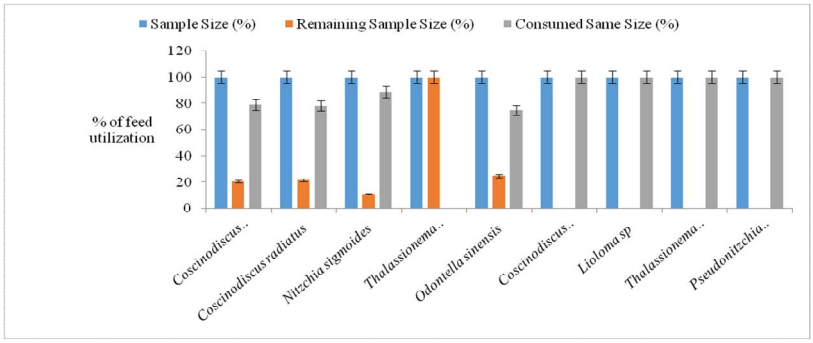

Figure 8: The present figure shows the percentage of feed utilization of by Microsetella norvegica recorded during the feed experimental trial.

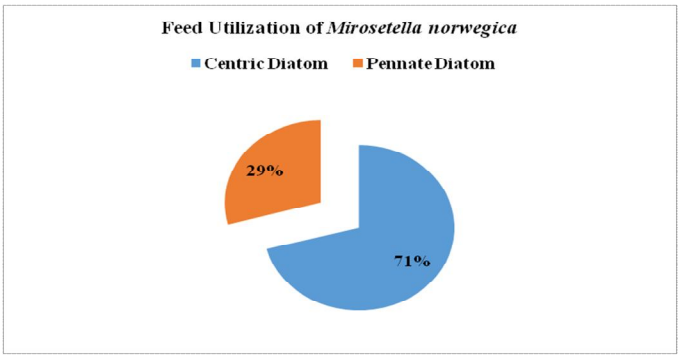

Figure 9: The present figure shows the preference of feed by Microsetella norvegica among the consumed microphytoplankton cell structure community

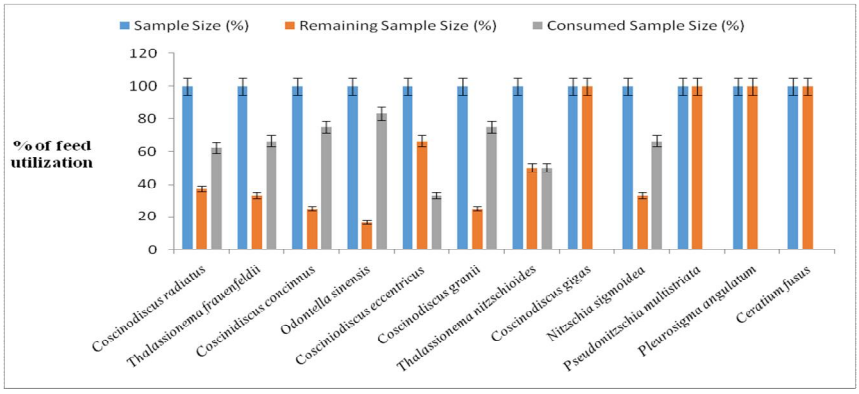

Figure 10: The present figure shows the percentage of feed utilization of by Paracalanus indicus recorded during the feed experimental trial.

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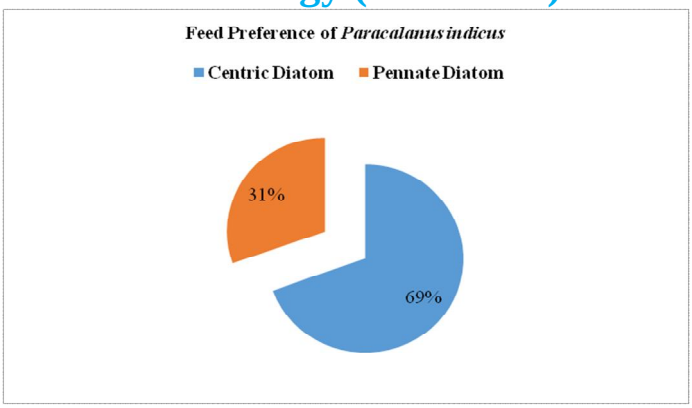

Figure 11: The present figure shows the preference of feed by Paracalanus indicus among the consumed microphytoplankton cell structure community

TABLES

Table 1: The following table represents the background parameters considered and recorded at the stations selected for the study during the course of the research work.

Parameters	Month	Bakkhali	Fraserganj	Namkhana	Kachuberia	Chemaguri	Gangasagar
pH	Jan'16	7.8	7.6	8.1	7.5	7.3	7.7
	Feb'16	8.2	8.1	7.7	8.3	8.05	8.2
	Mar'16	7.5	7.8	7.5	7.6	7.6	7.6
	Apr'16	7.5	7.7	7.3	7.5	7.3	7.9
aT (°C)	Jan'16	22	22.5	20	22	24.5	25
	Feb'16	25	26	17	26.5	28	28.5
	Mar'16	28	28.5	29	28	29.5	32.1
	Apr'16	26.5	28	31	25.6	27.5	29.5
wT (°C)	Jan'16	22.5	22	20	18.5	19.5	20
	Feb'16	22	20	20	20	23	23.5
	Mar'16	25	25.5	26.5	24.5	26	28.5
	Apr'16	27	27.2	28.5	25	26	28.5
Salinity (psu)	Jan'16	28	26	16.5	18.5	22.5	25.6
	Feb'16	28	27.9	15	20	24	28.2
	Mar'16	27	27	14	16.5	20	25.5
	Apr'16	27.6	26.2	24	18	20.5	26.5
D.O.	Jan'16	6.1	5.1	5.4	5.5	5.5	6.9
	Feb'16	6.3	6.5	6.1	6	5.6	6.5
	Mar'16	5.3	5.5	6.1	6.5	6.3	6.5
	Apr'16	5.2	5.8	5.5	4.5	6.1	6.7

Table 2: The following table represents the mixed microphytoplankton diet that was fed to *Acartia erythrae* during the feeding experiment trials. The table shows the microphytoplankton species with initial counting sample size, remaining sample size and consumed sample size.

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Species	Counting Sample Size (Unit/ml)	Remaining Sample Size (Unit/ml)	Consumed Same Size (Unit/ml)	Group
Ditylum brightwellii	74	18	56	Centric diatom
Coscinodiscus radiatus	140	122	18	Centric Diatom
Thalassionema frauenfeldii	30	2	28	Pennate Diatom
Coscinodiscus concinnus	86	16	70	Centric Diatom
Odontella sinensis	68	4	64	Centric Diatom
Coscinodiscus eccentricus	72	18	54	Centric Diatom
Lioloma sp.	14	4	10	Pennate Diatom
Coscinodiscus granii	4	2	2	Pennate Diatom
Thalassionema nitzschioides	6	2	4	Pennate Diatom
Coscinodiscus gigas	2	2	0	Centric Diatom
Nitzschia sigmoidea	18	0	18	Pennate diatom
Pseudonitzschia multistriata	10	0	10	Pennate Diatom
Pleurosigma angulatum	20	0	20	Pennate diatom
Ceratium fusus	6	0	6	Dinoflagellate
Pinnularia viridis	4	0	4	Pennate diatom
Cocconies sp	6	0	6	Pennate Diatom
Chaetoceros danicus	4	0	4	Centric Diatom
Total	564	190	374	

Table 3: The following table represents the mixed microphytoplankton diet that was fed to *Microsetella rosea* during the feeding experiment trials. The table shows the microphytoplankton species with initial counting sample size, remaining sample size and consumed sample size.

Species	Counting Sample Size (Unit/ml)	Remaining Sample Size (Unit/ml)	Consumed Sample Size (Unit/ml)	Group
Coscinodiscus radiatus	48	6	42	Centric Diatom
Coscinodiscus concinnus	46	6	40	Centric Diatom
Coscinodiscus eccentricus	22	2	20	Centric Diatom
Pseudonitzschia multistriata	4	2	2	Pennate Diatom
Lioloma sp.	18	0	18	Pennate Diatom
Thalassionema nitzschioides	4	0	4	Pennate Diatom
Thalassionema frauenfeldii	2	0	2	Pennate Diatom
Odontella sinensis	8	0	8	Centric Diatom
Total	152	16	136	

Table 4: The following table represents the mixed microphytoplankton diet that was fed to *Oithona brevicornis* during the feeding experiment trials. The table shows the microphytoplankton species with initial counting sample size, remaining sample size and consumed sample size.

Species	Counting Sample Size (Unit/ml)	Remaining Sample Size (Unit/ml)	Consumed Sample Size (Unit/ml)	Group

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Odontella sinensis	60	12	48	Centric diatom
Coscinodiscus eccentricus	50	12	38	Centric diatom
Coscinodiscus radiatus	40	10	30	Centric diatom
Coscinodiscus concinnus	40	20	20	Centric diatom
Thalassionema frauenfeldii	20	0	20	Pennate Diatom
Lioloma sp.	14	0	14	Pennate Diatom
Coscinodiscus granii	4	0	4	Centric diatom
Thalassionema nitzschioides	6	0	6	Pennate Diatom
Coscinodiscus gigas	2	0	2	Centric diatom
Nitzschia sigmoidea	18	0	18	Pennate Diatom
Pseudonitzschia multistriata	10	0	10	Pennate Diatom
Pleurosigma angulatum	20	0	20	Pennate Diatom
Ceratium fusus	6	0	6	Dinoflagellate
Pinnularia viridis	2	0	2	Pennate Diatom
Cocconies sp	2	0	2	Pennate Diatom
Chaetoceros danicus	4	0	4	Centric diatom
Total	298	54	244	

Table 5: The following table represents the mixed microphytoplankton diet that was fed to *Microsetella norvegica* during the feeding experiment trials. The table shows the microphytoplankton species with initial counting sample size, remaining sample size and consumed sample size.

Species	Counting Sample Size (Unit/ml)	Remaining Sample Size (Unit/ml)	Consumed Same Size (Unit/ml)	Group
Coscinodiscus concinnus	48	10	38	Centric diatom
Coscinodiscus radiatus	46	10	36	Centric diatom
Nitzschia sigmoidea	18	2	16	Pennate Diatom
Thalassionema frauenfeldii	2	2	0	Pennate Diatom
Odontella sinensis	8	2	6	Centric diatom
Coscinodiscus eccentricus	22	0	22	Centric diatom
Lioloma sp	18	0	18	Pennate Diatom
Thalassionema nitzschioides	4	0	4	Pennate Diatom
Pseudonitzschia multistriata	4	0	4	Pennate Diatom
Total	170	26	144	

Table 6: The following table represents the mixed microphytoplankton diet that was fed to *Microsetella norvegica* during the feeding experiment trials. The table shows the microphytoplankton species with initial counting sample size, remaining sample size and consumed sample size.

Species Name	Counting Sample Size (units/ml)	Remaining No. (unit/ml)	Consumed No. (unit/ml)	Group
Coscinodiscus radiatus	32	12	20	Centric Diatom
Thalassionema frauenfeldii	12	4	8	Pennate Diatom
Coscinodiscus concinnus	8	2	6	Centric Diatom

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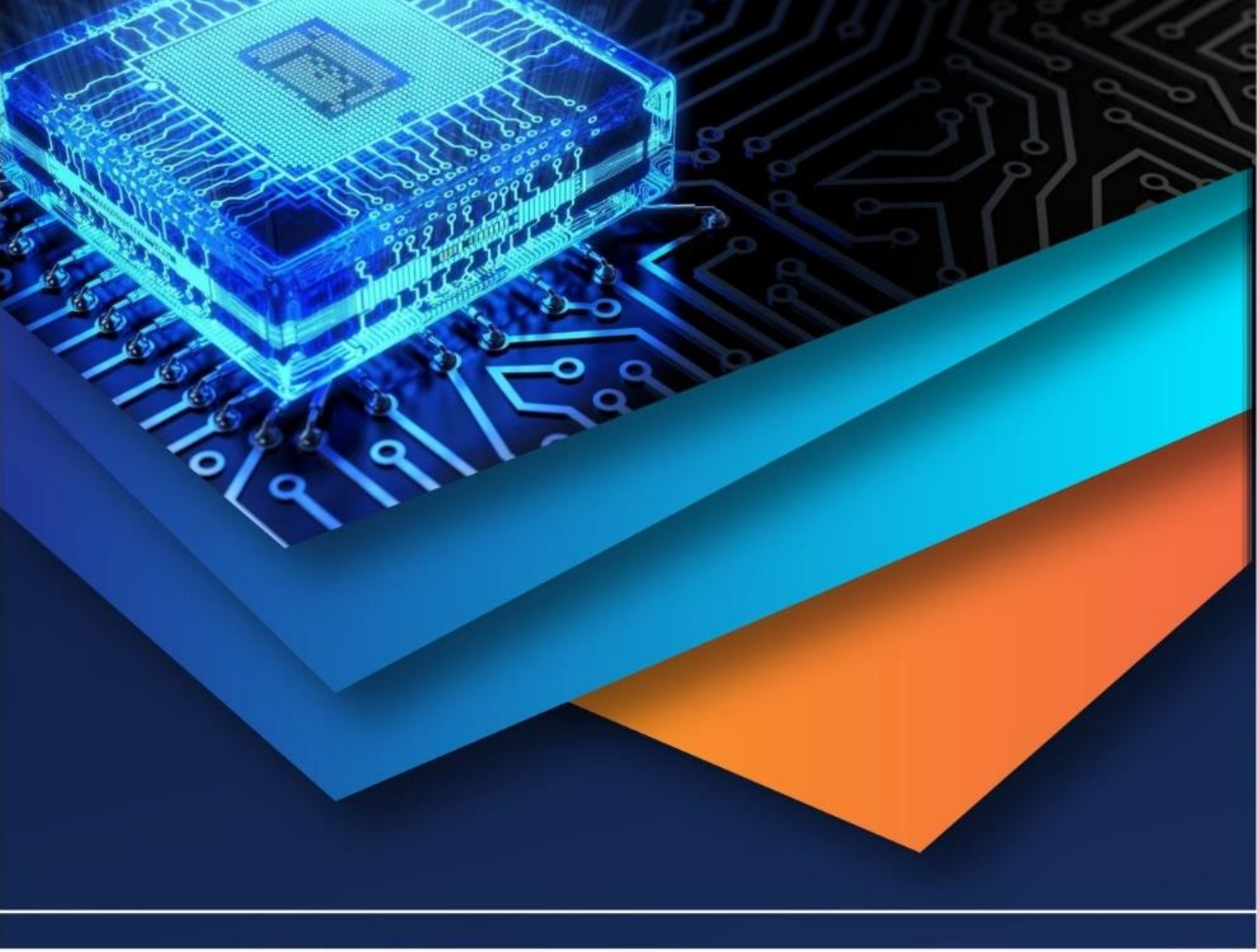
Odontella sinensis	12	2	10	Centric Diatom
Coscinodiscus eccentricus	6	4	2	Centric Diatom
Coscinodiscus granii	4	1	3	Centric Diatom
Thalassionema nitzschioides	4	2	2	Pennate Diatom
Coscinodiscus gigas	2	2	0	Centric Diatom
Nitzschia sigmoidea	12	4	8	Pennate Diatom
Pseudonitzschia multistriata	8	8	0	Pennate Diatom
Pleurosigma angulatum	6	6	0	Pennate Diatom
Ceratium fusus	4	4	0	Dinoflagellate
Total	110	51	59	



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