Pollution assessment of Ennore (India) creek using macrobenthos

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In the present study, the change in benthic community was identified in the coastal stretch from Ennore to Pulicat, total of 6 stations were identified to study benthic community. In order to understand the distribution of the benthic community structure with respect to macro fauna in the Buckingham canal benthic were collected from all the stations during high tide on Spring tide of each month from September 2004 to December 2005. Samples were collected using a fishing boat. From the 25 cm2 (SW) monsoon from June to September and Northeast (NE) monsoon from October to December. SW monsoon is normally temperate in strength. NE monsoon is rather more variable in speed and direction, but the strength is moderate, between N and NE for long spells over most of the area when well established. In the present study, the change in benthic community was identified in the coastal stretch from Ennore to Pulicat, total of 6 stations were identified to study benthic community. In order to understand the distribution of the benthic community structure with respect to macro fauna in the Buckingham canal benthic were collected from all the stations during high tide on Spring tide of each month from September 2004 to December 2005 from bed and bank.

STUDY AREA

The Ennore creek is located approximately 24 km in the northeastern part of Chennai City, Tamil Nadu, India at the coast of Bay of Bengal (Figure 1). The Ennore Creek is the estuary or the mouth of the river Kortalliyar, which is an outlet for the excess water from the Poondi Reservoir. The Ennore Creek flows west to east, and opens into the Bay of Bengal at Ennore. Buckingham canal runs parallel to the east coast of India, form Kakinada in the north till Pondicherry in the south. This canal cuts perpendicularly the Ennore Creek, south to north, and enters the vast Pulicat Lagoon in the north at the Kotalikupam Lock. It then is confluent with the Pulicat Lagoon, for about 1 km and then emerges onto the Sriharikota Island at the Moosamani Lock, and runs parallel along the western margin of the Srilhatikota Island. Between Ennore and Pulicat, the canal spreads out into vast open stretches of shallow waters. There is a second inlet to the Buckingham Canal around 21 km from the Ennore Creek, but this tidal inlet is closed permanently due to a natural sand bar formation. The climate at Ennore is tropical with high humidity. The coastal area is normally governed by land and sea breezes. The region experiences two distinct monsoons viz., the Southwest (SW) monsoon from June to September and Northeast (NE) monsoon from October to December. SW monsoon is normally temperate in strength. NE monsoon is rather more variable in speed and direction, but the strength is moderate, between N and NE for long spells over most of the area when well established. In the present study, the change in benthic community was identified in the coastal stretch from Ennore to Pulicat, total of 6 stations were identified to study benthic community. In order to understand the distribution of the benthic community structure with respect to macro fauna in the Buckingham canal benthic were collected from all the stations during high tide on Spring tide of each month from September 2004 to December 2005 from bed and bank.

MATERIALS AND METHODS

Surface sediment samples were collected at six stations in the Buckingham Canal with the help of Petersen grab sampler covering an area of 0.1 m2. In order to understand the distribution of the benthic community structure with respect to macrofauna in the Buckingham canal, from six stations during high tide on Spring tide of each month from September 2004 to December 2005. Samples were collected using a fishing boat. From the 25 km2 stretch of study area from Ennore Creek to Pulicat mouth, based on the various environmental stresses 6 sampling stations were identified as follows: Station 1 - near Ennore Creek mouth where coolant water from the thermal power plant is discharged. Station 2 - south of Ennore Creek representing the discharges from various industries. Station 3 - in the Buckingham canal 5 km away from Station 2. Station 4 - in the Buckingham canal near aquaculture farms and adjacent to the second inlet. Station 5 - 1 km after the second inlet. Station 6 - near the Pulicat Lagoon inlet where the environmental stress is comparatively less.
The larger organisms were handpicked immediately and then sieved through 0.5 mm mesh screen. The labelled container and fixed in 5% formalin. The organisms were stained with Rose Bengal solution (0.1 g in 100 mL of distilled water) for enhanced visibility during identification. The samples were then preserved in 75% alcohol for further identification. In the macrofauna three groups viz., polychaetes, crustaceans and molluscs were considered for analyses. All the specimens were sorted, enumerated and identified to the advance level possible with the consultation of available literature (19-24).

The total biomass of benthic macrofauna collected in the present study was estimated by wet weight method. In molluscs, the shells were sorted to size (mm-group) and the meat was removed from the shells before weighing. The shells were opened by immersion in boiling water (Table 1).

### RESULTS AND DISCUSSION

**Water quality of Ennore creek**

**pH**

pH varies from 6.5 to 8.9. Extensive buffering capacity of the sea water allows only little pH changes to be pronounced normally in enclosed portions whereas biological activity can cause sizeable variations. At Stations 4, 5 and 6 surface waters show high pH during September to November 2004. This may be due to the effect of the monsoon. When compared to the near bottom samples the surface waters experience a slight higher pH at Station 1 during January and February 2005. A similar observation is noted at Station 2 during February 2005. This may be due to the effect of Tsunami which resulted in the dilution of the canal waters. Otherwise the pH variations between surface and bottom are less significant. Comparatively low pH at Stations 2 and 4 may be due to the intense bacterial degradation of organic matter and less photosynthetic activity of algae. Low pH values in Station 2 could be attributed to the increase in Carbon dioxide resulting from a rise in temperature due to the coolant water discharge. Higher pH values are recorded at Stations 1, 3, 5 and 6. The relatively high pH may be attributed to the intense photosynthetic activity of algae as evident by high phytoplankton population and DO.

### Temperature

The surface water temperature in the stations varies from 29.5°C - 39.5°C and near bottom samples shows an average 10°C reduction than the surface waters. Station 1 records remarkably higher temperature with an average increase of 90°C compared to other stations. The consistent high temperature at Station 1 is due to the coolant water discharge from NCTPS. The recommended temperature for discharge into a water body is 320°C. Except at Station 1, all the other Stations record less and similar temperatures. The high temperature around 32°C observed during April-June might be due to the influence of summer season, low flow, clear atmosphere, and high percentage of humidity, low air temperature and the absence of rainfall. The low temperature of 29.5°C observed during October-December might be due to the climatic changes, precipitation and a reduction in incoming radiation, and winds. Pre monsoon and post monsoon record moderate temperature.

### Salinity

The salinity values ranges from 15ppt to 34ppt. A slight increase in salinity is observed in the near bottom samples than the surface samples in Stations 1 and 2. This variation is clearly portrayed during monsoon season which could be attributed to the fresh water mixing on the surface due to rainfall. In general, Station 2 records less salinity values (28ppt) which reduces further (15ppt) during monsoon due to the effect of industrial discharges. The tidal influence is very much pronounced in Station 2. During high tide, the salinity is more due to the large quantity of salt water that enters into the Canal from the sea. It is also seen that salinity decreases at Station 6 due to the influence of fresh water from Pulicat lagoon. Interestingly the increase in salinity in Station 5 can be attributed to the sea water seepage from the closed second inlet. Seasonally there is not much fluctuation in salinity during the period of study, but still slight variation is seen. In summer, excess evaporation, neritic water dominance and lack of freshwater inflow lead to higher salinity values than the other seasons. Large amount of sea water mixing due to Tsunami is evident from the higher salinity observed at Stations 1 and 2 during January 2005.

### Species composition of macrobenthos

Macroscopic organisms and other bottom dwelling invertebrates are primary food resources for fishes and other large animals (27). They also serve as sensitive indicators of overall aquatic ecosystem health. Table 2 displays the list of macrofauna identified in the study area. The polychaetes, crustaceans and molluscs are identified to species level and where identification was difficult it is done to the lowest practical level. In the Buckingham Canal, about 65 genera and 84 species of macrofauna are identified, consisting of schyphozoa (2 species), polychaetes (24 species), Crustaceans (15 species), molluscs (42 species) and echinodermata (1 species). Since polychaetes, crustaceans and molluscs forms the major classes in the Canal, only these

#### TABLE 1

| Stn. | Monsoon’04 | Post Monsoon’04 | Summer’04 | PreMonsoon’05 | Monsoon’05 |
|------|------------|----------------|-----------|---------------|-----------|
|      | Sand | Silt | Clay | Sand | Silt | Clay | Sand | Silt | Clay | Sand | Silt | Clay | Sand | Silt | Clay | Sand | Silt | Clay | Sand | Silt | Clay | Sand | Silt | Clay |
| 1    | 90  | 10   | 0    | 91  | 9    | 0    | 88  | 12   | 0    | 89  | 11   | 0    | 91  | 9    | 0 |
| 2    | 5   | 89   | 6    | 6   | 90   | 4    | 3   | 87   | 10   | 4    | 88   | 8    | 6   | 90   | 4 |
| 3    | 6   | 75   | 19   | 7   | 76   | 17   | 4   | 73   | 23   | 5    | 74   | 21   | 7   | 76   | 17 |
| 4    | 7   | 42   | 51   | 8   | 43   | 49   | 5   | 40   | 55   | 6    | 41   | 53   | 8   | 43   | 49 |
| 5    | 17  | 31   | 52   | 13  | 32   | 55   | 9   | 29   | 62   | 10   | 30   | 60   | 18  | 32   | 50 |
| 6    | 23  | 38   | 39   | 24  | 39   | 37   | 21  | 36   | 43   | 22   | 37   | 41   | 24  | 39   | 37 |
| 1a   | 87  | 13   | 0    | 86  | 12   | 2    | 85  | 11   | 4    | 88   | 12   | 0    | 88   | 12   | 0 |
| 2a   | 3   | 92   | 6    | 4   | 93   | 3    | 3   | 90   | 14   | 2    | 91   | 7    | 2   | 93   | 3 |
| 3a   | 5   | 76   | 19   | 6   | 77   | 17   | 3   | 74   | 23   | 7    | 75   | 21   | 8   | 77   | 17 |
| 4a   | 7   | 45   | 48   | 8   | 46   | 46   | 5   | 43   | 52   | 6    | 44   | 50   | 8   | 46   | 46 |
| 5a   | 20  | 36   | 44   | 14  | 37   | 49   | 10  | 34   | 56   | 11   | 35   | 54   | 21  | 37   | 42 |
| 6a   | 25  | 41   | 34   | 26  | 42   | 32   | 23  | 39   | 38   | 24   | 40   | 36   | 26  | 42   | 32 |

Bed – 1, 2, 3, 4, 5, 6  Banks – 1a, 2a, 3a, 4a, 5a, 6a
The occurrence of all the above mentioned species are seen from January. *Stenolepis japonica* and *Nephthys polybranchia* are found distributed in the entire canal. *Tibia curta*, *Haustellum haustellum* are found in Stations 5 and 6. *Stenolepis* are found in the sediments of Station 1. *Chloea parva*, *Portunus pelagicus* and *Marphyssagrayi* are referred as Red Ghost Crab is recorded in Station 1. *Ocypode macroura* also referred as Red Ghost Crab is recorded in Stations 1 and 5. In the beaches of the Second tidal inlet near Station 5 at the Pulicat lagoon. Two species of *Astropecten stelleroidea* occurred during January 2005 at Station 5 to March 2005, but after March 2005 their numbers declined. Only two species of *Astropecten stelleroidea* occurred during January 2005 at Station 6. These species should have entered the canal via the Ennore Creek and the Second tidal inlet near Station 5 at the Pulicat lagoon. **Macrobenthic density**

Bhat and Neelakantan (28) described the environmental characteristics of an estuary fluctuate periodically depending on three seasons i.e. pre-monsoon, monsoon and post-monsoon. The post-monsoon is known for stable environmental condition and increasing benthic production. In present study, the seasonal variations in abundance and biomass followed a similar pattern with low values in monsoon and pre-monsoon. The Standing Crop of macrofauna with respective to different seasons is represented in Figure 2. Though there are seasonal fluctuations seen in the faunal groups are taken for detailed analyses. Species are grouped into taxonomic classes in order to provide a reasonably succinct interpretation of the data. Table 2 also includes some of the off shore species recorded during tsunami. Amphinomenastra are seen in Station 1 attached to logs and they are planktonic in nature. *Janthanaglobosa* that are usually found on the surface of oceanic waters were seen floating in the Canal waters during January 2005. Along with the above species *Tonnadolium* and *Bursa spinosa* are also found in the sediments of Station 1. *Chloea parva*, *Portunus pelagicus* and *Marphyssagrayi* are referred as Red Ghost Crab is recorded in Stations 1 and 5. In the beaches of the Second tidal inlet near Station 5 at the Pulicat lagoon.

**TABLE 2**

| Scyphozoa          | 22    | Nephthys polybranchia | 43    | Turbo bruneus | 66    | Distorsioreticulata |
|--------------------|-------|-----------------------|-------|---------------|-------|---------------------|
| 1                  | Chryseraquinquesirha | 23    | Marphyssagrayi    | 44    | Nerita polita    | 67    | Bursa spinosa       |
| 2                  | Rhizostoma sp.       | 24    | Sabellarialaeoaki | 45    | Nerita polita   | 68    | Haustellum haustellum |
| **Polychaetes**    | 25    | Sabeltaracmenitantium | 46    | Littomiascabra  | 69    | Murex temispina     |
| 3                  | Stenolepis japonica  | 26    | Serpulavermiculari | 47    | Littorina undulate| 70    | Murex virgineus     |
| 4                  | Amphinomenastra      |       |                   |       |                   |       |                     |
| 5                  | Chloea parva         | 27    | Lepasan ancefiera  | 49    | Turritella colunmaris | 72    | Oliva oliva        |
| 6                  | Alciopinaparasitica  | 28    | Balanumspamhurite | 50    | Turritella acutangula | 73    | Melampuscyllonicus |
| 7                  | Tomopterishgelandonica | 29    | Balanusraculatus  | 51    | Turritella antennata  | 74    | Pythia plicata     |
| 8                  | Pelagobonia gongiora | 30    | Balanus varigates  | 52    | Architectonia perspective | 75    | Cardita bicolor    |
| 9                  | Ancistrolyscinsconstricta | 31   | Alpheus malabaricus | 53    | Telescopium telescopium | 76    | Trachybranchasculum |
| 10                 | Glycera alba         | 32    | Emerita asciatica  | 54    | Cerithidea acutiula | 77    | Macr Laevis        |
| 11                 | Lumbiniconereis simplex | 33    | Donipedocusripes  | 55    | Cerithidea obusta | 78    | Meretrix merex       |
| 12                 | Lumbiniconerealatrellii | 34    | Sylla serrata     | 56    | Janthanaglobosa | 79    | Meretrix casta      |
| 13                 | Lumbiniconereis impatien | 35    | Sylla requanebarca | 57    | Strombusasteri  | 80    | Margia opima       |
| 14                 | Diopotanesapallinana | 36    | Portunus pelagicus | 58    | Strombus margarina | 81    | Pernaviridis       |
| 15                 | Cossura delta        | 37    | Portunussanguinolentes | 59    | Tibia cura     | 82    | Volachlamytranquebarica |
| 16                 | Scoplogloma sanpulsiats | 38    | Charybdis fariatus | 60    | Naticamacrochonis | 83    | Crassobradaserasenisi |
| 17                 | Heteronematides similis | 39    | Ophiodeplatyatarsus | 61    | Natica tigrina | 84    | Astropcetstenstelloidea |
| 18                 | Capitellaca capita   | 40    | Ophiopodmacrocera  | 62    | Polinices didyma | 84    | Echinodermata      |
| 19                 | Aphiadite sp.         | 41    | Lacteaulinuples  | 63    | Polinices tunicidus | 84    | Echinodermata      |
| 20                 | Ceratonereis costae  | 42    | Molluscs           | 64    | Sinumeroiodeum  |       |                     |
| 21                 | Perinereicultrifera  | 42    | Umbronunum vestiarium | 65    | Tonnadolium    |       |                     |

**Figure 1**) Study area with sampling stations.
high biomass at Stations 2 and 4. and Capitellacapitata are the two important polycheats contributing to the large size of the Molluscs which increase their body weight. Glyceraalba less, the contribution towards biomass is more by the molluscs. This is due to the monsoons of the two years follow a similar pattern. Though numerically and biomass of the polycheates, crustaceans and the molluscs are identical. monsoon and it gradually decreases during summer. Trends of abundance The Crustaceans demonstrates high abundance during monsoon and post monsoon may be one of the factors responsible for this observation. The density of benthic seen in Station 2 (south of Ennore creek, where discharge of industrial effluents is seen) is the highest, is due to the absence of any environmental stress. Here the highest density is seen during pre-monsoon, monsoon and post monsoon and summer has less density. On the other hand though at Station 2, due to discharge of industrial effluents (coolant water, causes the death of fauna in large numbers resulting in less density of benthic. At all the Stations and seasons it is clear that the bed illustrates higher abundance of fauna than the banks, due to the availability of high nutrients and favorable environmental conditions.

Macrobenthic biomass

Macrobenthic biomass is estimated for different species of all the three classes. Table 3 gives the total biomass of the three different classes of macrofauna. High biomass of the polycheates is seen at Station 2, followed by Station 4. Least biomass of the polycheates is observed at Station 6. A vice versa trend in biomass is observed in the cases of Crustaceans and molluscs. Low biomass is also recorded at Station 1 due to the increased temperature. Stations 3 and 5 have intermediate values of biomass, proving that the pollutants are getting transferred to these stations thus decreasing the biomass of the fauna. A decrease in biomass and population density from pre monsoon to monsoon and a gradual increase towards post monsoon and summer are observed at all the stations in the case of polycheates and molluscs, the trend followed that of salinity closely. This is another proof for the high biomass at Stations 5 and 6 conforming to the observations of (30-32). The decrease in salinity during monsoon may be one of the factors responsible for this observation. The Crustaceans demonstrates high abundance during monsoon and post monsoon and it gradually decreases during summer. Trends of abundance and biomass of the polycheates, crustaceans and the molluscs are identical. The monsoons of the two years follow a similar pattern. Though numerically less, the contribution towards biomass is more by the molluscs. This is due to the large size of the Molluscs which increase their body weight. Glyceraalba and Capitellacapitata are the two important polycheates contributing to the high biomass at Stations 2 and 4.

Similarity between the stations

The similarity between the stations based on macrofauna abundance is shown in Figure 3. Irrespective of the season, the abundance data is averaged and the similarity between the stations are analysed for individual classes. At 90% similarity, the polycheates document four clusters. Stations 1, 2 and 6 cluster with their respective banks behave individually and Stations 3, 4 and 5 are linked together illustrating a single cluster. The dendogram of the crustaceans and the molluscs illustrate the formation of similar clusters. The Stations 1, 3, 4, 5 and 6 behave similarly. Station 2 due to the presence of anoxic conditions and various other environmental stresses behave differently and hence demonstrates an individual cluster.

Discriminating species in macrofauna

It is possible to discriminate species assemblages for each environmental stress in the study area through the routines implemented in PRIMER (SIMPER analysis). Table 4 explains the discriminating assemblages. Discriminating species differentiate one station from other. They are tolerant to the environmental conditions existing in that particular station. Based on the environmental stresses, Stations 1, 2, 4 and 6 were taken individually and Station 3 and 5 were considered together. SIMPER was also used to determine the degree of correlation of the samples with a community gradient. For all the species Average similarity (Av. Sim.) was divided by the ratio of Similarity and Standard deviation (Sim/SD), if the value >1 then such species are identified as discriminating species.

Polychaetes are found to be tolerant as it is observed in Station 2 owing to the organic enrichment and anoxic conditions. At Station 1, certain species of polychaetes, species of the genera Balanus are found to withstand the adverse temperature. Though species of all the three classes discriminate Stations 3 and 5, the polychaetes species constitute the majority, proving that these Stations are also polluted. This is due to the fact that the pollutants from Stations 2 and 4 get transported to the above Stations. At Station 6, species of Crustaceans and molluscs form the discriminating species. The contribution percentage of Dioptarianeolitana is the highest in Station 1 due to high salinity. The percentage contribution Capitellacapitata is the maximum at Station 2, proving that the abundance of the polychaetes species contributes to the high abundance found. Similar observation is seen in Station 4. Cossura delta contributes the maximum abundance at Stations 3 and 5. Station 6 being less polluted, Centhindeacinculata found in large numbers, increasing the percentage contribution.

The relation between abundance and biomass is illustrated in Figures 4-7. The biomass of undisturbed communities tend to be dominated by slow growing, conservative species with a large body mass (K selected species), but low density. Smaller rapidly growing opportunistic species (rselected) are more common in disturbed systems. This pattern is visible in Abundance Biomass Comparison curves (ABC) in which the total cumulative abundance and biomass is plotted against species – rank. In undisturbed systems, the biomass line tends to lie above the abundance line, whereas in disturbed systems the situation is reversed. Under moderate pollution, the large competitive dominants are eliminated and the inequality in size between
Assessment of pollution

Figure 3) Similarity of stations based on macrofauna abundance.

Figure 4) Abundance biomass curve for pre monsoon.

TABLE 3

Macrobenthic biomass.

|       | Monsoon'04 | Pre monsoon | Post Monsoon | Summer | Monsoon'05 |
|-------|------------|-------------|--------------|--------|------------|
|       | Stations   | Polychaetes (g/m²) | Crustaceans (g/m²) | Molluscs (g/m²) |             |             |
| 1     | 7          | 8           | 11           | 8      |            |
| 2     | 21         | 24          | 20           | 29     | 20         |
| 3     | 13         | 14          | 13           | 16     | 12         |
| 4     | 16         | 17          | 15           | 18     | 16         |
| 5     | 12         | 15          | 13           | 16     | 12         |
| 6     | 7          | 9           | 8            | 10     | 8          |
|       |            |             | Crustaceans  |        |            |
|       | 1          | 35          | 48           | 8      |
| 2     | 14         | 13          | 12           | 8      | 11         |
| 3     | 56         | 48          | 54           | 34     | 59         |
| 4     | 72         | 71          | 74           | 61     | 75         |
| 5     | 140        | 140         | 150          | 104    | 156        |
| 6     | 150        | 141         | 153          | 100    | 155        |
|       | Molluscs   |             |              |        |            |
|       | 1          | 45          | 51           | 41     | 53         | 47         |
| 2     | 31         | 40          | 35           | 47     | 47         | 32         |
| 3     | 78         | 96          | 100          | 121    | 81         | 81         |
| 4     | 98         | 112         | 131          | 142    | 97         | 97         |
| 5     | 123        | 163         | 154          | 185    | 130        | 130        |
| 6     | 152        | 181         | 165          | 197    | 158        | 158        |
Figure 5) Abundance biomass curve for summer.

Figure 6) Abundance biomass curve for monsoon.

Figure 7) Abundance biomass curve for post monsoon.
the numerical and biomass dominants is reduced so that the biomass and abundance curves are closely coincident and may cross each other one or more times (25). The contention is that these three conditions polluted, moderately polluted and grossly polluted should be recognizable in a community without reference to control samples in time or space, the two curves acting as an “internal control” against each other.

The k – dominance curve of the ABC – curves confirmed that in Stations 2 and 4, the degree of pollution is increasing from post monsoon to summer and decrease in pre monsoon. The dilution due to fresh water mixing leads to less pollution levels in these stations during monsoon. This indicates that the species composition in both the Stations is characterized by several numerically abundant species with relatively low biomasses. The reason for the occurrence of this type of curve is the communities present are composed of r-selected or opportunistic species. This plot showed that Stations 1 – 5 are characterized by low biomass species with high abundance, proving a disturbed environment. As the two lines intersect for Stations 1, 3 and 5, it is clear that they are moderately polluted. Irrespective of the seasons, the lower population density during monsoon could be attributed to less pollution levels in these stations during monsoon. This indicates that the species composition in both the Stations is characterized by several numerically abundant species with relatively low biomasses. The reason for the occurrence of this type of curve is the communities present are composed of r-selected or opportunistic species. This plot showed that Stations 1 – 5 are characterized by low biomass species with high abundance, proving a disturbed environment. As the two lines intersect for Stations 1, 3 and 5, it is clear that they are moderately polluted. Irrespective of the seasons, the lower population density during monsoon could be attributed to less pollution levels in these stations during monsoon.

### TABLE 4

**Discriminating species.**

| Species | Av.Sim | Sim/SD | (Av.Sim)/ (Sim/SD) | Contrib% |
|---------|--------|--------|---------------------|----------|
| STATION 1 |
| Diopatraneapolitana | 3.31 | 1.53 | 2.16 | 4.25 |
| Nephthys polybranchia | 2.98 | 1.4 | 2.13 | 3.83 |
| Glyceria alba | 2.81 | 1.5 | 1.87 | 3.62 |
| Balanusvariegatus | 1.2 | 1 | 1.2 | 3.1 |
| Capitellacapitata | 2.31 | 4.1 | 0.56 | 2.96 |
| Balanusamphirhile | 1.93 | 1.78 | 1.08 | 2.49 |
| STATION 2 |
| Capitellacapitata | 12.21 | 3.36 | 3.63 | 17.92 |
| Ceratonereis costae | 5.31 | 4.14 | 1.28 | 7.79 |
| Glyceria alba | 2.95 | 2.09 | 1.41 | 2.86 |
| Nephthys polybranchia | 1.9 | 1.65 | 1.15 | 2.78 |
| STATION 4 |
| Capitellacapitata | 5.46 | 4.78 | 1.14 | 5.56 |
| Cossura delta | 3.82 | 3.75 | 1.02 | 4.96 |
| Ancistrolysiscenstricta | 3.14 | 2.8 | 1.12 | 4.07 |
| Glyceria alba | 2.98 | 2.11 | 1.41 | 3.87 |
| Marcia opima | 5.78 | 4.78 | 1.2 | 4.23 |
| Scylla serrata | 1.71 | 1.1 | 1.5 | 2.22 |
| Balanusamphirhile | 1.55 | 9.13 | 0.17 | 2 |
| STATIONS 3 AND 5 |
| Cossura delta | 3.84 | 3.77 | 1.02 | 5.1 |
| Ancistrolysiscenstricta | 3.08 | 2.31 | 1.33 | 4.09 |
| Capitellacapitata | 4.91 | 4.95 | 1.21 | 3.87 |
| Ceratonereis costae | 3.69 | 2.88 | 1.28 | 2.25 |
| Mactralevis | 2.54 | 2.25 | 1.13 | 2.04 |
| Marcia opima | 3.09 | 3.09 | 1 | 1.93 |
| Scylla serrata | 1.71 | 1.1 | 1.5 | 2.22 |
| Turritellacolumnaris | 2.37 | 2.2 | 1.08 | 3.04 |
| STATION 6 |
| Cerithideacungulata | 4.21 | 3.34 | 1.26 | 4.16 |
| Meretrixmeretrix | 3.01 | 2.1 | 1.43 | 3.89 |
| Marcia opima | 1.87 | 1.79 | 1.04 | 2.43 |
| Turritellaattenuata | 1.72 | 1.1 | 1.5 | 2.23 |
| Meretrixcasta | 2.55 | 2.39 | 1.07 | 2 |
| Scylla serrata | 5.54 | 4.31 | 1.29 | 3.91 |
| Turritellacolumnaris | 2.37 | 2.2 | 1.18 | 3.04 |

### Polycheates, Crustaceans, Molluscs

Polycheates, Crustaceans, Molluscs
to save the environment as well as the macro benthic faunal community of Ennore Creek.

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