Sajeeb, J Marine Sci Res Dev 2021, 11:3

Journal of
Marine Science: Research & Development

Research Article Open Access

Macrobenthic Organisms & Water Quality Assessment of karnafully River Estuary

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Abstract

Benthos is the organism that inhabit in bottom of an aquatic body. Benthic organisms such as macro, meio and micro fauna and flora play an important role in food chains in an aquatic ecosystem. Macrobenthic organisms may be influenced positively or negatively by physico-chemical parameters of the environment depending on their sources. According to environmental conditions benthic communities vary considerably. The amount of nutrients released from the sediment by benthic communities may vary. Various physical and chemical conditions of the water body such as depth, current of the water, organic contents of the sediments, contaminations of bed sediments environment, toxicity of sediments influence the abundance and distribution of macrobenthos. Macrobenthos are the most commonly used organisms for bio-monitoring in lotic habitat worldwide. It is evident that macrobenthos play an important role in improving and preserving water quality through mineralization and recycling of organic matters. The physical and chemical status of the riverine ecosystem becomes recognizable through the elasticity of the community structure of the benthic organisms. That's why benthic macro-invertebrates make ideal subject for biological assessment of water quality.

The community of benthic organisms is strongly affected by its environment, including sediment and water quality, and hydrological factors that influence the physical habitat. Because the macrobenthos are dependent on its surroundings, it serves as a biological indicator that reflects the overall condition of the aquatic environment. The variety and abundance of macrobenthos also vary with latitude, depth, water temperature, salinity, locally determined conditions such as the nature of the substrates, and ecological circumstances such as predation and competition. Physical, chemical and biological qualities of water are some of the factors that influence species composition, diversity, productivity and physiological conditions of local populations of a body of water. Macrobenthos are mostly found in the standing water body where the concentration of organic carbon higher than the others. Environmental condition is mostly responsible for the variation of benthos in different area those are substratum type, food availability and predation. Reported that one of the causes of global warming and ocean acidification is the rising of atmospheric carbon dioxide (CO_2) which is considered as important drivers of change in biological systems. They are organisms serve as direct food for higher trophic organisms (e.g., fin and shell fishes) and act as ecological engineer recycling the organic matter and other debris. Soft bottom macro-benthos play an important role in aquatic community which is also involved in mineralization, promotion and mixing of sediments and flux of oxygen into sediments, cycling of organic matter and in effort to assess the quality of inland water. In addition, a number of benthic invertebrates, particularly clams, are consumed by humans and others, such as worms, are used for recreational purposes as fishing bait. Soft-bottom macrobenthos are used as the tools of bio assessment due to some special characteristics such as limited mobility, comparatively long life cycles and differential sensitivity to pollution of various kinds and they show the result of cultural eutrophication on aquatic environment quite satisfactorily. We gathered some information of macro benthic fauna from Sadarghat station, Avoymitroghat and Chaktai canal and also observed the biodiversity index and Water quality parameters from the 3 station, we visited.

Keywords: Benthos; Macrobenthic; Invertebrate; DO; BOD; Intertidal

Materials and Methods

Instruments

1) Mud corer
2) Sieve net (0.5mm)
3) Plastic bottles
4) Marker pens
5) Measuring cylinders
6) Formalin solution (10%)
7) Eosine
8) Plastic bottles
9) Measuring tape
10) Bucket

Study area and duration: Our studied stations were under Karnafully river estuary.

Site 01: Avoymitra Ghat

Site 02: Sadarghat

Site 03: Chaktai khal

Samples were collected from the three stations on 11th January, 2020.

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Received: December 13, 2020; **Accepted:** March 24, 2021; **Published:** March 31, 2021

Citation: Sajeeb MI (2021) Macrobenthic Organisms & Water Quality Assessment of karnafully River Estuary. J Marine Sci Res Dev 11: 305.

Sampling design: 1 transects were created(1m×1m),And took 1 scoop of sediment from 1m^2, similarly 3 scoop were taken from 1 stations for finding exact diversity of organisms of that area.

Sample Collection and processing: Samples were collected by using a mud corer. The collected samples were washed through a 0.5 mm mesh hand sieve with filtered water at collection point to separate animals from the sediment. The materials retained on the sieve were taken in plastic vials and labelled, to which 70% alcohol were added for killing and fixing the organism.

Colorization: 3-4 drops of eosin was added to the sample for the colorization of the unidentified species [1].Qualitative analysis: Rose Bengal was added to the vials which help in sorting the organisms from debris. The materials were poured into a round transparent glass dish (diameter 15 cm and depth 2 cm) [14-17], magnifying glass and microscope were used in necessity. Then the organisms were preserved in 75% ethyl alcohol for identification and future record [18-21]. Identification was made to the lowest possible taxonomic level following the works of Gosner (1971) [7], Sterrer (1986), Ahmed (1990) [2], Rao et al. (1995) and Misra (1995) [3, 4]. **Density measurement:** Total count of specimens of the same groups was determined and the results were converted into number per square meter by unitary method [5] (Figure 1-3) (Table 1).

Results

(Table 2) (Figure 4-9)

Dissolved oxygen (DO)

Take water sample in a BOD bottle but remember that as if there are no bubbles in BOD bottle taking water sample. Then the water sample has to be fixed with 1ml KI and 1ml $MnSO_4$ and shaking the mixer [6]. After settling (10 min wait) then add 1ml H_2SO_4 (Conc.) and wait minimum 10 min up to maximum 2 hours. Then take 10ml from mixer in a conical flask. Now add 2-3 drops starch solution and turn into blackish. Now titrates it with $Na_2S_2O_3$ (0.025N) [8]\, Just disappear the blackish point then stop $Na_2S_2O_3$ from burette. After taking three times then make an average volume of $Na_2S_2O_3$ [9-13] (Figure 10,11).

Sequence of benthos according to the abundance in Karnafully River Estuary:

Oligochaets>Eunicidae>Nereididae>Crab>Gastropda>Perinereis >Thais sp.

Figure 1: Citation of the sampling stations- Site-01.

Figure 2: Citation of the sampling stations- Site-02.

Figure 3: Citation of the sampling stations- Site-03.

Site	Location	Gps Location	Time	During	Sieve Net size	Sample Quantity	Formalin added
1	Avoymitraghat	22.32403° N & 91.82938 E	10.05 am	Low tide	0.5 mm	140 ml	8 ml
2	Sadarghat	22.32745°N 91.83901°E	12.15 pm	High tide	0.5 mm	50 ml	5 ml
3	Chakati canal	22.3542°N & 91.8481 E	2.55 pm	Low tide	0.5 mm	150 ml	9 ml

Table 1: We collected sample of benthos in Karnafully river estuary from the following points.

Stations &Types	Nereididae	Eunicidae	Perinereis	Crab	Oligochaets	Gastropods	Thais sp
Avoymitraghat	10	6	3	15	567	3	0
Sadarghat	23	47	1	19	343	5	3
Chaktai khal	7	3	0	3	307	13	0

Table 2: Percentage of identified species in the three stations.

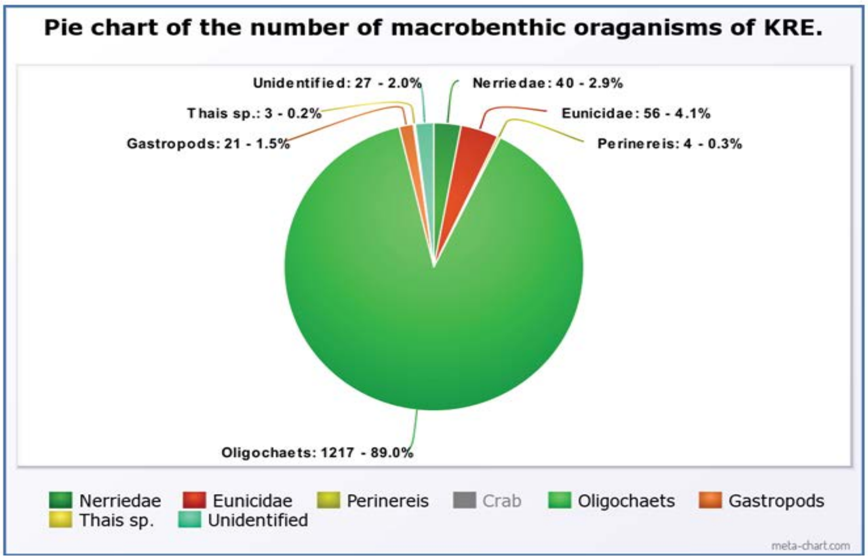

Figure 4: Comparative abundance of species in the three stations.

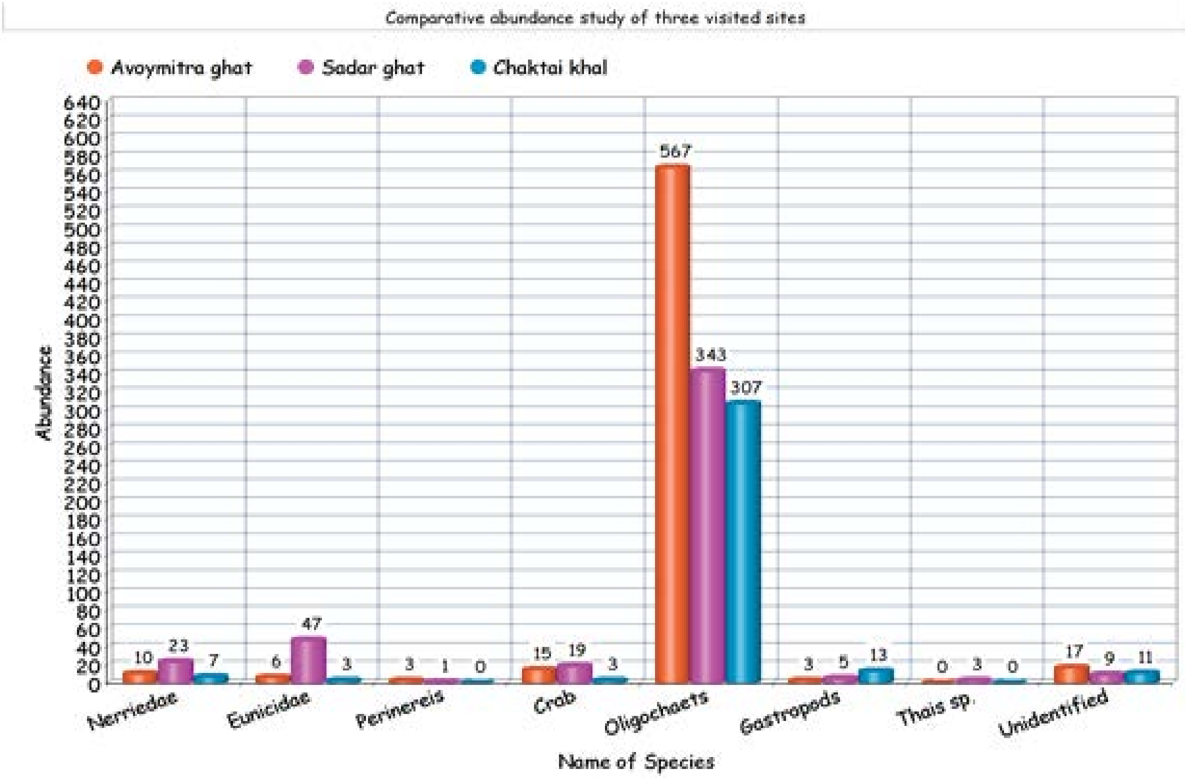

Figure 5: Percentage area of the abundance of species in studied sites.

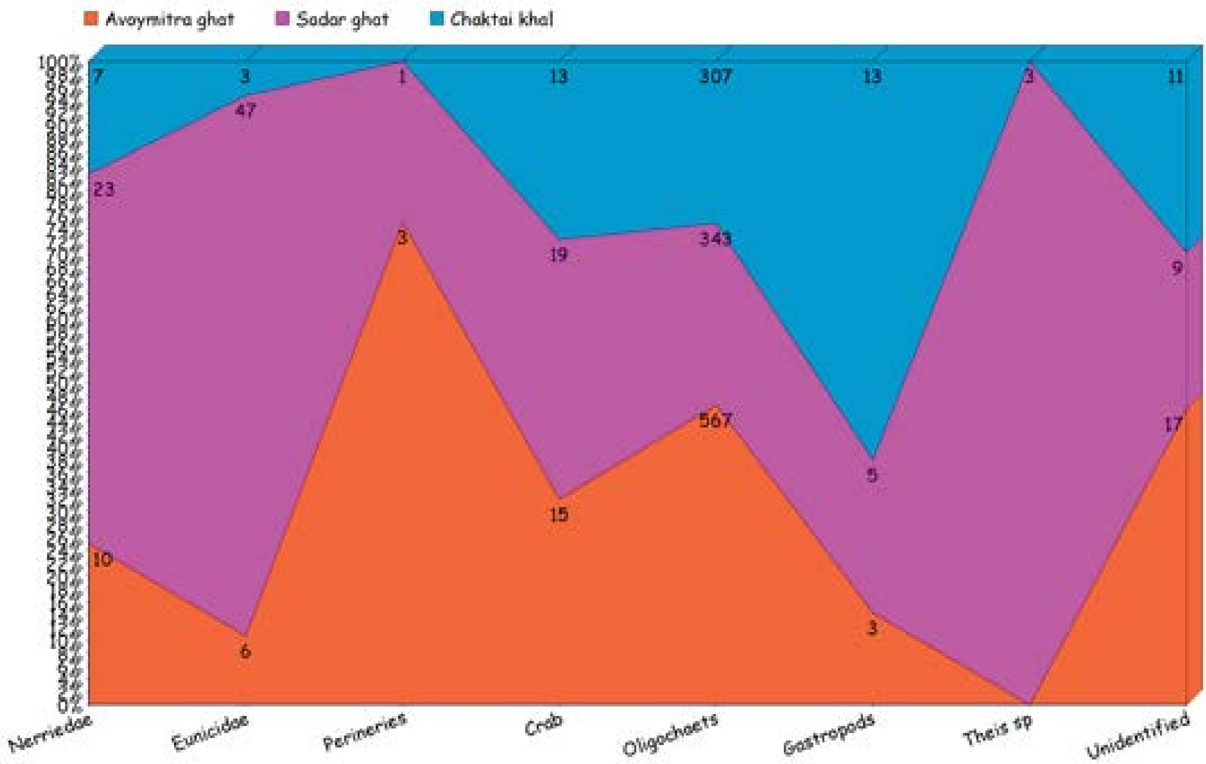

Figure 6: Graphical presentation of Percentage area of the abundance of species in studied sites.

8 Categories/Classes					
No	Category	Value	x	x^2	-x ln(x)
1	Nereididae	40	2.8%	0.001	0.101
2	Eunicidae	56	4.0%	0.002	0.128
3	Perinereis	4	0.3%	0.000	0.017
4	Crab	37	2.6%	0.001	0.096
5	Oligochaets	1217	86.6%	0.750	0.124
6	Gastropods	21	1.5%	0.000	0.063
7	Thais sp	3	0.2%	0.000	0.013
8	Unidentified	27	1.9%	0.000	0.076
R1	**Simpson Dominance**			0.7540	
R2	**Shannon Entropy**				0.6186

Diversity Indices	
Index	Value
Number of Classes N	8
Richness R	8
Berger Parker Index p_{imax}	86.6%
Shannon Entropy[1)] H (nat)	0.6186
Shannon Entropy[1)] H (bit)	0.8924
Number Eq. ^1D (True Diversity)	1.9
Shannon Equitability $H/\ln N$	29.7%
Simpson Dominance SD	75.4%
SD (unbiased - finite samples)	75.4%
True Diversity ^2D (Order 2)	1.3
Gini-Simpson Index 1-SD	24.6%
Gini-Simpson Equitability	28.1%

Figure 7: Diversity Index.

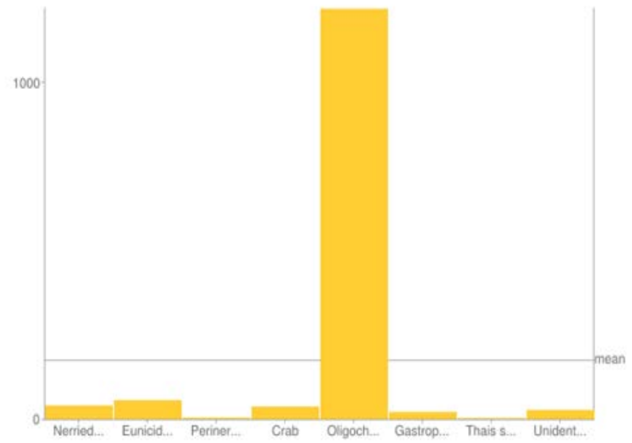

Figure 8: All populations.

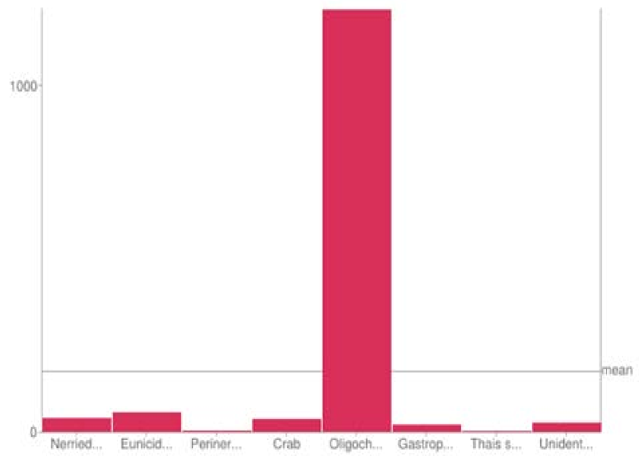

Figure 9: Common species.

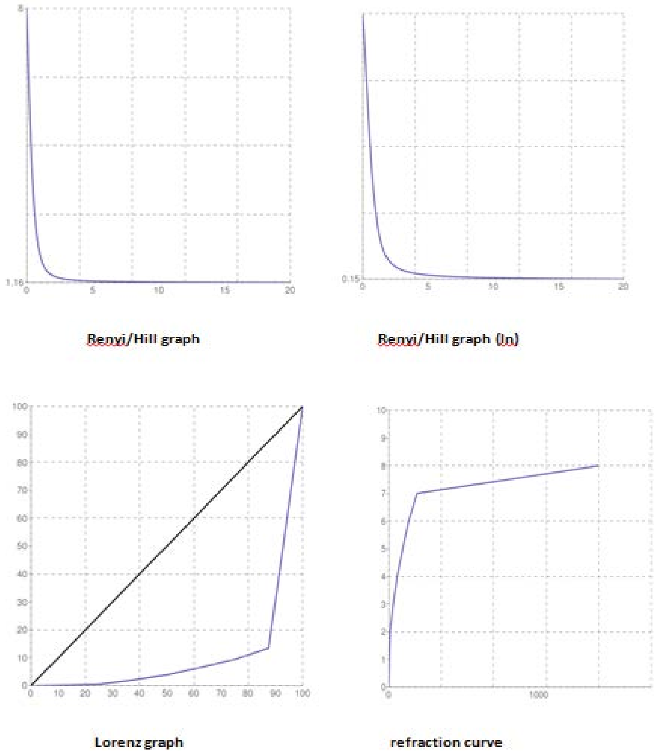

Figure 10: Graphical representation of species.

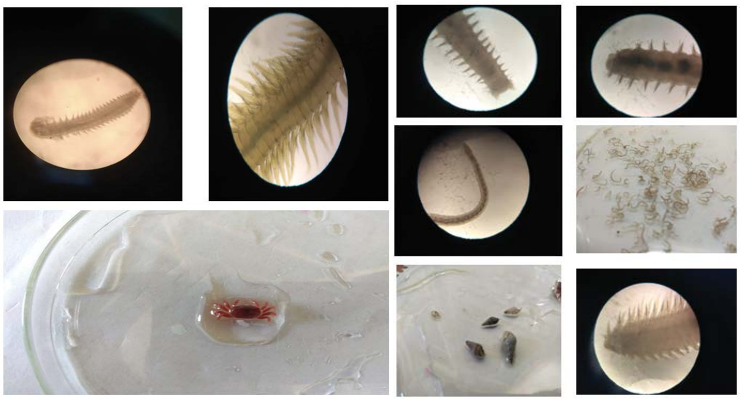

Figure 11: Some benthic organism's picture during identification.

Figure 12: Picture of mine during sampling.

Chemical Parameters	Avaymitro Ghat 1	Avaymitro Ghat 2	Shadher Ghat	Chaktai
DO	2.7	2.9	3	2.8
BOD	0.7128	0.69	1.14	2.14

Table 3: Dissolved Oxygen (DO) and Bottle of Dissolved Solution.

DO (mg/l) = V × N × 5.6 × (1000/S) × B/ (B-A)

Here,

V = Volume of $Na_2S_2O_3$

N = Normality of $Na_2S_2O_3$ = 0.025

S = Sample of volume taking for titration = 10ml

B = BOD bottle volume

A = 2 (1ml KI + 1ml $MnSO_4$)

Parameters	Avaymitro Ghat 1	Avaymitro Ghat 2	Shadher Ghat	Chaktai
Air temperature	21˚C	23	24˚C	23˚C
Water temperature	19	21	22˚C	21˚C
Salinity	5ppt	3ppt	6ppt	2ppt
Depth	6ft	2.5ft	2ft	6.5ft
Tidal condition	High tide	High tide	High tide	Low tide
Water pH	6.6	6.8	6.7	6.7
Transparency	14.67cm	22cm	22cm	22cm
Colour	Turbid colour	Turbid colour	Turbid colour	Turbid colour

Table 4: Physico-Chemical parameters of collected water sample.

Conclusion & Discussion

Nereididae, Eunicidae & Crab were found in most numbers in Sadarghat stations than the other stations, they are serially 23 ind/m^2,47 ind/m^2 and 19 ind/m^2.Oligochaets were mostly found in Avoymitra ghat, Gastropods were mostly found in Chaktai khal and its 13 ind/m^2. Thais sp were only found in Sadarghat . Unidentified species mostly found in Avoymitra ghat and it was 17 ind/m^2.Comparing data it can be said that Sadarghat is more bio diversified area than the other sites. Oligochaets number indicates that Avoymitra ghat is most polluted than the others. As, we didn't use Grab sampler, proper biodiversity determination was tough and polluted area indication was also very tough. But, our Monitoring says that Chaktai khal was most polluted than others.

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