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Marine Meiofauna in Songculan Lagoon, Songculan, Dauis, Bohol Philippines

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Abstract: Meiofaunal organisms are small animals found living in the benthic zones of both freshwater and marine habitats and are considered numerically dominant metazoans. Their presence in the benthic zone is important since they serve as links to higher trophic levels in the ecosystems. This study aimed to identify meiofaunal organisms found in Songculan Lagoon, Songculan Dauis, Bohol, Philippines; determine the physico-chemical properties of water and sediments in Songculan Lagoon and compute and compare for relative abundance of the meiofaunal taxa. This study was limited to meiofaunal taxa identification up to class level. Sampling involves coring method. The results identified eleven meiofaunal taxa namely; Netamoda, copepod, ostracod, turbellaria, gastropod, flatworms, gastroticha, polychaeta, oligochaeta, rotifera and tardigrada.

Key words: Meiofaunal organisms, marine habitats, metazoans, fresh water, animals

INTRODUCTION

Meiofaunal organisms are small animals (pass through a 500 mm sieve and are retained on a 0.063 or 0.045 mm sieve) found living in the benthic zones of both freshwater and marine habitats and are considered numerically dominant metazoans. They occur from the splash zone on the beach to the deepest sediments in the sea and found on all types of sediments. Their sizes are intermediate with that of the macrofauna and microfauna (Vincx, 1996; Kotwicki *et al*., 2005). Due to their taxonomic diversity and species richness, meiofauna represent an important but often neglected component of marine biodiversity.

About 23 higher taxa of the 33 metazoan phyla have some meiobenthic representatives. Some of these taxa are exclusively meiobenthic, like gastrotricha, kinorhyncha, loricifera, nematode, turbellaria, oligochaeta, polychaeta, copepoda, ostracoda, mystacocarida, halacuroidea, hydrozoa, nemertina, entoprocta, gastropoda, aplacophora, brachiopoda, holothuroidea, tunicata, priapulida, sipunculida wherein other taxa are meiobenthic in certain point in their life history (Vincx, 1996). To date, 390 of the approximate 700 described are exclusively marine species, with the remainder known from various freshwater habitats (Hochberg, 2008). Despite its taxonomic heterogeneity, meiofauna are believed to belong to a separate functional group of marine benthos (Kotwicki *et al*., 2005).

With these, their presence of these interstitial organisms in the benthic zone is important since they serve as links to higher trophic levels in the marine ecosystems. They play an important role in bioturbation and stimulation of bacterial metabolism in marine sediments (Vincx, 1996). They also participate in the biomineralization of organic matter particularly the sediments and act as a link between detritus and higher trophic levels in tropical habitats. This also exhibit high sensitivity to anthropogenic inputs, making them excellent sentinels of pollution.

Futhermore, the importance of meiofauna on ecosystem dynamics and the lack of background information on them suggest the creation of baseline research (Armenteros *et al*., 2009) and will provide the first steps for a comprehensive understanding of the effect of habitat loss and fragmentation, since the state and composition of meiofauna assemblages may reflect the general health of the marine benthos (Gheskiere *et al*., 2002).

Objectives of the study: This study aimed to identify possible meiofaunal organisms found in Songculan Lagoon, Songculan Dauis, Bohol, Philippines; determine the physico-chemical properties of water and sediments in Songculan Lagoon and compute for relative abundance of the meiofaunal taxa.

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Significance of the study: The main importance of this study is to identify the meiofaunal taxa in Songculan Lagoon. The results of this study serve as baseline information of the meiofaunal taxa and their abundance. This raised awareness of the importance of these interstitial organisms in Songculan Lagoon so that activities that directly or indirectly cause disturbance will be taken into consideration. The importance of meiofauna on ecosystem dynamics and the lack of background information on them suggest the creation of baseline research which provide the first steps for a comprehensive understanding of the effect of habitat loss and fragmentation, since the state and composition of meiofauna assemblages may reflect the general health of the marine benthos (Armenteros *et al*., 2009).

Scope and limitations of the study: This study was limited to meiofauna taxa identification up to class level in Songculan Lagoon. The sampling was conducted last July 25, 2012. Sampling involved coring method (Vincx, 1996). Salinity and temperature were the only physical parameters taken. The variables measured for water analysis included density, temperature, turbidity, salinity, suspended solids, color and pH.

MATERIALS AND METHODS

Sampling site: Three stations were selected, station 1 near the mouth (9°38'9" N, 123°50'18" E), station 2 in the middle (9°38'8" N, 123°50'13" E) and station 3 the other one in the end (9°38'5" N, 123°50'7" E) of Songculan Lagoon in Songculan, Dauis, Bohol Philippines with dense mangrove populations on the edges (Fig. 1).

Sample collection, fixation, extraction and identification: Sediment samples were collected during low tide in the intertidal zone through coring method (Vincx, 1996; Chindah and Braide, 2001) and fixed in 5% buffered formalin stained with congo red. Extraction was conducted through decantation (Vincx, 1996). The collected meiofaunal organisms were examined and identified under the use of stereoscope using pictorial key identification.

Sediment analysis: The samples were dried at 60°C, weighed and then sieved (sieves 75 and 150 μm). The sediments that were able to pass through each sieve were weighed and computed for sand, silt and clay (%) (Gheskiere *et al*., 2002).

Data analysis: In this particular study, in determining the abundance, the equation of Smith and Smith (1998) was used:

$$\text{Relative abundance} = \frac{\text{No. of individuals in a given species}}{\text{Total no. of individual of all species}} \times 100$$

and to compare the abundance was analyzed with Kolmogorov-Smirnov two sample test for the comparison among taxa. The significance level was set at $p<0.05$.

RESULTS AND DISCUSSION

The 11 meiofaunal taxa were identified in Songculan Lagoon, namely; netamoda, copepod, ostracod, turbellaria, gastropod, flatworms, gastroticha, polychaeta, oligochaeta, rotifera and tardigrada. In station 1, 6 meiofanual taxa determined which included the tardigrada, polychaeta, gastropod, turbellaria, ostracod, and nematodes. For station 2, 7 taxa were determined having the highest number taxa in Songculan Lagoon, namely; tardigrada, oligochaeta, flatworms, gastropod, ostracod, copepod and nematodes. In station 3 with 6 taxa which included the rotifera, polychaeta, gastroticha, gastropod, copepod and nematodes. Nematodes and garstropods were the taxa occurring in all stations.

The most dominant at the entire sampling site were the nematodes as shown in Table 1 and Fig. 2. Table 1 showed the relative abundance or dominant of meiofaunal taxa found among sediments in Songculan Lagoon, namely; Netamoda (34%, 552 individuals), copepod (17%, 282 individuals), Ostracod (16%, 258 individuals), turbellaria (15%, 241 individuals), gastropod (11%, 182 individuals), flatworms (2%, 40 individuals), gastroticha (1%, 22 individuals), polychaeta (1%, 21 individuals),

Fig. 1: Songculan Lagoon

Table 1: Relative abundance of meiofaunal taxa in Songculan Lagoon

	Station 1					Station 2					Station 3						
Meiofauna	R1	R2	R3	Abundance	Relative abundance (%)	R1	R2	R3	Abundance	Relative abundance (%)	R1	R2	R3	Abundance	Relaive aundance (%)	Abundance	Relative abundance (%)
Tardigrada	1	0	0	1	0	7	0	0	7	1	0	0	0	0	0	8	0
Rotifera	0	0	0	0	0	0	0	0	0	0	9	2	2	13	3	13	1
Oligochaeta	0	0	0	0	0	11	0	8	19	3	0	0	0	0	0	19	1
Polychaeta	4	1	0	5	1	0	0	0	0	0	0	10	6	16	4	21	1
Gastroticha	0	0	0	0	0	0	0	0	0	0	0	12	10	22	5	22	1
Flatworms	0	0	0	0	0	24	8	8	40	7	0	0	0	0	0	40	2
Gastropod	2	0	1	3	0	15	2	9	26	5	47	56	50	153	38	182	11
Turbellaria	84	87	70	241	36	0	0	0	0	0	0	0	0	0	0	241	15
Ostracod	79	72	20	171	26	30	8	49	87	15	0	0	0	0	0	258	16
Copepod	0	0	0	0	0	62	101	111	274	48	1	5	2	8	2	282	17
Nematodes	92	76	74	242	37	40	42	34	116	20	43	75	76	194	48	552	34
Total	-	-	-	663	-	-	-	-	569	-	-	-	-	406	-	1638	-

Table 2: Kolmogorov-Smirnov two sample test of Meiofaunal taxa in Songculan Lagoon

Meiofauna	Nematodes	Oligochaeta	Tardigrada	Copepod	Ostracod	Gastropod	Polychaeta	Rotifera	Gastroticha	Turbellaria	Flatworms
Nematodes	1										
Oligochaeta	0	1									
Tardigrada	0	0.966	1								
Copepod	0.028	0.307	0.307	1							
Ostracod	0.028	0.111	0.028	0.662	1						
Gastropod	0.028	0.028	0.028	0.662	0.966	1					
Polychaeta	0	0.966	0.966	0.662	0.111	0.307	1				
Rotifera	0	1	0.966	0.662	0.111	0.111	0.966	1			
Gastroticha	0	1	0.966	0.307	0.111	0.028	0.966	0.966	1		
Turbellaria	0.028	0.662	0.662	0.662	0.662	0.111	0.662	0.662	0.662	1	
Flatworms	0	1	0.662	0.662	0.307	0.111	0.966	0.966	1	0.662	1

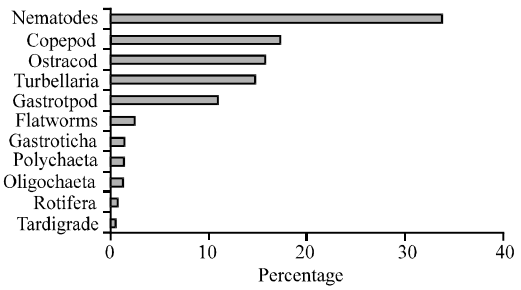

Fig. 2: Relative abundance of meiofaunal taxa in Songculan Lagoon Songculan Dauis Bohol Philippines

oligochaeta (1%, 19 individuals), rotifera (1%, 13 individuals) and tardigrada (0%, 8 individuals). In the Kolmogorov-Smirnov two sample test as shown in Table 2 and Fig. 3 for the comparison of the abundance of meiofauna tax a, for nematoda that there was a significant difference compared among meiofauna taxa identified in this study. For oligochaeta, there was a significant difference compared to nematoda ($p>0.05$) and gastropoda ($p>0.028$). For tardigrada, there was a significant difference compared to ostracod ($p>0.028$) and nematoda ($p>0.05$). For ostracoda, there was a significant difference compared to nematoda ($p>0.05$) and tardigrada ($p>0.028$). For gastropod, there was a significant difference compared to nematoda ($p>0.05$), oligochaeta ($p>0.028$) and gastroticha ($p>0.028$). For gastroticha, there was a significant difference compared to nematoda flatworms, polychaeta, ($p>0.05$) and gastropod ($p>0.028$). For copepod, rotifera and turbellaria, there was no significant difference among meiofauna taxa except for nematoda ($p>0.05$).

Table 3: Physico-chemical properties of seawater in Songculan Lagoon, Songculan Dauis Bohol Philippines

Properties	Values
Temperature	30°C
Salinity	31.5 ppt
pH	8 (Basic)
Turbidity	30 cm
Density	100.415 g mL^{-1}
Color	Clear
Suspended solids (100 mL)	8.75

The abundance of the interstitial organisms in Songculan Lagoon could be associated to the following environmental factors: Grain size, circulation of water, temperature, salinity and wave action (Table 3).

CONCLUSION

In this study, sediment analysis was conducted, it was found out that the sediments were composed of 81% sand, 16% silt and 3% clay. Having this type this would unable to hold-in water when tides ebbs leaving. This could explain the abundance of nematodes identified with 34% of relative abundance (552 individuals) like in the study of Gheskiere *et al.* (2002) that these are slender and adapted to live in small water-filled interstitial

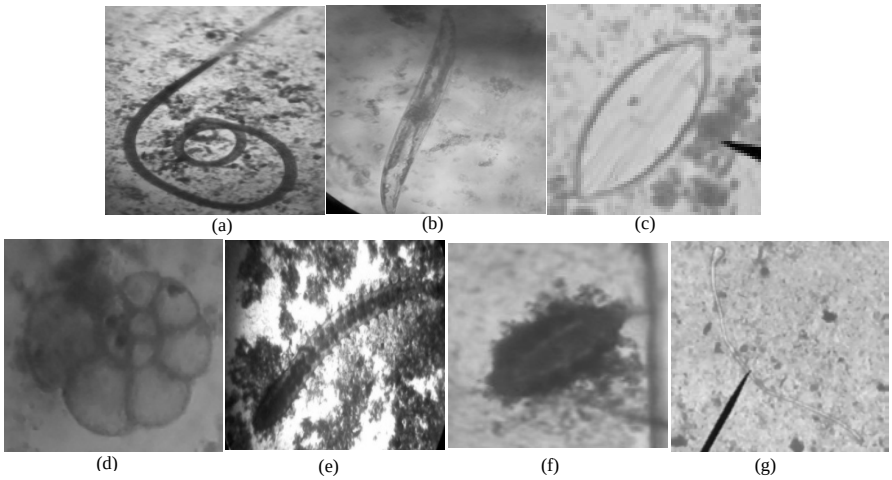

Fig. 3: Meiofaunal Organisms in Songculan Lagoon, Songculan Dauis Bohol Philippines; a) Nematoda; b) Turbellaria; c) Ostracoda; d) Gastropoda; e) Polychaeta; f) Tardigrada; g) Rotifera

Table 4: Sediment analysis in Songculan Lagoon, Songculan Dauis Bohol Philippines

	Dry weight (184.3 g)		
Wet weight	Sand	Silt	Clay
195.4 g	149.5 g (81%)	28.9 g (16%)	5.9 g (3%)

spaces like the fine grain sized sandy beaches are suitable environments. In addition, according the Nybakken (1997), nematodes are most abundant and diversed interstitial organism. This could be explain to the abundance of the crustacean representative the copepod and ostracod, turbellaria, gastropod, flatworms, gastroticha, polychaeta, oligochaeta, rotifera and tardigrada in relation to their sediment type preference. Circulation of water through pore spaces in sediments is an important factor because this is responsible for water movement in renewing the oxygen supply (Nybakken, 1997). This circulation is ideal to coarse type of sediment like documented in this study as shown in Table 4.

LIMITATIONS

Furthermore, with some limitations of the procedure and equipments used in this study eleven taxa of interstitial organisms from the three sample stations were identified. For future studies, more sampling stations should be selected inorder to show the clearer picture of how diverse the meiofaunal organisms that are found in Songculan Lagoon, Songculan, Dauis, Bohol, Philippines.

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