1. Spatial patterns of macrofauna community structure in multiple scales

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Our study aimed to characterize the macrofauna biodiversity of 60 sandy beaches in Rio de Janeiro state, and thus to evaluate their relationships with morphodynamic factors and the influence of spatial patterns in different scales. Relationships between values of species richness, abundance, biomass and morphodynamic and sedimentological variables of the beaches were investigated using GAM. PCA was used to investigate patterns of spatial variability in macrofauna composition of the studied beaches. The beta diversity of the coast and the sectors of the coast of RJ were also estimated. In general, patterns of relationship between species richness, abundance, biomass and the predictors used were distinct when considering different spatial scales. Species richness was lower in the Metropolitan region when considering all beaches included in this study. However, when considering only continental beaches, we found a gradient of increasing richness towards the North Coast. The PCA separated beaches into two large groups: beaches of the South Coast and beaches of Metropolitan / North Coast. As expected, highest values of beta diversity were found when considering the scale along the entire coast of RJ. This pattern was more evident for the South Coast, sector with greater spatial heterogeneity.

Keywords: Biodiversity, Macrofauna Community; Morphodynamic; Spatial Scales.

2. Investigating heavy metal bioaccumulation by macrofauna species of different feeding guilds from sandy beaches in Rio de Janeiro, Brazil

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The relationship between bioaccumulation by macrofauna species of different feeding guilds is a key concept to understand the bioavailability of different metals in the marine environment. Thus, spatial variations in concentrations of eight heavy metals in tissues of macrofauna species and in feeding guild composition were evaluated. We adjusted generalized linear models to test for differences between feeding guild abundances. Also, Redundancy Analysis was performed to explore the relationship among the feeding guilds composition and the environmental variables. Mixed effects models were run for each region to investigate the variation on metal concentrations across the feeding guilds using beaches, with different morphodynamic characteristics, and species, with different physiological traits, as spatial and biological random factors. In general, heavy metal concentrations were higher in carnivorous species. However, bioaccumulation across the feeding guild was not the rule and varied across regions. Our hypothesis is that variations are probably related to the different magnitudes of metal contamination along the coast and to spatial variability on feeding guild composition. This data revealed a complex scenario and highlighted the importance of linking the variability of environmental drivers to studies of bioaccumulation by macrofauna species of different feeding guilds in sandy beaches ecosystem.

Keywords: Benthos; Chemical pollutant; Environmental factors; Southeast Brazil
3. Seasonal variability and environmental factors forcing on beach meiofaunal communities: a case study from the Maltese Islands (Central Mediterranean)

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The mediolittoral zone of three sandy beaches in the Maltese Islands (central Mediterranean) were sampled on a monthly basis over the January-December 2016 period in order to investigate the existence of seasonal patterns in meiofaunal assemblage composition and to assess the possible influence of site-specific parameters (e.g. particle grain size, sand organic content, natural sand/artificial sand) on the same composition. Samples were collected through the use of 3.6 cm-diameter corer inserted to a depth of 15 cm into the sand column. Preliminary results indicate that the most pronounced degree of seasonality was recorded on the only replenished beach sampled in the study, with a peak of 1200 individuals/10cm² recorded from the beach during the month of January. Similar high winter month peaks in meiofaunal abundance were recorded on the second (unreplenished) beach sampled in the study, whilst a summer peak in abundance was recorded on the third sampled (unreplenished) beach due to the appearance of large numbers of Tardigrada, Turbellaria, Polychaeta and Acari, with Ostracoda dominating the assemblages during most of the remaining months. Sand grain size and the volumes of seagrass debris received by each beach were instrumental in shaping the meiofaunal assemblage on each beach.

Keywords: Sandy Beaches, Meiofaunal Communities, Seasonal Variability, Mediolittoral Zone

4. Ecological recovery of disturbed sandy beach ecosystems: an update on progress

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Although widely assumed to recover rapidly from disturbance, the ability of impacted beaches to regain ecological structure and function is not well studied. We investigated approaches that could be used to promote ecological recovery of impacted beaches. Following seasonal closures of a beach subject to intensive off-road vehicle (ORV) use, wrack-associated invertebrates were absent or rare in the impacted area yet diverse and abundant in adjacent reference areas. Seven months after seasonal ORV closure, wrack-associated invertebrates in ORV-impacted areas had not recovered and assemblages differed significantly from reference areas, even with added wrack, suggesting ecological recovery of disturbed beaches can be protracted. Scientists and managers collaborated from 2009-2017 to conduct carefully timed additions of talitrid amphipods and wrack that re-established populations and restored prey resources for endangered nesting shorebirds to the ORV impacted beach each year. Our results indicate recovery of macroinvertebrates from disturbance and their responses to wrack subsidies, depends on initial conditions, disturbance intensity and proximity of source populations, particularly for taxa with low dispersal. Importantly, the paradigm of beaches as disturbance-adapted ecosystems capable of rapid ecological recovery is not supported. Our findings have important implications for conservation, damage assessment, and restoration of sandy beach ecosystems.

Keywords: ecological impacts, recovery trajectory, restoration approaches, snowy plovers, nesting shorebirds
5. Arthropodofauna communities in two Uruguayan beaches with contrasting morphodynamics

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The aim of this study was to assess spatial variation in arthropodofauna communities along the sea-dune axis in two sandy beaches with contrasting morphodynamics in Uruguay: La Viuda – reflective – and Barra del Chuy – dissipative. The predictions of the Habitat Safety Hypothesis (HSH) were tested for both the supralittoral and dune arthropods, with a deconstructive analysis. Main predictions were to find more diverse and abundant supralittoral crustaceans in the reflective beach and more diverse and abundant supralittoral and dune insects and arachnids in the dissipative beach. Physical variables significantly differed between beaches: the reflective beach had higher dune elevation, sand temperature, grain size and sorting, and lower values of sand compaction and sediment moisture. No significant differences between beaches were found regarding species richness and abundance. The deconstructive analysis showed that crustacean abundance was higher in the reflective beach, supporting the HSH. A separation between the supralittoral and dune faunal assemblages was found in relation to abundance of Crustacea, Acarina, Insecta, Formicidae, Diptera, Coleoptera. Typifying/discriminating species were found and relationships between species richness/abundance and abiotic variables showed that main environmental predictors differed between beaches. The deconstructive analysis was a useful strategy to account for differences in beach zoning among macrofaunal members.

Keywords: Sandy Beaches; Habitat Safety Hypothesis; Arthropodofauna; Deconstructive Analysis

6. Does the type of beach influence the types of fish caught in the sub-littoral?

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In this study we test the hypothesis that the environmental characteristics of sandy beach determines the types of fish distributed in the intertidal. We trawled during June 2016 and May-June 2017, in Bahía de La Paz, Baja California Sur, Mexico, in three beaches: Eréndira, Balandra and Tecolote. 623 fish of four species were captured and examined: Hyporhamphus unifasciatus, Eucinostomus gracilis, Eucinostomus dowii and Eucinostomus currani. The expected variation was observed since when the beach contains coarser sediment increased the abundance of fish in the catch. The greater exposure of the beach decreased the size of the fishes. At higher wind speeds, the abundance and size of the fish decreased. The larger the size of the beach, the less variation in the size of the fish. The higher the percentage of rock, the greater the variation in the size of the fish. And as the depth increased, the abundance and variation in the size of the fish increased.

Keywords: Gulf of California; Catches; Coastal Resources; Ecological Variations

7. Ecostructuring of marine nematode communities by submarine groundwater discharge along the sandy shore of Long Island, NY

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Inputs of submarine groundwater discharge (SGD) to the coastal zone may alter the salinity, temperature and nutrient regimes of the coastal zone, thus impacting local and regional-scale biology. SGD can locally alter all trophic levels, from bacteria, through primary producers and up to higher consumers. The impact of SGD on nematode communities, important benthic taxa, has been neglected to date. Here, we report on nematode assemblages along the north shore of Long Island, NY, where SGD is a well-documented process. Sandy sediment cores were collected during August 2016 to test if nematode communities differed between sites impacted by mixed fresh-saline SGD and sites where SGD is exclusively saline. Diversity of nematodes was low at sandy beaches impacted by fresh SGD and communities were dominated by a few opportunistic genera. Moreover, a set of typical freshwater nematode genera restricted to impacted sites was observed. Diversity of nematodes was low at sandy beaches impacted by fresh SGD and communities were dominated by a few opportunistic genera. Moreover, a set of typical freshwater nematode genera restricted to impacted sites was observed. The presence of these freshwater nematode genera in the marine coastal zone of Long Island Sound is exceptional and underlines the structuring role that fresh SGD plays in the local ecosystem. The presence of saline SGD structured nematode assemblages differently than sites impacted by fresh SGD. The number of nematode genera was markedly higher where SGD was saline, with a highly different community structure. The site-specific nematode assemblages and high nematode variability, at a small spatial-scale, demonstrate that SGD is an important structuring factor for local biota. This study highlights the importance to which inputs of fresh groundwater discharge may have on local ecosystem diversity in marine coastal environments.

**Keywords:** Groundwater, Meiofauna, Nematode, Diversity, Coastal Zone

8. Variability in beach metabolism along a range of environmental conditions and wrack supply

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Eight exposed sandy beaches, from dissipative to reflective, along NW of Spain were sampled in a snap-shot study of the linkages between beach characteristics and sand metabolism. Samplings were performed between the drift line and the base of the fore dune system. CO2 emission, inorganic nutrients (NH4+, NO3-, NO2- and PO43-) and sand organic enrichment, calculated through the amount of edible C (lipids + proteins + carbohydrates), were measured. Data were interpreted in relation to beach morphodynamics, wrack supply and the wrack moisture content. Data on CO2 emission in algal patches ranged between 0.4 to 11 µM m-2 s-1, whereas those in bare sand averaged 0.21 µM m-2 s-1. Likewise CO2, values of total inorganic N in the sediment depended on the wrack amount and algal moisture, with values ranging between 100 and 2500 µM of N per g-1 of sediment. Edible C was an index of food availability within the interstitial environment; values were also linked to algal patch biomass, ranging from 5 µg g-1 to 170 µg g-1 of sediment. Edible C and abundance of macrofauna were linked, irrespective of the moisture content of the algal wrack, albeit the highest abundances were observed in fresh algal patches.

**Key words:** Beach Metabolism, CO2, Nutrients, Organic Matter, Algal Wrack
9. Does human pressure affect the community structure of surf zone fish in sandy beaches?

Leonardo Lopes Costa, Júlia G. Landmann, Luiz R. Gaelzer, Ilana R. Zalmon

Intense tourism and human activities have resulted in habitat destruction in sandy beach ecosystems with negative impacts on the associated communities. To investigate whether urbanized beaches affect surf zone fish communities, fish and their benthic macrofaunal prey were collected during periods of low and high human pressure at two beaches on the Southeastern Brazilian coast. A BACI experimental design (Before-After-Control-Impact) was adapted for comparisons of tourism impact on fish community composition and structure in urbanized, intermediate and non-urbanized sectors of each beach. At the end of the summer season, we observed a significant reduction in fish richness, abundance, and diversity in the high tourist pressure areas. The negative association between visitors’ abundance and the macrofaunal density suggests that urbanized beaches are avoided by surf zone fish due to higher human pressure and the reduction of food availability. Our results indicate that surf zone fish should be included in environmental impact studies in sandy beaches, including commercial species, e.g., the bluefish Pomatomus saltatrix. The comparative results from the less urbanized areas suggest that environmental zoning and visitation limits should be used as effective management and preservation strategies on beaches with high conservation potential.

Keywords: Fish; Surf Zone; Community Structure; Human Pressure; Predation, Sandy Beach.

10. Biogeography and species diversity of the sandy-beach isopods of the genus Excirolana

Gustavo Mattos, Pilar A. Haye, Paulo C. Paiva

Species of the genus Excirolana are common inhabitants of sandy beaches. The genus contains 14 formally valid species; yet, phylogeographic studies have detected high cryptic diversity within nominal species and lineages (E. braziliensis and E. mayana). In order to assess known information on Excirolana species diversity and geographic distribution we revised 110 published studies reporting Excirolana species. The recompilation showed that the greatest species diversity was found in the Eastern Pacific. Most species have a large geographic distribution. For example, E. chiltoni has a transoceanic distribution occurring on both side of Pacific, E. orientalis has a broad distribution along Indo-Pacific region, E. hirsuticauda has a distribution along Chilean coast across biogeographic break at 30° S; E. natalensis and E. latipes occur in South Africa across climatic barriers. The large geographic distribution of nominal species and the extremely low dispersal potential of these beach-dwelling isopods suggest that most species are potential cryptic species complexes. The actual diversity of this genus may be greatly underestimated. This study proposes a baseline for phylogeography studies, underscores the importance of taxonomic revisions to describe species in the genus Excirolana, and encourages a future study of molecular phylogeny to reconstruct the evolutionary history of this genus.

Keywords: Cirolanidea, Isopoda, Direct Development, Cryptic Diversity
11. Comparative phylogeography and genetic connectivity of two sandy beaches invertebrates with contrasting dispersal potential in South Atlantic Ocean

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The ability of a species to disperse directly influences connectivity between populations throughout its distribution range. In this study, we compare the phylogeography and genetic connectivity of two sandy beaches crustaceans with contrasting dispersal potential along Brazilian coast based in 16S mitochondrial gene. While the ghost crab Ocypode quadrata presents planktonic larvae, the isopod Excirolana braziliensis is a brooder. Phylogenetic analysis of haplotype networks yielded contrasting results between the two species. Four different lineages were observed for E. braziliensis, while O. quadrata showed a poor genetic structure, sharing haplotypes over ~7000 km. For the isopod, the two most frequent lineages (north and south lineages) had distribution ranges limits that agreed with the tropical-subtropical transition of 22° S, while the others were sympatric, less frequent and not abundant. While the north lineage presents high haplotype diversity with a high structuration, the south lineage presents shared haplotypes and low genetic structure. Our results corroborate that contrasting dispersal potential influences the population connectivity and consequently the genetic patterns, and these can be considered in management and conservation programs of sandy beaches ecosystems.

Keywords: Population Genetics, Mitochondrial Markers, Haplotype Network, Biogeography, Crustacea

12. Variability in meiofaunal abundance in sandy beaches in the Eastern Gulf of Thailand

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In this study, we investigated the spatial and temporal variability of meiofaunal abundance in four sandy beaches in Rayong Province, the Eastern Gulf of Thailand in 2016. At each study site, at least nine replicates of samples were collected with cylinders along transects throughout intertidal zone. Overall, the mean total densities of the meiofauna ranged from 38 to 996 ind.10 cm⁻². The highest mean abundance of meiofauna was found at Paknam Prasae in September, while the lowest one was found at Hat Maepim in March. In most study sites, foraminifera exhibited as a dominant group in both wet and dry season, accounting for 39% - 94% of the total abundance. The two-way ANOVA showed significant variation of meiofaunal abundance among study sites. The meiofaunal abundance at all study sites also varied seasonally with high values detected in wet season and low values in dry season. Overall, the mean abundance of meiofauna was positively correlated with median grain size and percentage of organic matter. This study provides a baseline information for further studies on sandy beach ecosystem in the Eastern Gulf of Thailand.

Keywords: Sandy Beach; Meiofauna; Temporal Variation; Spatial Variation; Gulf of Thailand
13. Analysis of surface activity of resident communities during storm events
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Increasing storminess is among the expected effects of climate change; systems such as sandy beaches are particularly exposed to these events. Data related to behavioural reactions of resident beach fauna to storms could hence provide useful insights for the study of beaches’ resilience. A study was carried out on two beach units on the NE coast of Crete, seasonally subjected to violent storms. Daily surface activity of resident fauna was analysed through temporal replicates (four different moon phases) during the months of March and April 2016. Pitfalls were placed along transects perpendicular to the shoreline and emptied every three hours, with spatial replicates on the two units. A wind storm hit the coast during the third replicate, so a control was carried out in occurrence of the same moon phase in the next month. Data indicate nocturnal peaks of activity for resident fauna, dominated in abundance by *Talitrus saltator*, *Deshayesorchestia deshayesi*, *Phaleria bimaculata* (in decreasing order). Not the storm neither the high variability recorded across replicates in terms of: wind speed, beach face slope, substrate temperature, stranded wrack presence seemed to reduce surface activity, neither to shift it. A local adaptation to environmental conditions seems therefore to be in place.

Keywords: Activity; Storms; Talitridae; Tenebrionidae

14. Detecting surf zone fish diversity using environment DNA
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Surf zones of sandy beaches are feeding, spawning, and nursery habitat for a diversity of fish, including recreationally and commercially important species. Sandy beaches are subject to increasing anthropogenic and climatic pressures that can affect their geomorphology and potential productivity. Little is known about the surf zone fish communities that will be increasingly affected by these changes. Monitoring of these communities is difficult, and to date has largely relied on destructive techniques such as seining or hook and line fishing. Molecular analysis of environmental DNA (eDNA) is a promising new tool for rapidly assessing vertebrate diversity in marine systems. We evaluated the effectiveness of eDNA for detecting diversity and characterizing community composition in surf zones at 15 beaches in the Santa Barbara Channel (California, USA) where we paired traditional surveys (beach seining and hook and line) with eDNA sampling (triplicate 1L seawater samples). We targeted a hypervariable region of the 12S mtDNA gene to quantify teleost and elasmobranch fish diversity from surf zone seawater samples. Here, we evaluate the efficacy of eDNA metabarcoding to characterize surf zone fish diversity as a biodiversity monitoring tool.

Keywords: Beach, Biodiversity, Ecological Genetics, eDNA, Fish, Molecular ecology, Surf Zone, Vertebrates
15. What about coastal zooplankton?

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La Paz Bay is one of the most productive watersheds in the Gulf of California for its primary and secondary production. Has three seasons: tempered (December to March), warm (July to November) and transitional (April to June). During the temperate season, it increases the concentration of phytoplankton and herbivore zooplankton that results in the increase of benthic macroinvertebrates and coastal fish. During this time, the predominance of zooplankton corresponds to copepods or cladocerans, from which upper-levels of the trophic network benefits of, like filter macroinvertebrates and predators. These zooplankton groups have a greater proportion of energy, which is transferred by the trophic web to the coastal ecosystem. This is promoted by the intense winds from the north and convective movements. During the warm and transitional season, adult ovigerous increase, who take advantage of high temperatures to reproduce. This coincides with a large amount of holoplankton present, like fish eggs and early stages of invertebrates. Also increases the complexity of the trophic plot in the bay when an increase in carnivorous zooplankton appears, like chaetognatha, jellyfish and mollusks. This is promoted by the lower intensity winds from the south and stratification of the bay.

Keywords: Coastal Plankton; Plankton Dynamics; Gulf of California; Mexico.

16. Sheltered Sandy Beaches from La Paz Bay, Baja California Sur, Mexico

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In Mexico, the description of ecological patterns of sheltered beaches located in embayments is scarce. For this reason, the relationship between environment and intertidal community of benthic invertebrates was examined during May 2016 and February 2017. This study took place on four sandy beaches within La Paz Bay: Balandra, Erendira, Mogote, and Datilito. These beaches are modified by the tide. Western beaches (Datilito and Mogote) are elongated with medium sand (average 0.29 mm) and dissipative morphodynamics. Eastern beaches (Erendira and Balandra) are pocket with coarse sand (average 0.53 mm) and intermediate morphodynamics. Malacostraca crustaceans were the most abundant macrofaunal group, followed by insects and polychaetes. Balandra was the one that lodged the greater amount of intertidal invertebrates. According to the results, these beaches are benign to crustaceans and not to mollusks as it has been previously reported. The climate and food available in February organisms abundance increase.

Keywords: Coastal Environments; Ecological Patterns; Invertebrates; Marine Ecology
17. Comparative study of polychaetes gametogenesis: a morphohistological approach

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The reproductive morphophysiology of polychaete species are highly varied and rich in relevant information for studies in developmental biology, ecotoxicology, taxonomy and phylogeny. Species of the Nereididae, Spionidae and Capitellidae families are abundant in intertidal zone of estuarine environments and sandy beaches, occupying relevant places in the local food chain. Therefore, the present study aimed to describe and compare the female reproductive system of three species of polychaetes, listing relevant morphohistological characteristics. Individuals of the species Laeonereis culveri, Scolelepis goodbodyi and Capitella biota were collected at intertidal sandy beaches on the North Coast and “Baixada Santista” of the State of São Paulo, Brazil, and processed for microscopic analysis for further photo documentation. The results highlighted the variety of reproduction and forms of the female reproductive system in polychaetes, which makes it difficult to use such characters in broad analyses. However, it became evident that characters such as: type of vitellogenesis and oogenesis, occurrence of a true ovary, ovary tissue organization, type of accessory cells present and oocyte morphology and ultramorphology are eligible for analyses that address families and subfamilies. Likewise, these characters may be useful in differentiating related species, truly cryptic species and geographically distinct subpopulations among annelids.

Keywords: Polychaete; Gametogenesis; Oogenesis; Histology

18. Microplastics in sandy beaches of Hat Chao Mai and Hat Pak Meng, the Andaman Sea

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Microplastics have been reported as a major threat to marine ecosystems for decades and their impacts on marine organisms are widely reported, including direct and indirect ingestion transfer of pollutants through food chains in various coastal and marine ecosystems. However, only a few studies of microplastics in Thai waters have been carried out. This study aimed to assess the abundance of microplastics in the sandy beach ecosystems of Hat Chao Mai and Hat Pak Meng, in Trang Province, the Andaman Sea. The sediment samples for the microplastic study were collected in different seasons in 2016-2017. The abundance of microplastics in the sediments was examined by hydrogen peroxide and floatation-filtration with saline (NaCl) solution treatments. The densities of microplastics in the sediment of both sandy beach ecosystems varied considerably. The abundance of microplastics was in the range of 20,888.9 - 84,555.6 particles/m². The microplastics abundance also varied among the sampling periods. The highest frequency of the particle sizes at both study sites was in the range of 1,000-2,000 µm. Further studies are required to examine environmental consequences of microplastics on coastal and marine ecosystems, particularly accumulation of microplastics in different trophic levels and their impacts on human health.

Key words: Andaman Sea; Microplastics; Pollution; Sandy Beach; Sediment
19. Comparing the meiofaunal communities in sandy beach ecosystems in the Andaman Sea with different levels of anthropogenic disturbances

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The application of meiofaunal studies in monitoring the impacts of anthropogenic disturbances in sandy beach ecosystems has been widely documented. The studies on sandy beach ecosystems in Thailand are limited although sandy beaches are important habitats in coastal zones in tropical countries and their ecosystem services are very significant, particularly for tourism sector. This study aimed to examine the structure of meiofaunal communities in Hat Chao Mai and Hat Pak Meng beaches (relatively higher human impacts) in Trang Province, the Andaman Sea during November 2016 – April 2017. The sediment samples for the meiofaunal study were collected using PVC meiocores of 3.5 cm diameter which were randomly inserted into the sediment down to a depth of 10 cm. The results showed that a total of fourteen taxa were observed at both study sites, including Ciliophora, Foraminifera, Turbellaria, Nemertea, Nematoda, Polychaeta, Oligochaeta, Tardigrada, Ostracoda, Nauplius larvae, Copepoda, sea mite, Gastropoda and Bivalvia. Higher values of meiofauna abundance and Nematode/Copepod index were recorded at Hat Pak Meng. The total density of meiofauna varied significantly among the sampling periods. Monitoring programs for meiofaunal community changes in relation to anthropogenic disturbances and global change are urgently needed.

Key words: Andaman Sea; Community Structure; Disturbance; Meiofauna