

Use of Meiofaunal Communities in Ecological Monitoring in Discovery Bay,
a Pristine Tropical Embayment.

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Bays and other coastal waters in the Caribbean are especially vulnerable as they are the buffer zone between land and sea, with accompanying interaction of many ecosystems. They are also subjected to the superimposed pressures of coastal populations. There is therefore a need to identify suitable monitoring parameters or organisms, which will indicate disruptions of the delicate balance of these tropical, coastal ecosystems. Discovery Bay is particularly challenging because changes to the ecosystem have been subtle although cumulative. Furthermore, there are no obvious and large-scale sources of stress to the area.

Considering this, 7 sets of baseline data on meiofauna communities were collected from 18 sites in Discovery Bay, over a 14 month period with a view to using these animals to indicate the present environmental status of the bay. A suite of physicochemical data, sediment physical characteristics and sedimentation rates was collected at the same time, to enhance biological trends found. This was expected to allow the determination of meiofauna spatial differences and if present, to

determine whether they are due to physicochemical factors, or to pollution related factors. Another aim was the building up of baseline data for purposes of further monitoring of short and long term changes in the bay.

Physical data were collected from the water column using a Ver 2.10 Hydrolab Water Quality Data System. This included temperature, salinity, pH, dissolved oxygen, and REDOX. In addition, a suite of sediment characteristics was also collected. These included grain size analysis, organic content, and rates of sedimentation in the bay. Meiofauna samples were taken using a syringe corer, and a Ponar grab. Samples were processed, preserved and counted for major taxa. Significance of results was tested using one-way ANOVA and Tukey's Multiple Range Test (MRT). Cluster analysis was used to clarify spatial trends. Stepwise variable selection Regression was used to define the physical factors which best explained the meiofauna community distribution found throughout the bay.

Results showed that meiofauna abundance and diversity significantly differed at all 18 sites in the bay ($p < 0.0001$). Physical parameters were essentially constant except at a few unusual sites where the presence of fresh water seeps, circulation patterns or sedimentation rates affected the equilibrium. Overall abundance was found to be generally low (expected in a pristine environment). However, diversity was high. Values ranged

from 15 ± 9 to 219 ± 89 individuals per cm^2 . Sites with high diversity had higher numbers of individuals than sites with low diversity. Sea grass sites were found to be particularly diverse habitats, supporting the greatest abundance and diversity of all taxa found. This agrees with previous studies. Grain size was found to be the predominant determining physical factor affecting distribution of meiofauna in the bay. Copepods were found to follow a bell curve distribution with the optimal grain size being medium sand. Nematodes were found to be evenly distributed throughout the sites, with high diversity in only 2 special cases. Annelids and "other" species were not used as defining indicators because of their constant numbers throughout the bay, as well as the fact that little is established on the ecology, feeding strategies or behaviour of most of the "other" species members. Results of regression analysis indicated that variation in physical parameters accounted for approximately half the variation in abundance and richness of species. This may indicate that biological factors e.g. predator-prey interactions, competition, etc. are of equal importance in determining spatial variation in the meiofauna communities in this bay.

Other physicochemical parameters associated with grain size e.g. 'food' availability and plasticity of feeding modes have been shown to strongly influence spatial distribution of meiofauna. There are benthic fauna and

factors not measured in this study, which may also affect distribution in the bay. Holothurian population numbers were found, in previous studies, to be large enough to control meiofauna distribution as they feed by ingesting large quantities of sediment, digesting all organic nutrients (including meiofauna) and egesting "clean" sediment. Large populations of elasmobranchs (skates and rays), also affect meiofauna populations by the long-term disturbance to the sediment created by their burrowing behaviour. Nitrogen content in sediments has been correlated strongly with nematode abundance, and in this bay could play an interesting role in spatial distribution. Also, contrary to literature supporting meiofauna's minimal long-term response to bioturbation and mechanical disturbances, sites directly in the path of the bauxite ship channel and docking area (sites 7,8,11,13,17) seemed to have a marked decrease in the abundance and diversity of species.

Meiofauna can be useful as indicators of certain kinds of stress and pollution. However, in cases where environmental degradation is subtle or minimal, more intensive studies on the biology, behaviour and energetics of this large and important group may be more beneficial.