

## Interannual Variability of the Meiobenthos and Hyperbenthos Communities from two Ecuadorian Sandy Beaches (1999-2001)

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A sampling program was set up to use benthos as an indicator of environmental impact on shrimp natural populations from August 1999 until February 2001. Meiobenthos and hyperbenthos were investigated quantitatively. It is important to notice that this period has been characterized by anomalous cold conditions during most of 1999 and 2000, and close to normal conditions during 2001. Total density from both benthic communities were analyzed during normal and anomalous conditions as were their responses to changes in environmental factors such as water temperature, salinity, median grain size, chlorophyll *a*, suspended particulate matter (SPM) and particulate organic matter (POM). Two sampling sites from the original seven were chosen based on one important characteristic: dominant use. The first site is a sandy beach mostly used for tourism (Salinas, 02°12'S 81°00'W); and the second is located in a fishing town (San Pedro, 01°55'53"S, 80°46'55"W). Fifteen meiobenthos taxa were identified. The meiofauna was mainly represented by nematodes which made up the highest population on both beaches. Total meiofauna density ranged from 244 to 2388 ind./10 cm<sup>2</sup>. Eight higher taxonomic levels of hyperbenthos were found in Salinas and seven in San Pedro, with total densities of 109-14911 ind/100m<sup>2</sup> in Salinas, and 199-1672 ind/100m<sup>2</sup> in San Pedro. Mysidacea was the most abundant hyperbenthic group, representing between 3.53 and 99.40 % of total density in Salinas and 3.76 - 98.31 % in San Pedro.

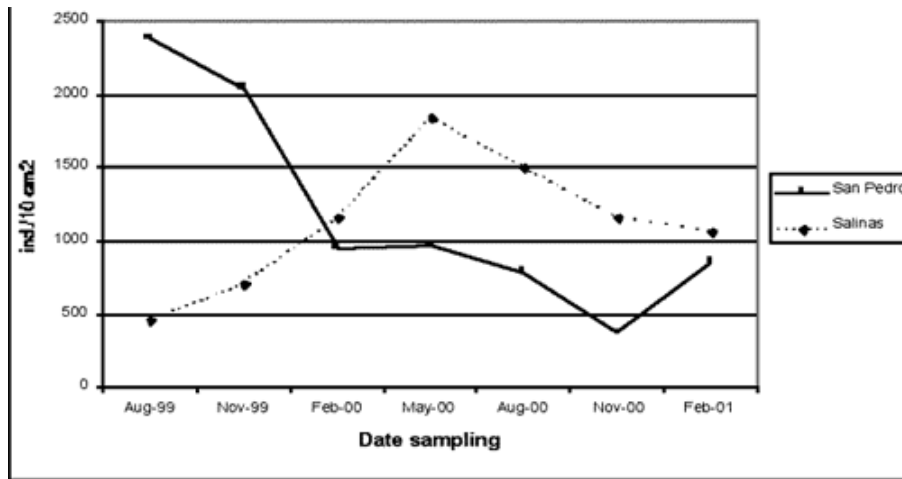
### Objectives

- To determine the interannual variability of meiobenthos and hyperbenthos during normal and anomalous conditions (period after ENSO event).
- To establish the effect of anomalous oceanographic conditions on the benthos density variations.
- To identify the meiobenthic and hyperbenthic communities and how they are related to environmental changes such as: temperature, salinity, sediment characteristics, chlorophyll *a*, SPM and POM.

### Results

The oceanographic variables observed at Salinas (S1) and San Pedro (S2) stations showed cooler than normal conditions for most of 1999, and longer dry season conditions during 2000 and 2001. These variables, along with intertidal sediment configuration and characteristics (see [table 1](#)), changed during the sampling period. The medium grain size ranged from 184.1 to 260.2 µm. In the analysis of chlorophyll *a*, concentrations increased mostly in February (rainy season), which also reflected the highest meiobenthos densities registered at San Pedro under normal conditions (see [figure 1](#)).

ENVIRONMENTAL VARIABLES														
DATE	Aug99		Nov99		Feb00		May00		Aug00		Nov00		Feb01	
STATION	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2	S1	S2
Salinity (PSU)	34	34	34	35	35	35	36	36	36	36	35	35	34	34
Temperature (°C)	22.5	23.0	25.5	25.5	26.5	27.0	22.0	26.5	23	24	23.5	23.5	28.5	28.5
Chla (mg/m <sup>3</sup> )	1.07	3.21	1.07	1.25	3.74	3.34	1.67	2.54	0.80	1,844	0.11	0.13	1.59	3.52
SPM (mg/l)	16.57	371.19	10.10	218.70	34.15	367.10	20.05	639.25	290.15	50.5	61.90	1392.42	66.34	1331.21
POM (mg/l)	4.50	40.80	5.00	20.70	8.20	20.00	3.20	33.90	53.52	197.67	12.65	80.67	24.47	72.90
Median grain size (um)	188.0	201.0	203.8	227.5	185.6	260.2	199.2	211.2	223.7	219.4	200	223.3	184.1	238.3

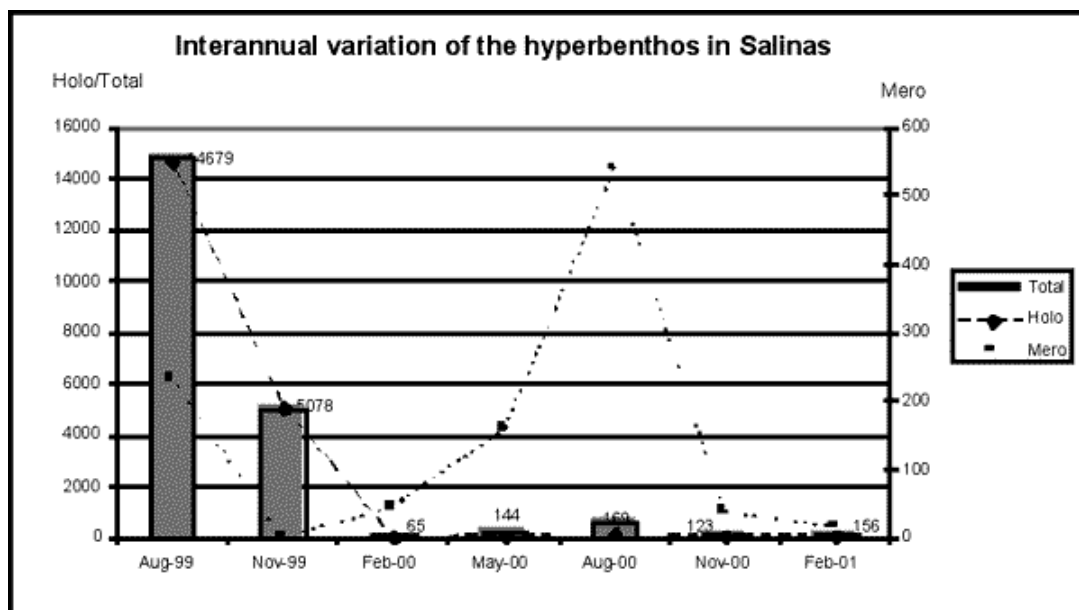


**Fig. 1** Interannual variability of the Meiobenthos

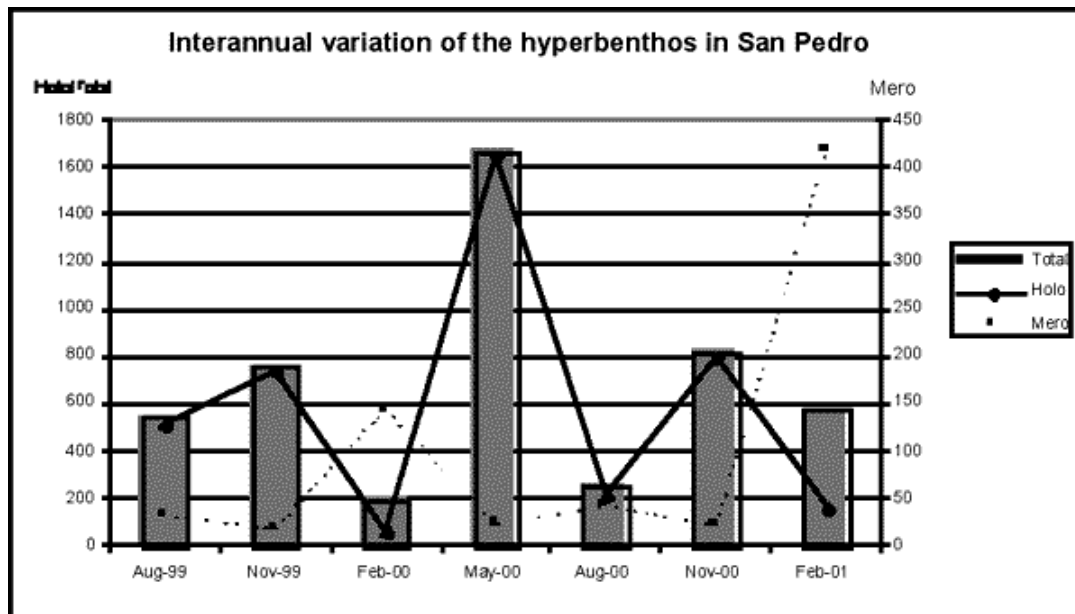
**Table 1** Environmental variables at the Salinas (S1) and San Pedro (S2) stations.

Within the meiobenthos, fifteen higher taxa were found: Nematoda, Turbellaria, Gastrotricha, Copepoda, Polychaeta, Ostracoda, Rotifera, Tardigrada, Cnidaria, Cladocera, Syncarida?, Isopoda, Amphipoda, Mysidacea and Bivalvia. Meiobenthic total densities showed a maximum of 2388 ind./10cm<sup>2</sup> at the San Pedro station and the lowest density was 244 ind./10 cm<sup>2</sup>, recorded at the Salinas station. The most abundant meiofauna group was Nematoda with the highest densities found at San Pedro with a maximum of 2273 ind./10 cm<sup>2</sup>, followed by turbellarians ranging between 31 and 1097 ind./10cm<sup>2</sup> at Salinas and 3-129 ind./10 cm<sup>2</sup> at San Pedro.

Total hyperbenthos, holohyperbenthos and merohyperbenthos densities in both stations are shown in Fig. 2 and 3. The highest density was present at Salinas in August and November 1999, where mysids accounted for 74 - 99% of the total sample composition, compared to 4 - 47% in later samples. At the San Pedro station, higher densities were found in seasonal transition months (November 1999, May 2000 and November 2000), with the highest density during May 2000. Mysids were the dominant hyperbenthic taxon in these months (November 1999: 94% of all animals; May 2000: 98%; November 2000: 96%), although their densities in the remaining samples were between 4 and 51% (except in August 1999: 86%).



**Fig. 2** Interannual variation of the hyperbenthos in Salinas station (ind./100m<sup>2</sup>)



**Fig. 2 Interannual variation of the hyperbenthos in San Pedro station (ind/100m<sup>2</sup>)**

## Discussion

Benthic Invertebrates along the Ecuadorian coast were studied between July and September of 1997. Eight macrobenthic taxa were identified: Cnidaria, Platyhelminthes, Annelida, Sipuncula, Arthropoda, Mollusca, Bryozoa and Echinodermata. The highest densities were recorded on Salinas beach (Mora *et al.*, 1998).

To date, no data are available on meiobenthic communities of the Ecuadorian Coast in the scientific literature. Only two studies are present, where free-living marine nematodes were identified to genus level (Aerts, 2000; Calles, 2001).

Coull (1988) summarized that meiofauna densities tend to be within a range of 200-3000 ind./10 cm<sup>2</sup> in shallow water. We found densities between 249 and 2388 ind./10 cm<sup>2</sup>.

Local studies on surf zone hyperbenthos are relatively scarce (De Mey, 2000; Dominguez & Fockedeey, 2001). In Ecuador, subtidal hyperbenthos of sandy beaches is intensively exploited as a source of wild penaeid shrimp postlarvae for local shrimp aquaculture. Subsequently, there is interest from coastal management institutions and universities to study the shrimp postlarvae fisheries and its companion fauna.

The observed inter-annual variation in the hyperbenthos is directly related to the inter-annual variability of the environmental variables sampled. In some studies, water temperature appears to be responsible for the hyperbenthos assemblages. In the present research, water temperature appears to be related only to inter-annual variability of the merohyperbenthos at San Pedro. Nevertheless, a possible joint effect of anomalous environmental conditions such as "La Niña" event seems to cause higher densities of the permanent residents (holohyperbenthos; eg. mysids, amphipods, isopods) at Salinas, and lower densities of the immigrants species (merohyperbenthos; eg. fish larvae, brachyura megalopa), compared with the densities found during the same months under relatively normal conditions. The differences between the two stations depend on their oceanographic conditions. The Salinas sample site is within a protected bay and the San Pedro site is on a dissipative beach. This could indeed result in different community composition and subsequently different inter-annual responses. Relatively small morphodynamic differences have been shown to influence the hyperbenthos (Beyst *et al.*, 2001).

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