CHAPTER IV

Temporal variability in the composition and biodiversity of free-living marine nematodes in a tropical beach (Ecuador)

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CALLES A, CORNEJO M.P, DEGRAER S, VINCX M.
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ABSTRACT

Free-living marine nematodes are the dominant metazoans in sandy beaches and are considered as indicators for environmental changes. In order to detect the influence of environmental variables such as pluviosity, temperature, salinity, chlorophyll *a*, organic matter and median grain size on the nematode assemblages, inhabiting the lower tide level at an exposed Ecuadorian sandy beach were monthly sampled from June 2000 to July 2001, covering the dry (April-December) and rainy season (January-March). This period had undergone a strong La Niña cold event. Thirty seven nematode species belonging to 30 genera were found, with dominance of *Daptonema* and *Metachromadora*. those species has been reported from estuarine sites and they are able to tolerate salinity changes. The total nematode densities ranged from 359±11 ind./10 cm^2 (April 2001) to 1170±119 ind./10 cm^2 (June 2000), no significant differences between dry and rainy season were detected. The maximum nematode densities registered in Ecuador are 50% lower than in the beaches in the Mediterranean and North Sea, but 90% higher comparing with the Baltic Sea. The non-selective deposit feeders were the most abundant feeding group at the nematode community (43%), although with fluctuating dominance (4-90%). Based on the species composition analysis, sample groups were detected by ordination, reflecting the following temporal pattern: (I) June-December, (II) January and (III) February-May. Dissimilarities (71%) were found between the species of the group II and III, explained principally by highest densities of *Daptonema* sp. 1 (490±197 ind./10 cm^2) and *Rhynchonema* cf. *hirsutum* (163±18 ind./10 cm^2) at the group II; *Ceramonema* sp. 1 (208±50 ind./10 cm^2) and *Ceramonema* sp. 2 (75±15 ind./10 cm^2) at group III. The *k*-dominance curves confirmed this trend, lowest diversity and highest dominance in January 2001 versus lowest dominance and highest diversity between June-December 2000. Evenness and Simpson diversity index revealed significant differences between seasons, with lowest values 0.63 and 0.70 respectively, in January 2001. The temporal variability of *Daptonema* sp. 1 and *Viscosia* sp. 1 is coincides with the pluviosity fluctuations, but only seasonal respond were detected to *Daptonema* sp. 1, which at the maximum rainfall, the density increased.

KEY WORDS: free-living marine nematodes; diversity index; exposed sandy beach.

INTRODUCTION

Although nematodes are among the most abundant metazoans in marine sediments, only few papers, apart from purely taxonomic ones, have described the nematode species composition at intertidal sandy beaches (GOURBAULT *et al.*, 1995; GHESKIERE *et al.*, 2002, 2004, 2005; and URBAN-MALINGA *et al.*, 2004) and their seasonal variability (SHARMA AND WEBSTER, 1983; GOURBAULT, 1998; NICHOLAS AND HODDA, 1999 and NICHOLAS, 2001). This is probably due to the time-consuming species identification process and the overall high species diversities of the nematode assemblages. Free-living marine nematodes do have several favourable features for using them as bio-indicators of environmental conditions (BONGERS AND FERRIS, 1999 and SCHRATZBERGER AND WARWICK, 1999) and it is known from experiments that they are ecologically very heterogeneous and occupy different positions in benthic food webs (AARNIO, 2001). However, quantitative data at the nematode species level from tropical sandy beaches is scarce (CALLES *et al.*, 2005). Geographically located in the equatorial tropical climate region, the Ecuadorian coast is strongly influenced by anomalous El Niño and La Niña events every 2-8 years (SANTOS, 2006). This causes fluctuating climatic conditions, which can have an effect on several sensitive marine living organisms. Baseline data describing the species diversity and community structure are needed to investigate the importance of nematodes for the sandy beach ecosystem and is a first step to detect eventual effects of climatic variability on the coastal ecosystem. In the intertidal habitats, the littoral zones can experience exposures to the atmosphere ranging between a few minutes at spring low tide levels to almost permanent exposure except when covered by sea water once a month during spring high tides. The effect of the differing of cyclical immersion and emersion on the osmotic pressure of the interstitial fluids can vary. Salinity of the upper layers of sediment may reduce due to precipitation and terrestrial surface water run-off (FORSTER, 1998). In their review of marine nematode ecology, HEIP *et al* (1985) compiled an extensive list of marine and estuarine species with their salinity tolerances.

The present study describes the monthly variability from June 2000 to July 2001 of the free-living nematode densities, diversity (at species level) and assemblages and their relationship with environmental factors (pluviosity, sea surface temperature, salinity, distance as a proxy for elevation, chlorophyll *a*, organic matter and median grain size). This period had undergone a strong La Niña phase, after the 1997-98 El Niño

(McPHADEN, 1999). Three climate seasons were monitored: two dry periods (June-December 2000 and April-July 2001) and one rainy period (January-March 2001). These months are the 'common' rainy and dry seasons along the Ecuadorian coasts (CORNEJO, 1999).

MATERIAL AND METHODS

Study site

The beach studied was San Pedro de Manglaralto, an exposed beach on the Ecuadorian Pacific Coast (1°56'30"S, 80°43'30"W) (See map at Chapter III, Figure 3.1). The samples were taken in front of the Centro Nacional de Acuicultura e Investigaciones Marinas (CENAIM). The beach is classified as an intermediate beach (Ω =1.2) but near to the reflective characteristics. The width of the intertidal zone is about 120 m with a Relative Tide Range of 4.2 m.

Sampling strategy and environmental factors

Sampling was done monthly from June 2000 until July 2001 during the spring tides (full moon) at low tide level; two replicates were investigated. Samples were obtained by forcing a hand core (sampling surface area 10 cm^2), to 20 cm depth in the sediment. The samples (except those for sedimentological analyses) were fixed at 60 ºC with a 4% buffered formaldehyde water solution. Hot formaldehyde prevents curling of the nematodes (HEIP *et al.,* 1985; VINCX, 1996).

Temperature Sea Surface Temperature (SST) and salinity data were referred to the nearby 'El Pelado' Oceanographic station (01º 55' 53" S, 80º 46' 55" W), and pluviosity data from the CENAIM-ESPOL (Escuela Superior Politécnica del Litoral) foundation. *In situ* water samples were taken and passed through Whatman GF/C filters (47 mm ϕ, porosity 1.2 μ) for the determination of chlorophyll *a* (Chl *a*) by spectrophotometry (PARSONS *et al.,* 1984), suspended particulate matter (SPM) was measured by weight difference (filters were dried at 60 °C/48h) and particulate organic matter (POM) by subsequently burning filters at 550°C for 2 hours. The concentration unit of water samples was measured in milligrams per litre (mg/l).

At each sampling location the beach profile was measured as the difference in elevation every 5 meters along the transect using a leveller from a fixed reference point (0) localized in front of CENAIM. The distance is used as a proxy for elevation.

Sediment particle-size distribution was determined using Coulter LS 100© particle size analysis equipment. The sediment fractions were defined according to the Wentworth scale (BUCHANAN, 1984).

Laboratory treatment and Nematoda identification

In the laboratory, samples were rinsed with a gentle jet of tap water over a 1 mm sieve to exclude macrofauna, decanted ten times over a 38 µm sieve, centrifuged three times with Ludox® HS 40 (at 1.18 density) and stained with Rose Bengal.

Nematodes were counted under a stereomicroscope and 200 individuals from each replicate were picked out randomly using a stereomicroscope, transferred through ethanol-glycerol solutions and mounted on glass slides (VINCX, 1996). The identification to genus level was done using the pictorial keys of Platt and WARWICK (1983, 1988) and WARWICK *et al.* (1998). The identification up to species was done using the librarian collection of the Marine Biology Section of Ghent University and nematode classification up to family level was based on LORENZEN (1994). The feeding types suggested by WIESER (1953), distinguishing selective (1A) and non-selective deposit feeders (1B), epistratum feeders (2A) and predators/omnivores (2B), linked to buccal cavity, were used to investigate the nematode trophic structure.

Data analysis

The analysis were applied to the nematode densities (ind./10 cm^2) of two replicates per sampling location. The number of species per sample (S), the expected number of species present in a population of 100 individuals (ES (100)), (HULBERT, 1971; SANDERS, 1968), Pielou´s evenness (J'), Simpson Index (1-λ') and Hill´s diversity numbers N_1 and N_{inf} (HILL, 1973) were calculated. Diversity patterns were visualized by k-dominance curves (LAMBSHEAD *et al.*, 1983).

Multivariate analysis was performed using standardised non-transformed data. The nematode species composition was ordinated by non-metric Multi-Dimensional Scaling (nMDS). One-way ANOSIM was used to test the significant differences between the species groups. Similarity percentage analysis (SIMPER) was applied to identify the species primarily providing the discrimination between the groups. The multivariate analysis was realized using PRIMER v5 software package (CLARKE AND GORLEY, 2001).

One-way ANOVA was applied to test differences in density and richness measures between dry and rainy season. The relationship between nematode species and environmental factors was analysed using Pearson product-moment correlation. The normal distribution of the data was checked by the Kolmogorov-Smirnov test. Levene's test was used to verify the homogeneity of variances prior to the analysis. Statistical analysis was performed using the STATISTICA v6 software package (STATSOFT, 2001).

RESULTS

Environmental factors

The SST varied from 21.9 °C (July 2000) to 27.5 °C (March 2001). The salinity of the water ranged between 32.5 PSU (February 2001) and 34 PSU (July 2000). The pluviosity registered the maximum values in January 2001 (150.9 mm) and March 2001 (113.8 mm). The chlorophyll *a* ranged from 1.2 mg/l (November 2000) to 11 mg/l (April 2001). POM varied from 10.5 mg/l (July 2000) to 365.4 mg/l (June 2001), while SPM concentrations varied from 111.8 mg/l (July 2000) to 4686.4 mg/l (June 2001). The ratios Chl *a*/SPM and Chl a/ POM were determined as a value of organic matter quality. The median grain size of the sediment ranged between 191-260 µm, corresponding to fine-medium sand (Table 4.1).

months	Chl *a* (mg/l)	SPM (mg/l)	POM (mg/l)	median grain size (um)	distance (proxy for elevation) (m)	SST (°C)	salinity (PSU)	pluviosity (mm)	Chl *a* /SPM	Chl *a* /POM
J00	-	-	-	245	84.0	23.6	33.8	9.9	-	-
J	3.4	111.8	10.5	212	89.8	22.0	34.0	1.5	0.030	10.7
A	1.8	-	-	219	75.8	22.7	33.9	1.0	-	-
S	2.0	478.4	249.0	244	90.0	22.6	33.9	3.3	0.004	1.9
O	2.9	483.2	23.9	260	102.4	24.0	33.8	3.5	0.006	20.2
N	1.2	1392.4	78.3	223	102.0	22.5	33.9	0.0	0.001	17.8
D	3.5	4368.0	147.7	211	105.3	25.1	33.6	0.0	0.001	29.6
J01	1.6	547.6	31.4	223	92.3	25.3	32.9	150.9	0.003	17.5
F	3.4	1331.2	70.1	238	114.8	27.5	32.5	141.6	0.003	19.0
M	2.9	-	-	241	114.6	27.5	33.8	113.8	-	-
A	11.0	295.7	-	194	118.1	27.4	32.5	21.1	0.037	-
M	-	3467.0	284.9	214	97.2	25.4	33.6	2.2	-	12.2
J	7.1	4686.4	365.4	241	91.6	23.1	33.9	1.9	0.002	12.8
J	4.0	128.8	20.7	191	88.3	22.4	33.9	10.5	0.031	6.2

Table 4.1 Environmental factors.

Nematode species composition, density and diversity

5567 specimens of nematodes were identified, belonging to 37 species, 30 genera and 17 families. Among the 17 families, Xyalidae were most dominant in densities (43%), number of genera (8) and number of species (12) (Table 4.2).

The total density of nematodes was highest in June 2000 (1170±119 ind./10 cm^2) and lowest in April 2001 (359±11 ind./10 cm^2), no significant differences between dry and rainy season were detected. However density fluctuations were observed along the year but with an increasing trend in January 2001 (948±233 ind./10 cm^2) (Figure 4.1).

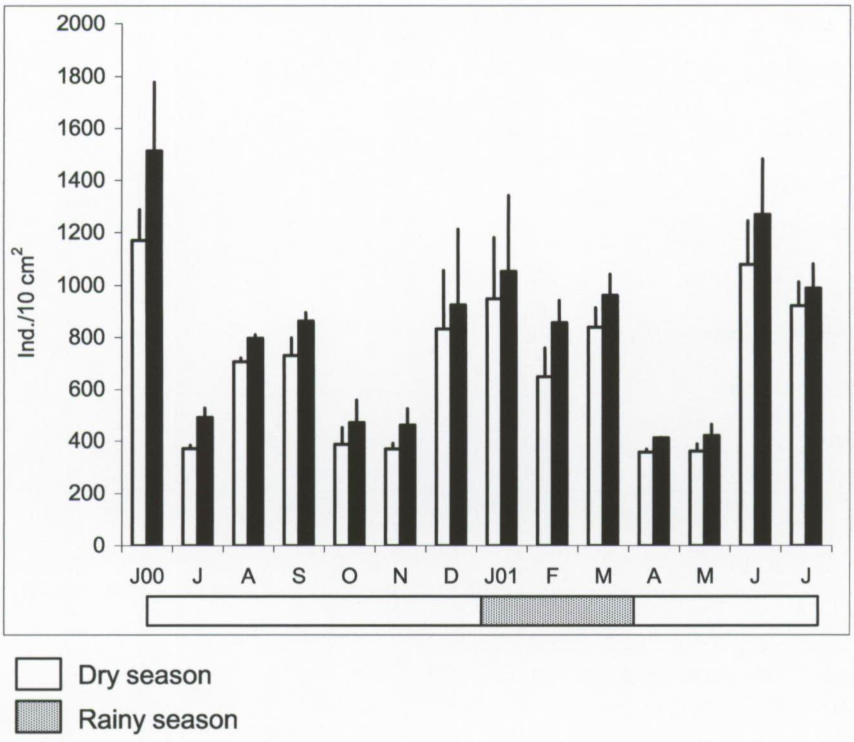

Figure 4.1 **Mean densities and standard errors of the mean (n=2) per month (June 2000-July 2001) for nematode densities (white bars) and total meiobenthic densities (black bars) at San Pedro de Manglaralto beach.**

Family	Percentage of total	Number of genera	Number of species
Xyalidae	42.55	8	12
Ceramonematidae	27.33	2	3
Desmodoridae	11.43	1	1
Cyatholaimidae	4.87	2	3
Axonolaimidae	4.47	1	1
Microlaimidae	3.37	1	1
Oncholaimidae	1.79	1	2
Anticomidae	1.64	1	1
Chromadoridae	0.68	2	2
Tripyloididae	0.62	1	1
Oxystominidae	0.49	1	1
Enchelidiidae	0.28	3	3
Anoplostomatidae	0.18	1	1
Thoracostomopsidae	0.15	1	1
Leptolaimidae	0.10	2	2
Selachinematidae	0.03	1	1
Linhomoeidae	0.03	1	1
TOTAL	100	30	37

Table 4.2 **Overall relative abundance of nematode families collected at San Pedro de Manglaralto beach, listed in descending order of dominance, with indication of the number genera and species found.**

The temporal distribution of the species richness was more or less constant throughout the year; the highest value (21±1 sp.) was registered in April 2001, concomitant with highest Chl *a*, and the lowest (15±3 sp.) in July 2001 (Table 4.3). The evenness and Simpson index expressed as (J') and (1-λ'), respectively, were significantly different ($p<0.05$) between dry and rainy season, being lowest in January 2001, suggesting, together with N_{inf}, a higher dominance of some species (*i.e. Daptonema* sp. 1, *Viscosia* sp. 1).

Months	N	S	J'	ES (100)	1-λ'	N_1	N_{inf}
J	1170 ± 119	17 ± 2	0.86 ± 0.011	14.28 ± 1.25	0.89 ± 0.001	11.03 ± 0.52	5.18 ± 0.41
J	373 ± 12	19 ± 2	0.85 ± 0.002	16.91 ± 1.21	0.89 ± 0.011	12.12 ± 1.00	5.11 ± 0.77
A	706 ± 15	16 ± 0	0.79 ± 0.043	13.32 ± 0.40	0.84 ± 0.035	8.99 ± 1.06	3.38 ± 0.81
S	729 ± 68	18 ± 1	0.76 ± 0.002	13.40 ± 0.63	0.83 ± 0.002	8.71 ± 0.13	2.98 ± 0.05
O	388 ± 64	19 ± 1	0.76 ± 0.016	15.23 ± 0.10	0.84 ± 0.015	9.17 ± 0.25	3.46 ± 0.31
N	371 ± 21	19 ± 2	0.81 ± 0.033	15.90 ± 1.55	0.87 ± 0.023	10.73 ± 1.71	4.17 ± 0.47
D	832 ± 225	18 ± 0	0.86 ± 0.015	15.66 ± 0.12	0.90 ± 0.008	11.96 ± 0.52	6.07 ± 0.72
J	948 ± 233	17 ± 1	0.63 ± 0.071	12.86 ± 1.48	0.70 ± 0.075	6.11 ± 1.43	2.08 ± 0.36
F	650 ± 109	18 ± 1	0.75 ± 0.077	13.88 ± 0.54	0.82 ± 0.067	8.74 ± 2.08	3.68 ± 1.48
M	838 ± 76	19 ± 1	0.75 ± 0.021	14.74 ± 0.33	0.83 ± 0.026	9.02 ± 0.72	3.60 ± 0.85
A	359 ± 11	21 ± 1	0.72 ± 0.055	17.15 ± 1.33	0.81 ± 0.059	9.28 ± 1.84	2.96 ± 0.85
M	362 ± 27	17 ± 1	0.76 ± 0.009	13.25 ± 0.55	0.86 ± 0.002	8.66 ± 0.16	4.48 ± 0.04
J	1078 ± 166	18 ± 1	0.79 ± 0.024	14.27 ± 1.20	0.86 ± 0.007	9.75 ± 0.89	3.87 ± 0.26
J	921 ± 92	15 ± 3	0.65 ± 0.032	11.70 ± 2.60	0.72 ± 0.037	5.92 ± 1.26	2.11 ± 0.13

Table 4.3 **Species number (N), species richness (S), Evenness (J'), expected number of species present in 100 individuals ES (100), Shannon diversity (H'), Simpson Index (1-λ') and Hill's number (N_{inf}) from each sample. Data are represented as means and standard errors of the mean (n= 2 replicates).**

Temporal variability of the nematode species

The variation of the relative composition of the Nematode species over the sampling year is given in the figure 4.2. Also the list of the nematode species recorded at the lower station and their corresponded densities are given in the table 4.4.

Some species have a limited distribution in time, such as *Camacolaimus* sp., *Ditlevsenella* sp. and *Metadesmolaimus* sp. 2; they are restricted to January-February 2001, February-April 2001 and March-July 2001 respectively (Table 4.4).

The results of ANOVA analysis for differences between seasons for nematode densities are given in the table 4.5. There were no significant differences between rainy and dry seasons, concerning nematode species density recorded, except to *Daptonema* sp. 1, (ANOVA, $p<0.01$).

The temporal variability of the 12 dominant species is showed in the figure 4.3. Several of the most of the dominant species, registered the highest densities between June (2000, 2001) and August 2000. *Ceramonema* sp. 1 had higher relative density (19%) on the overall nematode composition, the highest densities occurred in June (2000 and 2001) and July (2000 and 2001), followed by a decline of the density; the densities remained constant along the sampling year, but a decrease in early rainy season was observed. Similar pattern of density fluctuations were found in *Ceramonema* sp. 2, which represented 8% of the total nematode density, with the highest densities in June (2000 and 2001) and the lowest in January 2001.

Daptonema sp. 1 represented 13% of the total nematode species. The temporal variation of this species is different from *Ceramonema* species. Indeed opposite trends were observed: the highest values were obtained in January 2001 and March 2001 (rainy season), followed by a subsequent density decline; the lowest densities being attained in dry season (May-December 2001).

The third most abundant species was *Rhynchonema* cf. *hirsutum* (12%). There is not a clear trend in the densities occurred along the year; the densities increased from June 2000 until September 2000, where the maximum densities occurred; followed by a decline until November 2000, increasing again between December 2000 and February 2001, followed by a great reduction.

The temporal patterns of *Metachromadora* cf. *gerlachi*, comprised 11% of the total nematode densities; *Metadesmolaimus* sp. 1 and *Gonionchus ecuadoriensis* sp. n., each one comprising 5% of the total nematode densities, were similar. The highest densities occurred between June (2000, 2001) and August 2000 followed by a sharp decline.

The densities of *Parodontophora* sp. 1 (5%), showed a subsequently density increase from June 2000 until March 2001, the maximum densities being reached in May 2001.

The temporal patterns observed in *Paracyatholaimus* sp. 1 (4%) and *Omicronema* sp. 1 (2%) were similar; the highest densities were registered in June 2000 and August 2000 respectively, followed by density fluctuations to increase again in June and July 2001, nevertheless the densities of *Omicronema* sp. 1 disappeared in July 2001.

Microlaimus sp. represented 4% of the total nematode species and registered very low densities between June 2000 and February 2001. However, in March 2001 the densities increased and remained constant until July 2001.

Viscosia sp. 1 represented 2% of the total nematode species. The temporal variation of this species is similar to the trends observed in *Daptonema* sp. 1 species: the highest values were obtained in January 2001, followed by a subsequent density decline until May 2001, and increase again in June and July 2001.

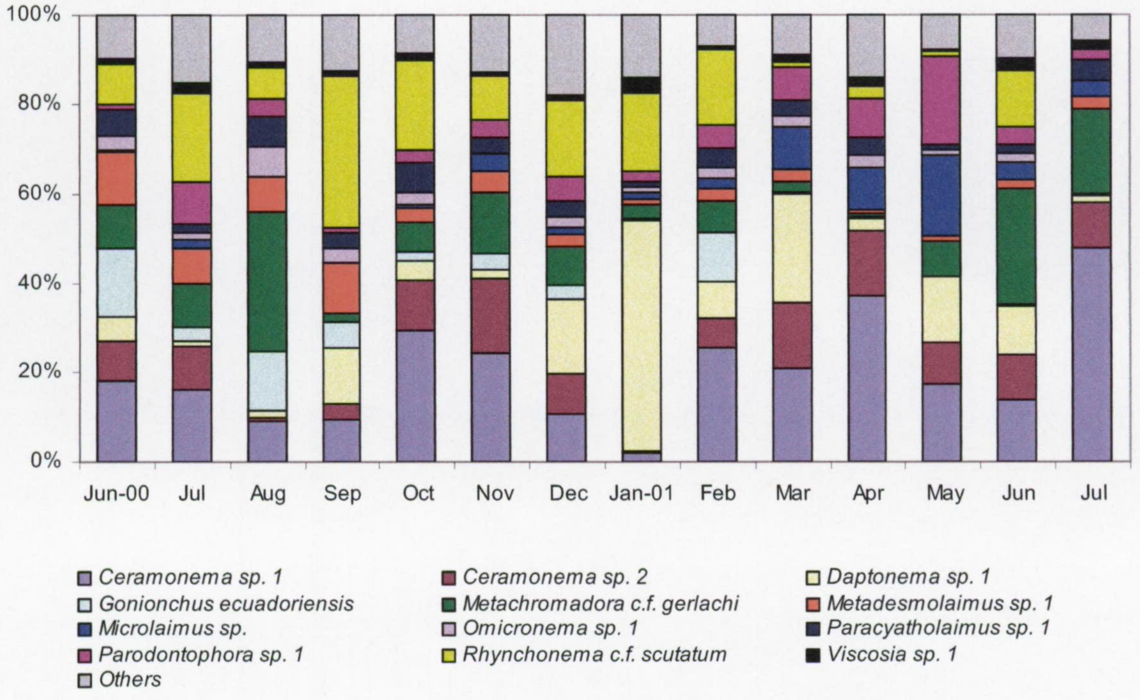

Figure 4.2 **Monthly variation of the relative composition of Nematode species at the lower station in San Pedro de Manglaralto beach (June 2000-July 2001).**

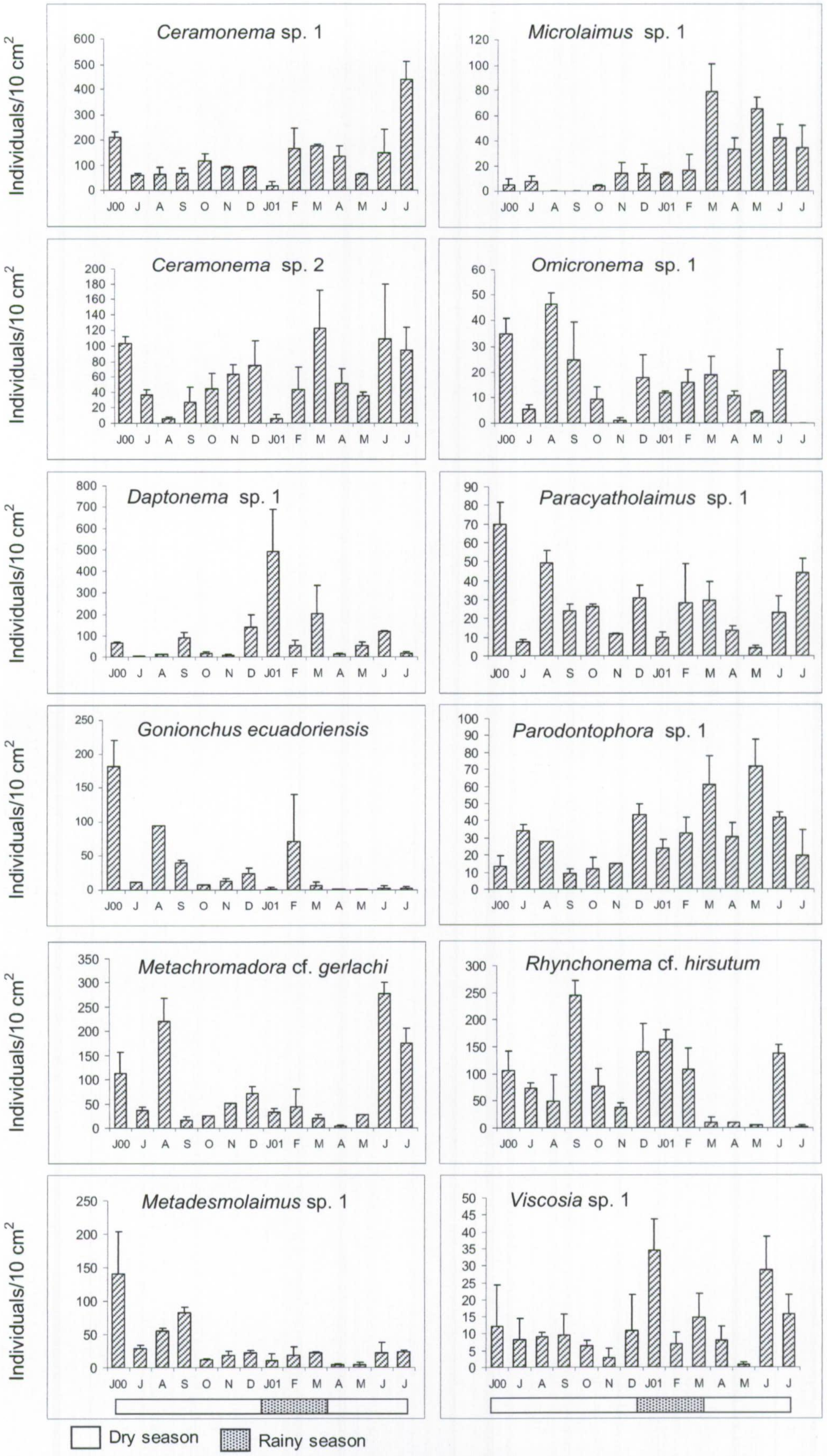

Figure 4.3 **Mean densities and standard errors (n=2) per month (June 2000-July 2001) of the 12 dominant Nematoda genera at San Pedro de Manglaralto.**

Nematode species:	type	%	Jun-00	Jul	Aug	Sep	Oct	Nov	Dec	Jan-01	Feb	Mar	Apr	May	Jun	Jul
			Av SE	Av SE	Av SE	Av SE	Av SE	Av SE	Av SE	Av SE	Av SE	Av SE	Av SE	Av SE	Av SE	Av SE
Anoplostoma sp.	1B	0.18	0 ± 0	3 ± 3	0 ± 0	2 ± 2	0 ± 0	0 ± 0	0 ± 0	5 ± 1	0 ± 0	0 ± 0	0 ± 0	0 ± 0	8 ± 2	0 ± 0
Bathylaimus sp.	1B	0.62	0 ± 0	0 ± 0	9 ± 5	2 ± 2	0 ± 0	0 ± 0	0 ± 0	34 ± 34	0 ± 0	4 ± 4	5 ± 5	1 ± 1	0 ± 0	4 ± 4
Camacolaimus sp.	2A	0.05	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	3 ± 3	2 ± 2	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
**Ceramonema* sp. 1	1A	18.91	211 ± 20	60 ± 7	64 ± 26	67 ± 20	115 ± 29	90 ± 5	90 ± 6	18 ± 18	165 ± 81	175 ± 8	134 ± 42	62 ± 4	148 ± 96	440 ± 71
Ceramonema sp. 2	1A	8.40	104 ± 9	36 ± 7	6 ± 2	27 ± 20	44 ± 21	64 ± 12	75 ± 32	5 ± 5	43 ± 29	123 ± 48	52 ± 19	35 ± 5	109 ± 71	94 ± 30
Cobbia sp.	2A	0.03	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	3 ± 3	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Daptonema sp.	1B	0.14	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	2 ± 2	0 ± 0	8 ± 4	0 ± 0	0 ± 0	0 ± 0	0 ± 0	3 ± 3	0 ± 0
Daptonema sp. 1	1B	13.21	65 ± 4	5 ± 1	11 ± 1	92 ± 22	16 ± 10	7 ± 5	140 ± 57	490 ± 197	55 ± 22	203 ± 129	11 ± 4	53 ± 18	121 ± 1	15 ± 10
Daptonema sp. 2	1B	0.64	2 ± 2	7 ± 1	3 ± 3	4 ± 0	1 ± 1	3 ± 3	9 ± 3	18 ± 11	0 ± 0	0 ± 0	4 ± 2	3 ± 3	2 ± 2	6 ± 6
Daptonema sp. 3	1B	0.37	20 ± 20	3 ± 3	0 ± 0	14 ± 14	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Dasynemoides sp.	1A	0.02	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	1 ± 1	1 ± 1	0 ± 0	0 ± 0
Dichromadora sp.	2A	0.03	0 ± 0	0 ± 0	2 ± 2	0 ± 0	0 ± 0	1 ± 1	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Ditlevsenella sp.	2B	0.11	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	3 ± 0	6 ± 2	1 ± 1	0 ± 0	0 ± 0	0 ± 0
Enoplolaimus sp.	2B	0.15	0 ± 0	1 ± 1	0 ± 0	2 ± 2	1 ± 1	0 ± 0	0 ± 0	2 ± 2	0 ± 0	2 ± 2	2 ± 2	0 ± 0	5 ± 5	0 ± 0
Eumorpholaimus sp.	1B	0.03	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	3 ± 1	0 ± 0	0 ± 0	0 ± 0
Eurystomina sp.	2B	0.07	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	2 ± 2	3 ± 3	0 ± 0	2 ± 2	0 ± 0
**Gonionchus ecuadoriensis*	2A	4.72	181 ± 39	11 ± 1	94 ± 0	40 ± 3	8 ± 1	13 ± 4	25 ± 7	2 ± 2	71 ± 69	6 ± 6	1 ± 1	1 ± 1	3 ± 3	3 ± 3
Halalaimus sp.	1A	0.49	3 ± 3	0 ± 0	2 ± 2	2 ± 2	2 ± 0	5 ± 3	10 ± 1	2 ± 2	1 ± 1	2 ± 2	6 ± 1	4 ± 2	6 ± 6	2 ± 2
Leptolaimus sp.	1A	0.05	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	3 ± 3	0 ± 0	0 ± 0	0 ± 0	2 ± 2	0 ± 0	0 ± 0	0 ± 0
Metachromadora cf. *gerlachi*	2B	11.43	112 ± 44	36 ± 7	220 ± 48	16 ± 8	26 ± 0	50 ± 1	72 ± 13	32 ± 7	44 ± 36	20 ± 7	3 ± 3	28 ± 0	277 ± 24	174 ± 32
Metadesmolaimus sp. 1	1B	4.79	141 ± 63	29 ± 4	55 ± 4	82 ± 8	12 ± 1	18 ± 7	23 ± 4	11 ± 11	18 ± 13	23 ± 1	4 ± 2	4 ± 3	22 ± 16	23 ± 3
Metadesmolaimus sp. 2	1B	0.68	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	14 ± 1	15 ± 1	15 ± 4	13 ± 6	9 ± 4
Microlaimus sp.	2A	3.37	5 ± 5	8 ± 4	0 ± 0	0 ± 0	4 ± 1	14 ± 9	14 ± 8	13 ± 1	16 ± 12	79 ± 22	33 ± 9	65 ± 9	42 ± 10	34 ± 17
Neochromadora sp.	2A	0.65	2 ± 2	7 ± 2	0 ± 0	4 ± 0	1 ± 1	1 ± 1	17 ± 5	0 ± 0	0 ± 0	24 ± 24	1 ± 1	1 ± 1	5 ± 5	0 ± 0
Odontanticoma sp. 1	2A	1.64	43 ± 18	8 ± 1	40 ± 5	2 ± 2	10 ± 4	12 ± 1	12 ± 9	3 ± 3	15 ± 13	8 ± 8	4 ± 0	0 ± 0	0 ± 0	2 ± 2
Omicronema sp. 1	1B	2.28	35 ± 6	6 ± 2	46 ± 4	25 ± 15	9 ± 5	1 ± 1	18 ± 9	12 ± 1	16 ± 5	19 ± 7	11 ± 2	4 ± 0	21 ± 8	0 ± 0
Paracyatholaimus sp. 1	2A	3.83	70 ± 11	7 ± 2	49 ± 6	24 ± 4	26 ± 2	12 ± 1	31 ± 6	10 ± 3	28 ± 21	29 ± 10	13 ± 2	4 ± 1	23 ± 9	44 ± 8
Paracyatholaimus sp. 2	2A	0.63	18 ± 9	2 ± 2	3 ± 3	2 ± 2	3 ± 2	3 ± 1	5 ± 5	0 ± 0	10 ± 4	4 ± 4	2 ± 2	2 ± 2	0 ± 0	6 ± 6
Paramonohystera sp.	1B	3.70	23 ± 4	21 ± 1	8 ± 8	59 ± 12	13 ± 3	13 ± 2	92 ± 31	56 ± 19	10 ± 0	2 ± 2	2 ± 2	2 ± 0	60 ± 21	0 ± 0
Pareurystomina sp.	2B	0.10	0 ± 0	0 ± 0	0 ± 0	0 ± 0	1 ± 1	2 ± 2	2 ± 2	0 ± 0	0 ± 0	2 ± 2	1 ± 1	0 ± 0	0 ± 0	2 ± 2
Parodontophora sp. 1	1B	4.47	13 ± 6	34 ± 3	28 ± 0	9 ± 3	12 ± 7	15 ± 0	43 ± 6	24 ± 5	33 ± 9	61 ± 17	31 ± 8	72 ± 16	42 ± 3	20 ± 15
Pomponema sp.	2B	0.41	0 ± 0	3 ± 3	6 ± 2	0 ± 0	1 ± 1	3 ± 3	0 ± 0	0 ± 0	0 ± 0	4 ± 0	0 ± 0	1 ± 1	0 ± 0	22 ± 9
Pseudosteineria sp.	1B	0.03	3 ± 3	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
**Rhynchonema* cf. *hirsutum*	1B	11.95	105 ± 37	74 ± 9	49 ± 49	245 ± 27	77 ± 32	37 ± 9	141 ± 51	163 ± 18	108 ± 38	10 ± 10	10 ± 1	4 ± 0	137 ± 17	2 ± 2
Synonchiella sp.	2B	0.03	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	3 ± 3	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0
Viscosia sp. 1	2B	1.74	12 ± 12	8 ± 6	9 ± 1	10 ± 6	6 ± 2	3 ± 3	11 ± 11	34 ± 9	7 ± 3	15 ± 7	8 ± 4	1 ± 1	29 ± 10	16 ± 6
Viscosia sp. 2	2B	0.05	0 ± 0	2 ± 2	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0	3 ± 3	0 ± 0	0 ± 0	0 ± 0	0 ± 0	0 ± 0

* Descriptions in Chapter VI

Table 4.4 Nematode densities (ind./10 cm^2) at the lower station in San Pedro de Manglaralto, from June 2000 to July 2001.

No significant differences between the relative abundance of the 4 feeding types were found between dry and rainy season (Table 4.5). On a yearly basis, non-selective deposit feeders are the most dominant (average of 43%), but with highly fluctuating patterns. The relative composition (Figure 4.4) of the nematode trophic structure ranged from 0% to 63% (January 2001 and July 2001 respectively) for selective deposit feeders (1A), 4-90% (July 2001 and January 2001 respectively) for non-selective deposit feeders (1B), 3-31% (January 2001 and June 2000 respectively) for epistrate feeders (2A) and 3-41% (September 2000 and August 2000) in predators/omnivores (2B).

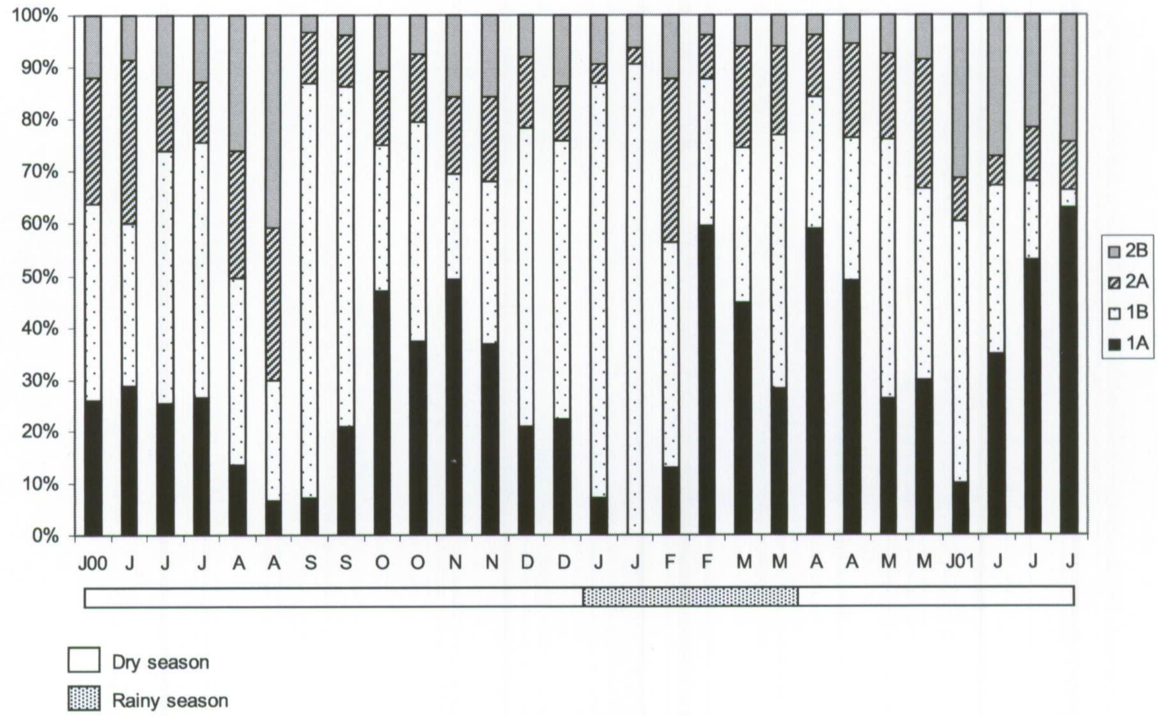

Figure 4.4 **Nematode feeding types according to Wieser (1953) at San Pedro de Manglaralto beach.**

	f-value	**p-value**
Ceramonema sp. 1	0,0179	0,8946
Ceramonema sp. 2	1,4004	0,2474
Daptonema sp. 1	9,7797	0,0043 *
Gonionchus ecuadoriensis sp. n.	0,0015	0,9690
Metachromadora cf. *gerlachi*	1,1865	0,2860
Metadesmolaimus sp. 1	2,2134	0,1488
Microlaimus sp.	2,6584	0,1151
Omicronema sp. 1	0,8164	0,3745
Paracyatholaimus sp. 1	0,0788	0,7811
Paramonohystera sp.	0,0485	0,8273
Parodontophora sp. 1	0,0042	0,9487
Rhynchonema c.f *hirsutum*	0,0146	0,9049
Viscosia sp. 1	1,5997	0,2172
Number of species (S)	0,0003	0,9866
Evenness (J')	4,8710	0,0363 *
ES(100)	0,8301	0,3706
Simpson index (1-λ')	4,2735	0,0488 *
N_1	3,2847	0,0815
Ninf	2,1074	0,1585
Selective deposit feeders (1A)	0,5478	0,4659
Non-selective deposit feeders (1B)	2,8423	0,1038
Epistratum feeders (2A)	0,2063	0,6534
Predators/omnivores (2B)	3,1128	0,0894

Table 4.5 **Results of one-way ANOVA fro mean univariate indices. F-values and p-values are reported (p<0.05* - significant).**

Assemblage structure

The results of the nMDS-analysis (Figure 4.5) and Cluster (not shown) divided the total nematode community into three different sample groups based on species composition, reflecting the seasonal periods (wet and dry): group (I) species registered at the period corresponding to June-December 2000; February (replicate 1) and June 2001 group (II) the nematode species registered in January 2000 (maximum rainfall) and group (III) species at the period February-May 2001 and July 2001. The MDS-ordination showed a considerable degree of similarity and low stress value (0.13), indicating a good and useful 2-D representation of the groups.

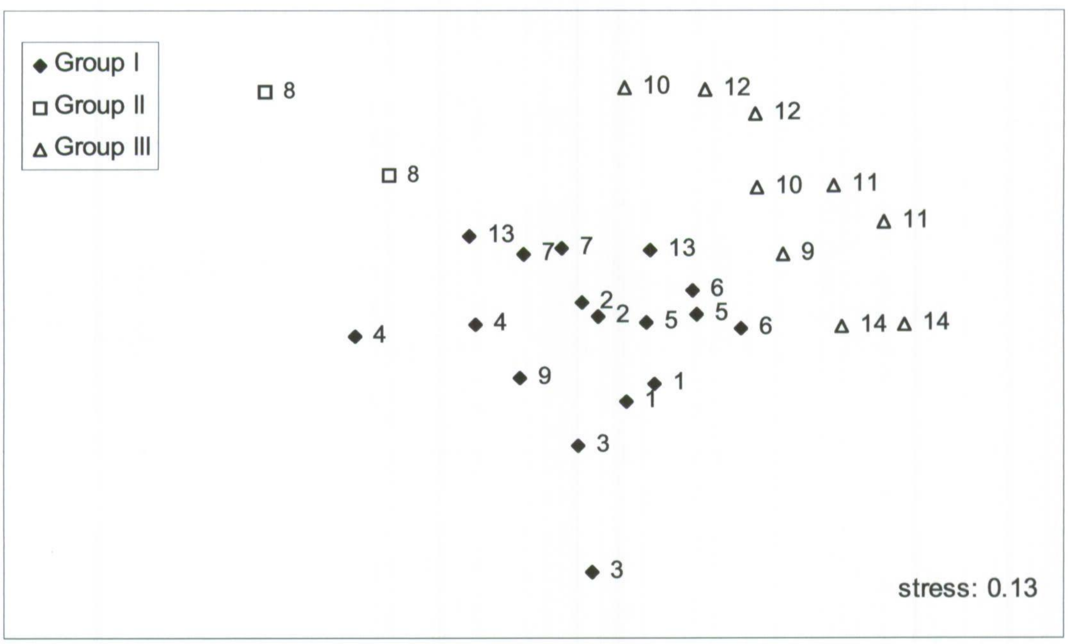

Figure 4.5 **Nematode assemblages: Output of non-metric Multi-Dimensional Scaling (nMDS) on standardised untransformed species abundance data (all replicates) with indication of the three sample groups. Numbers indicated the monthly sampling in a chronological order from June 2000 to July 2001.**

One-way ANOSIM results (Table 4.6) indicated that the composition of the nematode assemblages differed significantly between the three sample groups. The average dissimilarity between sample groups was 61%. The SIMPER analysis indicated a strong dissimilarity between the species groups II and III (71%). These significant differences were largely the result of high abundances of *Daptonema* sp. 1 (490±197 ind./10 cm^2), *Rhynchonema* cf. *hirsutum* (163±18 ind./10 cm^2), and *Paramonohystera* sp. (56±19 ind./10 cm^2) in group II; while *Ceramonema* sp. 1 (208±50 ind./10 cm^2), *Ceramonema* sp. 2 (75±15 ind./10 cm^2), *Metachromadora* cf. *gerlachi* (51±24 ind./10 cm^2), *Microlaimus* sp. (50±9 ind./10 cm^2), *Parodontophora* sp. 1 (43±9 ind./10 cm^2) and *Paracyatholaimus* sp. 1 (21±6 ind./10 cm^2) were abundant in group III.

	Nematode community structure		
	Dissimilarity	R-value	p-value
Global test	61%	0.668	0.001
Groups compared			
I>II	59%	0.761	0.012
I>III	53%	0.617	0.001
II>III	71%	0.934	0.018

Table 4.6 **Results of the ANOSIM and pair-wise tests for difference on nematode community structure between species groups of San Pedro de Manglaralto beach. Dissimilarities as calculated by SIMPER-analyses. (Analyses performed on standardise no transformed data).**

This is also clear from the SIMPER-lists, showing the percentages and feeding type of the dominant species for each sample groups (Table 4.7).

Figure 4.6 clearly indicated that the curve of species group I (June-December 2000) situated at the lower position, as the most diverse and the curve of species group II (January 2001) situated at the upper position as the lowest diverse. As these *k*-dominance curves are based on an unequal number of dates per sample groups, this can lead to a misleading interpretation. However, calculation of individual *k*-dominance curves per date (Figure 4.7) indicated the same patterns (*i.e.* January 2001: lowest diversity, highest dominance; June 2000: lowest dominance, highest diversity).

Analysis of the feeding types showed the dominance of non-selective deposit feeders (1B) in the group I and II and the selective deposit feeders (1A) dominated the group III (Figure 4.8).

Species Group I		
Ceramonema sp. 1	19 %	1A
Rhynchonema cf. *hirsutum*	18 %	1B
Metachromadora cf. *gerlachi*	13 %	2B
Ceramonema sp. 2	8 %	1A
Metadesmolaimus sp. 1	7 %	1B
Daptonema sp. 1	6 %	1B
Paracyatholaimus sp. 1	5 %	2A
Gonionchus ecuadoriensis sp. n.	5 %	2A
Paramonohystera sp.	5 %	1B
Parodontophora sp. 1	4 %	1B

Species Group II		
Daptonema sp. 1	56 %	1B
Rhynchonema cf. *hirsutum*	21 %	1B
Paramonohystera sp.	7 %	1B
Viscosia sp. 1	5 %	2B
Metachromadora cf. *gerlachi*	3 %	2B

Species Group III		
Ceramonema sp. 1	40 %	1A
Ceramonema sp. 2	16 %	1A
Microlaimus sp.	10 %	2A
Parodontophora sp. 1	8 %	1B
Daptonema sp. 1	7 %	1B
Metachromadora cf. *gerlachi*	4 %	2B
Paracyatholaimus sp. 1	3 %	2A
Metadesmolaimus sp. 2	2 %	1B

Table 4.7 SIMPER-lists, showing the contribution percentages for each sample groups and their feeding strategy according Wieser (1953).

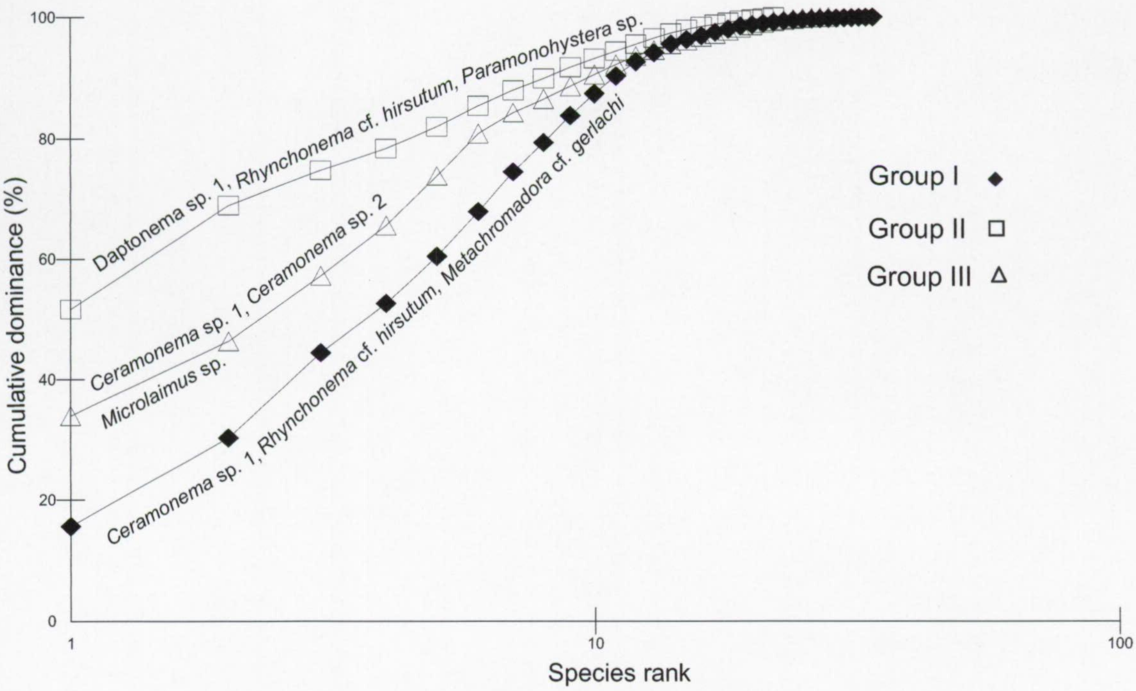

Figure 4.6 ***K*-dominance curves for nematode sample groups, with indication of the three most dominant species.**

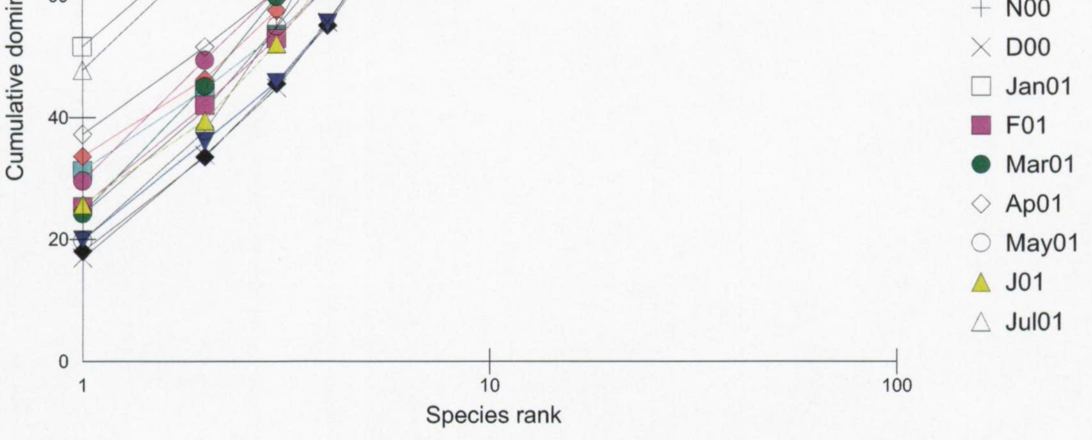

Figure 4.7 ***K*-dominance curves for nematode species per month.**

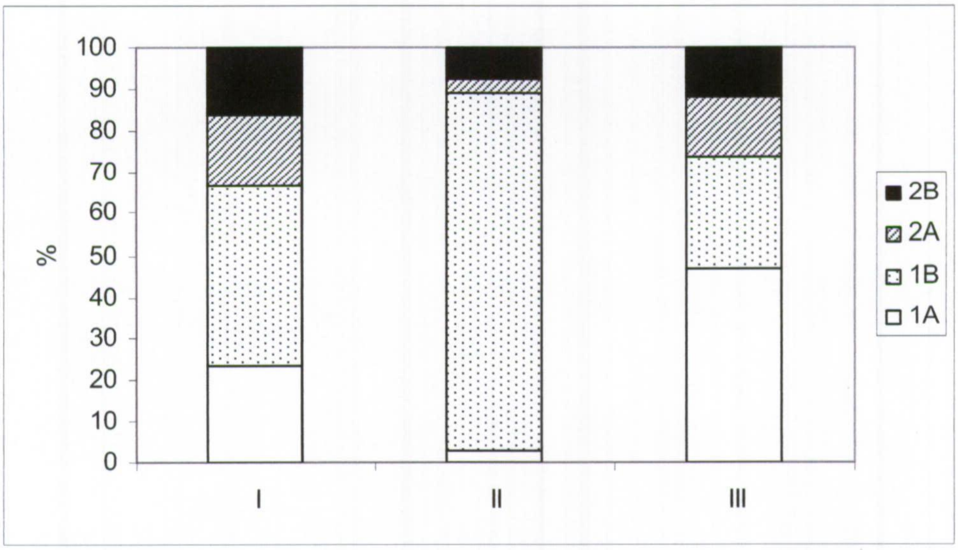

Figure 4.8 **Nematodes feeding types according Wieser (1953) at San Pedro de Manglaralto for sample groups (I= June-December 2000, June 2001; II= January 2001; III= February-May 2001 and July 2001).**

Relationship between nematode (density, diversity indices, trophic group) and environmental factors

Table 4.8 shows the results of the correlation analysis between dominant nematode species and environmental factors. Significant correlations were found between *Parodontophora* sp. 1 and SPM, *Microlaimus* sp. 1 with POM and SST. *Rhynchonema* cf. *hirsutum* with median grain size, between *Metachromadora* cf. *gerlachi* and distance and *Daptonema* sp. 1 with pluviosity. The relationship between *Daptonema* sp. 1 and pluviosity is showed in the figure 4.9.

The residual values were obtained from the nematode species densities and the distance (as a proxy for elevation). The nematode species residual values were correlated with the pluviosity. No relationships were found.

The ANOVA results showed significant differences between dry and rainy season, concerning densities of *Daptonema* sp. 1 ($p<0.01$). The number of species was positive correlated with distance indicating higher number of species lowest on the beach. The eveness, Simpson index and Hill's number (N_1) decreased when the pluviosity increased.

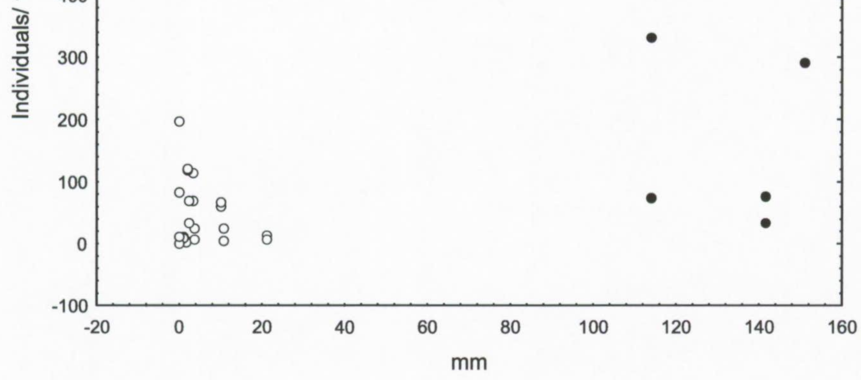

Figure 4.9 **Relationship between *Daptonema* sp. 1 and pluviosity; the sampling of the dry and the rainy season are indicated separately.**

		Chl *a*	SPM	POM	median grain size	distance (proxy for elevation)	SST	Salinity	Pluviosity	Chl *a* / SPM	Chl *a* / POM
Nematode species	*Ceramonema* sp. 1	0.21	-0.16	-0.18	-0.22	-0.01	-0.06	0.11	-0.05	0.42	0.27
	Ceramonema sp. 2	0.23	0.34	0.21	0.09	0.18	0.07	0.21	-0.07	0.08	0.00
	Daptonema sp. 1	-0.21	0.07	-0.02	0.11	0.02	0.27	-0.25	**0.60**	-0.33	-0.26
	Gonionchus ecuadoriensis sp. n.	-0.28	-0.02	-0.03	0.29	-0.37	-0.12	0.06	-0.05	-0.22	-0.15
	Metachromadora cf. *gerlachi*	0.09	**0.48**	0.40	-0.05	**-0.56**	**-0.45**	0.37	-0.30	-0.04	-0.01
	Metadesmolaimus sp. 1	-0.37	-0.15	0.23	0.32	**-0.48**	-0.33	0.32	-0.21	-0.10	-0.03
	Microlaimus sp.	0.32	**0.44**	**0.49**	-0.15	**0.39**	**0.46**	-0.05	0.20	0.04	-0.22
	Omicronema sp. 1	-0.11	0.26	0.41	0.32	**-0.38**	-0.06	0.11	-0.04	-0.30	-0.35
	Paracyatholaimus sp. 1	-0.14	0.01	-0.11	0.18	-0.37	-0.16	0.24	-0.12	0.06	0.04
	Paramonohystera sp.	-0.10	**0.46**	0.32	0.14	-0.13	-0.15	0.08	-0.05	**-0.43**	-0.32
	Parodontophora sp. 1	0.23	**0.61**	**0.45**	-0.18	0.29	**0.44**	-0.08	0.14	-0.14	-0.16
	Rhynchonema cf. *hirsutum*	-0.25	0.11	0.26	**0.42**	-0.22	-0.19	0.00	0.10	**-0.46**	-0.31
	Viscosia sp. 1	0.05	0.10	0.07	0.05	-0.18	-0.01	-0.08	0.34	-0.07	-0.04
Diversity index	S	0.40	-0.09	-0.04	-0.01	**0.51**	0.30	-0.28	0.00	0.21	0.05
	J'	-0.05	0.41	0.23	0.22	-0.10	-0.23	0.37	**-0.46**	-0.17	0.03
	ES (100)	0.32	-0.02	-0.12	-0.03	**0.38**	0.11	-0.09	-0.19	0.23	0.21
	$1-\lambda'$	0.00	0.41	0.31	0.25	0.01	-0.15	0.33	**-0.45**	-0.21	-0.04
	N_1	0.06	0.30	0.11	0.13	0.06	-0.14	0.23	**-0.38**	-0.05	0.10
	N_{inf}	-0.05	**0.51**	0.18	0.09	0.03	-0.07	0.24	-0.33	-0.22	0.01
Trophic	1A	0.25	-0.02	-0.08	-0.15	0.06	-0.01	0.15	-0.06	0.36	0.21
	1B	-0.22	0.27	0.27	0.26	**-0.39**	-0.13	0.04	0.26	-0.40	-0.31
	2A	-0.17	0.24	0.10	0.25	-0.25	0.03	0.13	0.00	-0.16	-0.17
	2B	0.21	**0.50**	0.34	-0.22	0.18	0.37	-0.08	0.34	0.00	-0.04

Table 4.8 Pearson's correlation values between nematode species density, diversity indices and trophic group with environmental factors (significant correlation in bold numbers).

DISCUSSION

The few quantitative studies on the nematode species composition of sandy beaches use different sampling and extraction techniques and moreover, sandy beaches can be very different from a hydrodynamical point of view (e.g. tidal regime and exposure) reflected in different beach morphodynamics (GOURBAULT AND WARWICK, 1994). Nematode densities reported from two microtidal intermediate beach in Italy (Mediterranean coast) (130-2001 ind./10 cm^2) and Poland (Baltic coast) (102-120 ind./10 cm^2), (GHESKIERE *et al.*, 2005) and from a macrotidal ultradissipative beach in Belgium (North Sea coast) (320-2784 ind./10 cm^2) (GHESKIERE *et al.*, 2004) are very different. The temporal variability in nematode densities of this mesotidal intermediate Ecuadorian beach (359-1170 ind./10 cm^2) is within the range of the nematode densities of the North Sea and Mediterranean coast. The maximum value in Ecuador is however 50% lower in densities than the ones in the study of GHESKIERE *et al.* (2004, 2005) (Italy and North Sea), but *ca.* 90% higher compared to the Baltic coast.

The temporal variability of free-living marine nematode species has only been studied in detail along two Canadian Pacific beaches (SHARMA AND WEBSTER, 1983), the Caribbean island of Guadeloupe (GOURBAULT *et al.,* 1998) and one beach on the south coast of New South Wales, Australia (NICHOLAS AND HODDA, 1999).

SHARMA AND WEBSTER (1983) found significantly more species occurred in the summer than in the winter season. The temporal variability of the species registered at Belcarra Park and at Iona Island, showed different patterns. The highest densities of *Sabatieria pulchra*, a dominant species at Iona Island occurred during the autumn months (October and December), whereas at the other site, the highest densities of the nematodes were registered during May, concomitant with the highest carbon content. GOURBAULT *et al.* (1998) found that the nematode generic composition was highly variable at the more wave-exposed locations, but less at the sheltered sites. The nematode composition was affected by the grain size. No temporal patterns were detected among the 23 beaches studied. NICHOLAS AND HODDA (1999) found significant differences between the nematode densities at the different tide level sampled, with density decreased at the low tide level; however no significant differences in diversity between the tide levels or times of sampling (summer and winter) were detected.

A total of 37 species belonging to 30 genera were registered at the Ecuadorian beach; while in Australia (NICHOLAS AND HODDA, 1999) 58 species belong 48 genera were found and 122 species belonging to 112 genera at Guadeloupe island (GOURBAULT *et al.*, 1998). The dominance of Xyalidae (43%) in our study (with 12 species) is comparable with the dominance of Xyalidae (21%) in Australia (NICHOLAS AND HODDA, 1999) with 11 species registered and GHESKIERE *et al.* (2004) also found that Xyalidae was the dominant in densities (30%) with 20 species at the Panne beach in Belgium.

The *k*-dominance curves for the temporal variation did not show a trend at the different stations in the tropical beaches of Guadeloupe (GOURBAULT *et al.*, 1998). In contrast, the Ecuadorian beach showed lowest diversity and highest dominance during the month with the highest pluviosity (January).

SHARMA AND WEBSTER (1983) found that the dominant species at one Canadian beach were non-selective deposit feeders and epigrowth feeders, while at the other beach a more even distribution of feeding groups was found. At the Ecuadorian beach the non-selective deposit feeders were dominant although with fluctuating values (16-91%).

Although no significant differences in the total nematode densities and species richness between dry and rainy season were detected, some species had a limited distribution in time such as *Camacolaimus* sp., *Ditlevsenella* sp. and *Metadesmolaimus* sp. 2, which were only registered in January and February (rainy season). In contrast, *Linhomoeus undulatus*, *Desmolaimus zeelandicus* and *Eleutherolaimus stenosoma* were recorded mostly during spring months at the Canadian beaches and significantly more species occurred in summer (August) than the winter (December and February). At a Belgian sandy beach (GHESKIERE *et al.*, 2004) non-selective deposit feeders were dominant along the beach profile (upper to lower).

Three nematode sample groups were found in our study, reflecting seasonal periods. Group I (June-December) is characterized by a high dominance of *Ceramonema* sp. 1 (19%), *Rhynchonema* cf. *hirsutum* (18%) and *Metachromadora* cf. *gerlachi* (13%). In group II (January), the non-selective deposit feeder *Daptonema* sp. 1 was dominant (56%). Group III (February-May) was characterized by the dominance of *Ceramonema* sp. 1 and *Ceramonema* sp. 2, which represented 40% and 16%, respectively, of the total nematode fauna of the group. While, GOURBAULT *et al.* (1988) found two genera groups related with the median grain size (finer and coarser sand).

In our study, *Daptonema* sp. 1 and *Viscosia* sp. 1, registered highest densities in January 2001; nevertheless only in *Daptonema* sp. 1 significant differences between dry and rainy season were detected. Both species follows the pluviosity fluctuations, and the period also characterized by lowest salinity and an increase of SST (Table

4.1). The abilities of free-living species of nematodes to survive short term salinity fluctuations were investigated by FORSTER (1998) in two sites on the east coast of England; throughout the year the salinity ranges between 33 and 35 PSU. *Axonolaimus paraspinosus* and *Cervonema tenuicauda* from the upper intertidal zone; *Daptonema oxycerca* from lower intertidal zone and *Sabatieria punctata* from subtidal zone, were studied to assess their ability to osmoregulate under various conditions (3.3, 16.6, 33.3 and 66.6 PSU) of osmotic stress. The results demonstrated that all species were able, to differing extents, to regulate water content. In general, in hypotonic solutions, an initial influx or loss of water was followed by a gradual recovery to water content values approaching those of nematodes in 33.3 PSU. However specific differences in the rate and efficiency of osmoregulation were distinct ranged from no change in body diameter content (*A. paraspinosus*; hypotonic solutions) to extreme expansion and rupture of the cuticle (*D. oxycerca*; hypotonic solutions). The species from the upper shore demonstrated the greatest capacity to osmoregulate and/or tolerate periods of raised body water content. Those results suggested that ability to overcome salinity fluctuations is a factor in determining horizontal distribution of nematode assemblages in littoral habitats. It would be expected that species found at the upper intertidal sites will be able to tolerate osmotic changes and resist the effects of the associated stress more effectively than species from lower intertidal or subtidal sites. In the natural environment, loss of motility during periods of osmotic stress will result in the cessation of normal activities such as feeding. This may be an important negative selection factor for it will undoubtedly have an effect on the long term survival of nematode species in intertidal habitats.

The presence of El Niño and La Niña events in the Ecuadorian coast causes fluctuating climatic conditions, which can have an effect on the meiofauna composition, but more studies will be necessary to compare the temporal patterns under normal and anomalous conditions. The nematode *Daptonema* sp. 1 could be studied as an indicator of the pluviosity fluctuations at the Ecuadorian coast. Nevertheless, the species that occur in estuary habitats are well adapted, not only to low or high salinities, but especially to fluctuations (HEIP *et al.*, 1985). The nematode species community along the Ecuadorian beach is more like an 'estuarine' community (with dominance of *Daptonema*, *Metachromadora*), than a real marine community. In the paper of HEIP *et al* (1985) it has been recorded nematodes such as *Daptonema oxycerca* and *Metachromadora remanei*, can survive in low salinity conditions up to 35

PSU. Another striking factor on Ecuadorian beach is the lack of Epsilonematidae and Draconematidae typical for Guadeloupe (12% and 10% respectively), Italy (42 and 4% respectively), Australia (only Epsilonematidae with less to 5%), Kenya (RAES, *et al.*, submitted) (6 and 10% respectively) and Zanzibar (RAES, *et al.*, submitted) (2 and 8% respectively).

CONCLUSIONS

The changes in nematode assemblages were associated with the seasons. Highest dominance of nematode species was found during January 2001 (maximum rainfall month); at the same time lowest diversity was registered. Seasonal respond was found in *Daptonema* sp. 1, the highest densities were correlated with the pluviosity fluctuations.

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