HETEROMASTUS SIMILIS SOUTHERN, 1921 (POLYCHAETA: CAPITELLIDAE) IN MAR CHIQUITA BRACKISH COASTAL LAGOON, ARGENTINA*

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INTRODUCTION

The only recorded species of *Heteromastus* in the southwestern Atlantic coast was identified as *H. similis* Southern, 1921 by Orensanz & Estivariz (1971). It occurs from Rio Grande (Brazil) to Mar Chiquita coastal lagoon (Argentina) and differs from *H. filiformis* (Claparède, 1864) from Europe and North America in habitat and setal morphology (Orensanz & Estivariz, 1971).

There is a considerable knowledge of the ecology and biology of northern capitellids (Grassle & Grassle, 1974; Warren, 1977; Cadée, 1979; Pocklington & Wells, 1992). However, the systematics, biology and ecology of southern species are still poorly known.

According to Olivier *et al.* (1972a), Spivak *et al.* (1989) and Boschi *et al.* (1992), the subtidal soft-bottom infaunal community in Mar Chiquita coastal lagoon is dominated by the polychaetes *Laeonereis acuta* Treadwell, 1923 and *Heteromastus similis*, the gastropod *Heleobia (=Littoridina) australis* (D'Orbigny, 1835), the bivalve *Tagelus gibbus* (Splenger, 1794) and the mud crab *Cyrtograpsus angulatus* Dana, 1851, together with the reef tube worm *Phycopomatus (= Mercierella) enigmaticus* (Fauvel, 1923). Local *Spartina-Salicornia* salt-marshes and/or "cangrejales", inhabited by *Chasmagnathus granulata* Dana, 1851, have an intertidal distribution, with a supralittoral fringe with *Uca uruguayensis* Nobili, 1901 (Olivier *et al.*, 1972; Spivak *et al.*, 1989).

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Although *L. acuta* is a common inhabitant of intertidal areas in southern mixohaline environments (Elías & Ieno, 1993), H. similis had not been previously recorded along the intertidal in Mar Chiquita. It was first recorded by Ieno (1993) in an assessment of the organic gradient of local sediments.

This paper describes the spatial and vertical distribution, together with biological and ecological aspects, such as burrowing behaviour, faecal pellet production, reproduction and sediment interactions, of an intertidal population of *H. similis* in the southern brackish Mar Chiquita coastal lagoon. This study is part of the Benthic Ecology Program of Mar del Plata National University.

STUDY AREA

Mar Chiquita coastal lagoon (37 46' S - 57 27' W) is a sheltered environment, with a mean surface area of 46 km^2 and a N-S gradient from oligohaline to mixohaline waters, with extended salt-marshes.

The sampling area was near the confluence of the Arroyo Vivoratá and "Cangrejos" creek, in the southern part of the lagoon (Fig. 1). The first is a small fresh-water runoff with a high load of suspended matter, while the other is a sheltered muddy-sand creek without fresh-water. Local salinity ranges from 5 to 15 PSU (Alvarez *et al.*, 1982).

MATERIAL AND METHODS

Benthic investigations were carried out at three points in the exposed tidal flat of Cangrejos Creek. Samples were collected in April 1992, in April, June, August, and December 1993, and in April 1994. Worms and substrate were sampled with a 10 cm diameter core tube to a depth of 30 cm. Each sample unit was divided into two subsamples, the first from the upper 0-5 cm layer, and the other from the 5-25 cm layer. Samples were washed through a 0.5 mm sieve in the field. Organisms were preserved in 5% formalin and counted under a binocular microscope.

To investigate the interactions between organisms and the substrate, granulometric and organic content analyses were carried out twice, in April 1992 and April 1994. Particle size analysis was carried out from dried sediments (Ingram, 1971) by sieving at 0.5 phi intervals (-2 to 4 ϕ, following Wentworth, 1922). Mean grain size (X) and standard deviation (Sd) were determined for each sample (Folk & Ward, 1957). Differences in color between upper and lower layers were recorded following the Munsell table. Organic matter content was determined according to Walkley & Black (1965).

Abundances (individuals/sampling units) are refered as densities (ind.m^{-2}) in the text. An x^2 test was used to estimate density differences between the two sediment layers.

Faecal pellets of six adults were removed and measured according to Cadée (1979). Adults were not separated from juveniles because most of the animals were broken, consisting of anterior parts with variable lengths.

In December 1993, additional samples were taken and stored without fixation for gamete observation. Gametes could usually be obtained from live worms longer than 30 mm after relaxing specimens in menthol solution.

RESULTS

Sediment analysis - Sediment was dominated by fine and very fine sand (Fig. 2). Mud content ranged from 5 to 30%. Particles over 2 mm were usually biogenic, including remains of mollusc shells and calcareous tubes from worms. General trends in sediment texture were very similar from the the first to the second year in station I. On the other hand, there was a net decrease in the content of very fine sand in stations II and III from the first to the second year. In addition, gravel and coarse sand contents from these latter stations were higher in 1994. Within a given station, no significant differences in sediment texture were found between upper and lower layers.

Substrate could be characterized as mud-sandy, with mean grain size of 3.014 ϕ, and moderate to poor selection (mean 1.04), typical of a low energy environment. A 2-5 cm grey-olive upper layer, and a black-grey lower one, with similar sediment composition and organic matter content were evident (Table 2).

Faunal patterns - *Heteromastus similis* and *Laeonereis acuta* were numerically dominant in the lower intertidal zone, living under a great variety of physical conditions. The polychaete Neanthes succinea (Frey & Lanckart, 1847) and the bivalve Tagelus gibbus occurred sporadically, always in small numbers, during summer.

Field observations showed that *H. similis* makes vertical mucus-lined burrows extending into the sediment, divided into two shorter burrows at the end. The head protracts inside the sediment deriving all its food from the anaerobic subsurface layer. Thus, its characteristic faecal pellets, deposited at the surface, are always black. *L. acuta* burrows can be distinguished by their oxigenated walls, completely absent in H. similis burrows.

Densities varied throughout the sampling period, and peaked at different times of the year (Table 3). Numbers in April 1992 were higher than in April 1993/1994. Data from 1993 were less complete and did not permit any comparisons. Vertical distribution showed no clear pattern (Fig. 3). The X^2 test showed highly significant differences ($p < 0.01$) between layers, though no clear dominance in either of the sections could be assessed.

Free coelomic eggs were clearly visible through female body walls. They first appeared in December and were also observed in early April in fresh samples. Males with sperm packets were also present. However, sex could not be determinated in many worms due to immaturity or lack of abdomens. Oocytes were commonly attached to

blood vessels and in some instances spawning behaviour was observed in laboratory. Releasing of coelomic eggs masses was observed once.

Most of the individuals were adults, but younger worms were sampled in the summer and early autumn. Unfortunately spring data were not available. Great amounts of black reddish pigment occur in adults and can be easily recognised both ventrally and dorsally all along the body. Benthic juveniles are very narrow and lack pigments, and often occur in highly aggregated patches. Organisms less than 0.4 mm wide had not fully developed prostomium and pigidium, whereas worms above 0.8 mm wide were sexually mature.

Faecal pellets are egg-shaped, and show a brownish colour. Average and standard deviation were 377 48 μm, 360 47 μm, 378 41 μm, 440 40 μm, 406 09 μm and 403 11 μm. The number of pellets per individual may vary from a maximum of 14 in juveniles to 71 in adults. They are relatively resistant to mechanical breakdown; when stored in formalin for one year a great number of pellets remained intact, even though the body wall of some individuals was destroyed.

DISCUSSION

Sediment was dominated by fine and very fine sands, as reported by Olivier *et al.* (1972a) and Fasano *et al.* (1982). The preference of H. similis for very fine sandy sediments had been reported for the subtidal area (Olivier *et al.*, 1972a; Orensanz & Estivariz, 1971), and was confirmed in the present study. Organic matter content increases from an average of 1.72% in the subtidal (Olivier *et al.*, 1972a) to 3.33% (0.82) in the intertidal.

The species has been described as a deposit feeder (Olivier *et al.*, 1972b). According to Fauchald & Jumars (1979), it belongs to the feeding guild BMX (burrower, motile, with an unarmed proboscis).

In Brazil, *H. similis* was found both in subtidal (Bemvenuti, 1987; Lana *et al.*, 1989) and intertidal areas (Capitoli *et al.*, 1978; Bemvenuti *et al.*, 1978; Amaral, 1979). This is the first record of intertidal *H. similis* in Mar Chiquita coastal lagoon, which seems to be its southernmost distribution point, since the species is lacking in Bahía Blanca, a similar muddy-mixohaline environment (Elías, 1992).

This infaunal intertidal community resembles the northern *Nereis diversicolor* O.F.Muller - Hidrobia ulvae (Penn.) community. In Mar Chiquita, H. ulvae is replaced by Heleobia australis and H. conexa Gaillard, 1974, not recorded in this study.

Intertidal densities of *H. similis* are higher (mean of 207, with peaks of 1529 ind.m^{-2}) than those reported by Olivier *et al.* (1972a) for subtidal areas (mean of 126 ind.m^{-2}). Values of 5640 ind.m^{-2} were also recorded in April 1992. We are unable to explain why the vertical distribution varies so much in time and space, as displayed by data from 1992. Our results suggest that more than two replicates should be taken in order to evaluate the patchy intertidal distribution of this species.

Measurements of populational densities of *H. similis* in southern Brazil showed marked variations in spatial distribution (Bemvenuti, 1987). Large variations were also observed in Samborombón Bay, where a maximum of 8000 ind.m^{-2} was recorded (Ieno, unpubl. data). It appears, therefore, that a value over 5400 ind.m^{-2} in Mar Chiquita might not be exceptional. The species, often characteristic in estuaries, tends to fluctuate widely both within and between years. Our observations suggest that data from April 1992 could be explained as an episodic event.

The tolerance of *H. filiformis* to sulfide and low levels of oxygen is well known (Pals & Pauptit, 1979). The species has been shown to adapt well to extremely anaerobic conditions. In fact, fresh samples stored in closed plastic bags remained alive for three months.

H. filiformis is considered to be an important sediment reworker, since its characteristic feeding behaviour produces turn over of deeper sediments to surface (Cadeé, 1976; Neira & Hopner, 1993). *H. similis* also shows a high production of faecal pellets, which are present as black faecal casts at the sediment surface during low tides (Elías, pers. obs.). Individuals of *H. filiformis* produce faecal pellets within a limited size range (Cadeé, 1979). In our study, the size of faecal pellets were clearly correlated with animal length. This suggests that pellet length can be a useful tool to study the populational dynamics of *H. similis.*

Mature females, with free oocytes in the coelomic fluid, were recorded during the warm season. Some males with "spermatic packs" were also observed, suggesting that sexes are separate. The number of gametes was correlated to body length, a pattern also observed for *H. filiformis* (Shaffer, 1983). Our observations show that adults and juveniles can be easily separated by the width of body.

The exact spawning period could not be determined since spring data were not available. In Brazil, *H. similis* breeds in summer and late autumn (Bemvenuti, 1987).

According to Warren (1976), organisms identified as juveniles are morphologically similar to the larvae of *Capitella capitata* (Fabricius, 1780). In addition, juveniles tended to aggregated among themselves or with adults, and formed gregarious settlements under laboratory conditions. This behaviour may be a consequence of direct development. It is hoped that further studies will reveal whether *H. similis* undergoes a purely benthonic development.

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ABSTRACT

This paper analyzes the spatial and vertical distribution and describes biological and ecological features of the capitellid polychaete, *Heteromastus similis*, in the southern part of Mar Chiquita coastal lagoon, Argentina. Sampling was carried out in three intertidal sand-muddy areas from April 1993 to April 1994. Sediment composition and organic matter content were analysed in two different depths. Feeding activity of this head-down deposit feeder occurs below aerobic sediment layers. Galleries are not ventilated, remaining as grey-black as the sourrounding sediments. Average densities vary markedly between upper and lower layers, and over time. Juveniles are frequently recorded in gregarious settlements. Feeding type, morphology of juveniles and habitat are similar to those of other capitellids. Size, faecal pellet production and food availability for *H. similis* are compared with the northern *H. filiformis*.

Key words: *Heteromastus similis*, biology, ecology, intertidal soft-bottoms, Southwestern Atlantic coast.

RESUMO

Heteromastus similis Southern, 1921 (Polychaeta; Capitellidae) da laguna costeira de Mar Chiquita (Argentina).

Este trabalho analisa a distribuição espacial e vertical do poliqueta capitelídeo *Heteromastus similis*, no setor sul da laguna costeira de Mar Chiquita (Argentina), além de descrever algumas de suas características ecológicas e biológicas. A amostragem foi feita em três áreas areno-lodosas da região entre-marés de abril de 1993 a abril de 1994. Os animais, que têm hábito detritívoro, se alimentam nas camadas anóxicas subsuperficiais. As galerias não são ventiladas, permanecendo com a mesma coloração cinza-escura do sedimento adjacente. Densidades populacionais variam marcadamente ao longo do tempo e entre os estratos do sedimento. Juvenis são freqüentemente registrados em agregados. O tipo de alimentação, a morfologia dos juvenis e o habitat são semelhantes àqueles descritos para outros capitelídeos. O tamanho, a produção de pelotas fecais e a disponibilidade de alimento para a espécie são comparados com a congênere *H. filiformis*, do hemisfério norte.

Palavras-chave: *Heteromastus similis*, biologia, ecologia, sedimentos não consolidados entre-marés, costa atlântica sul-ocidental.

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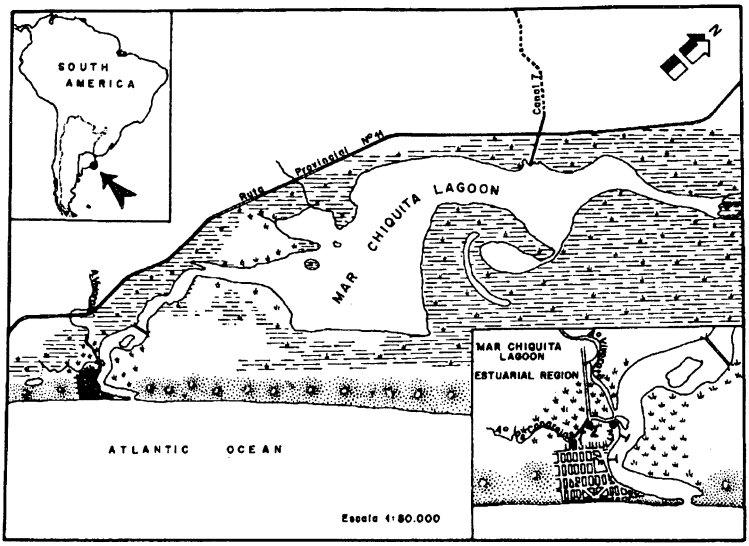

Fig. 1
Study area and sampling stations.

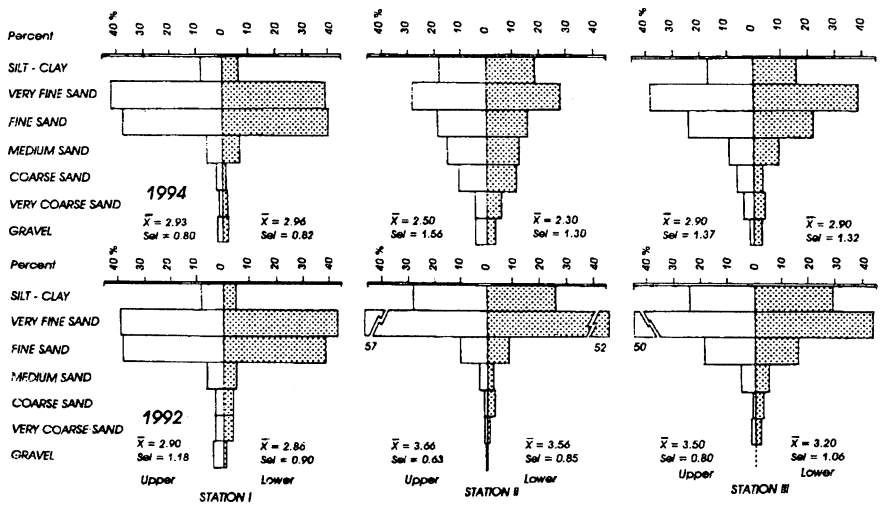

Fig. 2
Proportion of granulometric fractions in stations I-III in April 1992 (left) and April 1994 (right). Upper layer: white, and lower layer: dotted. Mean grain size (X) and selection (sel.) are showed for each one.

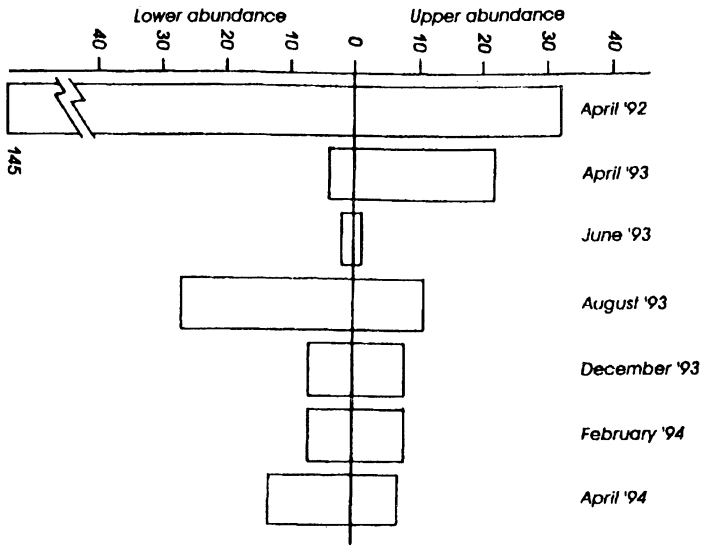

Fig. 3
Total abundance, mean and variance of *Heteromastus similis* showing data from upper and lower layers.

Table 1 - Organic matter content (%) in sediments from April 1992 to April 1994.

	1992	1994
	St. I	
upper	3.96	3.19
low	1.90	2.75
	St. II	
upper	2.93	3.09
low	3.96	3.01
	St. III	
upper	4.27	2.75
low	4.96	3.20

Table 2 - Abundance of *Heteromastus similis* in upper and lower sediment layers.

		I		II		III		tot.
April 92	upp	3	2	7	7	3	10	32
	low	15	2	15	28	56	29	145
April 93	upp	4	0	1	0	5	12	22
	low	0	0	0	0	4	0	4
June 93	upp	0	0	1	0	0	0	1
	low	0	0	0	0	2	0	2
Aug 93	upp	2	1	6	1	1	0	11
	low	11	13	0	3	0	0	27
Dec 93	upp	1	0	0	7	0	0	8
	low	6	1	0	0	0	0	7
Feb 94	upp	1	0	0	7	0	0	8
	low	0	0	0	0	7	0	7
April 94	upp	0	0	2	3	2	0	7
	low	0	13	0	0	0	0	13
Total		43	34	35	51	80	51	