Hydrobiologia 155: 209–214 (1987)
R. O. Brinkhurst and R. J. Diaz (eds) Aquatic Oligochaeta
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The ecology of some Benthic Oligochaeta from the Paraná River, Argentina

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Key words: aquatic Oligochaeta, environmental parameters, zoogeography, Paraná River

Abstract

Simple and multiple correlations among physical and chemical parameters and densities of the dominant Oligochaete species were calculated for various channels of the middle Paraná valley and its tributaries. *Paranadrilus descolei* Gavrilov, 1955, was observed in rivers with average depth and current velocity, mud-clay sediments, and low conductivity. *Tubifex tubifex* f. *blanchardi* Vejd., 1891, was found in channels of low depth, current velocity and discharge but with high conductivity. *Limnodrilus hoffmeisteri* Claparède, 1862, and *Aulodrilus pigueti* Kowalewski, 1914, were ubiquitous species. *Narapa bonettoi* Righi and Varela, 1983, was typical of rivers highest in depth, current velocity, and discharge with sandy sediments and low conductivity.

Introduction

In this study of the zoobenthos of the middle reach of the Paraná River an attempt was made to identify the ecological requirements of the 5 species of aquatic oligochaetes present. These are *Paranadrilus descolei* Gavrilov, 1955; *Tubifex tubifex* f. *blanchardi* Vejdovsky, 1891; *Limnodrilus hoffmeisteri* Claparéde, 1862, *Aulodrilus pigueti* Kowalewski, 1914 and *Narapa bonettoi* Righi and Varela, 1983.

Materials and methods

Forthy-three sites (Fig. 1) were sampled with the aim of analyzing the structure of the zoobenthic communities. Monthly samples were taken for five years (1976–81) from the main channel of the middle Paraná River, and for one year (1983–84) the flood plain secondary channels except the San Geronimo, Coronda, and Santa Rosa rivers that were sampled with the tributaries only twice. The data may be considered comparable because these are qualitatively stable communities.

The samples were extracted with a 440 or 319 cm^2 "Tamura" dredge, fixed in 5% formaldehyde, and filtered with a 200 μm sieve. Physical and chemical parameter values (Table 1) from both the banks and the centers of each site were analyzed using the similarity co-efficient of Gower. From these, dendrograms were obtained using the weighted pair-group method (average linkage, Sokal and Sneath, 1963). The simple and multiple correlations among the parameters and the density (ind. m^{-2}) of each species were calculated.

Results

The middle of the Paraná River has a moderate water fluctuation (mean: 2.40 m), an average discharge of 15000 $m^3\ s^{-1}$ (Q mean max.: 18000 $m^3\ s^{-1}$ and Q mean min.: 9500 $m^3\ s^{-1}$), mean current velocity of 1 ms^{-1}, low conductivity and a pH at about neutral. The bed is predominantly sandy with dunes up to 8 meters high (Drago, 1977).

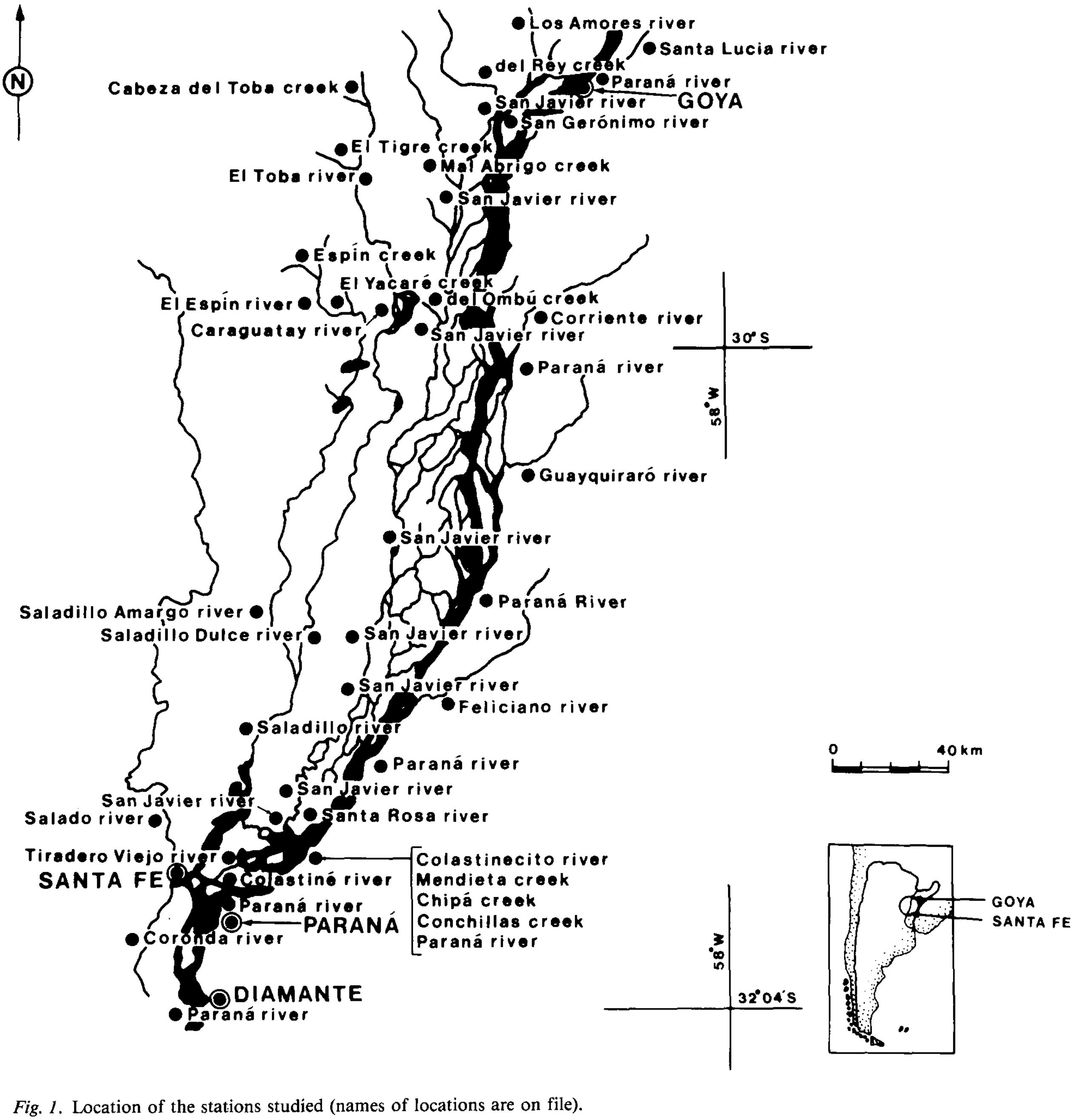

Fig. 1. Location of the stations studied (names of locations are on file).

The secondary channels have limnological characteristics similar to the main channel, but their discharges are considerably less and their conductivities are greater. The pluvial regime of the tributaries produces great fluctuation in discharge and conductivity. Four groups (Fig. 2A) are defined to show the similarity between the central stations of all channels. Group A contains Subgroup A1 which includes the secondary channels and the Corriente River (tributary). Subgroup A2 includes the tributaries with greater conductivity. Group B contains the highest conductivity sites (Ayo. del Ombu and El Toba River) and some other lower salinity tributaries. Group C contains channels in the Saladillo River

Table 1. Physical and chemical parameters and species densities (min./max.) for "bank" and "center" sites of the various groups of stations. (See Figs. 2a, b).

	Banks		Centers				
	A	B	A_1	A_2	B	C	D
depth (m)	0.35 7	0.35 3.6	3.28 10.5	0.24 1.20	0.49 4.4	0.27 5.28	1.50 23
*discharge (m^3s^{-1})	1203 25000	0.431 2279	26.58 2279	1.65 17.04	0.35 82.66	0.051 46.199	10000 25000
current velocity (ms^{-1})	0.07 0.76	0.04 0.58	0.24 0.67	0.08 0.41	0.08 0.64	0.04 0.44	0.42 1.36
Secchi disc. (m)	0.06 0.30	0.04 0.70	0.16 0.26	0.08 0.44	0.15 0.37	0.04 0.70	0.20 0.45
Conductivity ($\mu S\ cm^{-1}$)	8 3500	80 5715	80 720	1350 3800	240 7800	191 5250	75 88
pH	7.0 7.8	6.5 8.8	7.1 7.7	7.3 8.2	7.6 8.1	6.5 8.8	7.2 7.4
organic matter (g C%)	0.061 0.967	- -	0.007 0.892	0.005 0.119	0.114 0.466	0.319 2.557	0.005 0.800
sand (%)	7 62	51 97	17.30 99.65	94.95 99.60	68.95 80.38	8.33 57.34	97 99.80
mud (%)	19 69.15	0.85 36.95	0.20 71.70	0.05 3.20	3.35 23.10	13.53 48.45	0.10 2.30
clay (%)	8.95 74	1.10 31.9	0 14.80	0.15 2.40	3.65 20.50	13.15 72.06	0 1.20
Paranadrilus descolei	0 2461	0 322	0 930	0 0	0 0	0 0	0 69
Aulodrilus pigueti	0 341	0 1519	0 372	0 46	0 0	0 1240	0 0
T. tubifex f. *blanchardi*	0 31	0 682	0 0	0 0	0 124	0 1333	0 0
Limnodrilus hoffmeisteri	0 1364	0 598	0 1886	0 0	0 31	0 775	0 1035
Narapa bonettoi	0 4876	0 529	0 10373	0 0	0 0	0 0	0 92943

* They belong to the environments of each group.

basin that resemble each other closely, plus the very different secondary channels of the Santa Rosa River (whose inclusion we cannot explain). Group D represents the main channel of the Paraná River which has limnological characteristics different from the other environments.

The bank sites of all the channels may be divided into two groups (Fig. 2B). Group A is formed by the banks of the secondary channels of the flood plain, the Salado River tributary and the main channel of the Paraná River. These banks are similar mainly in granulometric and organic matter bottom composi-

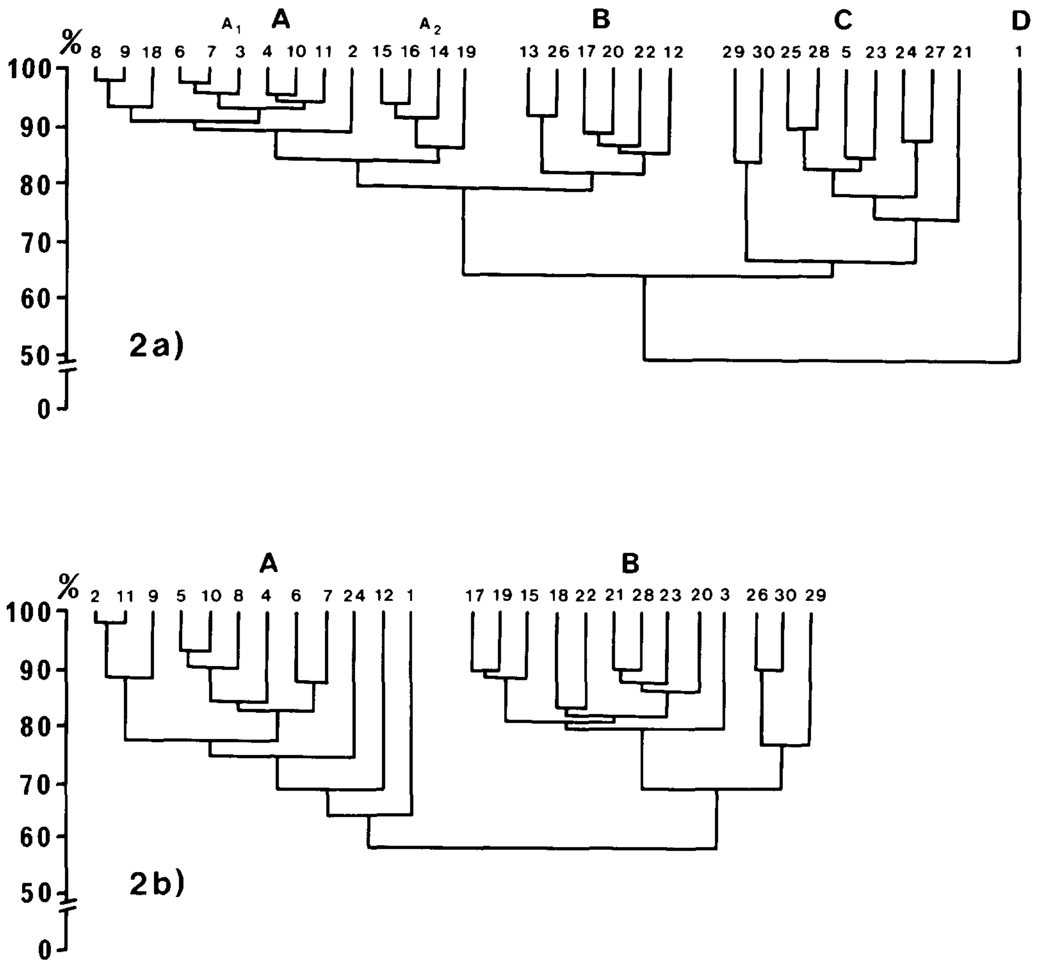

Fig. 2. a) Dendrogram of similarity between the central stations of the rivers obtained by the weighted pair group method. Subgroup A_1: secondary channels and Corriente River (tributary). Subgroup A_2: tributaries. Group B: tributaries. Group C: basin of Saladillo River (tributary) and Santa Rosa River (secondary channel). Group D: main channel of the Paraná River. b) Dendrogram of similarity between the banks of all the channels. Group A: secondary channels of the flood plain, Salado River (tributary) and the main channel of the middle Paraná River. Group B: tributaries (including the basin of Saladillo River).

tions. Group B contains the Saladillo River basin and those tributaries which have similar limnological behavior due to the pluvial regime.

In the channel centers there are significant correlations (Table 2) between *Limnodrilus hoffmeisteri* densities and water conductivity, $r = -0.37$ ($p < 0.05$), *Paranadrilus descolei* and conductivity $r = -0.39$ ($p < 0.01$), and with current velocity, $r = 0.37$ ($p < 0.05$). In the banks there are correlations between *Narapa bonettoi* and discharge, $r = 0.41$ ($p < 0.01$) with clay, $r = 0.35$ ($p < 0.05$). *Tubifex tubifex* f. *blanchardi* densities correlate with

Table 2. Multiple correlation coefficients between physical/chemical variables and the density of each species for "banks" and "center" sites.

	banks		center	
	R	R^2 (%)	R	R^2 (%)
Paranadrilus descolei	0.35	12	0.51	26
Aulodrilus pigueti	0.45	20	0.49	24
Tubifex tubifex f. *blanchardi*	0.69	48	0.51	26
Limnodrilus hoffmeisteri	0.46	21	0.59	35
Narapa bonettoi	0.72	52	0.55	30

depth, $r = -0.45$ ($p<0.01$), with discharge, $r = -0.37$ ($p<0.05$), with current velocity, $r = -0.45$ ($p<0.01$) and with clay, $r = 0.34$ ($p<0.05$).

Multiple correlation co-efficients (Table 2A) of center channel samples explain the quantitative variations of *Limnodrilus hoffmeisteri* (35%) and to a lesser extent those of *Aulodrilus pigueti* (24%). In the banks, these co-efficients account for a high percentage of variation of *Narapa bonettoi* (52%) and a lower percentage for *Paranadrilus descolei* (12%).

Discussion and conclusions

From these studies and published data we can define the ecological requirements of the zoobenthos of the middle Parana River. *Paranadrilus descolei* was dominant on mud-clay or mud-sand beds where there is moderate current velocity, low conductivity, and a neutral pH value. During the five year study it was consistently dominant in the banks of the main channel of the middle Paraná River (as Tubificidae sp. 1, of Marchese, 1984). It was also noted in secondary channels with similar limnological characteristics to the main channel (Gavrilov, 1955; Bertoldi de Pomar *et al.*, 1986; Marchese, pers. obs.) and in some tributaries (Marchese & Ezcurra de Drago, 1983; Bertoldi de Pomar *et al.*, 1986).

Aulodrilus pigueti is an ubiquitous species found in greater density in channels with high conductivity, low to moderate current velocity, and mud-clay sediments with abundant organic matter. It was found in the banks of some secondary channels (Marchese & Ezcurra de Drago, 1983; Bertoldi de Pomar *et al.*, 1986; Marchese, pers. obs.); in tributaries (Ezcurra de Drago & Copes, 1985; Marchese & Ezcurra de Drago, 1983; Varela *et al.*, 1980; Bertoldi de Pomar *et al.*, 1986) and occasionally and sparsely in the main channel of the middle Paraná River (Marchese, 1984).

Tubifex tubifex f. *blanchardi* is typical of environments with high conductivity, low depth, low current velocity, clay-sandy or clay-muddy sediments and variable amounts of organic matter. However, there was no significant correlation with conductivity because of the absence of *blanchardi* from some tributaries with high conductivity. This was presumably due to some influence of conditions in the main channel on the fauna of those stations sampled in the tributaries. It was only recorded in the basin of Saladillo River (Ezcurra de Drago & Copes, 1985). Previously it had been found in Misiones, Argentina (Cernosvitov, 1941; Brinkhurst, 1963), in salt waters of high conductivity in France (Giani & Martinez-Ansemil, 1981), in Sahara pools (Brinkhurst & Wetzel, 1984) and in Paraguay (Stephenson, 1931).

Limnodrilus hoffmeisteri is an ubiquitous species predominant in sediments with abundant organic material and pollution. It was found mainly in the banks of the main channel of the Paraná River (Di Persia, 1980; Marchese, 1981, 1984; Marchese & Ezcurra de Drago, 1983; Bertoldi de Pomar *et al.*, 1986; Marchese, pers. obs.), in tributaries (Ezcurra de Drago & Copes, 1985; Marchese & Ezcurra de Drago, 1983; Bertoli de Pomar *et al.*, 1986) and in secondary channels (Di Persia *et al.*, 1982; Marchese & Ezcurra de Drago, 1983; Bertoldi de Pomar *et al.*, 1986 and Marchese, pers. obs.).

Narapa bonettoi Righi and Varela, 1983, is considered in previous studies as *Achaeta?* sp. (Ezcurra de Drago, 1980; Marchese, 1981; Marchese & Ezcurra de Drago, 1983) and as *Potamodrilus* sp. (Marchese, 1984). This species may be described as "rheophilous" and "psammophilous" and was found in greatest density in the main channel of the middle Parana River. In this river environment it was often the only benthic species present (Ezcurra de Drago, 1980; Marchese & Ezcurra de Drago, 1983; Marchese, 1981, 1984; Bertoldi de Pomar *et al.*, 1986). It was found in lesser density in the banks and centers of secondary channels with high discharges and sandy beds. The species was dominant in the High Parana River in sandy bottoms (Varela *et al.*, 1983).

Acknowledgements

I feel especially grateful to Dr. Brinkhurst for his kindness in presenting this paper at the third International Symposium on Aquatic Oligochaeta. I sincerely appreciate the assistance given by Prof. I. Ezcurra de Drago and Prof. E. Drago in critically reviewing the manuscript.

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