

Population structure of *Uncancylus concentricus* (d'Orbigny, 1835) (Ancyliidae, Pulmonata, Basommatophora) in the Multiple Use Reserve Martín García Island, Upper Río de la Plata, Argentina

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Abstract

The present work analyzes the population dynamics of *Uncancylus concentricus* in natural conditions in the northeastern coastal area of the Multiple Use Natural Reserve Isla Martín García (Beach of Basural), Buenos Aires, Argentina. Martín García Island is located in the Upper Río de La Plata, to the south of the mouth of the Uruguay River (34° 11' 25" S and 58° 15' 38" W). Monthly collections were made from August 2005 to December 2006. The size frequency of the *U. concentricus* population throughout the sampling period ranges from 1.2 to 8.3 mm. The changes in the size frequencies throughout the months surveyed indicate a variable distribution pattern because of the increase and decrease in water flow, but we observed a peak in the frequency of individuals within the size range 3.5 to 4.5 mm in the population. It can be concluded that this species lives for at least a year in the wild since the juveniles are highly abundant in spring and summer.

Keywords: *Uncancylus concentricus*, population dynamics, Martín García Island, Argentina.

Estrutura populacional de *Uncancylus concentricus* (d'Orbigny, 1835) (Ancyliidae, Pulmonata, Basommatophora) da Reserva Natural de Usos Múltiplos Ilha Martín García no Rio de La Plata Superior, Argentina

Resumo

O presente trabalho analisa a dinâmica populacional de *Uncancylus concentricus* em condições naturais da zona costeira noroeste da Reserva Natural de Usos Múltiplos Ilha Martín García (Praia de Basural), Buenos Aires, Argentina. A Ilha Martín García está localizada no Rio da Prata Superior, ao sul da desembocadura do Rio Uruguai (34° 11' 25" S e 58° 15' 38" W). Amostras mensais foram analisadas entre os meses de agosto de 2005 e dezembro de 2006. Foi determinado que a população de *U. concentricus* ao longo do período de amostragem tem uma frequência de comprimento que varia de 1,2 a 8,3 mm. As mudanças nas frequências de tamanho ao longo dos meses pesquisados indicam um padrão de distribuição variável, devido ao aumento e à diminuição do fluxo de água; entretanto, observou-se um pico na frequência de indivíduos na faixa de tamanho de 3,5 a 4,5 mm na população. Conclui-se que essa espécie vive há pelo menos um ano em condições naturais e os juvenis são muito abundantes na primavera e no verão.

Palavras-chave: *Uncancylus concentricus*, estrutura populacional, Ilha Martín García, Argentina.

1. Introduction

Uncancylus concentricus (d'Orbigny, 1835) belongs to the Ancyliidae family and is distributed throughout the Neotropical region from Costa Rica to Lago Buenos Aires, Patagonia, Argentina (Dos Santos, 2003). *U. concentricus* has likewise been registered in Ecuador and Peru (Lanzer, 1996), Venezuela (Hubendick, 1967), and Brazil (Haas, 1949a, 1949b, 1952; Irmiler, 1975). This species was first noted and characterized in Antioquia (Colombia) by Gomez et al. (2004).

The species of this family inhabit lotic and lentic environments of inland limnic ecosystems worldwide. Within the Neotropical region, the Ancyliidae are represented by seven genera, *Anisancylus* Pilsbry, 1924; *Gundlachia* Pfeiffer, 1849; *Uncancylus* Pilsbry, 1913; *Hebetancylus* Pilsbry, 1913; *Burnupia* Walker, 1912; *Ferrissia*, Walker, 1903; and *Laevapex* Walker, 1903 (Lanzer, 1991, 1996; Dos Santos, 2003). According to Walther (2008), the genera from the new world (*Laevapex*, *Hebetancylus*, *Uncancylus*,

Gundlachia) are members of a Holarctic clade, which also includes the following genera: *Ferrissia* and *Ancylus* Müller, 1774. The Ancylidae play a key role in ecosystems both as the prey of invertebrates, fish, aquatic birds and as grazing predators of algae, thus affecting the population development of other predatory organisms.

Ecological studies on gastropods of medicinal and veterinary relevance have gained great significance because of the role that certain species within the community can play as either competitors or predators regulating the populations of disease-transmitting organisms (Ferrer Junior et al. 1989).

Snails are medically significant gastropods also as a result of their ability to act as temporary hosts for trematodes (Platyhelminthes). In India, *Ferrissia tenuis* (Bourguignat, 1862) by Gadgil and Shah (1955) has been identified as the intermediate host for *Schistosoma haematobium* (Basch, 1963; Morgan et al., 2002; Thiengo et al., 2004). Moreover, Thiengo et al. (2000) reported the presence of larvae of the nematode family Anisakidae in the visceral cavity of specimens of *Gundlachia radiata* (Guilding, 1828) within the area of Pantanal de Paiguá's, Mato Grosso do Sul, Brazil.

In addition to these medically related associations, certain species, such as *Burnupia stenochorias* (Melvill and Ponsonby, 1903), have been reported as potential indicators of toxicity within the Eastern Cape of South Africa (Davies-Coleman and Palmer, 2004).

Despite the importance of these freshwater gastropods in terms of ecology and medicine, the Ancylidae family has been poorly studied over the last decades, while the few investigations conducted along those lines have thus far been complicated by persistent systematic uncertainties (Jørgensen et al., 2004; McMahon, 2004).

The freshwater gastropods from Martín García Island include species from the families Ampullariidae, Hydrobiidae, Physidae, Chiliniidae, Planorbidae, and Ancylidae. The last of these is represented by the genera *Uncancylus* Pilsbry, 1913 and *Hebetancylus* Pilsbry, 1913.

The aim of this work was to analyze the population structure of *U. concentricus* in natural conditions in the northeastern coastal area (Basural Beach) of the Multiple Use Natural Reserve Martín García Island, in the upper Río de La Plata estuary, Argentina. Various thorough investigations on the biodiversity of the fauna and flora of this island have already been conducted at the Reserve (Lahitte and Hurrell, 1988, 1994; Rumi et al., 1996; Armendariz et al., 2000; Armendariz and César, 2001; César et al., 2009; Martín et al., 2009) and this constitutes a ready source of background information.

2. Material and Methods

2.1. Study site

Martín García Island is located in the upper Río de la Plata estuary south of the mouth of the Uruguay river (34° 11' 25" S and 58° 15' 38" W) (Figure 1). It constitutes an outcrop of the Brazilian massif of Precambrian crystalline

basement rocks, upon which there are sediments of the Holocene and Pleistocene (Quaternary) (Ravizza, 1984). The climate of the island is temperate and humid with a mean annual temperature of 17.6 °C and an annual precipitation of 980 mm.

The site sampled in the present study is the Basural Beach located on the northeastern coast of the island. The area contains abundant communities of coastal plants commonly known as rushes. The area is delimited by the coastal strip of the marginal forest inland and by rushes toward the coast. These latter grasslands include species of *Echinodorus grandiflorus*, *Eryngium pandanifolium*, *Schoenoplectus californicus*, and the cortaderal *Cortadera selloana* (Lahitte and Hurrell, 1996; Lahitte et al., 1997).

2.2. Methods

Monthly collections of *U. concentricus* were conducted from August 2005 to December 2006. Specimens (n = 620) were collected by hand in the coastal area (captures per unit effort: CPUE, that is, specimens/60 minutes/person). The environmental physico-chemical parameters such as water and air temperature, dissolved oxygen (mg.L⁻¹), dissolved solids (TDS) and pH were measured. All variables were measured using a digital Water Quality Meter (Sper Scientific Ltd). The correlation coefficient between environmental variables and the modal lengths to estimate the degree of association were calculated (Table 1)

In the field, using brushes, the specimens were separated and extracted from the angle formed by the stem and leaves of the aquatic vegetation and from the decomposed leaves. The snails thus collected were kept alive for transportation to the laboratory in plastic containers with water from the site. There, we followed the techniques of fixation and dissection suggested by Thiengo (1995).

The total length of the specimens was selected as the parameter to determine the size frequency of the population studied. We measured the specimen's body length under a stereoscopic microscope equipped with a micrometer in the ocular (Dos Santos, 2003). The size frequencies obtained were used to graph the seasonal population structure.

3. Results

Size distribution: The size frequency of the *U. concentricus* population ranged from 1.2 to 8.3 mm throughout the sampling period.

The juveniles (1 to 2 mm) appeared in the spring and summer, but thereafter became incorporated in the population throughout the year. Individuals whose sizes ranged from 3.5 to 4.5 mm (mature adults) were recorded from September to November along with senile specimens (4,5 to 8,2 mm) during the same period.

It can be inferred that this species lives for at least a year in the wild since the juveniles are highly abundant in spring and summer. The changes in the size frequencies throughout the months surveyed indicate a variable distribution pattern because of the increase and decrease in water flow, but we observed a peak in the frequency

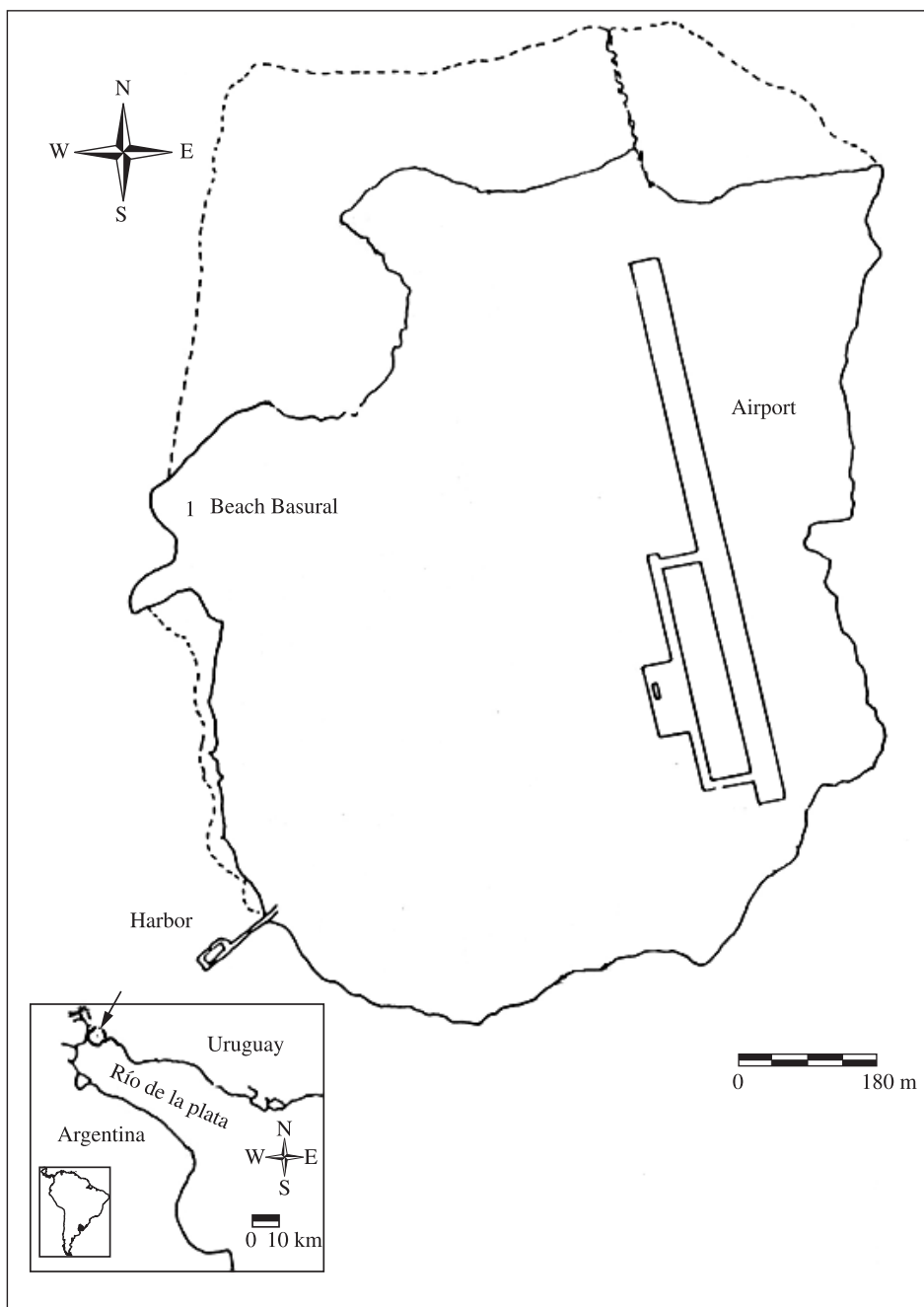


Figure 1. Martín Garcia Island map with station Basural Beach.

Table 1. Mean, range and correlation coefficient of the environmental variables.

Environmental variables	Mean	Range	Correlation coefficient (r)
TDS (g)	97	1.2-307	0.43
Water temperature(°C)	23	16.1-32	0.63
O ₂ (mg.L ⁻¹)	5.25	0.7-8.01	0.18
pH	7.55	6.38-8.62	0.55

of individuals within the size range 3.5 to 4.5 mm in the population. The water temperature during this period ranges from 17.8 to 32.0 °C. New recruitments were not observed during autumn and winter; this population only consists of adults, but contains a low frequency of seniles (Figure 2).

Environmental Variables: The analysis of environmental variables in Basural Beach throughout the sampling period from August 2005 to December 2006 indicated high average

pH values, most likely related to the low water levels (low tides). In general, however, the dissolved oxygen and conductivity of the water remained at moderate mean values. The correlation coefficients of water temperature, dissolved oxygen, pH and dissolved solids with the modal lengths of *U. concentricus* population were calculated. Figure 3 shows the changes in water temperature, dissolved oxygen and pH between August 2005 to December 2005.

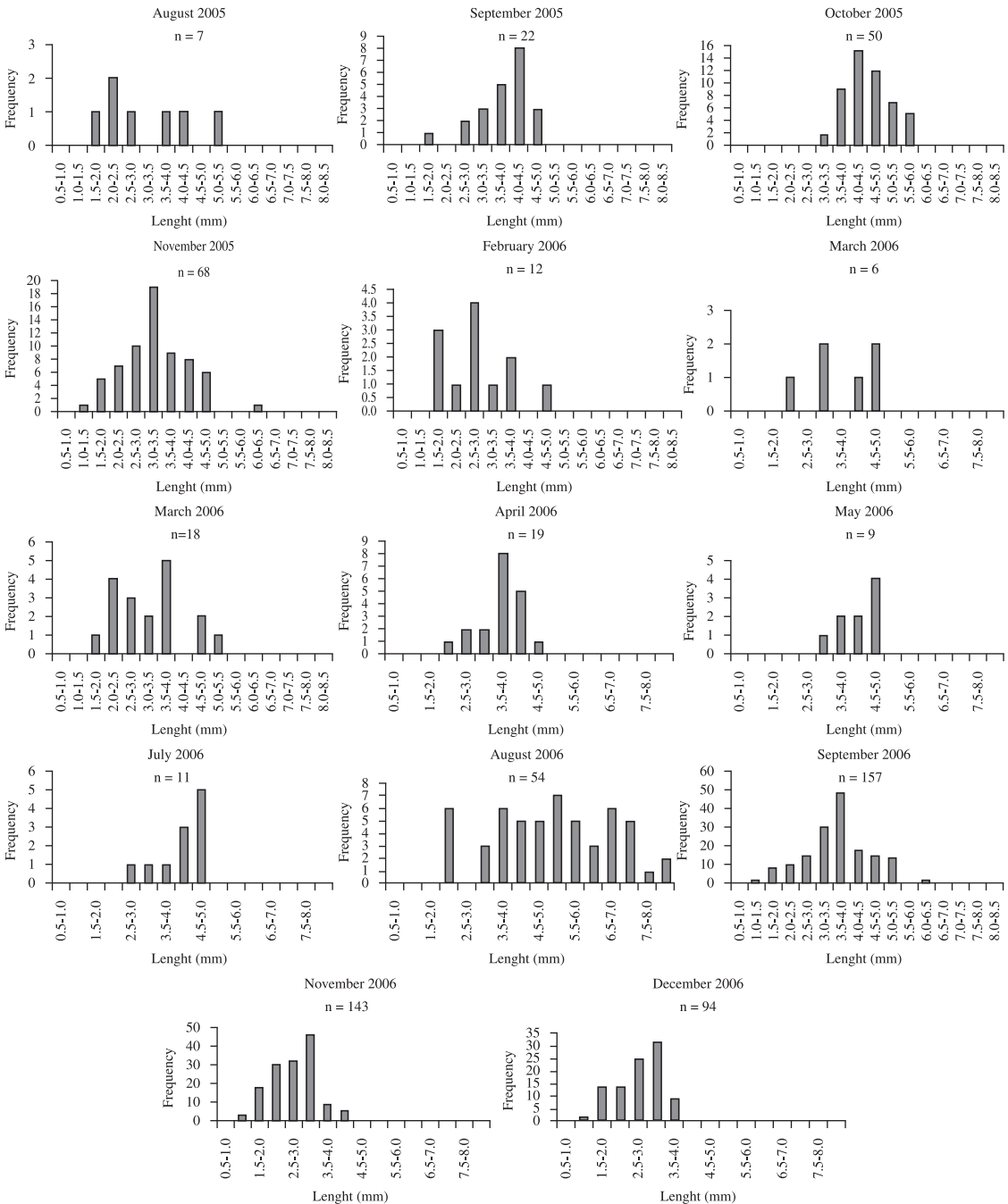


Figure 2. Size frequency distributions of *Uncancylus concentricus* in Basural Beach, Martin Garcia Island.

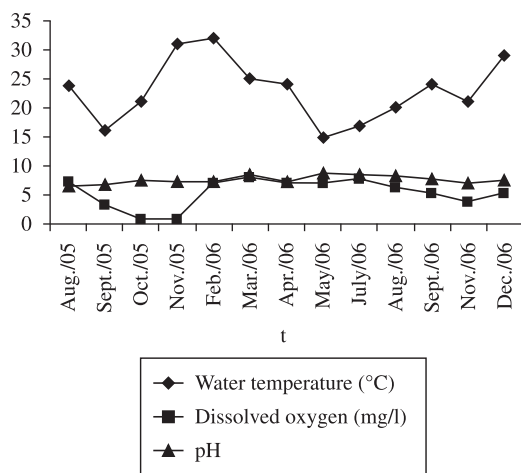


Figure 3. Distribution of temperature, dissolved oxygen and pH in “Basural Beach”, Martín García Island.

4. Discussion

The present study followed and recorded the seasonal timing and life-cycle of populations of *U. concentricus* along with their ability to adapt to the range of climatic and ecological variations in the Multiple Use Natural Reserve Martín García Island. The occurrence of the highest abundance of juveniles during the spring and summer indicated that the population structure of this species is most affected by the environmental variable of water temperature. The longevity of this species may not exceed a year in the wild, with those same two seasons being the period of maximum number of individuals present. The temperature could be a regulating influence on growth and reproductive activity, although this and related questions must await future studies on gametogenesis and body sizes for complete confirmation.

A comparison of the size frequency of *U. concentricus* within Basural Beach with that of populations from other Ancyliidae genera elsewhere such as *Ancylus fluviatilis* Müller, 1774 from Europe, as reported by Geldiay (1956), Durrant (1980), and McMahon (2004) revealed that despite the differences in the latitudes of their habitats, the size frequencies of these species are determined by the ambient water temperature, and their growth rate is the same as one generation per year. Hunter (1953, 1961), and McMahon (1976) described these types of life cycles in detail.

Uncancylus concentricus likewise showed a similarity to *Ferrisia wautieri* (Mirolli, 1960), another European species (The Netherlands), in that the occurrence of juveniles within the size frequency throughout the year mainly depended on the water temperature as well (Haddinger et al., 1987; Van Der Velde, 1991) (correlation coefficient $r = 0,63$). According to Durrant (1980) these results would indicate that, with population-growth kinetics such as these, a long period of study is required to observe a reproducible pattern.

With regards to the influence of the measured environmental variables, we can infer that the constant values total levels of dissolved solids (correlation coefficient $r = 0,43$), dissolved-oxygen concentrations (correlation coefficient $r = 0,18$), and pH (correlation coefficient $r = 0,55$) occurring within the eastern coastal area (Basural Beach) affect the size frequencies of *U. concentricus* throughout the year.

Finally, it can be inferred that the longevity of this species does not exceed the year in natural conditions and is very abundant in spring and summer, mostly showing the presence of numerous juveniles.

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