

Population Structure and Condition Factor of *Pseudotothyris obtusa* (Hypoptopomatinae) from Three Coastal Streams in Southern Brazil

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ABSTRACT

Population structure features and condition factor of *Pseudotothyris obtusa* were compared between three coastal streams in southern Brazil. Fishes were monthly collected through electric fishing and measured in the total length. Fifteen fishes from each stream were dissected to identify their sex. The structure in size, sex ratio and young/adults ratio of populations were analysed and the length-weight relationship was obtained. The condition factor (K_1) and the relative condition factor (K_n) were calculated for each stream. Fishes were grouped in 11 length classes of 3mm. The intermediate and bigger size classes were preponderant in the “Mergulhão” and “Colônia Pereira” streams, and the smaller and intermediate ones in the “Ribeirão” stream. Females prevailed in bigger size classes, reached bigger lengths than males, and were preponderant in all streams. The condition factors (K_1 and K_n) were different in all streams, indicating better condition and higher weight values in fishes from the “Mergulhão” and “Colônia Pereira” streams.

Key words: coastal streams, *Pseudotothyris obtusa*, Hypoptopomatinae, population structure, condition factor.

INTRODUCTION

The bionomic strategies adopted by the species of fish can present tactical variations (Wootton, 1984), because fishes are capable of answering to the biotic and abiotic conditions in their environment. A certain degree of flexibility in the answers to the environment can be desirable in unstable places to make the survival of the species possible. In Brazil, variations in the life-history of fish species related to environment were found by many authors (Vazzoler, 1971; Garutti, 1989; Basile-Martins *et al.*, 1986).

The population structure is an important aspect to be analysed in the biology of fish, because together with other aspects, they characterise the life strategy adopted by a species. The structure of a population can reflect the current and previous environmental conditions tried by the fish. On the same lines, the relationships

between the structure of population and the structure of habitat were explored by Rakocinski (1988) with North American fish species. In Brazil, some authors studied the population structure of fish (*e.g.* Narahara *et al.*, 1985; Basile-Martins *et al.*, 1986) for the knowledge of the biology of a certain species.

The variations in the condition factor can indicate variations related to the fitness of the fish, development and fat accumulation (Le Cren, 1951). Then, it is possible that fish from different places, in different development phases and of different sexes present different values for these factors (Le Cren, 1951), indicating conditions peculiar to the place where the species inhabit.

There are many reports on the fish biology of the Loricariidae family (Agostinho *et al.*, 1986; Menezes & Caramaschi, 1994). However, not much information is available Hypoptopomatinae.

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This paper aims to characterise the structure in size, the sex ratio, the young/adult ratio, and to compare the condition factor of the populations of *Pseudotothyris obtusa* (Ribeiro, 1911), in three coastal streams of Paraná state: “Mergulhão”, “Colônia Pereira” and “Ribeirão” streams.

MATERIAL AND METHODS

Samples of *P. obtusa* were monthly collected from March/1995 to March/1996, using electric fishing in an extension of approximately 50 m. For each sample, fifteen fishes were separated and measured for the total length (mm) and the total weight (mg). In laboratory, fishes were dissected, and their sex was identified.

Bimonthly samples were collected in order to obtain the large number of fishes, which were measured in terms of total length and returned to the stream.

Data referring to medium temperatures and precipitation were supplied by meteorologic stations near the streams.

We adopted 11 classes of total length obtained from the Sturges formulation (Silva & Souza, 1987). In each stream the size class, the sex ratio and the young/adult ratio were analysed by the distribution of frequencies of the whole sample and the differences were tested by the χ^2 test ($\alpha = 0.05$). The length-weight relationship was initially obtained for males and females separately. The straight lines estimated for males and females were compared to each other by the interval of confidence of the straight line (95% of confidence) estimated for the whole data. This straight lines were obtained by the logarithmic transformations of the data.

According to this methodology, it was analysed if the straight line obtained for males and

females separately were contained in the interval of confidence for the straight line obtained for both sexes together.

The condition factor (K1), excluding the weight of the gonads, and the relative condition factor (Kn) were calculated (Le Cren, 1951) for the females of each stream, and the test of Kruskal-Wallis was applied (Siegel, 1975) to verify differences. In case those differences were significant, the Dunn test of multiple comparison was applied, in order to verify in which streams the difference was significant.

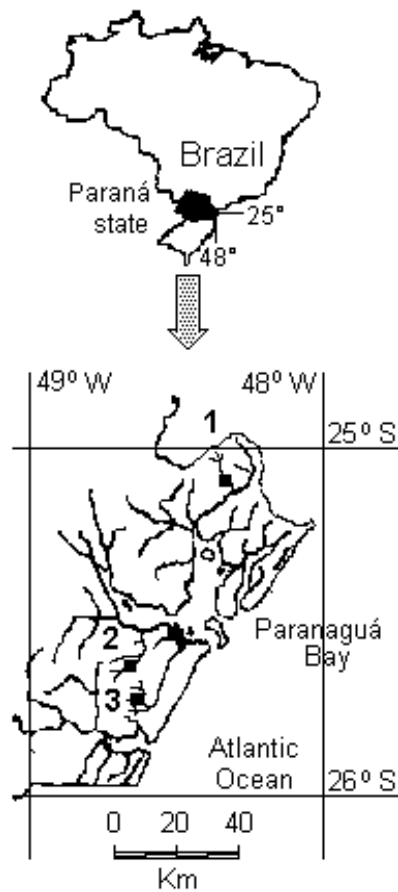
STUDY SITES

The climate in the area is subtropical, without a dry season. The highest precipitation levels occurred from November/1995 to March/1996. The highest medium temperatures happened from March to April/1995 and from November/1995 to March/1996.

The “Mergulhão” stream (approximately 25°17'S; 48°44'W; Fig 1) is located in the municipality of Antonina and its head-waters are located at an altitude of 1,700m. The “Colônia Pereira” stream (approximately 25°41'S; 48°35'W; Fig 1) is located close to the municipality of Paranaguá and its head-waters are located at an altitude of 650m. The “Ribeirão” stream (approximately 25°36'S; 48°37'W; Fig 1) is 10 Km far from the “Colônia Pereira” stream. Its head-waters are located at an altitude of 766m.

A detailed characterisation of the sampled stretches is shown in the Table 1. In the three streams changes during periods of high precipitation occurred, such as the flash floods, which decreased the transparency of water, increased its speed, and cause the elevation of its level and the physical disturbance of the habitats.

Figure 1. Map of Paraná coast showing (1) “Cabral”, “Ribeirão” and “Mergulhão” stream.



RESULTS

In the studied streams *P. obtusa* was usually collected under litter, logs, branches and close to the vegetation in the palisades. We collected 1499 fishes (305 in “Mergulhão” stream, 549 in “Colônia Pereira” stream and 645 in “Ribeirão” stream) and adopted 11 classes of total length (Table 2).

In the three streams, the length amplitude varied from the class 12 to 14 mm to the class 42 to 44 mm (classes 1 to 11), except in the “Ribeirão” stream, where class 11 did not occur. We considered frequent classes those equal or superior to 20%. In the “Mergulhão” stream classes 8 and 9 were the most frequent; in the “Colônia Pereira” stream, classes 7, 8 and 9; and in the “Ribeirão” stream, class 5.

Table 1. Studied areas characterisation.

	“Mergulhão”	“Colônia Pereira”	“Ribeirão”
Stretch	Inferior	inferior	medium
Order	3 rd	2 nd	3 rd
Width	6 to 9 m	5 to 7 m	4 m
Depth	50 to 80 cm	40 to 60 cm	40 cm
Bottom	Silt, sand, pebble, rocks, litter, trunk and branches	Manly sand. Litter, clay; trunk and branches in edges	Preponderance of sand. Litter in the left edge
Right edge	Grass partially submerge	Shrubs and trees	Shrubs and trees
Left edge	Shrubs and trees, whose branches covered the water surface	Grass	Grass partially submerge
Shadow	Left edge	Right edge	Right edge partially

Males presented higher frequencies in the classes 7 and 8 in all the streams, whereas females presented higher frequencies in the classes 8 and 9 in the “Mergulhão” stream, in the classes 9 and 10 in the “Colônia Pereira” stream, and in the class 8 in the “Ribeirão” stream. The largest length reached by males was 39 mm in the “Mergulhão” stream (class 10), whereas in the “Colônia Pereira” and “Ribeirão” streams it was 35 mm (class 8). Females reached up to 43 mm of total length, except in the “Ribeirão” stream whose larger length was 40 mm.

Table 2. Categories of total length classes of *P. obtusa*.

Class	Length (mm)	Class	Length (mm)
1	12 – 14	7	30 – 32
2	15 – 17	8	33 – 35
3	18 – 20	9	36 – 38
4	21 – 23	10	39 – 41
5	24 – 26	11	42 – 44
6	27 – 29		

The sex ratio was significantly different from 1:1, prevailing females in all streams, in the total samplies and in the majority of bimonthly ones (Figure 2).

Figure 3 presents the sex ratio for the length classes. It can be observed that there was prevalence of females in the largest size classes, in the three streams. In general, there was balance between sexes or males prevailed in classes from 1 to 4 and 7.

In the “Mergulhão” and “Colônia Pereira” streams, the young fishes were present in March-April and from September-October to March of 1996. In the “Ribeirão” stream the young were present during, all bimonthly periods. They were in larger proportion than adults from November-December to March of 1996.

The straight lines estimated for males and females separately were partially out of the interval of confidence of the straight line for all data. Therefore, they indicated differentiated relative growth for sexes. The expressions for males and females for the length-weight relationship were: males $\ln W_t = -4.420 + 2.920 \ln L_t$; and females $\ln W_t = -5.355 + 3.204 \ln L_t$.

We used the females relative growth constant (3.204) in the condition factor (K₁) and the relative condition factor (K_n). Statistically significant differences between streams were found for the values of K₁ (H=26.6; p <0.05) and K_n (H=29.1; p <0.05). The values of K₁ were different in the three streams, being higher in the

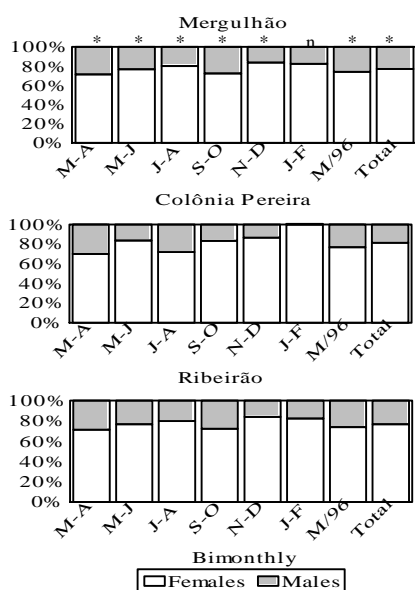


Figure 2. Bimonthly and total sex ratio of *Pseudotothyris obtusa* in the three streams.

(* = statistically significance, p < 0.05; n = it was not possible test it).

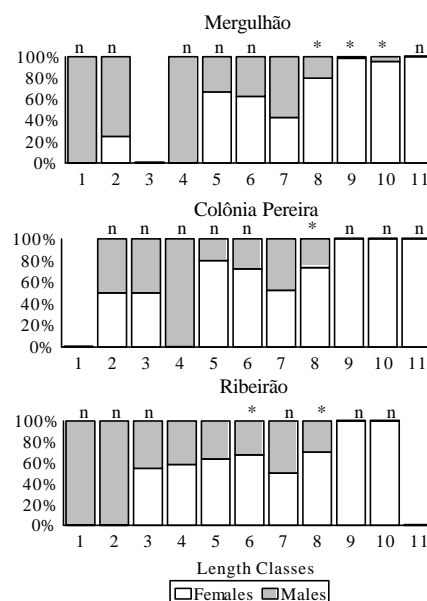


Figure 3. Sex ratio in the length classes of *Pseudotothyris obtusa* in the three streams. (* = statistically significance, p < 0.05; n = it was not possible test it).

“Mergulhão” and “Colônia Pereira” streams and smaller in the “Ribeirão” stream (Table 3). The same was observed for the K_n values (Table 3).

Table 3. Dunn’s test results for the females condition factors (K₁ and K_n) of *P. obtusa*, in the three studied streams (bold = statistically different values; p < 0.05).

	“Mergulhão”	“Colônia Pereira”	“Ribeirão”
K ₁	R_M = 29583^a	R_{CP} = 28135.5^b	R_R = 13912.5^c
K _n	R_M = 36144^a	R_{CP} = 35087^b	R_R = 21004^c

DISCUSSION

P. obtusa was considered a frequent species in the sampling sites of the stream where the samples were collected, except in the “Mergulhão” stream, in which the species, in spite of frequent, was in smaller number (305 fishes captured in 13 samplings). Branches and under water roots made it very difficult the access to the left edge in this stream, and it could explain the smallest number of sampled fishes.

An important characteristic of many coastal streams is the degree of instability, related to

high precipitation levels. During periods of high rain levels, individuals can be taken alone by the flow, and it can influence the sampling. *P. obtusa* has a morphologic structure that gives it adhesive capacity in the substrate, and it is associated with the vegetation in the edges, where the water speed was lower. It makes possible the permanence of the species in a certain extension of the stream during the floods. In the “Mergulhão” stream in January, when the rain levels were very high, only 4 fishes of *P. obtusa* were collected. Two hypotheses are suggested in order to explain the small occurrence of the species in this month: a) the transport of specimens down by the floods, or b) the individuals' displacement for another area of the stream.

The length amplitude of the species was the same in the three streams, yet in the “Ribeirão” stream individuals belonging to the biggest size class were not registered (class 11). Besides this, in the “Ribeirão” stream, a larger occurrence of small and intermediary sizes of fishes was observed, whereas in the other two streams, larger individuals prevailed. It is possible that the larger individuals occupy different sites from the ones sampled. São Thiago (1990) verified for *Schizolecis guntheri* (other Hypoptopomatinae) extensive home range in the “Parati-Mirim” stream (RJ), observing different structures in size of the population in three sampling stretches. Basile-Martins *et al.* (1986), studying *Pimelodus maculatus* in three sections of the “Jaguari” and “Piracicaba” rivers (SP), reported that young concentrated in a section moved to other sections as they grew. M. S. Menezes (personal communication) reported the differentiated occurrence of young and adults of *Hypostomus punctatus* along the “Ubatiba” stream (RJ) and suggested that the young move stream up with the growth. Regardless of fishing method used (because the same method was used in the three sampling points no difference was in stretches of the same extension) observed that did not justify the capture of bigger individuals' in the “Mergulhão” stream.

The females of *P. obtusa* reached bigger lengths than the males and they were in larger number in the classes of bigger size in the three streams similar findings have been reported by other authors also (Narahara *et al.*, 1985; Basile-Martins *et al.*, 1986; Moraes *et al.*, 1988). A

bigger body can present advantages in relation to the individuals' fecundity and, therefore, for the population as a whole. Differentiated growth rates in sexes can explain the biggest size reached by females, as well as its prevalence in the biggest size classes (Vazzoler, 1971). This way, it is believed that males would have smaller growth rate than females, the latter reaching superior lengths. The results of the sex ratio for length classes of *P. obtusa* seem to suggest a differentiated growth.

The sex ratio, considering the bimonthly and the total sampling, was significantly different from 1:1. Considering the ratio in each size class, it was verified that in spite of the existence of a general prevalence of females, in the size classes 1, 2, 3, 4 and 7, the proportion approached the expected and/or males prevailed.

The condition factor (K_1) was statistically different in the three streams, and it could indicate different fat accumulations for *P. obtusa* in these streams. The weight of the gonads was excluded, and therefore the influence of the gonad development was practically eliminated in its values. Thus, in the “Mergulhão” and “Colônia Pereira” streams, fishes were in better condition than in the “Ribeirão” stream, where the values of the condition factor were smaller.

Similarly, the relative condition factor (K_n) was different in the studied streams, indicating that in the “Mergulhão” and “Colônia Pereira” streams, fishes were heavier than in the “Ribeirão” stream.

In general, the studied populations differed in aspects of the population structure and in values of the condition factor. The populations of *P. obtusa* from the “Mergulhão” and “Colônia Pereira” streams were similar, when compared to that forms the “Ribeirão” stream. Thus, it would be believed that the environmental conditions of these streams might be influencing the life histories of this species.

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RESUMO

Características da estrutura da população e o fator de condição de *Pseudotothyris obtusa* foram comparados em três rios costeiros na região sul do Brasil. Os peixes foram coletados mensalmente através de pesca elétrica e medidos quanto ao comprimento total. Quinze peixes de cada rio foram dissecados e identificados quanto ao sexo. A estrutura da população em tamanho, a proporção sexual e a relação jovem/adultos foram analisadas e foi obtida a relação peso/comprimento. O fator de condição (K_1) e o fator de condição relativo (K_n) foram calculados em cada rio. Os peixes foram agrupados em 11 classes de comprimento de 3mm. As classes de tamanho maiores e intermediárias foram preponderantes nos rios Mergulhão e Colônia Pereira, e as classes menores e intermediárias no rio Ribeirão. Fêmeas prevaleceram nas maiores classes de comprimento, atingiram maiores comprimentos que os machos, e foram preponderantes em todos os rios. Os valores dos fatores de condição (K_1 and K_n) foram diferentes nos três rios, indicando melhor condição e maiores valores de peso total para os dos rios Mergulhão e Colônia Pereira.

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