

GROWTH OF THE ANNUAL FISH *Cynopoecilus melanotaenia*  
(REGAN, 1912) BASED IN A TEMPORARY WATER BODY  
POPULATION IN RIO GRANDE DO SUL STATE, BRAZIL  
(CYPRINODONTIFORMES, RIVULIDAE)

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(With 4 figures)

**ABSTRACT**

The growth of the annual fish *Cynopoecilus melanotaenia* was studied in its natural environment, in order to obtain information about its biology. A total of 797 specimens of *C. melanotaenia* were collected on a monthly basis between April 1994 and March 1995 in a temporary water body, located in Rio Grande do Sul State, Brazil. The growth curve in total length suggests, to both sexes, a fast initial growth. Males present a smaller growth rate than females, but they attain a higher average maximum length than the females.

*Key words:* annual fish, growth, *Cynopoecilus melanotaenia*, Brazil.

**RESUMO**

**Crescimento do peixe anual *Cynopoecilus melanotaenia* (Regan, 1912) com base na  
população de um corpo d'água temporário do Rio Grande do Sul, Brasil  
(Cyprinodontiformes Rivulidae)**

O crescimento do peixe anual *Cynopoecilus melanotaenia* foi estudado em seu ambiente natural, visando obter informações referentes a sua biologia. Foram capturados 797 espécimes de *C. melanotaenia*, em coletas mensais entre abril de 1994 e março de 1995, em um corpo d'água temporário localizado no Estado do Rio Grande do Sul, Brasil. A curva de crescimento total sugere, para ambos os sexos, um rápido crescimento inicial. Os machos apresentam uma taxa de crescimento menor que a das fêmeas, mas atingem, em média, um comprimento máximo maior que o das fêmeas.

*Palavras-chave:* peixe anual, crescimento, *Cynopoecilus melanotaenia*, Brasil.

**INTRODUCTION**

Annual fish are defined as a group of Cyprinodontiformes fish that can be found in temporary ponds, ditches and mudholes occurring in some parts of South America and Africa that dry out seasonally (Myers, 1942). The complete drying out of that aquatic habitat leads to the death of all adult and juvenile fish. The population survives as buried eggs for up to 18 months (Wourms,

1972). When the next rainy season comes, a new reproductive cycle begins, ponds refill and embryos hatch. The larval fish rapidly grow, become sexually mature and spawn repeatedly over a long period (Myers, 1942, 1952; Carvalho, 1957; Walford & Liu, 1965; Lacerda, 1969; Costa, 1990; Arenzon, 1996).

Because of fast corporal growth, precocious sexual maturity and long reproductive period, these annual fish seem to present basic characteristics

to the species to be used in toxicity tests. Some species can even become sexually mature after six-eight weeks of life (Vaz-Ferreira *et al.*, 1964; Walford & Liu, 1965; Weitzman & Wourms, 1967; Arenzon, 1996). The use of annual fish as test organisms in toxicity test may solve the problems of this kind of biomonitoring, the continuous culturing and/or recruitment of live stocks of test organisms, in a healthy state and in sufficient numbers.

The culture of organisms in the laboratory implies previous knowledge of biological characteristics such as the reproduction and growth of the species. The present study aims to establish some information on the growth of *C. melanotaenia*.

#### MATERIAL AND METHODS

From April, 1994 to March, 1995, specimens of *C. melanotaenia* were collected in a temporary water body, located in Tramandaí municipality, in the north of the Coastal Plain of Rio Grande do Sul State, Brazil (29°58'48" and 29°58'54"S; 50°14'12" and 50°14'20"W). Specimens were collected monthly using a hand net of 2 mm mesh. No specimens were collected during December 1994, when the water body was dry. The total length (mm) of each specimen was determined using a sliding calliper (0.5 mm) for specimens with a length higher than 100 mm, and stage micrometer in a microscope for smaller ones.

The population structure in length described here was determined based on the analysis of frequency distribution of total length classes by the Petersen method (Bagenal, 1968). These data were plotted monthly, for males and females separately. The growth curves in total length for each sex were obtained by Bertalanffy (1938) expression, after it had been validated by the Ford-Walford transformation (Walford, 1946). A total of 19 specimens hatched in the laboratory and obtained from spawning of specimens from the studied population, also kept in laboratory, were used to estimate the length of new born fries.

According to Lacerda (1969), annual fish eggs begin its hatch immediately after the raining season. Thus, it was possible to estimate the age of the specimens collected on the months subsequent to the dry spell period (December).

Data from the nearest meteorological station indicate that the raining season started 21 days

before the January collection. This information confers the specimens collected in this period the maximum age of 21 days, as no specimen was previously present in the water body.

For the specimens collected after January, the age was determined adding the number of days between each collection period to the 21 initial days.

The age of the specimens collected on the period before the drying period was made comparing the modal length from this period with the modal length obtained after the drying season.

#### RESULTS

The monthly displacement of modes, both for male (Fig. 1A) and for female (Fig. 1B) confirms the adequacy of using Petersen method for this study.

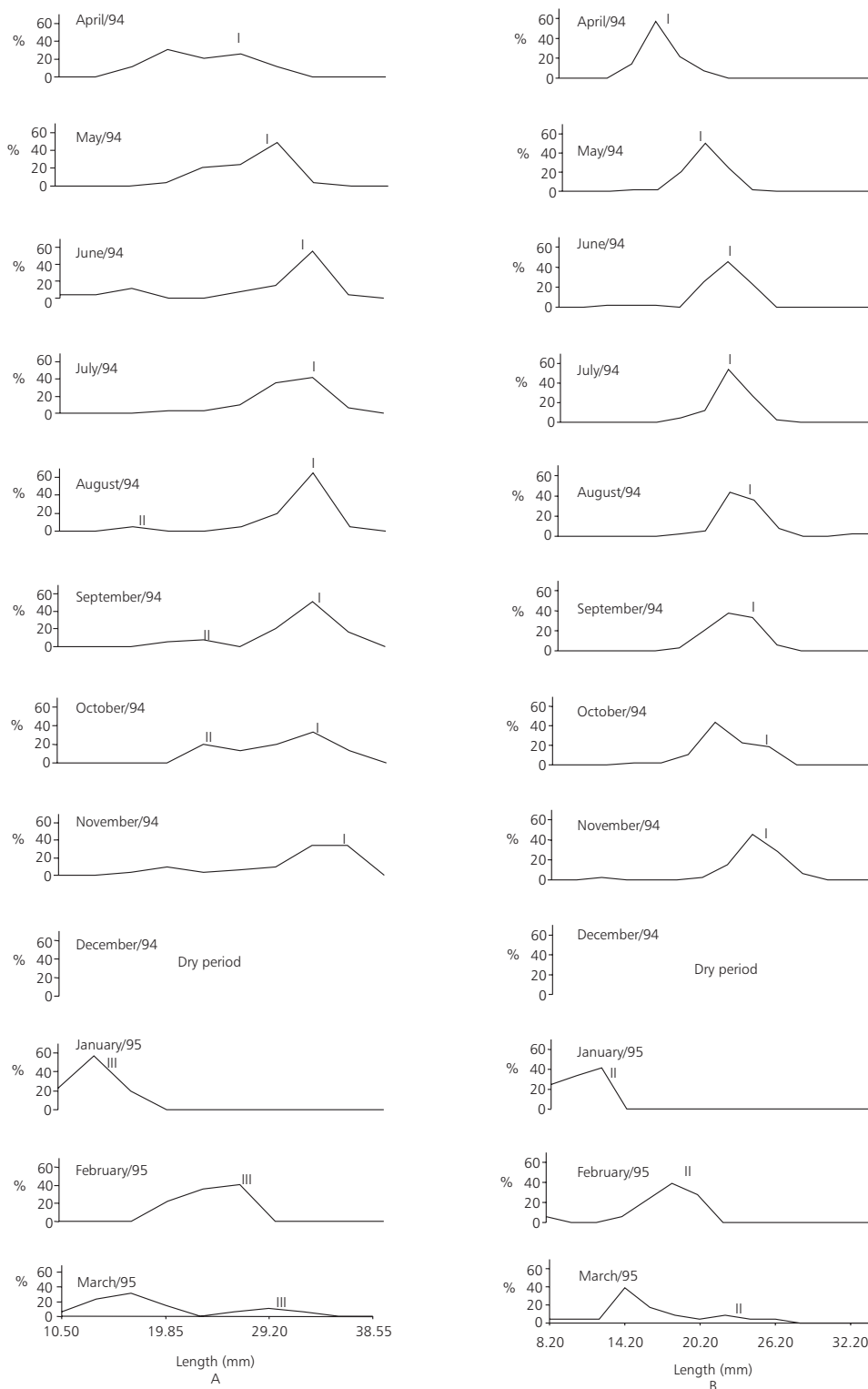
The obtained modal values demonstrate a fast initial growth in both sexes (Fig. 2). The average individual length at birth, estimated in laboratory, was 4.69 mm, with a standard deviation of 0.258 mm (VC = 5.5%).

The Bertalanffy length of mathematical expressions curves for males (Fig. 3A) and females (Fig. 3B) of *C. melanotaenia*, show a smaller growth rate for males ( $K = 0.5243$ ) when compared for females ( $K = 0.6373$ ). Males attain an average maximum length ( $L_{\infty}$ ) higher than females.

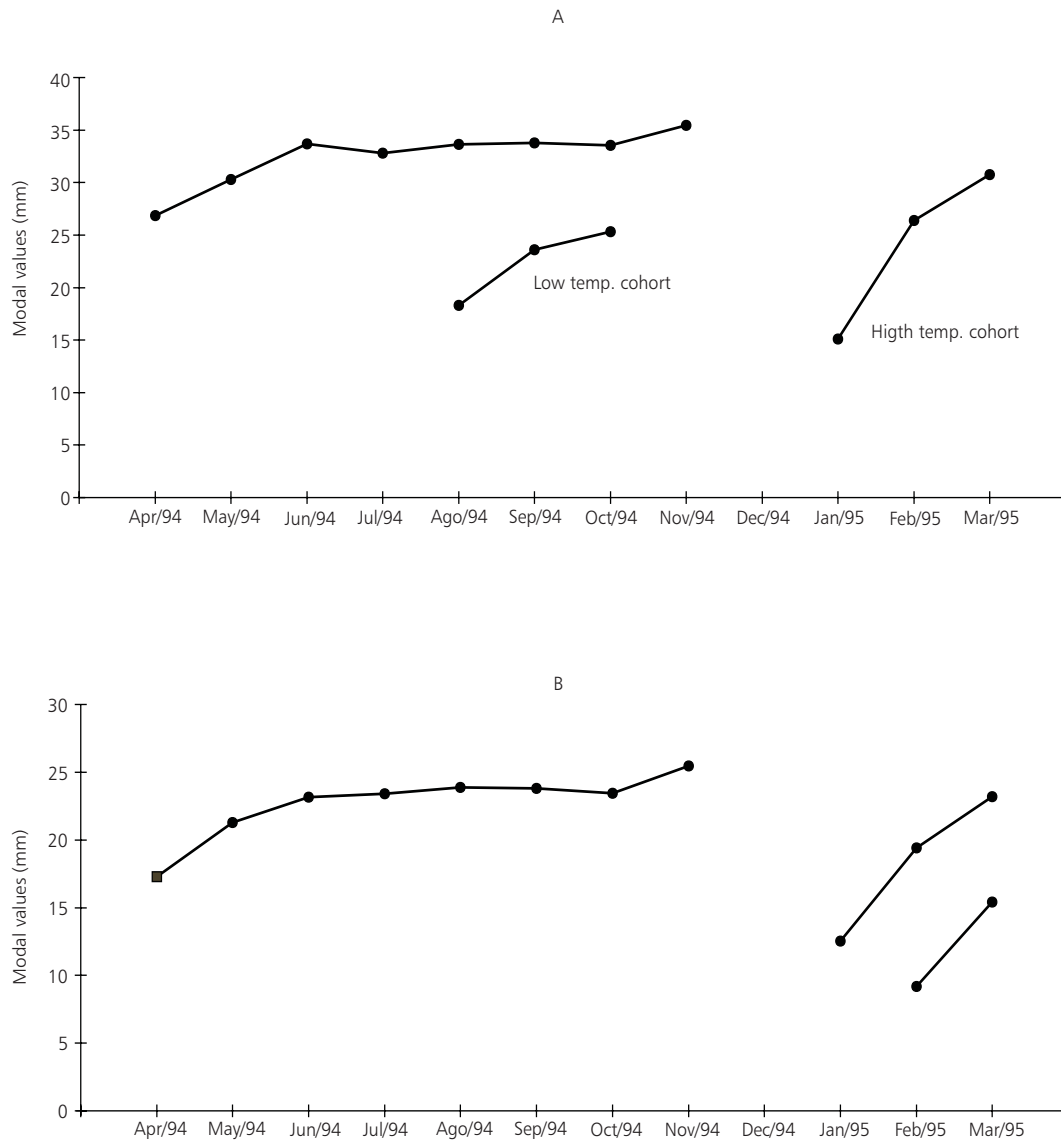
The appearance of modes of new cohorts in the population of males (Fig. 1A) was observed in August-October. The temporal displacement of these modes allowed the analysis of the growth of these cohorts separately, during the coldest and hottest period. The coldest period (August-October) showed average water column temperature of 17.3°C and the hottest (January-March) showed average water column temperature of 25.5°C. The statistics analysis showed no significative difference ( $p = 0.05$ ) on the growth rate between the two cohorts (Fig. 4).

#### DISCUSSION

It is known that to use the Petersen method, besides a complete sample of all existing age classes, its also necessary a well-defined and periodic spawning period present in the studied population, permitting the coexistence of distinct size groups in the area.



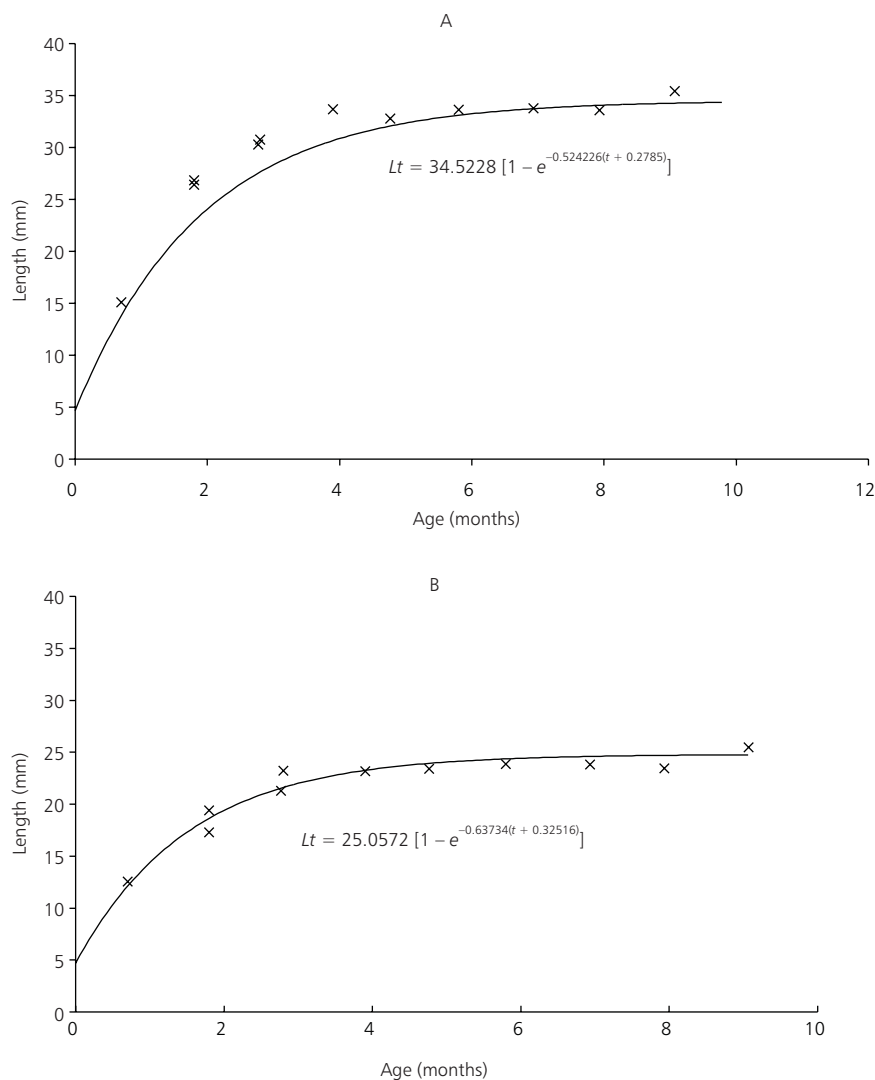
**Fig. 1** — Monthly length-frequency distribution (mm) of males (A) and females (B) of *Cynopoecilus melanotaenia*, collected from April/94 to March/95 in a temporary water body located in Tramandaí municipality, in the north of the Coastal Plain of Rio Grande do Sul State, Brazil (29°58'48" and 29°58'54"S; 50°14'12" and 50°14'20"W).



**Fig. 2** — Length modal values for (A) males and (B) females of *Cynopoecilus melanotaenia*, collected from April/94 to March/95 in a temporary water body, located in Tramandaí municipality, in the north of the Coastal Plain of Rio Grande do Sul State, Brazil (29°58'48" and 29°58'54"S; 50°14'12" and 50°14'20"W).

Although the reproduction of *C. melanotaenia* is not periodic (Arenzon, 1996), annual fish eggs are "stocked" at the bottom, hatching when the abiotic conditions become favourable again. This process makes the hatch of *C. melanotaenia* to occur in batches, producing different cohorts. Thus, in most cases, instead of the presence of multi-modal curves, we found each month a uni-modal curve

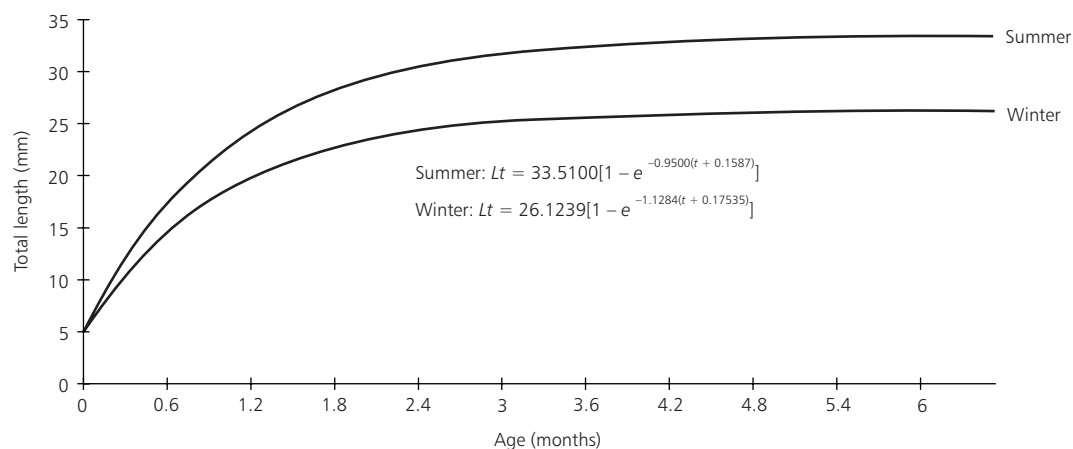
representative of the same age class, which moved itself along the time. According to Santos (1978) the modes represent natural age classes, that is it, a group of specimens from the same spawn or from the same period of the year when the spawning process was more intense. In *C. melanotaenia* case, the modes represent groups of specimens resultant of the same hatch, but from different spawning.



**Fig. 3** — Length growth curves (A) males and (B) females of *Cynopoecilus melanotaenia*, collected from April/94 to March/95 in a temporary water body, located in Tramandaí municipality, in the north of the Coastal Plain of Rio Grande do Sul State, Brazil (29°58'48" and 29°58'54"S; 50°14'12" and 50°14'20"W).

The male growth in the summer and winter periods shows no significant difference on the temperature influence on the growth of *C. melanotaenia*, at last during the very short observed period of each cohort. Walford & Liu (1965) and Liu & Walford (1966), based in laboratory experiments, reported that studies with sexually mature *Cynolebias adloffii*, a closely related species (Costa, 1990) showed that faster growth occurred at a lower temperature (16°C vs. 22°C). Liu & Walford (1969, 1970) also observed that *Cynolebias bellottii* was able to attain a very large size in less than one

month, at relatively high temperatures (22 to 32°C). According to Liu & Walford (1970) and Liu *et al.* (1975) the higher growth of annual fish at lower temperature could be related to a more efficient food conversion in this condition, thus energy conversion becomes more efficient with the same amount of food at a lower than a higher temperature. These last authors comment that the faster growth of annual fish in natural conditions, on higher temperature, could be resulting from a large food availability, enough to keep a good growth rate.



**Fig. 4** — Length growth curves for summer and winter male cohorts of *Cynopocilus melanotaenia*. Collected from April/94 to March/95 in a temporary water body, located in Tramandaí municipality, in the north of the Coastal Plain of Rio Grande do Sul State, Brazil (29°58'48" and 29°58'54"S; 50°14'12" and 50°14'20"W).

Besides, we should add here that the higher day length during the hottest months, allows a longer feeding period.

Thus, according to our data, *C. melanotaenia* shows a very fast growth, having the possibility of growing close to the maximum length in the period of three months. This characteristic favours its cultivation in laboratory conditions, as fast body growth is usually related to a precocious sexual maturity.

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