CHANGES IN GROWTH SEASONALITY THROUGHOUT *Netuma barba* (LACÉPÈDE, 1803) (SILURIFORMES, ARIIDAE) ONTOGENY

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(With 1 figure)

The somatic and populational growth of living organisms is affected directly and indirectly by the environment (Nikolskii, 1969; Weatherley, 1972; Pauly, 1984; Margalef, 1995). A direct effect is metabolism change (much more apparent in ectotherm organisms); indirect effects include variable food availability and differing vulnerability to predation since temperature and other physical variables cause cycles in ecosystem productivity as well as migration in some competitor and predator species (Margalef, 1995). This is more clearly observed in long-lived organisms (Nikolskii, 1969; Weatherley, 1972; Pauly, 1984).

It is commonly accepted that individual growth in temperate water fishes shows some degree of oscillation during the year, following temperature or other environmental cycles like day length, rain seasonality, moon cycle, etc. Most somatic growth models do not include such information about this type of variation or oscillation and more simple but useful models are generally used such as the von Bertalanffy growth function (Casselman, 1983; Pauly, 1984; Moreau, 1987; Sparre *et al*., 1989).

In medium- and high-latitude ecosystems, the warm season causes an increase in the individual growth rate with a decrease, reaching zero in some groups of fishes, occurring in the cold season (Pauly, 1984; Sparre *et al*., 1989). In such cases, growth in some groups may be conveniently described by a kind of sine-wave growth curve for a one-year period (Pauly, 1984). This pattern is believed to represent the life cycle of all the species.

For the semi-anadromous catfish *Netuma barba* (Lacépède, 1803) (Siluriformes, Ariidae) the growth cycle appears to be different. Length frequency analysis and modal progression analysis for juveniles (n = 38.838; Velasco, 1998) in the Patos lagoon estuary, southern Brazil showed the expected pattern: fast growth in the warmer months (October-April) and slow growth in the colder months (May-September) (Fig. 1). However, the adult fraction of the population showed a quite different behaviour. Reis (1982, 1986a) studied growth of adult catfish from artisanal fishery catches. *Lapillus* otolith structure showed that the greatest increment of material deposition (calcium and protein; see Casselman, 1983) occurs in winter.

What factor could affect adult catfish growth more than the cold season itself? The species biology may be the answer. Juveniles up to three years of age inhabit the estuarine area of Patos lagoon for feeding and further development (Araújo, 1983; Velasco, 1998). In this region, they are affected by temperature variations and the rain cycle: generally warm and dry summers (December-February) and cold and rainy winters (June-August) (Seeliger *et al*., 1997). These variations induce metabolic changes as reflected in the cohort mean-size analysis shown in Fig. 1, where a decrease in the growth rate is evident during the colder months. This is specially clear for the strong 1979 cohort, followed during two years.

Pre-adult (3 to 7-years-old) and adult (age 7 up) *Netuma barba* spend autumn and winter feeding on the continental shelf. Some of these individuals are caught by the trawler fleet in southern Brazil and adjacent regions (southeastern Brazil, Uruguay, and Argentina) (Reis, 1986a; Haimovici, 1997; Velasco, 1998). In spring (September-November) the mature individuals start to enter the estuary for reproduction, which takes place around November. After that, females leave the estuary followed by the males that carry the developing embryos in their oral cavity for protection (Reis, 1986b). During this period, which may last up to 2 months (Rimmer & Merrick, 1982; Reis, 1986b), male adults do not feed.

We believe the stress caused by the environmental change from marine to brackish water, coupled with the absence of feeding activity, causes the low growth

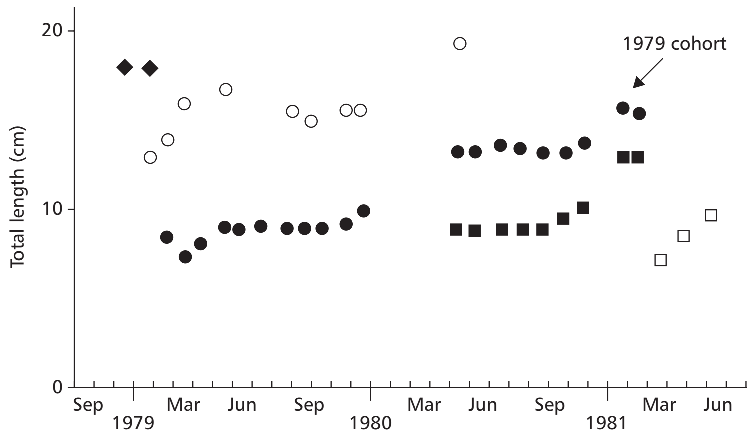

Fig. 1 — Cohort mean-size analysis (total length in cm) for *Netuma barba* juveniles inside Patos lagoon estuary, southern Brazil (from Velasco, 1998). The 1979 cohort is represented by full circles. Different symbols represent different cohorts.

rate and low deposition of material in otoliths and other calcified structures (Reis, 1986a).

The absence of feeding activity is not only critical for incubating males, but also for the females, most of whose abdominal cavities are occupied by an ovary filled with very large eggs (15 mm ∅) during maturation (Rimmer & Merrick, 1982; Reis, 1986b). The poor physical condition of adults that leave the estuary shows how demanding the reproduction and incubation period is (Reis, 1986a, b).

The growth pattern presented by *Netuma barba* is different from what is known about other fishes. This change may be present in other organisms with similar biological characteristics and if so would lead to a new approach to fish growth and in creating mathematical models that include such variations.

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