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Fecundity of the *Astyanax bimaculatus* (Reinhardt, 1874). (Teleostei, Characidae) from upper Rio São Francisco basin, Brazil

(Fecundidade de Astyanax bimaculatus (Reinhardt, 1874) (Teleostei, Characidae) da bacia do Alto São Francisco)

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SUMMARY

The average frequency of oocyte diameter by size classes, and the relative and total fecundity for the yellow-tail-lambari (*Astyanax bimaculatus*) were determinated. Twenty-one females from ponds of the Hydrobiology and Fishculture Station at Três Marias, collected in December, 1992 and February, 1993 were used. The fecundity 1(FEC1) was estimated through volumetric sampling, using only oocytes with diameter above 400μm, histologically defined as vitellogenic. Eight specimens had all their oocytes counted and measured under the microscope. For these, the fecundity 2(FEC2) was also calculated, including oocytes larger than 200μm. The results showed the presence of two modes. FEC1 varied from 2,300 to 14,100 oocytes, and FEC2, from 8,300 to 32,700. The oocyte diameter distribution resembles that of total spawning fish. The values for the correlation coefficient (r) between FEC1 and standard length and FEC1 and body weight were, respectively, 0.64 and 0.65.

KEY WORDS: Fecundity, *Astyanax bimaculatus*, oocyte diameter

RESUMO

Foram determinadas a frequência média do diâmetro ovocitário por classe de tamanho e a fecundidade total e relativa do lambari-do-rabo-amarelo (*Astyanax bimaculatus*). Utilizaram-se 21 fêmeas coletadas em tanques da Estação de Hidrobiologia e Piscicultura de Três Marias, nos meses de dezembro de 1992 e fevereiro de 1993. A fecundidade 1(FEC1) foi estimada por sub-amostragem volumétrica, levando-se em conta apenas os ovócitos com diâmetros superiores a 400μm, histologicamente definidos como vitelogênicos. Oito exemplares tiveram todos seus ovócitos contados e medidos com ocular micrométrica. Para estes,

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determinou-se, também a fecundidade 2(FEC2), abrangendo os ovócitos acima de 200μm. Os resultados mostraram a ocorrência de 2 modas. FEC1 variou de 2.300 a 14.100 ovócitos e FEC2, de 8.300 a 32.700. A distribuição de diâmetros ovocitários assemelha-se à de peixes de desova total. Os valores do coeficiente de correlação (r) entre FEC1 e comprimento padrão e FEC1 e peso corporal foram, respectivamente, 0,64 e 0,65.

PALAVRAS-CHAVE: Fecundity, *Astyanax bimaculatus*, oocyte diameter

INTRODUCTION

Yellow-tail lambari (*Astyanax bimaculatus,*) is a forage species, common in reservoirs and rivers of southeast Brazil, and popular in sport fisheries. Its reproductive biology has been studied in many aspects, including fecundity and type of spawning (Barbieri & Barbieri, 1988; Genari-Filho & Braga, 1988, among others). The present work aims to determine the average frequency of oocyte diameter by size classes, and also the total and relative fecundity for this species, collected from Três Marias Reservoir, State of Minas Gerais (18° and 20° S, 45° and 46° W) and kept in captivity.

MATERIAL AND METHODS

In December, 1992 and February, 1993, twenty-one females, in advanced stage of gonadal maturation, were collected from the ponds of the Hydrobiology and Fishculture Station at Três Marias. From each specimen, the standard length (SL), in cm, and body weight (BW), in g, were obtained. The gonads were removed and their contents placed in flasks containing Gilson's solution, where they remained for 60 days. The dissociated material was submitted to a continuous water flow in order to retain only large oocytes whose diameter, according to Bazzoli & Rizzo (1990) and Bazzoli (1992), measured above 400 μm and were vitellogenic.

Absolute fecundity was determinated by volumetric subsampling, as described by Bagenal & Braum (1978). After been settled in beakers, the oocyte mass from each specimen had its volume completed to 500 ml with water. The suspension was then homogenized and two subsamples were collected using a 5 ml Stempel's pipette. The oocytes were counted and those from eight specimens were also measured under a microscope. Absolute fecundity for each fish was estimated basing on the mean value of the subsamples.

Two types of absolute fecundity were estimated. The absolute fecundity 1 (FEC1) was estimated using vitellogenic oocytes (O-IV) and absolute

fecundity 2 (FEC2), w
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BW = body weight
A = linear coefficient (in
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fecundity 2 (FEC2), which included O-IV as well those at the stage of cortical vesicles (O-III) (Bazzoli & Rizzo,1990; Bazzoli, 1992). The latter oocytes measured above 200 μm in diameter.

In order to obtain the relative fecundity, the values of FEC1 were plotted on SL and BW, according with the following equations:
FEC1 = A + B x SL, and FEC1 = A + B x BW, where
FEC1 = absolute fecundity
SL = standard length
BW = body weight
A = linear coefficient (intercept)
B = angular coefficient

RESULTS AND DISCUSSION

The distribution of yellow-tail lambari oocytes by diameter classes (Fig. 1) shows two distinct modes. The first mode represents the recruitment stock made of immature oocytes (O-I), pre-vitellogenic oocytes (O-II) and cortical alveoli oocytes (O-III.). The second mode corresponds to vitellogenic oocytes (O-IV) whose maximum diameter reached 848 μm.

A. bimaculatus is referred to as a fractional spawner (Ihering & Azevedo, 1936; Agostinho *et al.*,1984; Andrade *et al.*,1985; Barbieri & Barbieri, 1988) or total spawner (Nomura, 1975). Garutti (1989) stated that this species may show fractionated spawning in habitats with low water volume, such as water springs and river headwaters, and total spawning in wider environments, which are less exposed to abrupt changes. Andrade *et al.* (1985) registered low frequency of O-III during the reproductive cycle in pond raised *A. bimaculatus,* probably due to the fact that yolk deposition is rapidly accomplished in this species. They also stated that it shows vitellogenic oocytes throughout the annual cycle.

These observations could explain the oocyte distribution pattern found in the present work which is similar to those of total spawners, with only one mode of vitellogenic oocytes.

FEC1 varied from 2300 to 14100 oocytes, with the average of 9171.4 ± 3605.5. For the specimens which had their oocyte measured, FEC2 oscillated from 8300 to 32700, with the average of 18240 ± 9351.7 oocytes. The yellow tail lambari fecundity is low, being within the limits found by other authors (Tab. 1).

Table 1 -Absolute fecundity for some species of *Astyanax*

Species	Study site	Absolute fecundity	Source
A. bimaculatus	Mogi-Guaçu river, SP	714 -31778	Nomura, 1975
A. bimaculatus	Lobo reservoir, SP	1020-6000	Barbieri & Barbieri, 1988
A. bimaculatus	Barra Bonita reservoir, SP	12749-75734	Genari-Filho & Braga, 1988
A..bimaculatus	Três Marias reservoir, MG	2300-14100	Present study
A. fasciatus	Mogi-Guaçu rive, SP	593-10115	Nomura, 1975
A. fasciatus	Lobo reservoir, SP	9933.6-151214.8	Barbieri & Barbieri, 1988
A. schubarti	Mogi-Guaçu river, SP	657-7820	Nomura, 1975

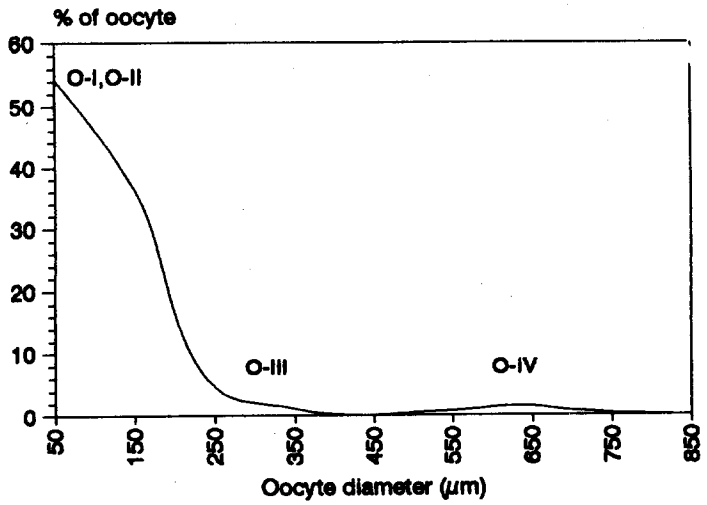

Fig. 1 - Percentage distribution of *A. bimaculatus* oocyte I, II, III and IV by diameter class.

The regressions of FEC1
the following equations:

FEC1 = -16176 + 3098.3
FEC1 = -1555.3 + 435.8

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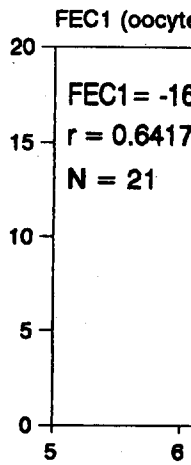
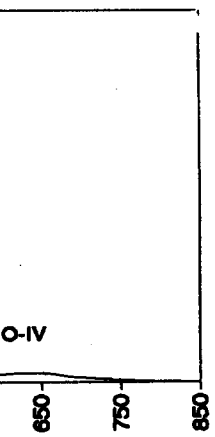


Fig. 2 - Relationship betwe
A. bimaculatus.

yanax

ute dity	Source
1778	Nomura, 1975
6000	Barbieri & Barbieri, 1988
75734	Genari-Filho & Braga, 1988
4100	Present study
0115	Nomura, 1975
51214.8	Barbieri & Barbieri, 1988
820	Nomura, 1975



e I, II, III and IV by diameter

The regressions of FEC1 on SL (Fig.2) and FEC1 on BW (Fig.3), resulted in the following equations:

FEC1 = -16176 + 3098.3 x SL . r = 0.64176 and
FEC1 = -1555.3 + 435.80 x BW . r = 0.64997

The correlation between lnFEC1 and lnSL presented a value (0.56898) lower than the one obtained with the non transformed data. For this reason, the potential curve model was not used to describe this relation. According to Zanetti (1979) *apud* Barbieri & Barbieri (1982), high correlation occurs in total spawning species whereas low correlation values is characteristic of fractionated spawners. The correlation between relative fecundity and SL and BW were similar in the yellow-tail lambari. Although not high, they were above the values found in fish with fractionated spawning.

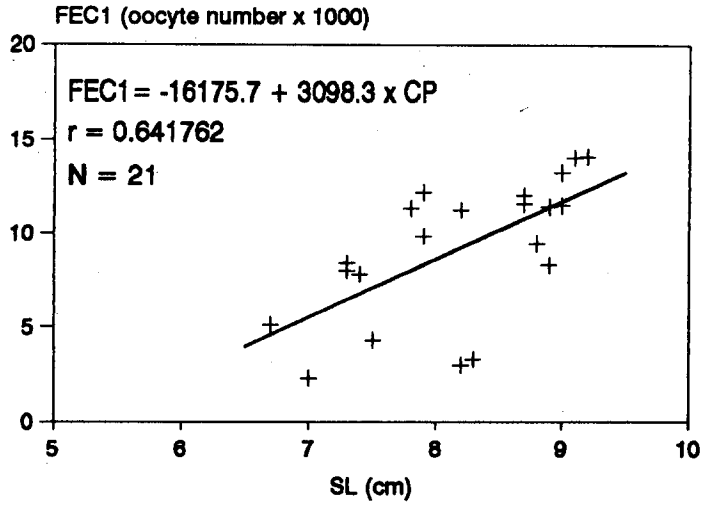


Fig. 2 - Relationship between absolute fecundity (FEC1) and standard length (SL) of *A. bimaculatus*.

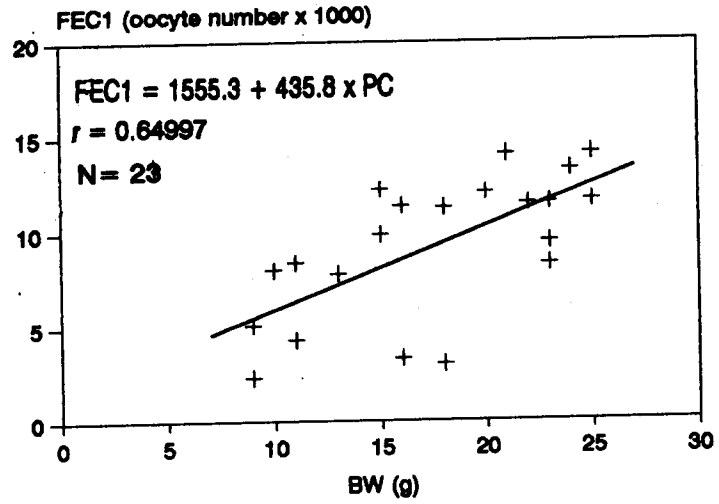


Fig. 3 - Relationship between total fecundity (FEC1) and body weight (BW) of *A. bimaculatus*.

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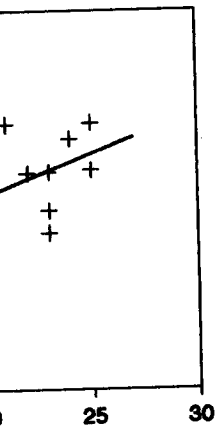

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