Reproductive biology of Myleus ternetzi

Pierre-Yves Le Bail, Anne Margeridon, Chantal Cauty, P. Planquette, Etienne Prévost, Maurice Loir

Reproduction in fish - Basic and applied aspects in endocrinology and genetics
Tel-Aviv, Israel, 10-12 November 1986
Ed. INRA, Paris 1988 (Les Colloques de l'INRA, nº 44)

Reproductive biology of *Myleus ternetzi*

P.Y. LE BAIL, A. MARGERIDON, C. CAUTY,
P. PLANQUETTE*, E. PREVOST** and M. LOIR

INRA, Laboratoire de Physiologie des Poissons, 35042 Rennes Cedex, France
** INRA, Laboratoire d'Hydrobiologie tropicale, 97310 Kourou, Guyane*
*** ENSA, Laboratoire d'Hydrobiologie-Ecologie, 35042 Rennes Cedex, France*

Summary

A semi-quantitative analysis of Myleus ternetzi spermatogenesis was carried out using a steorological method. The data were treated with a computer and a factorial analysis of the correspondences has lead to define 6 maturation stages. Ovogenesis was studied and the maturation stage of every female was determined. It has appeared that vitellogenesis is discontinuous and that at least 3 spawnings could occur during a breeding season. The mean relative fecundity of the females is around 10 000 oocytes per kg and per spawning. Myleus ternetzi is able to breed throughout the year but more animals should breed just before the major wet season.

Serrasalmidae inhabit freshwaters in tropical and subtropical regions of South America. One of them, Myleus rhomboïdalis which is present in the largest rivers in Guyana and the weight of which rises 5 Kg, is one of the fishes which have been selected to start fishfarming in French Guyana, although informations are lacking about its growth performances, reproductive biology and its ability to breed in captivity. A closely related species Colossoma macroponum is already cultured in Brazil since some years.

Myleus rhomboïdalis is rarely netted. So, we have choosen to study the reproductive biology of Myleus ternetzi, a smallest and less interesting species, but which is often caught.

A total of 187 males and 149 females have been netted from May 1981 to May 1982, in December 1984, 1985 and in March 1986.For every fish, morphometric data were collected and as soon as possible the gonads were fixed for histology and sometimes for electron microscopy.

The testis of Myleus ternetzi is of the type named "lobular" or "unrestricted spermatogonial". Between the tubules, the interstitial tissue is particularly large, this contrasting markedly for instance with the trout. Indeed, in maturing or mature males, between 18 and 32 % of the area of the testis sections are occupied by the interstitium. After electron microscopy, most of the cells of this tissue are Leydig cells, identified by ultrastructural features characteristic of steroidogenic cells.

Because of a marked asynchronous maturation of the germ cells present in one testis, it was impossible to ascribe a maturation stage to every male without to undertake a semi-quantitative analysis of spermatogenesis. This was done using a steorological method allowing to estimate the relative volumes occupied inside the tubules by spermatogonia, spermatocytes, spermatids and spermatozoa. The data were treated with a computer and a factorial analysis of the correspondences has lead to define 6 maturation stages numbered from 2 to 7. Each of them was defined by characteristic percentages of the four germ cell types.

Only spermatogonia were present in testes at the stage 2. So, the males at this stage were considered to be unpubescent. The stage 3 would correspond to the start of the first gametogenesis. Males at the stages 3 to 7 were considered as pubescent males. The stage 4 has a germ cell composition somewhat apart from the progressive evolution characterizing the stages 2, 3, 5 and 6, evolution which fit well with the advancement of spermatogenesis. It was also observed with electron microscopy that the basal lamina in testes at the stage 4 were extremely convoluted while they are nearly extended at stages 2 and 7 and this fact was interpreted as resulting from the removal of a lot of germ cells (spermatozoa) previously present inside the tubules. Taking in consideration these observations and the fact that the weight of the animals at the stage 2 is always below 200g and at the stage 3 below 325g, we conclude that the stage 4 is likely the stage of regression after spermiation. So, after a first gametogenesis, a testis never contains only spermatogonia, but, at the opposite of, for instance, the trout, all the germ cell types remain present.

Excepted in the more mature stage 7 males which have a gonadosomatic index between 0,3 and 0,8 %, this index is usually low. It does not change significantly according to the maturation stages and thus cannot be used to determine it.

The ovaries are surrounded by a tunica, the thickness of wich increases during ovogenesis. After spawning this thickness does not decrease significantly. Especially in mature females, the oocyte population of

an ovary is heterogenous and in addition to ovogonia always present, oocytes at various stages can be observed :

- oocytes in previtellogenesis ; their diameter is below 350 m
- oocytes in endogenous vitellogenesis named here vitellogenesis I. They are white and their diameter is below 750 m
- oocytes in endogenous vitellogenesis named here vitellogenesis II. In early vitellogenesis II, they are beige and their diameter is below 1.8 mm. In late vitellogenesis, they are yellow.

The maturation stage of every female was determined as that of the more advanced oocytes present in the ovaries. In addition, after the thickness of the ovary tunica and the presence or not of atretic and post-ovulatory follicles, it was possible to know if a pubescent female was either in first gametogenesis or in second or more. It has appeared that above a total weight of 380g all the females were at least in 2nd ovogenesis.

The gonadosomatic index increases lightly from 0.3 % for females in previtellogenesis to 0.7 % for females in vitellogenesis I. During vitellogenesis II it increases markedly to 11 %.

Although it was a time-consuming and tedious work, the composition of the oocyte population of 4 females was quantitatively studied. Ovaries fixed in formaldehyde were mechanically dissociated and the oocytes in vitellogenesis were sorted in at most 3 populations according to their colour. Histograms were drawn as a function of the oocyte diameter. It has appeared that :

- vitellogenesis is discontinuous in Myleus ternetzi
- the number of oocytes is roughly similar in the 3 populations of oocytes

We propose that each of the three oocyte populations will give a spawning. If so there is at least 3 spawnings during a breeding season. Because it was not possible to count the number of oocytes in previtellogenesis, we do not know how many spawnings could effectively occur during a breeding season.

At the oppposite of the male, after the last spanwing at the end of the breeding season, the ovaries regress to the previtellogenesis stage. These females are distinguished from the unpubescent ones by the thickness of the ovary tunica.

Biology of reproduction :

To judge of the opportunity to put one species in aquaculture, some data about reproduction are especially interesting to know, such as :

- the possibility or not to sex early the animals,
- the size or age at puberty,
- the fecundity,
- the period and length of the breeding season.

Sexual dimorphism is appearent at the level of the anal fin. It is falciform in the young immature, nearly triangular in the female and bilobate in the male. The anal fin acquires male shape in the youngest stage 2 males. Seventy per cent of these males have a male anal fin.

The distribution of the number of pubescent males, as a function of the weight indicates that 50 % of the males with a total weight between 150 and 200 g are pubescent. For the females, 50 % of those with a total weight between 200 and 250 g are pubescent. It should be noted that this weight corresponds to about the third of the maximum weight for this species.

The fecundity of the females has been calculated after the size of the population of oocytes in late vitellogenesis II, this population being supposed to give one spawning. Per Kg and per spawning the mean relative fecundity is around 10 000 oocytes. This is much lower than in Colossoma which spawn 100 000 eggs per Kg, however only once per year. This is higher than in Salmonids.

So, from a zootechnical point of view the fecundity of Myleus-ternetzi appears to be interesting.

The distribution of the unpubescent and mature males and of the mature females throughout the year was drawn as a function of the climatic seasons. It has appeared that Myleus ternetzi is able to breed throughout the year but that more animals should breed just before the major wet season. It is noteworthy that a higher proportion of unpubescent males was netted during the major dry season. We hypothesize that they are issued from breedings 6 months earlier. We have not caught undifferentiated juveniles (stage 1), that is to say animals with a weight below 25-30 g but, according to our hypothesis, we suppose that they should be in a higher propitious during the major wet season which likely is more propitious for them.A higher percentage of males in stage 3 was netted during the minor wet season. This suggests that the first spermatogenesis could start at this time for animals 9 months old.

If we have obtained some interesting data about the reproductive biology of Myleus ternetzi, some questions remain without answer :

- we do not kno how many times a female can spawn per year
- we do not know if Myleus ternetzi breed in the large rivers or

if it prefers to swim up in the narrow ones to search for an habitat more quite and more secure for larvae and juveniles. It is known that an other Myleus, M. Pacu migrates at the beginning of the wet season to breed

- at the present time it is impossible to know the age of a Myleus ternetzi

In conclusion, our data about the reproductive biology of M.ternetzi suggest that myleinae could be interesting to start freshwater aquaculture in french Guyana.

Résumé : *Biologie de la Reproduction de Myleus ternetzi*

Une analyse semi-quantitative de la spermatogenèse de Myleus ternetzi a été réalisée par une méthode stéorologique. Les données ont été traitées sur ordinateur et une analyse factorielle des correspondances a permis de définir 6 stades de maturation. L'ovogenèse a été étudiée et le stade de maturation de chaque femelle a été déterminé. Il est apparu que la vitellogenèse est discontinue et que au moins 3 pontes pourraient avoir lieu par saison de reproduction. La fécondité relative des femelles est d'environ 10 000 oeufs par kg par ponte. Bien que aptes à se reproduire toute l'année, plus de Myleus ternetzi se reproduiraient juste avant la grande saison des pluies.