Production of “pejerrey” *Odontesthes argentinensis* fingerlings: A review of current techniques

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The marine “pejerrey” *Odontesthes argentinensis* is a valuable marine fish resource in Southern South America, and its culture is considered promising. Several aspects related to the culture of *O. argentinensis* have been studied and the objective of this work is to review the techniques currently available for reproduction, incubation, larviculture and fingerling production.

**Reproduction**

*O. argentinensis* is a partial spawner, its breeding season extends from late winter to the end of spring. The eggs, which average 2 mm in diameter and have several attachment filaments, are laid in entangled clutches. Fecundity is low, a 300 g female spawns less than 5,000 eggs per spawning. Fertilized eggs can be obtained: (1) from the wild; (2) through artificial fertilization of wild captured broodstock; or (3) from natural spawning of captive broodstock.

(1) Egg clutches stick to substrates available in the sea (fishing nets, shells, wood sticks), giving the marine pejerrey the possibility to have its eggs launched to the coast, where they lay in the sand and are exposed to the air (Phonlor and Vinagre, 1989), a unique characteristic among the Southern West Atlantic coast fish. These eggs remain viable for 3-4 days and they can be easily collected by hand, taken to the hatchery and incubated, providing an ample source of larvae.

(2) Wild broodstock are captured by beach seine and carefully stocked into holding tanks, where they are kept until arriving in the hatchery. Artificial fertilization can also be done in the field, and in this case the eggs are transported to the hatchery in small buckets with sea water. In the hatchery, fish are immediately sexed and gametes are hand stripped. No hormonal induction is used for ovulation, as only naturally ovulated females are selected for artificial fertilization. Milt from two males is collected in a syringe and the ova are released into a bowl, the spermatozoa are activated with a few drops of sea water immediately before it is added to the ova. The newly fertilized eggs are washed with running sea water and taken to the incubation room.

The fertilization rate is influenced by the salinity of the spawning media. Fertilization is hampered in fresh water, in salinities of 5% the fertilization rate achieves only 12%, but between 10 and 30% the fertilization rate averages 90% (Sampaio, 1992).
Incubation

The embryonic development of *O. argentinensis* is slow, depending on the temperature and the salinity larvae will take from 10 up to 16 days to hatch. Time for hatching is inversely proportional to the temperature, eggs maintained at 18°C take 16 days to hatch, and those kept at 26°C will hatch 13 days after the fertilization. The hatching rate at 26°C is about 55%, higher hatching rates are observed at lower temperatures (18-23°C) reaching 80-100% depending on the quality of individual batches (Sampaio, 1992; Sampaio and Pisseti, 2001).

The effects of salinity on *O. argentinensis* eggs resemble those on fertilization. The hatching rates for eggs incubated at salinities between 10 and 30‰ are above 90%, but the hatching rate decreases to 70% in low salinity water (5‰). The negative effect of low salinity water was probably more pronounced up to two days after the fertilization, as no further deaths were observed among embryos that survived this period (Sampaio, 1992).

Considering the results of the studies described above, it is recommended that incubation of *O. argentinensis* eggs should be carried out at 23°C in sea water (30‰).

Larviculture and Fingerling Production

Notochord length at hatching is between 7-8 mm, at this point larvae are already well formed, with pigmented eyes and a functional digestive tract, allowing them to prey directly on *Artemia* nauplii, thus dispensing the labour intensive culture of rotifers (Phonlor and Vinagre, 1989).

Larvae will die of starvation 12 days after hatching if kept without food, but recrudescence of growth will be observed if *Artemia* nauplii are provided as late as 9 days after hatching (Phonlor and Vinagre, 1989). Prolonged starvation induces general cellular atrophy, the epithelium of the intestine suffers desquamation, a drastic reduction of zymogen granules is observed in the spleen, and necrosis is observed in the liver (Costa, 2001).

The appropriate density of *Artemia* nauplii is proportional to the age of *O. argentinensis* larvae. At a stocking density of 15 larvae/l, the density should increase from 1 nauplius/ml the first day after hatching to 15 nauplii/ml two weeks after hatching (Tesser and Sampaio, 2001).

Dry diets are accepted at first feeding, but larval growth is reduced when compared to larvae preying upon *Artemia* nauplii, thus weaning should be attempted with older larvae (Sampaio et al., 1995). Currently, *O. argentinensis* larvae are weaned 15 to 30 days after hatching (Sampaio and Minillo, 1995a; Sampaio et al., 1998a), this approach seems to give good results, but better techniques for precocious weaning should be attempted in order to reduce the dependence on live food.

The appropriate ration for larvae fed on dry diets decreases from 25% of their live weight per day 15 days after hatching (Sampaio and Minillo, 1995a) to 15% per day for 30 days old individuals (Sampaio et al., 1998a). At these ages, the feeding frequency should be at least six times per day in order to reach maximum growth rates (Sampaio et al., 1998b).

The optimum temperature for larvae and fingerling culture is 23°C, temperatures as high as 26°C reduce the survival rate and lower temperatures result in lower growth rates (Streit, 2000; Sampaio and Pisseti, 2001). However, it is important to emphasize that *O. argentinensis* presents a termolabile sex determination, and its sex rate at 18-21°C is female biased (Strussmann, et al., 1996).

Larvae of *O. argentinensis* do not survive in fresh water, but they can be reared in low salinity water (5‰) from the first day after hatching without compromise of growth and survival, when compared to the performance of larvae reared in salt water (35‰) (Phonlor and Sampaio, 1992). The acute transfer of young juveniles (30 days old) from salt water (35‰) to fresh water resulted in the death of all individuals (Sampaio and Phonlor, 1992). However, when the salinity is gradually reduced during one week, the survival is around 67% for the fish kept in 1‰ during 15 days, but all die within 2-3 days after the transfer to fresh water. Growth and survival are similar for juveniles raised in salinities between 2 or 35‰ (Sampaio et al., 2000).

Larval growth is influenced by the photoperiod, larvae kept without light during the day are unable to prey on an adequate amount of *Artemia* nauplii, result-
ing in a reduced growth rate. Larvae reared under continuous light, or in a 12 hours light regime grow faster than those kept in the dark, but growth is maximized at 18 hours of light per day (Freitas, 2003).

The stocking density can be as high as 90 larvae/l during the first month of life (Sampaio and Phonlor, 1996), but currently lower densities (20-30 larvae/l) have been used. Fingerlings are reared at lower stocking densities, typically 1-2 individuals/l when they are 90 days old.

Ammonia toxicity is influenced by temperature and salinity. Sampaio and Minillo (1995b) determined an inverse relationship between temperature and ammonia toxicity for 15 days old larvae. The LC50-96h (lethal concentration for 50% of the population after 96 hours of exposure) is 0.73 mg/L N-NH₃ at 15°C and 0.96 mg/L N-NH₃ at 23°C. As it is observed for other species, the toxicity of ammonia is lower in saltwater (30‰) than at a lower salinity (10‰) (Sampaio and Minillo, 2000).

Growth of O. argentinensis larvae is hampered when they are exposed to 0.18 mg/L N-NH₃ during 15 days, showing that chronic effects can be observed at concentrations easily found in hatcheries. On the other side, it is not likely that nitrite toxicity could be a problem for the culture of O. argentinensis, as the LC50-96h is equal to 88 mg/L N-NO₂ and no chronic effects were observed at concentrations as high as 25 mg/L N-NO₂ (Peres, 2002).

Information on the grow-out phase of “pejerrey” is still scarce, but the current knowledge on reproduction, larviculture and fingerling production should be enough to start up the commercial culture of this species.

**References**


