THE OHIO STATE UNIVERSITY EXTENSION

FACT SHEET

Agriculture and Natural Resources

Artificial propagation of Amazonian catfish (*Pseudoplatystoma* sp.) in captivity

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Introduction

South American catfishes (e.g., *Pseudoplatystoma corruscans, P. fasciatum*, and *P. tigrinum*) have the potential to be important species for commercial production in South America (Kossowski, 1996). Spawning of *Pseudoplatystoma* sp. occurs in South America between October and February and this also includes fish maintained in ponds. For instance, Carolsfeld et al. (2003) observed that carp pituitary injections resulted in ovulation and spermiation in *P. coruscans* maintained in ponds in Minas Gerais State, Brazil, between December and January. Godinho et al. (2007) concluded that "sprint migrations" at 31 km per day are an intimate part of spawning behavior of *P. corruscans* in Sao Francisco River, Brazil. It is well documented that exercise is an important component of maturation process and perhaps a physiological stimulus for the onset of gametogenesis and determinant of the gamete quality in fish (van Ginneken et al. 2007). Godinho et al. (2007) also suggested, based on tagging spawning fish between November and March, that *P. corruscans* is a multiple spawner.

Leonardo et al. (2004) obtained 100% ovulation in females of *P. fasciatum* maintained in ponds in Sao Paulo State, Brazil, following hormonal injections of carp pituitary extract (CPE) or human chorionic gonadotropin (hCG). In that study, the most detailed thus far, females released between 17 and 20% of hydrated oocytes (expressed per wet body weight) and fertilization was not different between 3- and 4-year-old fish, with levels of 54 and 56%, respectively.

Most recently Nunez et al. (2008) induced spawning in catfish *P. fasciatum* caught in the wild and then maintained in ponds for the following year. Fish were injected intraperitoneally with two doses of Ovaprim (Syndel, Qualicum Beach, Canada) and 74% of ovulation responses were observed in the course of the spawning season. Some of the fish responded 2–4 times in the course of 5 months under pond conditions, at sites located in the Bolivian Amazon. Furthermore, eggs were collected 8.5 h after resolving injection (90% of the dose) at 27.6°C. They reported an excellent hatching rate of 23 ovulation responses of 73.7%. Based on these multiple spawnings, Nunez et al. (2008) provided the mean fecundity for surubim of 147,000 eggs per kg.

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Experiments at the Ohio State University

Broodstock of Amazonian catfish *Pseudoplatystoma* sp., were raised since March 2003 in our tropical aquaculture unit at the Ohio State University, Columbus, Ohio. Fish are maintained in 200-L tanks at 25–30°C located in the greenhouse of the Department of Plant Biology and fed commercial feed (BioDiet Brood, Bio-Oregon, Inc., 5 mm) at 1–2% body weight. The objectives of this study were (1) to determine gametogenesis and differentiation of ovary and testis in captive stock of South American catfish, surubim, *Pseudoplatystoma* sp., (2) to determine changes in plasma sex steroid hormones during an annual cycle in *Pseudoplatystoma* sp., (3) to induce reproduction by carp pituitary extract injection, and (4) to assess gamete production (egg and sperm quality).

To achieve these objectives, the majority of the fish were PIT-marked (passive integrated transponders; Destron Fearing Co., St Paul, MN) and 3–4 samplings were performed each year (weighing, sexing, blood withdrawn, fish sacrificed for gonad histology).

We observed great variation in the profiles of fish growth over the 3-year period and final individual weights varying from 1 to 4.6 kg (figure 2).

In March 2003, mean plasma testosterone was 208 ± 92 pg/ml and 234 ± 57 pg/ml in females and males, respectively. Plasma estradiol-17β levels were low in females (45 ± 22) and were similar to those observed in males (25 ± 10). 11-ketotestosterone levels were significantly higher in males (912 ± 491 vs. 158± 113). In February 2004, plasma sex steroid hormones were low and similar to those reported in March 2003. In April 2004, one surubim presented a high level (>1 ng/ml) of 11-ketotestosterone (1185 ng/ml), however it was far more evident among 3-year-old males in 2005 (Dabrowski et al. 2008). In 2005, T and

Figure 1. Weighing of surubim (photo by Kyle Ware).

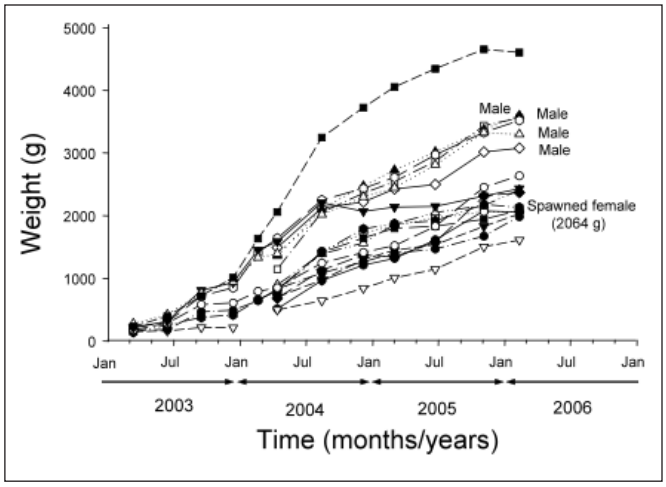

Figure 2. Individual growth of surubim (source: Dabrowski et al. 2008).

E2 concentrations were much higher in both males and females in June than just prior to expected maturation in November.

No sign or maturity was observed in females until 2006 being proved by both biopsy and gonad histology examinations, but two males spermiated in 2005. In February 2006, fish were again checked for signs of maturity (release of sperm by gentle pressure on the abdomen in males and oocyte biopsy using a catheter in females). Two males (3,599 and 3,521 g in mass) were found to be spermiating. At the same time, oocytes were collected from six females which varied from 1,936 to 4,605 g in mass and fixed in Bouin's solution to measure the oocyte size. The six females, the two spermiating males, and two other potential males were injected with CPE (0.5 mg/kg). Then these fish were observed regularly after treatment in accordance with the description given for propagation of *P. fasciatum* (Leonardo et al. 2004). No response to hormonal induction was observed. One week after the injection, the females were injected again with two doses of carp pituitary extract (0.5 and 5 mg/kg) at 11-h intervals and checked regularly as described above. Nine hours after the injection, two females produced eggs (figure 3). Sperm samples were collected from two males. Sperm from each individual male was used to fertilize egg sub-samples (2 g with 0.1 ml sperm). Eggs were incubated in McDonald jars. The water temperature was 25°C at fertilization and ranged from 25 to 27°C during the incubation period.

During final maturation, GSI reached 2.9% in a female which spawned successfully and 6.0% in another female which failed in fertilization. Oocyte size for individual females varied from 0.30 ± 0.08 to 0.74 ± 0.06 mm in

Figure 3. Spawning of surubim (photo by Murat Arslan).

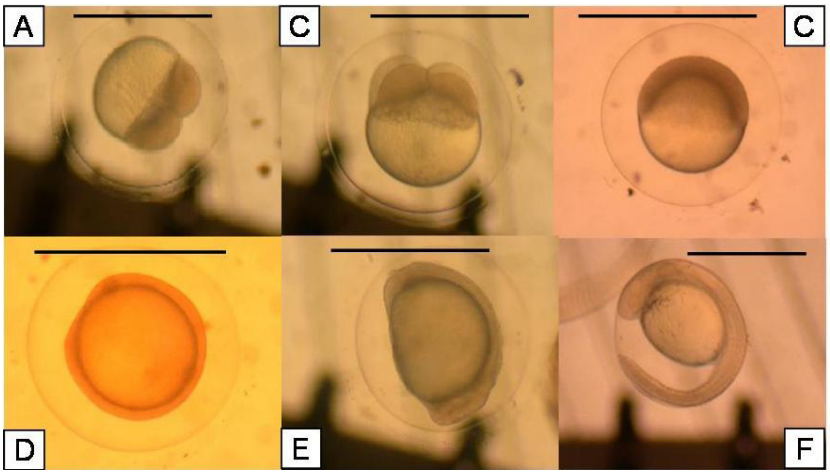

Figure 4. Embryonic development of surubim, 2-cell stage (A), 4-cell stage (B), early blastula (C), early gastrula (D), neuralization (E), and hatching (F). Black bars = 1 mm (photo by Murat Arslan).

diameter from the onset of the hormonal injection through spawning.

During final maturation oocyte diameter increased following the hormonal injection in two ovulating females (0.62 ± 0.09 to 0.73 ± 0.06 and 0.56 ± 0.10 to 0.74 ± 0.06 for successfully fertilized and failed females, respectively) and sperm concentrations reached 24 x 10^9 and 15.5 x 10^9 spermatozoa/ml in male 1 and male 2, respectively. Sperm motility was checked after activation in 0.3% saline. Nine h after the second injection (resolving dose, 5 mg/kg), 47.9 g of eggs (~84,500 eggs) were produced by a female weighing 2,064 g and these eggs were fertilized successfully. Oocyte diameter was 0.73 ± 0.06 mm at stripping. Embryo development was followed during the incubation period (figure 4). Embryo survival 9 hours after fertilization was 44 and 23% for male 1 and male 2, respectively. Embryos hatched 15 h after fertilization. Larvae were 3.53 ± 0.09 mm in length at hatching.

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