Advances in aquaculture of the tripletail *Lobotes surinamensis*

Avances en acuicultura del pez triple cola *Lobotes surinamensis*

Avancées dans l'aquaculture de la feuille *Lobotes surinamensis*

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EXTENDED ABSTRACT

The tripletail, Lobotes surinamensis, is a pelagic fish common in coastal waters of the southeastern United States. Initially targeted primarily as a game fish, the species has become prized for the quality of its flesh. Franks et al. (2001) and Saillant et al. (2021) documented fast growth rates in captivity placing tripletail among the fastest-growing marine finfish species currently developed for aquaculture (Saillant et al. 2021). These fast growth rates combined with the excellent quality of tripletail flesh, contribute to the high potential of this species for marine aquaculture.

Available data on Tripletail aquaculture to date are limited to small-scale projects implemented at the University of Southern Mississippi (USM) focused on captive spawning and hatchery methods. Work on tripletail culture was also conducted in private groups but findings were not published. During projects conducted at USM, broodstock were maintained in captivity and protocols for hormonal induction of spawning were developed (Saillant et al. 2014, 2021, Saillant and Adams 2022). Embryos produced were used in larval culture trials by Saillant et al. (2021) and Saillant and Adams (2022). Initial growout data at low density were also reported by Franks et al. (2001) as well as Saillant et al. (2021) in recirculating systems.

METHODS

Spawning

Broodstock collected in Mississippi and Louisiana coastal waters were conditioned for maturation under a photothermal cycle that followed natural variations in Mississippi coastal waters, except that temperature was maintained above 20 °C to avoid the complete cessation of feeding that was observed below this value. In recent trials, conditioning occurred in 28-m^3 round fiberglass tanks (1.5 m depth) connected to thermo- and photo-regulated recirculating systems. The protocol that led to highest success (Saillant et al. 2021, Adams and Saillant 2022) involved selecting females at advanced oocyte maturation stage suitable for hormonal induction, and pairing them with males in a 32-m^3 round fiberglass tanks (3.1 m depth) for final maturation and volitional spawning.

Spontaneous spawns were very infrequent and displayed low or no fertility in all trials conducted to date in these conditions (Saillant et al. 2014, 2021, Saillant and Adams 2022). Hormonal induction of males and females selected at advanced stages of oocyte pre-maturation using gonadotropin releasing hormone analog (GnRHa) implants led to large egg

Figure 1. Tripletail adult broodstock handled under anesthesia

Figure 2. Recirculating systems for medium-scale larval rearing production (1-m3 working volume per tank)

releases but fertility remained very low, suggesting inhibitions affecting spontaneous spawning in culture also impact response to GnRHa treatments (Saillant et al. 2021). Recent experiments incorporated a dopamine inhibitor and led to success producing fertilized spawns. In these experiments, control mating groups that received no hormonal treatment did not spawn, those treated with GnRHa implants (75 $mg.kg^{-1}$ for females, 55 $mg.kg^{-1}$ for males) only produced spawns with no or very low fertility (average 0.6 ± 1.3%) as previously reported, but administration of GnRHa implants in combination with 5 $mg.kg^{-1}$ Domperidone lead to a major increase of fertility (42 ± 32.2%). Higher Domperidone dosage (10 $mg.kg^{-1}$) further improved the fertility of spawns (65.2 ± 34.5%), the number of egg releases, fecundity and viability to hatch and post hatch.

Larviculture

The embryos obtained during captive spawning events were cultured under a sequence of rotifer and Artemia live preys, a protocol compatible with implementation in standard marine hatcheries.

Larval rearing trials were conducted in a medium-scale experimental unit made of two independent twin thermo-regulated recirculating aquaculture systems each composed of three cylindro-conical rearing tanks with a maximum working volume of 1,000-L per tanks. All tanks are located in a temperature-controlled room and connected to a water filtration unit providing biological filtration, filtration through a bubble bead filter, protein fractionation, UV sterilization, and temperature control via a water heater/ chiller.

Experimental systems were filled with artificial seawater prepared at 30 psu using Crystal sea marine mix salt mixture. Air stones were set to deliver a very gentle aeration in each tank. A constant artificial photoperiod of 24 hours Light was applied using natural-spectra LED light -bulbs providing approximately 1,100 lux a the surface of rearing tanks. Tanks were isolated from external light sources using black curtains to standardize illumination (Figure 2). Water temperature was set at approximately 27 °C from egg stocking until 5 dph and progressively increased to 29 °C. Systems were stocked at an initial density of 20 larvae per liter.

Under the current reference protocol enriched rotifers (S-strain enriched with Selco S-presso enrichment mixture, INVE Aquaculture) are introduced in tanks at 2.5 days post hatch. Subsequently, tanks are fed three times daily. Water turnover is adjusted to remove uneaten residual prey items before new feedings and maximize access to freshly enriched rotifers. Cultures are checked periodically for the presence of bacteria. Prey input at each meal is determined

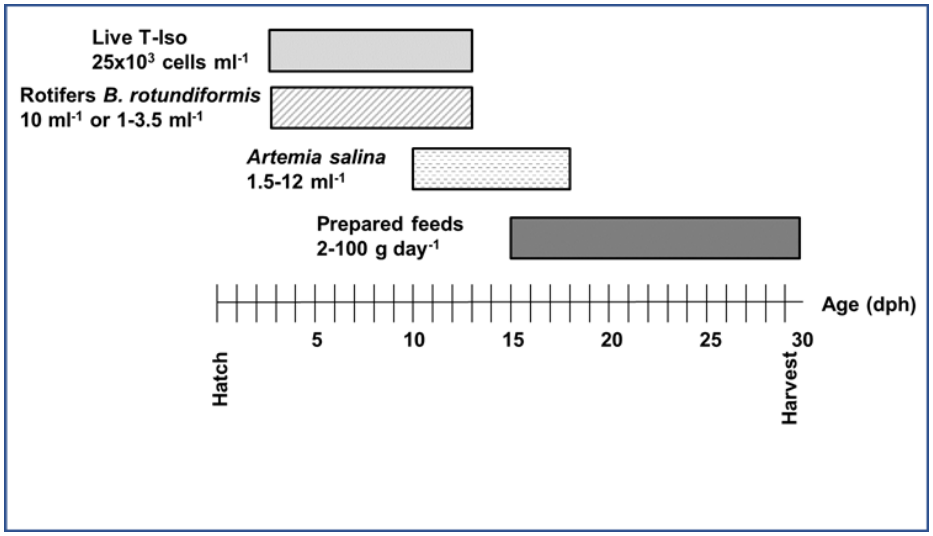

Figure 3. Sequence of feeds during larval culture of Tripletail Lobotes surinamensis. Dph: days post hatch, N1: unenriched newly hatched *Artemia Nauplii*, N2: enriched *Artemia nauplii*. .

based on the protocol target and residual prey counts determined before feeding. Tahitian strain Isochrysis sp. (T-iso) 50,000 cells/ml are introduced as background beginning 2.5 days post hatch. The target rotifer density is 10.ml^{-1} based on preliminary trials and is reduced progressively beginning at 11 dph and discontinued at 13 dph (Figure 3). Artemia nauplii enriched with Easy- DHA Selco (INVE aquaculture) are introduced progressively beginning at 10 dph. Dry food (Otohime diet sequences from A1 to C sizes 75 μm to 1,410 μm, Reed Mariculture) are first introduced at 15 dph and Artemia feeding is progressively decreased then and discontinued at 18 dph.

The current protocol still leads to very low survival rates (< 1%). Improvements of the enrichment protocol are currently under investigations as mortality appear particularly severe during the late rotifer phase of the culture when larvae engage in metamorphosis.

Growout

Growout trials were conducted only at low density and revealed a very fast growth potential for this species with fish reaching a mean weight of 1,725 g in 10 month from an initial weight of 0.2g in recirculating systems (Saillant et al. 2021). Further growth to 20 months at low density followed this trajectory (3.58 kg at 616 days, Saillant and Apeitos, unpublished results). The growth rate is likely to decrease in older and larger fish as they reach sexual maturity but these initial results indicate that very fast growth is maintained for at least 20 months up to weights over 3 kg.

FUTURE WORK

Future work is needed in all three areas discussed above. Spontaneous spawning, without the use of hormones would ease hatchery operations although the current protocol does produce multiple large egg releases with high viability and also presents the advantage of producing controlled crosses (as opposed to group spawning in a mass-spawning tank) which could become important for domestication programs. A high immediate priority is to improve survival through the larval culture phase. Tripletail larvae initiate feeding on rotifers with high success but mortality is observed in the second part of the larval culture as they experience metamorphosis. Forthcoming work aims to improve the enrichment of rotifers, introduce early co-feeding with microdiets, and optimize aspects of the feeding protocol. Growout will need to be formally tested and described at commercial densities although growth rates are very promising based on initial trials at low density. Tripletail appear more common in restaurants and retailers in particular in the Southeast United States suggesting the demand is increasing but the market has not been formally described and will need to be studied so the viability of aquaculture can be evaluated once production costs are available.

KEYWORDS: *Lobotes surinamensis*, Tripletail, aquaculture, captive spawning, larval culture

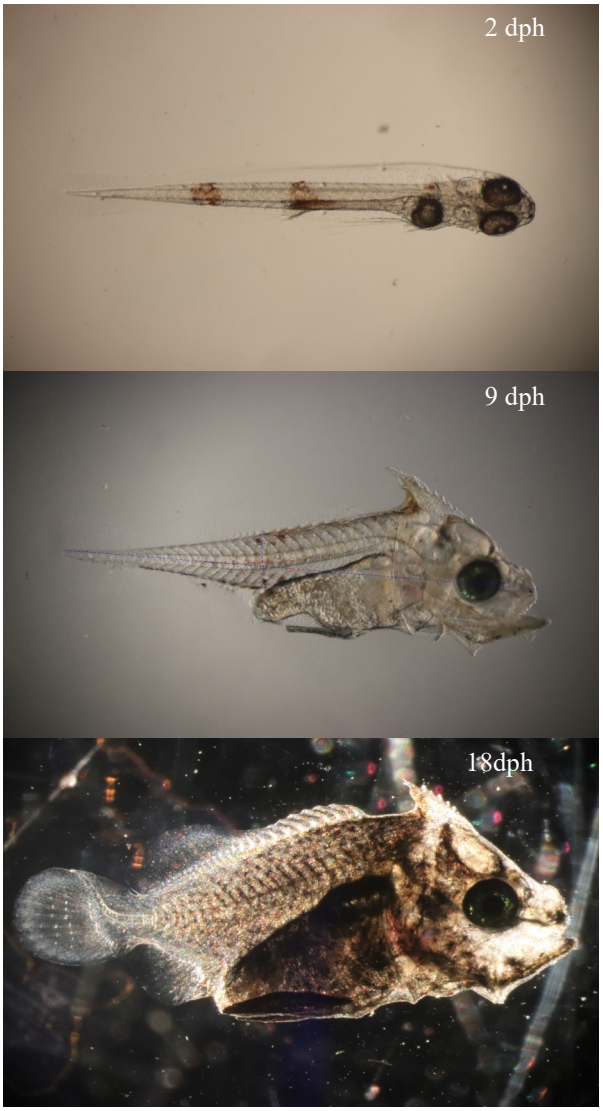

Figure 4. Tripletail larvae at various stages of development.

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