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Larviculture and seed production of the silver pompano, *Trachinotus blochii* (Lacepede, 1801) for the first time in India

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ABSTRACT

Larviculture and seed production protocols for the silver pompano *Trachinotus blochii*, which is one of the promising finfish species for brackishwater and marine aquaculture was developed based on six trials for the first time in India. The newly hatched larvae were stocked at a density of 20 larvae l^{-1} in 2 t FRP tanks with 1.5 t of seawater. Green water technique was employed during larviculture upto the weaning period. Enriched S-type rotifers were fed at a density of 10-12 nos. ml^{-1} until 3 day post hatch (dph) and the enriched L-type rotifers were given at a density of 6-8 nos. ml^{-1} from 7 dph and thereafter with enriched *Artemia* at a density of 3-5 nos. ml^{-1}. Weaning started from 15 dph and by 20-25 dph metamorphosis was completed. The survival on completion of metamorphosis ranged from 10-15% and the specific growth rate in terms of length (mm) was 8% per day. The larval morphology and growth pattern are also described.

Keywords: *Artemia* nauplii, Green water technique, Larviculture, Rotifer, Silver pompano, Survival, *Trachinotus blochii*

Introduction

The silver pompano, *Trachinotus blochii* is one of the suitable candidate species for aquaculture due to its fast growth, good meat quality and high market demand. Further, silver pompano grows excellently in low salinity (as low as 8 ppt) (Gopakumar *et al.,* 2011) and has good adaptability to different farming environments. This species easily accept artificial feeds as it is omnivorous and has a rapid and uniform growth rate compared to other farmed fishes (Chavez *et al.,* 2011). It can be successfully cultured in tanks, ponds and cages. This species is caught sporadically in commercial fishery and therefore its availability is rather scarce in fish markets. Though the seed production and farming of the Florida pompano, *Trachinotus carolinus* has been established much earlier (Moe *et al*., 1968; Hoff *et al*., 1972, 1978; McMaster, 1988), until recently there was no focused research on pompano aquaculture in India.

Although silver pompano is a good candidate for aquaculture, its hatchery production is not without problems. Even the availability of brooders from wild for initiating the breeding trials is limited and the availability of male brooders from the wild is furthermore scarce. Due to its potential in mariculture, major thrust was given by the Central Marine Fisheries Research Institute (CMFRI) for captive broodstock development since the year 2007 and the first success in breeding and seed production of silver pompano was achieved at Mandapam Regional Centre of CMFRI in 2011 (Gopakumar *et al.,* 2012).

Trials on larviculture were conducted to develop a protocol for seed production. Published reports on the larviculture of silver pompano are very scarce except the one reported by Juniyanto *et al.* (2008). The results of larviculture and seed production conducted at Mandapam Regional Centre of CMFRI are described in the present paper.

Materials and methods

The fertilized eggs obtained from captive broodstock developed as reported in our earlier publication (Gopakumar *et al.,* 2012) were counted and incubated in 2 t capacity circular fibre reinforced plastic (FRP) tanks with mild aeration. The eggs hatched between 34 to 36 h of incubation. The newly hatched larvae were stocked in rectangular FRP tanks of 2 t capacity. Each FRP tank was filled to a volume of 1.5 t of dechlorinated seawater. The larvae were stocked at a density of 20 nos. l^{-1}. The number of tanks employed varied with the number of newly hatched larvae obtained in each spawning. The aeration in the tanks was increased slightly during larviculture. Larviculture tanks were provided with green water, feeding was initiated

with enriched rotifers, followed by enriched *Artemia* nauplii and subsqquently switched to larval inert feeds. The details of water exchange in the larviculture tanks are given in Table 1.

Green water technique employing the microalga *Nannochloropsis oculata* was followed during the larviculture up to the weaning period. Both S-type (*Brachionus rotundiformis*) and L-type rotifers (*Brachionus plicatilis*) cultured using S.parkle (INVE, Thailand) supplemented with *Nannochloropsis oculata* at a density of 3 x 10^7 cells ml^{-1} and *Artemia* nauplii were used as live feeds. The weaning to NRD formulated larval diet (INVE, Thailand) of appropriate particle size was started from 15 day post-hatch (dph). The rotifers were enriched for 12 h while *Artemia* nauplii were enriched for 22 h prior to use. The enrichment medium used was Selco S. presso (INVE, Thailand).

Natural photoperiod was used for the larviculture tanks with illumination curtailed up to 70% using translucent FRP sheets in the hatchery roof. Salinity (by portable refractometer), dissolved oxygen, DO (by Winkler's method) and temperature (using mercury thermometer) were recorded in each tank daily. Dead larvae were collected using appropriate strainers during the period of water exchange and were counted for estimating the mortality. The larval survival was quantified by taking samples at different locations of the tanks, using a PVC pipe of 1.5 inch dia and 150 cm length. The lengths of at least 20 larvae were measured daily to the nearest mm. They were placed on glass slides and photographed using Zeiss stemi-2000C stereo-microscope and Canon Powershot-G10 camera. Specific growth rate (SGR) in mm was calculated as follows, to estimate the percentage length increase per day.

$$SGR = \frac{ln \text{ final length (mm)} - ln \text{ Initial length (mm)}}{\text{Duration of the experiment (days)}} \times 100$$

Six larviculture trials were conducted during July to December 2011.

Results and discussion

Larval feeding protocol

The larval feeding protocol developed for successful seed production is summarised in Table 1. Green water was used till the weaning period at a density of 3 x 10^7 cells ml^{-1}. Enriched S- type rotifers were given at a density of 10-12 nos. ml^{-1} from 3 dph onwards while the enriched L- type rotifers were provided from 7 dph at a density of 6-8 nos. ml^{-1} two times daily. The lorica length of the S- type rotifers was 120.8 ± 16.21 µ and that of L-type rotifers was 222.9 ± 23.10 µ. The enriched *Artemia* nauplii were provided at a density of 3-5 nos. ml^{-1}. Along with *Artemia*, co-feeding with decreasing quantities of rotifers was continued for 3 days due to the presence of different size groups of larvae. From 15 dph onwards, weaning of the larvae from *Artemia* to commercially available NRD larval feed was started. Generally, water exchange was not carried out during the first 4 days. The water exchange to an extent of 20% was provided initially to remove the algal settlement and dead larvae. Water exchange was increased after weaning to artificial feed.

While weaning to inert larval feeds, very small quantities were fed initially to make the larvae gradually accept the feed and also to reduce the accumulation of uneaten feed at the bottom of the tank. The transition from *Artemia* nauplii to NRD inert feed was found to be smooth and quick. The size of the weaning feed used first was 300-500 µ. From 20 dph onwards, only formulated feed was provided. The inert feed of size range of 600-800 µ was provided on 19 dph along with the feed of size 300-500 µ to cater to the different size groups of larvae present in the larviculture tanks. From 23 dph onwards, NRD feeds of 0.8 to 1.2 mm were used. The length of the

Table. 1. Larval feeding protocol for *T. blochii*

Green water / Feed	Days post-hatch (DPH)	Density	Frequency of feeding	Water exchange
Green water (*N. occulata*)	0 - 2	3 x 10^7 cells ml^{-1}	Nil	0 %
Green water +Enriched S-type rotifer	3 - 6	10-12 nos. ml^{-1}	2 times per day	20%
Green water +Enriched L-type rotifer	7 - 14	6-8 nos. ml^{-1}	2 times per day	20 %
Green water +Enriched *Artemia* nauplii	12 - 19	3-5 nos. ml^{-1}	2 times per day	70 %
Formulated feed (300-500 µ particle size) – provided 1 h before the supply of live feed	15 - 18	Weaning started on 15th day	2 times per day	70 %
Formulated feed (300-500 µ to 600-800 µ particle size) – provided before the supply of live feed	19 - 22	Provided *ad libitum*	3 times per day	100 %
Formulated diet (0.8-1.2 mm)	23 - 25 dph onwards	Provided *ad libitum*	3 times per day	100 – 200%

larvae measured on 0 dph and 25 dph were 2.1 and 15.5 mm respectively. The final survival (on completion of metamorphosis) recorded during the larviculture trials ranged from 10-15% (Fig. 1). The specific growth rate recorded was 8 % per day. Salinity and temperature ranged from 33-35 ppt and 28-30 °C respectively throughout the culture period. The DO recorded ranged from 4.5 to 6 mg l^{-1}.

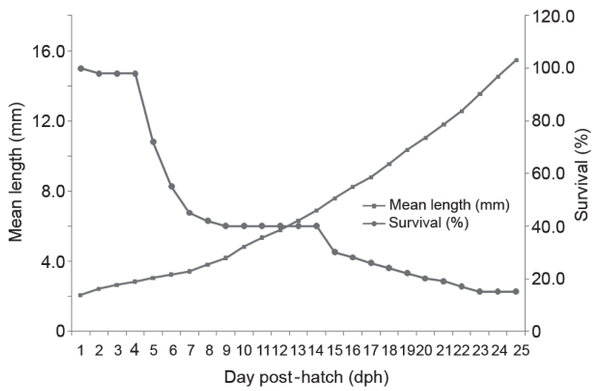

Fig. 1. Survival and growth of silver pompano (*T. blochii*) larvae

During the larviculture of pompano, two critical stages with varying mortalities were recorded: 1) during 5-6 dph when the larvae completely changed from endo- to exogenous feeding. Heavy mortality was noticed at this stage, and 2) during 15-19 dph when the larvae were weaned to formulated feed.

Juniyanto *et al.* (2008) reported the use of 5-15 nos. of rotifers per ml three times a day during the larviculture of *T. blochii* from day 3 to day 14. Artificial pellets of size 250-300 µ were provided from day 10 onwards, in addition to rotifers. *Artemia* nauplii were given from day 14 onwards at 0.25 individual per ml. The use of rotifers was stopped on day 15 while the quantity of artificial feed was gradually increased every 1-2 h. At day 18, the quantity of *Artemia* was also increased to 0.5 individual per ml which was stopped at day 22. The survival rate reported was 20-25 %.

In a larviculture study of Florida pompano, *Trachinotus carolinus* conducted by the Mote Marine laboratory (MML) in collaboration with Florida State University (Main *et al*., 2005) to determine suitable live feeds, it was reported that a maximum survival of 3% was achieved if 100% rotifers were used as live feed while a maximum of 23% survival was reported while using 75% *Acartia tonsa* and 25% L-type rotifers. Based on the pooled data collected from the six trials, it was reported that the live feed comprising 75% *Acartia tonsa* and 25% L-type rotifers were the best as live feeds for larviculture of Florida pompano (Main *et al*., 2005). With regard to the use of *Artemia* nauplii as live feed, it was started from 13 dph onwards at MML whereas in the present study with the silver pompano, the same was initiated from 12 dph onwards. In another study on *T. carolinus* by Riley *et al*. (2009), INVE NRD Micro Pellet of 400-800 µ was provided to 10 dph larvae.

The stocking density followed in the present study was 20 nos. l^{-1} where as MML reported a stocking density of 25 nos. l^{-1}. In another study with *T. carolinus*, a stocking density of 50 nos. l^{-1} was followed (Cavalin and Weirich, 2009).

Larval growth, morphology and behaviour

Various stages of larval development of silver pompano are presented in Fig. 2(a-h) . The newly hatched larvae lack mouth opening (Fig. 2a). They have large and elongated yolk sac extending beyond the head and along the ventral region of the head and alimentary canal. The yolk reserves generally last for two to three days depending on water temperature and it coincides with eye pigmentation, mouth formation and first feeding. The mouth gape of larvae was around 200 µ at first feeding stage. Around 6 nos. of opercular spines started appearing from 12 dph (Fig. 2e) which became prominent on 15 dph. Among the spines, one was longer. These spines gradually disappeared as the fish grew beyond 30 dph. The differentiation of the dorsal, caudal, anal and pelvic begins on 9 dph. The fin rays started appearing on 10 dph and became prominent on 12 dph. The different fin types are well demarcated on 12 dph (Fig. 2f).

Melanin pigmentation gradually started on the head and dorsal surface of the body from 3 dph onwards which spread all over the body and became intense as the larvae grew. Thereafter, the larvae looked darker in colour till the metamorphosis on 20 to 25 dph when it turned into silvery white in colour (Fig. 2h). During this time, the fishes developed entire compliments of all fins and scales. The larval growth pattern recorded during the larviculture is provided in Fig. 1.

The larvae do not swim actively till first feeding and they start swimming faster and feed voraciously on 12 dph. When overfed, the larvae were found swimming lazily and vertically with the head in upside position. It is always better to avoid over feeding in order to keep the larvae healthy. Though we experimented with a stocking density of 20 larvae l^{-1}, it appears better to stock the larvae initially at lesser densities and pooled in higher numbers again when they become hardy at around 12-15 dph. Nevertheless, further investigation is required in this direction. It is interesting to note that there was no sibling cannibalism noticed in the silver pompano larviculture, except a case or two when a weak larva died or settled at the bottom. In our experience, any cannibalism in pompano larviculture should only be due to shortcomings in the

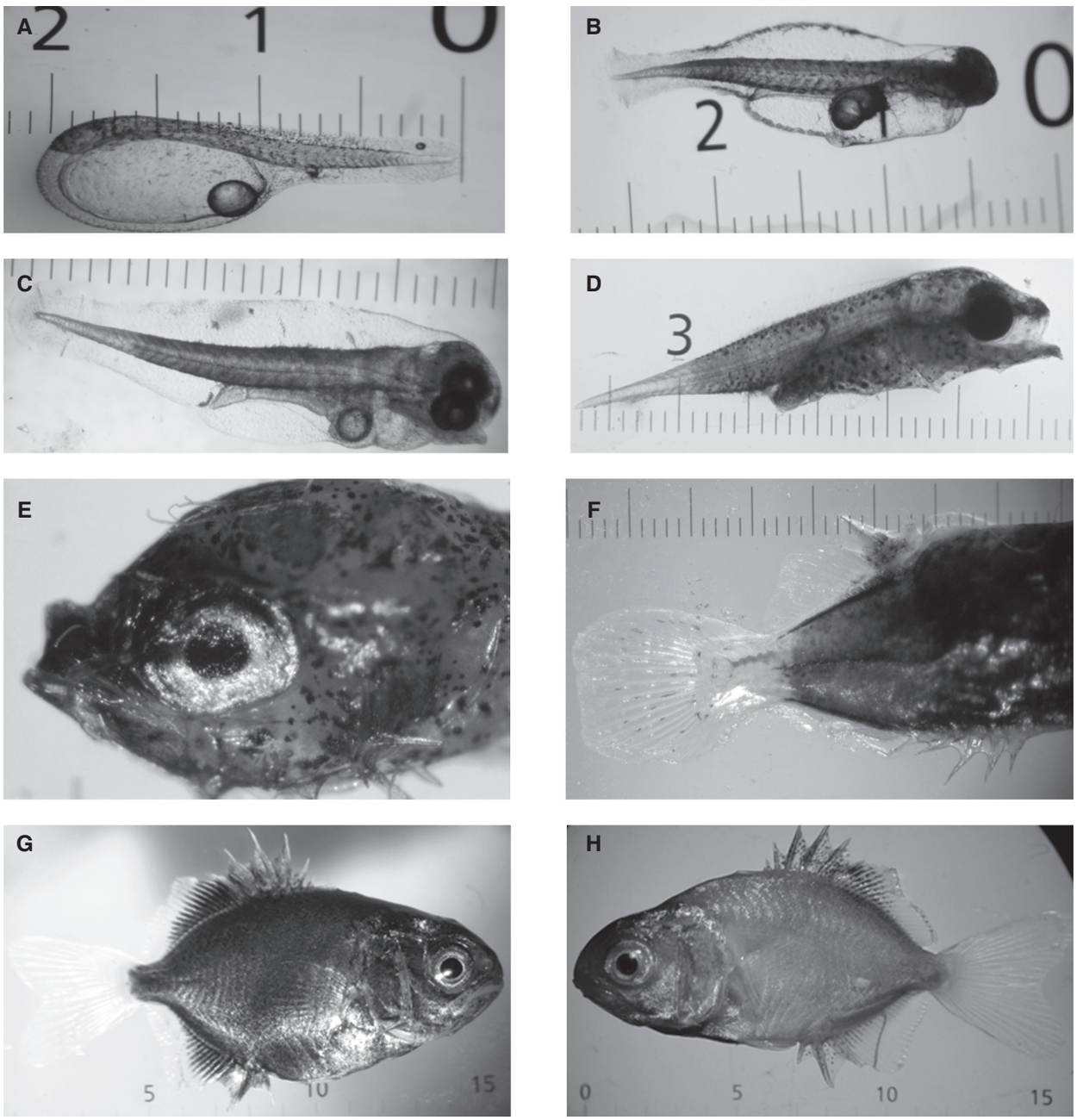

Fig. 2. Stages of larval development of silver pompano (*T. blochii*)
a. Newly hatched larva; b. larva on 2 dph; c. larva on 3 dph; d. larva on 8 dph; e. larva on 12 dph showing opercular spines; f. larva on 12 dph showing fin demarcation; g. larva on 20 dph; h. Just metamorphosed larva on 25 dph

feeding strategies. It is felt that enhancing the survival rate at metamorphosis could be achieved by standardisation of feeding protocols, initial larval density and the intensity of light in the larval tanks. The larviculture of this species is comparatively less difficult, which is a positive aspect for mass scale production. However, the number of eggs released per spawning is limited and hence, more pairs of brooders are needed for commercial level seed production. If the required seed availability can be met, lucrative pompano farming practices both in coastal ponds and sea cages can be developed in India in the near future.

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