Cannibalism, a cause of high mortality in
Wallago attu (Schneider) larvae

S. K. SAHO, S. S. GIRI AND A. K. SAHU
Central Institute of Freshwater Aquaculture, Kausalyaganga,
Bhubaneswar - 751 002, Orissa, India

ABSTRACT
A study was conducted to find the effect of stocking density on bio-growth, specific growth rate, percent weight gain and survival of Wallago attu larvae during in-door larval rearing. The larvae of average weight 2.64 ± 0.21 mg and length 5.80 ± 0.36 mm were stocked at a density of 2, 4, 6, 8 and 10 nos/l and reared by feeding live zooplankton, for a period of 10 days. The final body weight, specific growth rate and percent body weight gain of larvae was influenced significantly (P<0.05) by stocking densities and highest performance was observed in fish stocked at 10 nos/l. The percent survival of larvae decreased significantly with increase of stocking density and the rate of survival was similar among 6nos/l - 10 nos/l groups. The loss of larvae was observed due to cannibalism during rearing. The lowest stocking density resulted in least cannibalism. Systematic approach and some anatomical feature of W. attu larvae are believed to be helpful for predation during rearing.

Introduction
Catfishes possesses special status in the market for their high consumer demand and delicacy and are regarded as an expensive fish in Indian markets. Wallago attu is one of the large varieties of catfishes often available from capture sources. W. attu is highly predatory in nature throughout the life, (Datta-Munshi et al., 1990 and Anwar and Siddique, 1992). The species has been successfully induced bred by Parameswaran et al. (1988) and Gupta et al. (1992). Further, its distribution, habit and habitat, biology, nutritional qualities have been studied by various workers (Lailabati and Vishwanath, 1992; Chondar, 1999). Apart from some initial studies in our laboratory, no literature is available on the larval rearing of this species. The main constraint for commercial culture of this species is the non-availability of stocking material. The survival during its larval period is greatly reduced due to high cannibalism, which is noticed even in the day old larvae. Some of the factors like fish and food density, size difference, space for activity, delayed feeding, suitable feeds etc. are known causes which influence aggression among the fishes. Stocking density, which is a commercially important abiotic factor, affects both biology as well as economy in terms of growth rate, survival and running cost. In some occasions of cannibalism, controversial results were observed with regard to the factors like
stocking density and food density. Low stocking density of larval walleyes (<10 nos/l) enhanced survival (Li and Mathias, 1982) but survival of Clarias gariepinus fry was not significantly affected due to high stocking density (Haylor, 1991). Likewise, it was worked out for walleye larvae, that 100-200 daphnoids per litre of water reduced cannibalism (Li and Mathias, 1982), while abundance of brine shrimp in the culture system could not suppress cannibalism (Braid and Shell, 1981). So all the factors may not hold good for predatory fishes and it may be species specific. This experiment attempts to optimise stocking density during rearing for increased survival and growth, observing the cannibalism pattern with behaviour, specific growth rate and percent weight gain in W. attu larvae reared in different densities.

Materials and methods

W. attu brood fish of 1.5-2.5 kg sizes were collected from wild ponds and reared in the Institute’s earthen pond (0.04 ha) for three months prior to breeding season which commences at the end of June. The fish were fed on freshly boiled chicken offal once daily @10% wet body weight. The males were selected by observing free oozing milt and females with soft and bulging abdomen. Induced breeding was undertaken with the techniques suggested by Gupta et al. (1992). The larvae were collected from the incubation tanks before 24 h of hatching. The body biometry was recorded with the help of electronic digital balance provided with ± 0.01 mg accuracy. Compound microscope with ocular micrometer was used to measure the length. Fibreglass tanks of 60-l capacity was filled with 30-l water. The triplicate tanks were stocked with 2-10 nos of larvae/l and provided with aeration. Live zooplankton was provided daily for ad libitum feeding. Three fourth water from each tank was exchanged twice daily and replenished with freshwater. The water quality parameters like DO and alkalinity were analysed by APHA (1989) and pH was recorded by pH meter once in three days. The values ranged from 5.4-6.2 mg/l, 128-140 mg CaCO3/l and 7.4-7.8 respectively. The census was made daily morning to record the survival and disappearance of larvae was considered due to cannibalism. The final biogrowth, survival, specific growth rate, percent weight gain and cannibalism were recorded at the end of the experiment and calculated as follows.

\[
\text{No. stocked} - \text{No. disappeared} \over 100
\]

\[
\text{Final survival (\%)} = \text{Final weight - Initial weight} \times 100 \over \text{Days of experiment}
\]

\[
\text{Percent weight gain} = \text{Final weight - Initial weight} \times 100 \over \text{Initial weight}
\]

Results

The initial length and weight of larvae were 5.80 ± 0.36 mm and 2.64 ± 0.21 mg respectively. The final weight of larvae increased with increase of stocking density (Table 1). The final body weight of larvae stocked @2/l and 4/l were alike. The larvae stocked @6 nos/l and 8nos/l gained equal body weight which was significantly higher (P<0.05) than that of 2nos/l and 4nos/l stocking density and lower than 10nos/l. The specific growth rate and percent weight gain followed the same pattern. Final length of the fish stocked at a density of 10nos/l was significantly higher than the other larvae. The survival was 7-62% at the end of ten days of rearing period (Table 1). The percent survival significantly decreased with increase of stocking density. The rate of survival was similar in 6nos/l - 10 nos/l stocking density. No dead larvae were en-
Cannibalism in Wallago attu

**Table 1.** Survival, final length and weight, specific growth rate and percent weight gain of *W. attu* larvae stocked at different densities

<table>
<thead>
<tr>
<th>Larval density (nos/I)</th>
<th>Final weight (mg)</th>
<th>Final length (cm)</th>
<th>Specific growth rate (%)</th>
<th>% weight gain</th>
<th>Survival (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>108.33±4.63c</td>
<td>2.50±0.03b</td>
<td>37.12±0.43c</td>
<td>40.04±17.50c</td>
<td>62.33±0.33a</td>
</tr>
<tr>
<td>4</td>
<td>110.33±6.12c</td>
<td>2.32±0.04b</td>
<td>37.29±0.56c</td>
<td>40.79±23.16c</td>
<td>45.00±5.51c</td>
</tr>
<tr>
<td>6</td>
<td>164.33±2.96b</td>
<td>2.84±0.06c</td>
<td>41.31±0.18b</td>
<td>61.25±112.02b</td>
<td>18.66±1.86c</td>
</tr>
<tr>
<td>8</td>
<td>200.67±2.33b</td>
<td>3.10±0.09b</td>
<td>43.30±0.12b</td>
<td>75.01±88.36b</td>
<td>11.33±2.33cd</td>
</tr>
<tr>
<td>10</td>
<td>266.67±1.80b</td>
<td>3.61±0.10b</td>
<td>46.00±1.22b</td>
<td>10.00±120.4a</td>
<td>7.33±1.76e</td>
</tr>
</tbody>
</table>

a, b, c Mean values bearing different superscript in a column differ significantly (p<0.05)

 countered in the tanks and the disappearance was considered to be due to cannibalism. The cumulative cannibalistic pattern per day when stocked at different densities revealed that lowest stocking rate resulted in lowest cannibalism (Fig. 1). Similarly, cannibalistic pattern in different densities showed a higher percent at higher stocking (Fig. 2). Even one day old larvae were often observed to be cannibalistic. The larvae were active swimmers from the day of hatching. Chasing was not observed during rearing. It was also observed that the larvae came closer and swam along, bite to any part of the prey and moved away keeping it in mouth. So preying during this stage was believed to be systematic. Cannibalism was noticed first either from head or tail in every occasion. During the course of swimming, the larvae gradually engulfed the prey completely even of its own size leaving no remnants. In case of tail biting, the cannibal had to struggle more to control the prey that gave jerk sometimes and remained motionless subsequently.
The engulfing was quicker in tail than head. A sign of cannibalism is the expanded abdomen of the cannibals. The cannibals after engulfing were found to be less active than the non-cannibals. Cannibalism among the larvae facilitated a spurt of growth of the predator.

**Discussion**

Development of a suitable method of larviculture is one of the most pre-requisite for aquaculture. Abiotic factor like stocking density directly affects the survival of a number of cannibalistic fishes (Li and Mathias, 1982; Haylor, 1991). Cannibalism was frequently observed in *W. attu* larvae in this study. The cannibalism of larvae increases with increase in stocking density. The cause of cannibalism in larvae in higher stocking density might be due to the less space for activity. The availability of space at lower stocking densities reduced cannibalism. Li and Mathias (1982) reported that more space for activity and low stocking density of larval walleyes resulted in low cannibalism. It was observed that once the fish became cannibalistic, other fry became preferred item for them (Braid and Shell, 1981). In the higher density, the larvae start cannibalism due to frequent encounter with other larvae and become robust than non-cannibals and were more efficient for further predation. The growth difference in cannibal and non-cannibal was also reported in *C. gariepinus* (Hecht and Appelbaum, 1988) and Atlantic cod (Fløkvard and Otter, 1993). Larval walleyes showed cannibalism during post larval stage 1 (6-16th day) since utilizing the stored feed, ceased during post larval II when swimming ability enabled them to escape from predator (Li and Mathias, 1982). Though Wallago larvae were free swimmers from the day one, they did not have much capability to escape from cannibals. It might be due to the predation tactic of larvae, in which it swims along with the prey and strikes immediately when it comes closer. Further, the anatomical feature of incurved vomerine teeth of larvae facilitates the predation. Cannibalism is believed to be an inherent behaviour in these fish larvae, which continues even though food material is abundant (Braid and Shell, 1981). Successful cannibalism among identical or small size larvae imparts a spurt of growth in cannibals leading to size difference among the larvae. As the size difference is one of the criteria for cannibalism (Ketavic et al., 1989), it cannot be ruled out in *W. attu*. The increased specific growth rate and percent weight gain in the higher stocking density might be due to cannibalism. It is inferred from the results that the highly cannibalistic *W. attu* larvae can be reared at a low stocking density. More than 60% larval survival with uniform size of *W. attu* larvae can be obtained when stocked at a density of 2 nos/l in indoor rearing system.

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**References**


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