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Economic evaluation of *Piaractus mesopotamicus* juvenile production in different rearing systems

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Abstract

In this study, the costs and gross income related to the production of pacu *Piaractus mesopotamicus* juveniles were evaluated. This evaluation took into consideration a semi-intensive rearing, with direct stocking of the larvae into fertilized ponds (IL_0), or an initial intensive larviculture system, in which the larvae were fed in the laboratory for 3 (IL_3), 6 (IL_6), or 9 days (IL_9) before being transferred to the ponds. After 45 days of rearing, a gradual increase in production costs was observed as intensive larviculture time increased. Gross income also increased due to better survival rates (11.0, 25.3, 45.4, and 54.0% for IL_0, IL_3, IL_6, and IL_9, respectively). Therefore, increased profits were obtained under intensive larviculture (US$ 0.27, US$ 6.07, US$ 11.99, and US$ 13.16 per one thousand larvae in treatments IL_0, IL_3, IL_6, and IL_9, respectively).

In a larger scale production simulation, the results obtained with initial intensive larviculture also showed evident economic advantages, confirming the feasibility of this system in comparison with the direct stocking of larvae in ponds for the production of pacu juveniles.

Keywords: Economic feasibility; Pacu; Larviculture; Juvenile rearing; Intensive rearing system; Semi-intensive rearing system

1. Introduction

A reduction in the offer of freshwater fishing products associated with the technological advances in aquaculture production have contributed to a more competitive fish farming (Martin et al., 1995) and to its establishment as an economically promising activity.

Even with the great improvement in production techniques, the larviculture of native fish in South America is one of the main problems in the production cycle, presenting many constraints and frequent failures. One of the possible causes for this lack of success could be related to the rearing technique employed in Brazil, which is in general an

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adaptation of techniques used in other countries; therefore, it is not always suitable for the species and climate of each area (Fontes et al., 1990).

The larviculture technique for the production of juveniles usually employed in Brazil is the semi-intensive system, which consists in stocking the larvae in fertilized ponds from the time when exogenous feeding begins until the juvenile stage (Senhorini et al., 1991). Nevertheless, the survival rates obtained with this system are usually low, making large-scale production more difficult.

When rearing common carp (*Cyprinus carpio*), tambaqui (*Colossoma macropomum*), and pacu (*Piaractus mesopotamicus*) larvae in fertilized ponds, Chabalin et al. (1989) obtained survival rates around 35%, 30%, and 20%, respectively, at the end of juvenile rearing. The authors suggested that the pacu juvenile rearing technique needed to be improved.

An alternative technique for larviculture is the intensive system, which provides better survival conditions since the larvae are initially reared in the laboratory before being transferred to the ponds. However, intensive larviculture brings an increase in juvenile production costs due to expenses related to the production of live food and labor.

Economic evaluations of intensive larviculture provide important information to help fish farmers increase the production of juveniles and profitability with the adoption of more efficient techniques. According to Scorvo Filho et al. (1999), economic information on the aquaculture industry in Brazil is still scarce. This lack of information is also noticeable in some other South American countries; as a consequence, all planning is guided by information that is obtained from the fishing industry.

Among the native species that are suitable for intensive rearing, pacu *P. mesopotamicus* stands out because of its potential in terms of rustic management, good growth rate and consumer market's approval. In Brazil, according to Castagnolli (1995), the production of juveniles of this species reached about 9 million individuals per year. Pacu is a species that arouses great rearing interest in Brazil and some other South American countries along the Parana River Basin (Paraguay, Uruguay, and Argentina). In addition, it is closely related to other important species (i. e., *C. macropomum* and *Piaractus brachypomus*) that are important commercially in other countries of South America. In Brazil, the production of *P. mesopotamicus* and *C. macropomum* together reached a total amount of 14,821 tons in 2001 (Borghetti et al., 2003). Consequently, this paper studied the economic feasibility of intensive pacu larviculture, proposing alternatives to minimize production costs by comparing three different periods of larvae rearing in the laboratory in relation to the semi-intensive system.

2. Material and methods

In this study, different production methods of pacu *P. mesopotamicus* juveniles were compared: production in a semi-intensive system with direct stocking of the larvae in fertilized ponds (IL_0) and initial larviculture in the laboratory (intensive larviculture [IL]) for periods of 3 (IL_3), 6 (IL_6) and 9 days (IL_9) before being transferred to fertilized ponds.

The experiment was carried out at the Aquaculture Center of Sao Paulo State University-CAUNESP, Jaboticabal, SP, Brazil. Five-day-old pacu larvae at the end of the lecitotrophic period were used, and all treatments (IL_0, IL_3, IL_6, and IL_9) began on the same day and lasted for 45 days.

The detailed methods used, larval growth, and survival rate results are described in Jomori et al. (2003). In short, the larvae were reared in 27 polyethylene tanks containing 100 L of water at continuous flow and constant aeration at a stocking density of 18 larvae/L. Nine tanks were used in each treatment. The larvae were fed *Artemia* nauplii three times a day at a daily rate of 100, 250, and 500 nauplii per larva during the first 3 days, from day 4 to day 6, and from day 7 to day 9, respectively, according to the scheme proposed by Jomori (1999) for pacu larvae. At the end of each intensive rearing period, on days 3, 6, and 9, the survival rate was evaluated in each treatment, and the animals were transferred to the fertilized ponds.

Rearing in the fertilized ponds was held in 12 earthen ponds with concrete walls measuring 45 m^2 each; the ponds were continuously supplied with local spring water. Three ponds were used in each treatment. The larvae were stocked at a density of 100 larvae/m^2 totaling 4500 larvae per pond. The initial food was natural plankton. From day 4 forward, a