

DEVELOPMENT OF SUSTAINABLE POND AQUACULTURE PRACTICES FOR *PIARACTUS BRACHYPOMUS* IN THE PERUVIAN AMAZON

Eighth Work Plan, Peru Research 1 (PR1)

Christopher C. Kohler
Fisheries Research Laboratory
Southern Illinois University at Carbondale
Carbondale, USA

Susan T. Kohler
Economic and Regional Development Office
Southern Illinois University at Carbondale
Carbondale, USA

Fernando Alcantara
Instituto de Investigaciones de la Amazonia Peruana
Iquitos, Peru

Enrique Rios Isern
Universidad Nacional de la Amazonia Peruana
Iquitos, Peru

INTRODUCTION

A need exists to evaluate the aquaculture potential of local and native species, and to develop appropriate culture technologies. *Piaractus brachypomus*, native to the Orinoco and Amazon Rivers (Goulding, 1982), is an

important food fish in the Amazon basin. However, little production technology has been developed and published. In addition, there has been inadequate attention to economic analyses, such as determinations of cost of

production. Such information is critical for the sustainable development of this new aquaculture species.

Presently the available broodstocks are generally taken from the natural environment although some have been produced in aquaculture stations. The fish are captured as fry, fingerlings, juveniles, or adults and are then stocked in culture ponds and prepared as future broodstock. The selection of broodstock is made on the basis of external characteristics during the spawning season. Only in Brazil and Panama do culturists select broodstock based on individual performance (growth rate, quantity and quality of semen, fertilization rate, fry production, etc.).

No standardization exists for stocking densities of fry or fingerlings (Campos, 1993). Likewise, no uniform fish diets are available in the region (Cantelmo et al., 1986; Ferraz de Lima and Castagnolli, 1989). This project will determine the stocking densities necessary to efficiently and economically rear *Piaractus brachypomus* to marketable size (approximately 1 kg). Replicated pond studies will be carried out in Iquitos at the Instituto de Investigaciones de la Amazonia Peruana (IIAP) pond facility. Pond water quality and effluents will be monitored.

METHODS AND MATERIALS

Initially *Colossoma macropomum* was the focal species of this study; however, due to a spawning failure, *Piaractus brachypomus* was substituted for the first year study, as approved by the PD/A CRSPs Technical Committee co-chairs. *Piaractus brachypomus* could not be obtained until March 1997 and were at an advanced fingerling size. Consequently, the fry production aspect of the study was precluded in the first year. The fingerling production trial commenced 29 April 1997.

Site Characterization

Eighteen ponds at the Quistacocha Aquaculture Station of the Institute for the Investigation of the Peruvian Amazon were mapped and measured. Ponds range from 60 to 5320 m². Eighteen ponds are also available at the University of the Peruvian Amazon Quistacocha Fish Culture Station. These ponds range in size from 20 to 596 m². Soil and water samples were collected from representative ponds at both stations and

Table 1. Feed ingredients and costs in U.S. dollars.

Ingredient	Percent in Diet	Cost per Unit
Fish Meal	19.9	1.00 kg ⁻¹
Soybean	19.9	0.72 kg ⁻¹
Wheat	19.9	0.26 kg ⁻¹
Rice	29.8	0.19 kg ⁻¹
Corn Meal	9.9	0.68 kg ⁻¹
Vitamin C	0.1	32.00 kg ⁻¹ *
Vitamin/Mineral Premix	1.0	
Fish Oil	0.5	1.60 kg ⁻¹

* Cost reflects price of vitamin C and vitamin/mineral premix combined.

sent to Dr. Claude Boyd at Auburn University for analysis. Preliminary studies on water quality parameters have been initiated. More detailed analyses await equipment currently being held in customs in Lima, Peru.

Six ponds, ranging in size from 1,015 to 5,320 m², were stocked with *Piaractus brachypomus* at two densities; three ponds at 3,000 fish ha⁻¹ and three ponds at 4,000 fish ha⁻¹. The mean initial weight was 27.5 g with the exception of one replicate pond of the lower density treatment where the initial mean weight was 4.0 g. Data will be collected from this replicate, but will not be used in the density comparisons. A locally manufactured feed was given to ponds (see Table 1 for feed composition and cost). The study commenced 29 April 1997 and will continue for approximately seven months. General water quality parameters (hardness, dissolved oxygen, temperature, conductivity, ammonia-nitrogen, carbon dioxide, pH, alkalinity, nitrite-nitrogen, and nitrate-nitrogen) are being analyzed; however, detailed analyses have not commenced because equipment purchased for the project is halted in customs.

RESULTS

First month production and water quality results are summarized in Tables 2 and 3.

Wild caught *Colossoma*, 4 to 12 g in size are sold to fish farmers for \$100 US per 1,000 fish. Hatchery production at IIAP costs \$70 US per 1,000 fish 4 to 12 g in size; fingerling production cost includes broodstock maintenance, labor, food, and fertilization. IIAP sells fingerlings and establishes the price for the wild catch.

Table 2. Weight gain and feed conversion efficiency of *Piaractus brachypomus* cultured at two densities in Iquitos, Peru, from 29 April to 30 May 1997 (n = number of ponds).

Density	Mean			n
	Initial Weight (g)	Weight Gain (g)	Feed Conversion Efficiency (%)	
3,000 fish ha ⁻¹	27.5	41.4	103.9	2
4,000 fish ha ⁻¹	27.5	48.4	121.9	3

Pond construction estimates were made by the Ministry of Fisheries. Estimates were made for machine- and hand-construction of levees and include land clearing, levee construction, pipes, and fencing. Cost of purchasing land is not included. Total costs are lower for machine-constructed ponds (\$1,960 US) than for manually-constructed ponds (\$2,700 US). The levee is 30 m in length; 2 m wide at the top; 9.5 m at the base; and 2.5 m in height. The surface area of pond water is 3,000 m².

DISCUSSION

It is too early in the study to draw conclusions. Fish are feeding well and water quality should improve as the addition of organic material in the form of excess feed and fish feces accumulates in the ponds. More detailed production cost data are being collected.

Table 3. Ranges for water quality parameters taken at midday, Iquitos, Peru (May 1997).

Parameter	Range
Hardness	20
Dissolved oxygen (mg l ⁻¹)	3.2-7.8
T _{min} /T _{max} (°C)	26.5-32.0
Conductivity (mS cm ⁻¹)	80-150
Ammonia-nitrogen (mg l ⁻¹)	<1.0
Carbon dioxide (mg l ⁻¹)	6-20
pH	5.6-6.9
Alkalinity (mg l ⁻¹)	20
Nitrite-Nitrogen (mg l ⁻¹)	0.09-0.12
Nitrate-Nitrogen (mg l ⁻¹)	0.15-0.25

ANTICIPATED BENEFITS

The development of aquaculture techniques for the culture of *Piaractus brachypomus* will benefit many sectors throughout the Peruvian Amazon. Sustainable aquaculture offers rural farmers an alternative source of food and/or income in addition to agricultural production and will provide a steady supply of high quality protein in the marketplace. *Piaractus brachypomus*, a native species, along with *Colossoma* play a crucial role in disseminating seeds in the flooded rainforests. The culture of this species should relieve some commercial fishing pressure.

LITERATURE CITED

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