Potential of Channel Catfish Production in Virginia

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Citation: Douglass, Vaughn M., and Robert T. Lackey. 1973. Potential of channel catfish production in Virginia. *Virginia Journal of Science.* 24(2): 89-92.

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Received September 19, 1972

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Abstract—Research on the feasibility of raising channel catfish (*Ictalurus punctatus*) in Virginia for supplemental agricultural income was conducted from 1969 to 1971. Results have shown catfish farming to be possible, but various problems must be solved, especially with respect to cage culture. Some conclusions are: (1) the production of marketable channel catfish (> 400g) is economically and biologically feasible; (2) there are existing ponds suitable for commercial catfish production; and (3) under normal conditions and with good management, reasonable returns can be realized.

Introduction

Virginia presently does not have a commercial channel catfish (*Ictalurus punctatus*) farming industry, but for the past several years we have been investigating the potential for one in the state. The general objective of our research was to provide the necessary technical information for the establishment of a catfish industry in Virginia. In areas of the state where tobacco is the only major cash crop, low income farmers could use catfish farming as a supplemental income source.

Three phases of our research were conducted from October, 1969 to November, 1971. The first, a survey of farm ponds in Pittsylvania County, was conducted to determine their suitability for commercial production of channel catfish. If a significant portion of these ponds are suitable for catfish culture, their use would minimize necessary capital investment, and result in greater net profits to the farmer. Specific objectives of this phase of the study were: (1) to provide an estimate of the number of suitable ponds available; (2) to design a simple pond rating form that would allow a farmer or county agent to determine if a specific pond is suitable for catfish culture; and (3) to indicate the amount of interest expressed by local pond owners regarding catfish culture.

Experimental culture studies were conducted during two growing seasons (1970 and 1971) to test the biological feasibility of channel catfish production in Virginia. The objectives were: (1) to determine whether marketable catfish can be produced in existing ponds in one growing season; (2) to determine the growth rate of channel catfish in Virginia; (3) to determine the effects of pond location on the growth of channel catfish; and (4) to compare the results of pond culture versus cage culture.

The final phase dealt with a preliminary evaluation of the economic potential of catfish production in Virginia. If such an industry is to be established, then information will be needed on profit possibilities, market potential, and marketing channels. The major objectives were to estimate: (1) the extent of potential demand for catfish in Virginia and the Washington, D. C. area; (2) the approximate cost of producing channel catfish; and (3) whether there are sufficient outlets for marketing various catfish products.

Methods

Located within the Piedmont region of Virginia, Pittsylvania County contains about 1500 farm ponds. Topographic maps were utilized to randomly select ponds to be surveyed. The history of the pond, its uses, and drainage and drawdown characteristics were obtained from the owner or farm manager. Physical parameters such as depth, presence of a catch basin, the amount of aquatic vegetation, turbidity, water transparency, and water temperature were determined. Chemical parameters such as alkalinity, total dissolved solids, pH, and dissolved oxygen were obtained by analyzing subsurface water. Upon completion of the survey, the pond was subjectively rated for suitability.

Three ponds were stocked with channel catfish fingerlings in October, 1969. Two were situated in Pittsylvania County (Farmer and Dalton) and one in Montgomery County (Hoge). Five thousand fingerlings were stocked in each pond, but they were not fed until spring, 1970. Cage culture was also conducted during 1970 in conjunction with the pond culture experiments. Two cages were placed in Dalton Pond and Kessinger Pond (Montgomery County), and one was placed in Farmer Pond. In June cages in Dalton Pond were each stocked with 500 fingerlings. The Farmer Pond cage and

[1] Supported in part by Pittsylvania County Community Action, Inc., Chatham, Virginia, through funds from the Office of Educational Opportunity, Department of Health, Education, and Welfare. John M. Beland, Donald W. Holmes, Arn R. Smith, and Richard J. Pfeifer were employed as research assistants during various phases of this project.

Kessinger Pond cages were each stocked with 350 fish. Cages were commercially produced and measured 2.7 × 1.8 × 1.0 meters. The netting was 7 mm mesh Ace treated (rotproof) nylon, and a 12 mm plywood cover was constructed for each cage.

Dalton and Farmer Ponds were again used for research in 1971. Salem Pond, Roanoke County, was added. Dalton and Farmer Ponds were each stocked with 3,000 fingerlings, and Salem Pond was stocked with 6,000. Cage culture was attempted again during the 1971 growing season. Three cages were built from 12 mm mesh hardware cloth on a frame of 12 mm diameter steel pipe. Cages were divided into two sections, each measuring 0.8 × 1.8 × 0.9 meters. Each half was considered to be a complete cage. Two cages, purchased from the Pockman Manufacturing Company, measured 0.8 × 1.8 × 1.0 meters covered with 12 mm × 25 mm galvanized wire mesh. Two cages were placed in Dalton Pond and the remaining were placed in Farmer Pond. The fingerlings were stocked on March 23, 1971, at the rates of 200, 250, 300, and 350 fish per cage.

Feeding was done manually six days per week, using Purina Floating Catfish Chow. For pond culture, feed was broadcast over a wide area for up to thirty minutes or as long as fish continued to consume the food. Fish in cages were fed all they would eat in a 15 minute period. Feeding during the 1971 growing season was conducted in the same manner in both cases.

Economic analysis of farm-reared channel catfish incorporated estimates of pond construction cost for similar ponds in Tennessee (Rogers and Madewell, 1971) and production costs from Farmer Pond.

Results

A total of 125 ponds were surveyed in Pittsylvania County during July and August, 1971. Ponds were classified into one of three categories: *suitable, unsuitable,* and *marginal.* Suitable ponds were further subdivided by the culture type that could be best utilized: cage or pond culture, or both. Of the 1500 ponds in Pittsylvania County 804 were suitable. The total surface area available was 1420 hectares, of which 1050 hectares was suitable. The opinion of pond owners towards culturing catfish was also determined. Almost 20% of the owners surveyed, either gave no opinion or were unavailable for comment, but of the remaining owners, 42% were interested in catfish farming while 38% were not.

Ponds were harvested from mid-October to early November in 1970 and 1971 (Table I).

During the 1970 summer, the caged fish in Farmer Pond escaped. The mesh of the cage had been torn in several places. On 21 September an oxygen deficit was recorded resulting in 100% mortality in the Dalton Pond cages. The fish in one cage in Kessinger Pond also escaped through holes in the mesh, while the fish in the remaining cage were found dead on 21 September, also due to an oxygen deficit. The final average weight per fish in the two Dalton Pond cages was 159 grams and 137 grams. This resulted in a conversion ratio (amount of food to weight gain) of 2.28 in one cage and 2.50 in the other. The average weight per fish in one cage in Kessinger Pond was 70 grams which gave a conversion ratio of 2.18.

TABLE I

Results of pond culture of channel catfish in 1970 and 1971

	Research Pond		
1970	Dalton	Farmer	Hoge
Number of fish harvested	2800	4130	3780
Feed consumption (kg)	1840	2330	660
Fish wt. produced (kg)	1030	1380	530
Average fish wt. (g)	375	335	140
Conversion ratio	1.77	1.76	1.41
Survival (%)	76	83	76
Marketable fish (%)	39	16	5
1971	Dalton	Farmer	Salem
Number of fish harvested	1330	1240	2720
Feed consumption (kg)	1140	1420	1640
Fish wt. produced (kg)	370	200	820
Average fish wt. (g)	281	165	301
Conversion ratio	3.06	6.90	2.00
Survival (%)	44	41	45
Marketable fish (%)	25	14	38

At the end of the 1971 growing season the cages were harvested along with the ponds (Table II). Results were greatly improved over 1970 in that none of the cages suffered mortality due to low dissolved oxygen and fish did not escape.

The production of channel catfish in farm ponds is financially feasible for at least the southern portion of Virginia providing a market would exist (7–27% profit excluding pond cost; a loss to 9% including pond cost). Even though costs and yields can be extremely variable, as indicated by results obtained from Farmer Pond (Tables III and IV), catfish farming can become an income supplement for small operators. The differences depend greatly

TABLE II

Results of cage culture of channel catfish in 1971

	Research Ponds	
	Dalton	Farmer
Feed consumption (kg)	426	176
Fish wt. produced (kg)	186	41
Average fish wt. (g)	221	111
Conversion ratio	2.28	4.19
Survival (%)	76	44
Marketable fish (%)	30	0

TABLE III

Financial analysis of channel catfish production in Farmer Pond, excluding pond construction costs

Annual Expenses	
Fingerlings—4,000, 150 mm @ $0.04 each	$ 160.00
Feed —2,334 kg @ $.15 per kg	384.00
Labor	
Daily checking & feeding—49.3 hours @ $1.65/hr	81.34
Harvesting — 9.0 hours @ $1.65/hr	14.85
Equipment	
Oxygen kit (amortized at 8% for 20 years) ($14.00 × .1018)	1.42
Seine, 15 m (amortized at 8% for 3 years) ($45.00 × .388)	17.46
Interest on borrowed capital for:	
Fingerlings @ 8%	32.00
Feed and labor @ 4%	
TOTAL	$ 691.07
Returns (Expected)	
1,319 kg fish @ .66/kg	$ 870.60
@ .88/kg	1160.80
(Based on conversion ratio of 1.77 w/average fish wts. of 330 g)	
Less Expenses	−691.07
Net returns to land management and other fixed costs before taxes/year/0.6 ha	
@ .66/kg	186.53
@ .88/kg	469.73
Breakeven price per kg of fish $.52	
Rate of return 27.4% @ .66/kg	

TABLE IV

Financial analysis of channel catfish production in Farmer Pond, including pond construction costs

Annual Costs	
* Pond construction and pipe (amortized at 8% for 20 years) ($1,176.00 × .1018)	$ 119.78
Fingerlings—4,000, 150 mm @ $.04 each	160.00
Feed —2,334 kg @ $.15 per kg	384.00
Labor	
Daily checking & feeding—49.3 hours @ $1.65/hr	81.34
Harvesting — 9.0 hours @ $1.65/hr	14.85
Equipment	
Oxygen kit (amortized at 8% for 20 years) ($14.00 × .1018)	1.42
Seine, 15 m (amortized at 8% for 3 years) ($45.00 × .388)	17.46
Interest on borrowed capital for:	
Fingerlings @ 8%	32.00
Feed and labor @ 4%	
TOTAL	$ 810.85
Returns (Expected)	
1,319 kg fish @ .66/kg	$ 870.60
@ .88/kg	1160.80
(Based on conversion ratio of 1.77 w/average fish wts. of 330 g)	
Less Expenses	−810.85
New returns to land management and other fixed costs before taxes/year/0.6 ha	
@ .66/kg	59.75
@ .88/kg	349.95
Breakeven price per kg of fish $.52	
Rate of return 7.3% @ .66/kg	

* Costs are the estimated costs of land and construction of a 0.6 hectare pond in Tennessee (1).

upon the ability of the particular producer.

There appears to be a large potential market for farm raised channel catfish in Virginia and surrounding area. Our research indicates that about 1,600,000 kilograms of catfish (dressed weight) will be consumed annually during the "latent" market phase. Approximately 14,600,000 kilograms of processed catfish will be needed yearly to satisfy the needs of a mature market in the future. It must be noted though, that these figures are potential figures, since the consumer needs to be informed and educated about the product. The product in turn must be made available to the consumer at a reasonable price and in accordance with competitive product quality.

In regards to marketing, the sale of live fish for fee fishing may offer promise. However, there are few heavily populated areas where fee fishing is feasible and these locations can probably be satisfied by a small number of producers. Therefore, channel catfish marketed as food fish seems to have the greatest potential in Virginia.

Discussion

The pond rating form was effective in determining general pond suitability, but beyond that classification, rating form accuracy was considerably lower. The percentage of ponds correctly assigned to the suitable and unsuitable categories was high, while the percentage for the marginal category was low. The percentage of correctly assigned ponds in the culture type subcategories (cage culture or pond culture) was unexpectedly high and this is attributed largely to selection bias. Despite these faults, the form was quite accurate in distinguishing between suitable and unsuitable pond types, and is satisfactory for determining these categories.

Results of experimental culture show that it is biologically feasible to raise channel catfish in Virginia. Temperature and elevation have a marked effect on the growth rate as can be seen from the results. Hoge Pond, located in the mountain region of Virginia, had a lower feed consumption due to cooler water temperatures. Therefore, a lower growth rate resulted in a lower total weight produced, a lower average fish weight, and a lower percentage of marketable fish. Dalton, Farmer, and Salem Ponds, located at lower elevations and having higher water temperatures, showed significantly better results.

Stocking size was also a factor in determining the percentage of marketable fish. Hastings (2) found that channel catfish grow at a rate commensurate with their size at the time of stocking. In this study, fish that were initially less than 150 mm in length when stocked did not reach a marketable size.

Conversion rates and survival in ponds compared favorably with other studies except during 1971 when a bacterial infection (*Chondrococcus columnaris*) occurred. As a result conversion rates

increased and survival decreased. Accordingly, the prevention of disease can make a catfish farming operation much more profitable.

There are still many technological difficulties to be solved in regards to cage culture. Our research shows that dissolved oxygen is much more critical with this method than with pond culture. With low dissolved oxygen conditions prevailing, the fish in cages died while those free in the pond did not suffer any mortality. The fish in the pond can carry on what is known as surface breathing, or escape to more highly oxygenated areas of the pond while the fish in cages are crowded and restricted to one area.

The food fish market is the only one capable of absorbing a large volume from a channel catfish industry in Virginia. The products and markets that should be entered depend a great deal upon the size of the industry that develops in the state. If the size remains small, then local markets within the immediate areas of production could provide an outlet for producers. Low scale operation would supply a product in the form of processed fish, iced for preservation, and delivered to local restaurants or grocery stores. In the event that interest by pond owners is high and production is on a medium to large scale, then local marketing structure would not be able to absorb the amount of channel catfish available. In these circumstances large scale processing and distribution facilities would be needed.

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