

A FEASIBILITY STUDY FOR THE SALE OF CULTURED
CATFISH IN VIRGINIA AND WASHINGTON, D. C.

by

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Thesis submitted to the Graduate Faculty of the
Virginia Polytechnic Institute and State University
in partial fulfillment of the requirements for the degree of

Master of Science

in

Forestry

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December, 1971

Blacksburg, Virginia 24061

ACKNOWLEDGEMENTS

Sincere appreciation is extended to the following individuals whose time and guidance helped to make this study possible:

Dr. Enoch F. Bell who served as the committee chairman for this study and who also provided valuable aid and assistance in all phases of this study, especially in the editing and organization of the final paper.

Dr. Emmett F. Thompson, a committee member for this study, whose advice and assistance proved to be valuable in analyzing the production cost data of this study.

Dr. Edward M. Mazze, professor of marketing at VPI & SU, whose knowledge and assistance aided in all the marketing phases of this study, and who served as a committee member.

Dr. Henry S. Mosby who with the above served to make up the graduate committee for this study and who also greatly aided in the original development and organization of this study.

Dr. George J. Flick, assistant professor of Food Science and Technology at VPI & SU, who provided valuable information on the fishery products industry in Virginia.

Graduate student Donald W. Holmes for providing the necessary cost data needed to complete the economic analysis done in this study.

Kenneth Thorson, director of the Pittsylvania Community Action Incorporated organization, whose knowledge on channel catfish marketing and whose printed material on the subject, aided greatly in the collection of data throughout the study.

My parents and grandparents who sacrificed so much that I might be able to attend graduate school.

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INTRODUCTION

Aquaculture is the raising of various species of fish in controlled water environment for ultimate sale and human consumption. As such it is not a new field in the United States. Studies concerning aquaculture in general started as early as 1915 when George C. Embury of Cornell published his work "The Farm Fish Pond." His study concerned itself with native species other than catfish, but it sparked an interest in the field of aquaculture. After Embury's publication, significant advances were not made until the 1930's when Professors H. S. Swingle and E. V. Smith of Alabama Polytechnic Institute published results of their studies on chemical fertilization, weed control and mixed fish crops (Miller and Nash, 1969:34-35).

Major interest in aquaculture in this country did not start until the 1950's. During this time the aquaculture industry was concentrated in the states of Arkansas, Mississippi, Louisiana and Texas. Also, around this time there was an attempt made to rotate rice crops with fish crops in the delta region of Arkansas. This practice along with aquaculture in general declined toward the end of the 1950's because of insufficient consumption of the less desirable species such as goldfish, minnows, and buffalofish (Miller and

Nash, 1969:34-35). Even though large scale production had decreased, there still remained enough interest for some farmers to try and switch to catfish. From their experience enough was learned to encourage more farmers to get into the industry and create the fish farming boom of the 1960's which has continued up to the present time (Miller and Nash, 1969:34-35).

Importance of Catfish Farming

Commercial catfish farming is the raising of channel catfish (Ictalurus punctatus) through controlled feedings and limited chemical applications for ultimate harvesting and sale as various catfish products such as fingerlings, broodfish, and food fish. It is now considered as one possible solution to the widening gap between the potential consumption of fish products and the quantity of fish products produced in the United States. In 1967 five billion pounds (whole fish weight) of fish and shellfish were consumed, and of that amount U. S. fisheries supplied only 2.4 billion pounds -- less than 50% of total consumption (Jones, 1969a:52). This gap leaves ample room for the expansion of the catfish farming industry in the United States, provided a competitive cost structure exists.

It has been estimated that U. S. markets will need around three billion pounds of additional fish and

shellfish for the food markets over the next 15 years (Jones, 1969a:61). This expected increase in quantity desired by consumers is due largely to the expected increase in per capita consumption of fish and shellfish products (Jones, 1969a:61).

The ability of U. S. fisheries to provide for present fish and shellfish consumption (let alone the expected increases in per capita consumption) will probably diminish due to the effects of contamination by pollutants upon aquatic life. The number of uncontaminated species of fish caught in international and public waters, acceptable to U.S.D.A. regulations, is diminishing each year. This is exemplified by the current curtailment of the swordfish industry along our coasts and all commercial fishing upon Lake Erie because of mercury contamination. This trend will probably increase rather than decrease in the future; thus providing opportunity for the catfish farming industry to expand.

There are other indicators that the importance of farm fish products, including channel catfish, will increase. Farm fish products are a highly nutritious, low cholesterol food source which are now more desirable with an increasing number of diet-conscious Americans. In addition catfish represent an animal protein food

supply totally within the U. S., which could be used in time of war (Jones, 1966:18). In contrast to ocean resources, farm fish can be produced within the country with a minimum of equipment, no large ships and little risk to personnel (Jones, 1966:18).

Catfish farming and fish farming in general also present an important possibility for substantial relief from the world's protein shortage, and a solution which could be more acceptable (socially and economically) to the world's people (Madewell and Carroll, 1969:10). Catfish range from \$1.00 to \$1.25 per pound on a 100% protein basis as compared to meat in general which is about \$2.00 per pound on a 100% protein basis (Jones, 1966:19).

Justification

The justification for this marketing/economic feasibility study stems initially from the fact that the development of a catfish farming industry is currently under consideration for Virginia, specifically in Pittsylvania county. Channel catfish farming may be able to provide sufficient supplemental income to the large number of low income farmers in the region to enable them to support themselves.^{1/} This possibility

^{1/} Related in discussion with Mr. Kenneth Thorson, Director, Pittsylvania Community Action, Inc., Chatham, Virginia, July, 1971.

has important implications for the many small Virginia farmers in the southern and western portions of the state. If such an industry is established in Virginia, then information as to what the profit possibilities and market potential for farm-reared channel catfish are, and what, if any, marketing channels are capable of absorbing the channel catfish produced will be needed. Since research on these topics has never been done before in Virginia, this study proposes to fill this need.

Objectives

The major objectives of this study were to estimate: (1) the extent of potential demand for catfish in Virginia and Washington, D. C. area; (2) the approximate cost of producing channel catfish; and (3) whether there are sufficient outlets for marketing the various catfish products.

Procedures

The procedure for this marketing and feasibility study were as follows:

- (1) To review the different types of products that presently can be made from cultured catfish. A literature search into secondary sources concerned with the marketing of catfish provided the

answers as to what products are presently made from catfish resources and also future product developments.

- (2) To estimate the approximate cost from stocking, feeding and establishing a production pond for cultured catfish. Economic analysis was applied to the cost data supplied by Don Holmes, graduate assistant at Virginia Tech, who investigated the production of channel catfish in two ponds in Pittsylvania county near Chatham, Virginia. Data was also assembled and analyzed from cost estimates of Tennessee ponds of the same size and nature as those found in Virginia.
- (3) To estimate the size of the potential market in Virginia and Washington, D. C. for cultured catfish. This procedure followed the format of Mitchell and Usry (1969:6). The framework for the forecast was composed of:
 - a) population projections by age groups,

- b) estimate of the "fish-eating," population,
 - c) estimate of the individual's capacity to consume catfish by age groups,
 - d) per cent of "fish-eating" population that will eat catfish, and
 - e) the consumption levels for catfish.
- (4) To estimate whether there are sufficient marketing outlets to get the various catfish products from the production ponds to the consumers. To accomplish this Dr. George J. Flick, assistant professor of Food Science and Technology at VPI & SU, who is closely connected with the fishery industry in Virginia, was interviewed. His professional judgment on the present industry structure in Virginia and its ability to absorb the channel catfish products that could be produced in this state was used in this step of the procedure.

CATFISH PRODUCTS

There are basically two major categories under which all of the present catfish products may be represented: (1) the live fish market, and (2) the food fish market (Schubert, 1968:6). In the live fish market, living catfish are sold in specific sizes to brokers, live fish haulers, retailers and channel catfish producers for ultimate recreational or production activities. The range of products in this market include fingerlings, broodfish and live fish for stocked or fee-fishing ponds.

The food fish market consists of farm-reared channel catfish sold to either processors, brokers, wholesalers or retailers in either the round (whole fish) or processed forms for ultimate human consumption. The range of products in this market falls into three main categories: round fish, processed fish, and fish waste, with a further breakdown of processed products into the various treatments applied to the processed fish.

Live Fish Market Products

Fingerlings

Fingerlings are one-half to one year old channel catfish that have been raised from eggs, following the

spawning of broodfish (Mitchell and Usry, 1967:25). They range in size from two to ten inches and are produced by either the pond spawn method or by a method using pens, hatching troughs and nursery ponds (Madewell and Carroll, 1969:24-25). These fingerlings are sold to channel catfish producers who raise them to a marketable size for either food fish or recreational purposes. The prices paid for fingerlings range from \$.05 to \$.18 each, (Schubert, 1968:III-1), or on the average of \$.01 per inch (Donahue, 1969:63).

Broodstock

Broodfish are channel catfish raised from fingerlings to ages from three to not more than eight years, (Hatcher, 1969:35). The preferred size is from two to ten pounds, but channel catfish may mature and be able to spawn at as little as 3/4 pound (Hatcher, 1969:35). These broodfish are used to produce fingerlings for their owners operation or for sale to other fingerling producers. The prices paid for broodfish range from \$1.00 to \$1.75 per pound depending upon their size and quality (Schubert, 1968:III-1).

Live Fish for Public Stocking or Fee-Fishing Ponds

Channel catfish sold for stocking are raised from the fingerling stage, in production ponds, until they

attain a weight of at least 3/4 pound or more (Schubert, 1968:III-1). These fish are then sold to brokers or live fish haulers who in turn sell them to fee-fishing ponds, clubs or agencies for stocking (Mitchell and Usry, 1967:5). The prices received by producers range from \$.40 to \$.60 per pound (Donahue, 1969:63). The operators of these fee-fishing ponds in turn may receive a \$1.00 per person entrance fee plus \$.35 to \$.60 per pound for fish caught plus concession revenues (Schubert, 1968:III-1).

Food Fish Market Products

Round

Catfish in the food fish market category are sold in one of three product forms: round, processed, or waste from processed fish. The fish sold in the round are those that are not cleaned before they are sold. These fish have been raised in production ponds and are usually sold at the pond site after harvesting, to brokers, wholesalers, retailers or processors. The product is usually delivered in either a live form to be put into holding tanks before processing (Billy, 1969:45), or they are shipped in ice for immediate processing or sale to consumers in such places as fish markets. This product is usually priced from \$.30 to

\$.40 per pound depending upon fish size, quality, and market supply conditions at the time. The ideal size for sale is from one to one and one-half pounds before dressing (Mitchell and Usry, 1967:5). However there are large markets for other size catfish especially for the smaller one-half to one pound fish (Mitchell and Usry, 1967:5).

Processed

Catfish sold in the processed form can be handled in one of two ways, depending upon the size and capital investment of the operation in question. The catfish can either be cleaned by hand or by a mechanical device which performs a complete dressing of the fish. These fish are dressed to different degrees depending upon the needs of the ultimate buyer (Schubert, 1968:IV-6).

A completely dressed fish is the carcass after the entrails, head, pectoral fins, and skin are removed (Schubert, 1968:IV-6,7). It is also considered desirable to remove the collarbone of the catfish (Schubert, 1968:IV-7). The dressed fish can then be packaged, weighed and labeled according to the specifications of the market at which this product will be sold. Prices received for fully dressed catfish by the processor selling to retail outlets range from \$.75 to \$.95 per pound (Donahue, 1969:64). The retailer realizes

approximately a 20% price markup over processor or wholesaler cost, and the retail price is in the area of \$1.09 per pound (U. S. Department of the Interior, 1967:16).

Processed Product Storage

Catfish after they have been processed and packaged can be stored for up to two weeks at a temperature of 33°F before any significant deterioration takes place (Mitchell and Usry, 1967:63). Catfish can also be treated by a process of irradiation to give them a longer shelflife. By irradiating the product with a radiation dose of 0.2 or 0.3 megarads, a two to threefold expansion in shelflife may be attained provided the product is kept at 33°F (Mitchell and Usry, 1967:63). Catfish may also be flash frozen after they have been processed and packaged. In this form, research indicates that catfish can be successfully stored under commercial conditions for a period of ten to twelve months without losing their texture or taste (Mitchell and Usry, 1967:64).

Waste From Processed Fish

Approximately 35 to 40 percent of the fish is lost in the dressing process (Schubert, 1968:IV-7). Although this waste cannot be used for human consumption it can

be sold for industrial uses. Typical industrial product outlets include animal foods, fish meals, fish oils, liquid feed supplements and fertilizers. The fish waste is ground, quickly heated to high temperatures (190°F), and then pressed under low pressure to separate solids, oil, and water. (U. S. Department of the Interior, 1965:10-12). A return from the sale of fish waste can be expected in the range of from \$.05 to \$.20 per pound depending upon market outlets (U. S. Department of the Interior, 1967:4).

ECONOMIC ANALYSIS OF THE PRODUCTION PROCESS

The production process is fundamentally the same for farm-reared channel catfish, whether free pond, cage culture, or the raceway methods are used. The basic process entails constructing a production facility (pond or raceway) or utilizing an existing one. Existing production facilities should be drained and cleaned of all trash fish (bluegills, sunfish, etc.) and any undesirable vegetation.

Once the production facility is prepared, it is filled with water and stocked with 4 to 7 inch fingerlings. Fingerlings can be stocked in the spring or fall of the year. Feeding usually begins when the water temperature reaches 60°F. Either sinking or floating feed can be used, depending on the preference of the producer. When sinking feed is used, the fish are fed approximately 3% of their body weight daily. Floating feed is easier to use since the amount of feed used daily depends on the feeding reaction of the fish. The producer can observe the feeding and feed rates can be adjusted accordingly.

The oxygen content of the water is checked periodically to determine whether the oxygen level is sufficient (5 parts per million) to insure survival of the fish crop (Wheeler, N.D.:3). Low oxygen levels, besides causing

mortality, can result in poor feed consumption and increased disease potential.

Applications of chemicals and fertilizers to the pond water may be necessary during the production process. Chemicals may be applied to control unwanted vegetation or to prevent or arrest fish diseases. Applications of fertilizers may be necessary to increase the amount of plankton in the water for fish food. This procedure is not recommended for ponds in which supplemental feeding programs exist (Wheeler, N.D.:3). The schedule of feeding and checking, with limited chemical and fertilizer applications if necessary, is carried out from early spring until mid-October or November when the fish are harvested.

In mid-October or November the ponds are drained and the shallows are seined for the fish. If the physical layout of the pond permits, the pond can be seined without draining. The harvested fish are then transported to their various destinations for ultimate sale.

In economically analyzing this production, the operating costs were determined for two experimental ponds in Pittsylvania. Then these costs were combined with similar costs from other sources. These costs for various types of operations were then compounded to a given point

in time and subtracted from comparable revenue figures to determine profit potential. The results are shown in Tables 1-4.

Source of Costs

The production costs used in this economic analysis of the production process for farm-reared channel catfish were gathered from two sources. The pond construction costs were estimated costs from similar ponds in Tennessee (Rogers and Madewell, 1971: 9). The production costs were actual costs determined by Don Holmes, a graduate assistant at Virginia Tech, who worked on the production feasibility of pond-reared catfish in Southwestern Virginia (Holmes, 1971).

Ponds

Two ponds were selected for this marketing/ economic feasibility study. These ponds were located in the county of Pittsylvania, Virginia. They were each 1.5 acres in surface area and were constructed prior to the undertaking of the study. The fact that these ponds were previously constructed necessitated the use of estimated pond construction costs when required. The ponds are distinguished by the number of days in which the fish were fed. Farmer's Pond had 148 feeding days while Dalton's Pond had 151 feeding days.

Table 1. Financial analysis of channel catfish production in Farmer's Pond excluding pond construction costs

<u>Annual Expenses</u>	
Fingerlings - 4000, 4" @ \$.04 each	\$ 160.00
Feed - 5136.5 lbs @ \$150 per ton	384.00
Labor	
daily checking and feeding - 49.3 hrs. @ \$1.65/hr.	81.34
harvesting - 9.0 hrs. @ \$1.65/hr.	14.85
Equipment	
Oxygen kit (amortized at 8% for 20 years) (\$14.00 x .1018)	1.42
Seine, 50 ft. (amortized at 8% for 3 years) (\$45.00 x .388)	17.46
Interest on borrowed capital for:	
fingerlings @ 8%	32.00
feed and labor @ 4%	
TOTAL	<u>\$ 691.07</u>
<u>Returns (Expected)</u>	
2902 lbs. fish @ .30/lb.	\$ 870.60
@ .40/lb.	1160.80
(Based on conversion ratio of 1:1.77 w/average fish wts. of 11.8 ounces)	
Less expenses	-691.07
Net returns to land management and other fixed costs before taxes/year/1.5 acre	
@ .30/lb.	189.53
@ .40/lb.	469.73
Breakeven price per pound of fish .238 per pound	
Rate of return 27.4% @ .30/lb.	

Table 2. Financial analysis of channel catfish production in Farmer's Pond including pond construction costs

<u>Annual Costs</u>	
*Pond construction and pipe (amortized at 8% for 20 yrs.) (\$1176.00 x .1018)	\$ 119.78
Fingerlings - 4000, 4" @ \$.04 each	160.00
Feed - 5136.5 lbs. @ \$150 per ton	384.00
Labor	
daily checking and feeding - 49.3 hrs. @ \$1.65/hr.	81.34
harvesting - 9.0 hrs. @ \$1.65/hr.	14.85
Equipment	
Oxygen kit (amortized at 8% for 20 years) (\$14.00 x .1018)	1.42
Seine, 50 ft. (amortized at 8% for 3 years) (\$45.00 x .388)	17.46
Interest on borrowed capital for:	
fingerlings @ 8%	
feed and labor @ 4%	32.00
TOTAL	<u>\$ 810.85</u>
<u>Returns (Expected)</u>	
2902 lbs. fish @ .30/lb.	\$ 870.60
@ .40/lb.	1160.80
(Based on conversion ratio of 1:1.77 w/average fish wt. of 11.8 ounces)	
Less expenses	-810.85
Net returns to land management and other fixed costs before taxes/year/1.5 acre	
@ .30/lb.	59.75
@ .40/lb.	349.95
Breakeven price per pound of fish .279 per pound	
Rate of return 7.3% @ .30/lb.	

*Cost are the estimated costs of land and construction of a 1.5 acre pond in Tennessee (Rogers and Madewell, 1971:9).

Table 3. Financial analysis of channel catfish production in Dalton's Pond excluding pond construction costs

<u>Annual Expenses</u>	
Fingerlings - 4000, 4" @ \$.04 each	\$ 160.00
Feed - 3781.6 lbs @ \$150 per ton	283.50
Labor	
daily checking and feeding - 50.3 hrs. @ \$1.65/hr.	82.99
harvesting - 9.0 hrs. @ \$1.65/hr.	14.85
Equipment	
Oxygen kit (amortized at 8% for 20 years) (\$14.00 x .1018)	1.42
Seine, 50 ft. (amortized at 8% for 3 years) (\$45.00 x .388)	17.46
Interest on borrowed capital for:	
fingerlings @ 8%	28.04
feed and labor @ 4%	
TOTAL	<u>\$ 588.26</u>
<u>Returns (Expected)</u>	
2148.5 lbs. fish @ .30/lb.	\$ 644.55
@ .40/lb.	859.40
(Based on conversion ratio of 1:1.76 w/average fish wts. of 13.2 ounces)	
Less expenses	-588.26
Net returns to land management and other fixed costs before taxes/year/1.5 acre	
@ .30/lb.	56.29
@ .40/lb.	271.14
Breakeven price per pound of fish .273 per pound	
Rate of return 9.5% @ .30/lb.	

Table 4. Financial analysis of channel catfish production in Dalton's Pond including pond construction costs

<u>Annual Costs</u>	
*Pond construction and pipe (amortized at 8% for 20 years) (\$1176.00 x .1018)	\$ 119.78
Fingerlings - 4000, 4" @ \$.04 each	160.00
Feed - 3781.6 lbs. @ \$150 per ton	283.50
Labor	
daily checking and feeding - 50.3 hrs. @ \$1.65/hr.	82.99
harvesting - 9.0 hrs. @ \$1.65/hr.	14.85
Equipment	
Oxygen kit (amortized at 8% for 20 years) (\$14.00 x .1018)	1.42
Seine, 50 ft. (amortized at 8% for 3 years) (\$45.00 x .388)	17.46
Interest on borrowed capital for:	
fingerlings @ 8%	28.04
feed and labor @ 4%	
TOTAL	<u>\$ 708.04</u>
<u>Return (Expected)</u>	
2148.5 lbs. fish @ .30/lb.	\$ 644.55
@ .40/lb.	859.50
(Based on conversion ratio of 1:1.76 w/average fish wts. of 13.2 ounces)	
Less expenses	-708.04
Net returns to land management and other fixed costs before taxes/year/1.5 acre	
@ .30/lb.	- 63.49
@ .40/lb.	151.46
Breakeven price per pound of fish .329 per pound	
Rate of return -8.9%	

*Costs are the estimated costs of land and construction in a 1.5 acre pond in Tennessee (Rogers and Madewell, 1971:9).

Explanation of Costs and Revenues

Initial Costs

Land, pond construction and drain pipe costs are the estimated construction costs for establishing a production pond in Tennessee (Rogers and Madewell, 1971:9). These costs were chosen because the surface areas of the Tennessee ponds were equal to those of the study ponds located in Virginia. The cost of construction can be extremely variable and differences can be found depending upon location, terrain and contractor consulted. However, these pond construction costs give an indication as to the approximate cost that can be incurred.

Other initial costs include the cost of a 50 foot seine and an oxygen kit. The oxygen kit is needed to check the oxygen level of the pond water. If the oxygen content of the water is too low, certain procedures must be followed in order to insure survival of the catfish. The seine is used in the harvesting of the fish.

Annual Costs

The annual costs include fingerlings, feed, labor and interest charges. The fingerling cost was calculated on the basis of \$.01 per inch, with 4000 four inch fingerlings being stocked (Donahue, 1969:63). The amount

of feed needed was calculated by multiplying the number of pounds of yield by the conversion ratio (the pounds of feed needed to yield a pound of fish). This figure was then converted to tons and multiplied by the feed price of \$150 per ton to arrive at the feed cost. Labor was estimated to be 20 minutes a day for feeding and three hours by three men for harvesting. A charge of a \$1.65 per hour (current minimum wage) was multiplied by the total number of hours of labor required to arrive at the labor cost. All these figures were derived from Holmes (1971).

The entire operation of both ponds and in both situations (constructing a pond and utilizing an existing pond) was considered to be financed completely by borrowed capital. An 8% interest charge on the borrowed capital was used to calculate the total interest charge. This rate was chosen because it is the probable rate of interest that would be charged by local banks. In the case of an asset that had a useful life of over one year, the asset was amortized at 8% over its expected useful life, to arrive at an annual expense.

The expenses that were incurred for only one year were financed at their effective rather than their nominal rates. An 8% interest charge on borrowed capital for the cost of the fingerlings was used because the

capital borrowed was carried for a full year before payback. A 4% interest rate was charged on feed and labor costs because the capital borrowed for these costs is carried for only a period of approximately six months before payback. Payback is assumed to occur at the time of harvest.

There are two other annual costs that may be incurred in the production of channel catfish, the costs of fertilizer and chemicals. These costs usually run to about \$7.20 per pond acre per year for fertilizer and \$18 to \$25 per pond acre per year for chemicals (Beland, 1969:43). The chemicals, primarily copper sulfate, are mainly used for fish disease and weed control. The cost of chemicals and fertilizers were not included in calculating total costs, because they were not used in the production of channel catfish in either of the ponds considered in this study.

Revenues

Revenues were estimated by multiplying the two extremes of the range of prices, (\$.30 and \$.40 per pound) (Schubert, 1968:III-15), being paid for farm-reared channel catfish as a food fish product by the catfish yield (in pounds). These calculations assume that the amount of catfish produced can be completely sold at current prices.

Furthermore, a breakeven price was calculated to give an indication of how low the price could fall before profits would change to losses for the operations considered. This breakeven price was arrived at by dividing the total annual expenses by the catfish yield.

A rate of return was also calculated for each of the four operations at the \$.30 price level. It was calculated by dividing the annual net revenues by the annual costs generated by the respective catfish farming operations. The rate of return can be used to compare investments, when trying to decide among alternatives. Since a particular acceptable rate of return was not required in the original proposal for this study, the rate of return was calculated for all four operations with determination of an acceptable rate of return left up to the potential producer of the farm-reared channel catfish. The range of rates of return ran from -8.9% to 27.4%.

Analysis for Virginia

As can be seen in Tables 1, 2, 3, and 4 the production of channel catfish in farm ponds, on a one year production schedule, seems to be financially feasible for at least the southern portion of Virginia provided a market exists. Even though costs and yields can be extremely variable, as indicated by the differences

in costs and yields from Farmer's Pond to Dalton's Pond, catfish farming can become an income supplement for small operations. The differences found from one operation to the next will depend greatly upon the skill and management ability of the producer involved.

Catfish farming on this scale can only be regarded as an income supplement. A 100 acre operation would be about the minimum pond acreage needed to generate sufficient net revenues to provide sufficient income for an individual. A 500 acre operation would be more competitive (Mitchell and Usry, 1967:10).

MARKET POTENTIAL

In order to estimate the market for farm-reared channel catfish, the following procedure was used in calculating the market potential.

- A. Population by age groups for Virginia, Tennessee and Washington, D. C. from General Population Characteristics was obtained (U. S. Department of Commerce, 1971a, b, c).
- B. The proportion of the population eating fish was estimated from the survey, "Expenditure Patterns of the American Family." Of the 12,000 families who took part in the survey, 4,650 of these families reported actual purchases of fish and seafood. Based on this and a judgment factor, 40% of the population was considered to eat fish (Mitchell and Usry, 1967:76).
- C. The individual's capacity to consume catfish was estimated by age group as follows. For the individual who has an appetite for catfish, the typical serving was considered to be .75 pounds dressed basis for the age group 10 to

65. Above or below this age, the serving was considered to be one-half the amount or .375 pounds (Mitchell and Usry, 1967:76).

- D. The "fish-eating" population that will eat catfish, and the "latent" and "mature" potential (as defined in the following section) for catfish were estimated in the following manner. The judgment was made by several collaborators that for the "latent" potential about one-half of the "fish-eating" populace will eat catfish on the average of six times a year, if it was available (Mitchell and Usry, 1967:76). The "mature" potential estimate is based on the "fish-eating" populace eating catfish once every two weeks, or 26 times per year. The estimated quantity consumed per year by the catfish eating individual is (Mitchell and Usry, 1967:76):

Potential Pounds Per Year Consumed (Dressed Weight)

	Age <u>10 - 65</u>	Age under 10 <u>over 65</u>
"Latent" or Current Potential	4.5	2.3
"Mature" or Future Potential	20.0	10.0

The results of implementing the preceding procedure are found in Tables 5, 6, and 7. The figures found in these tables represent the potential market for farm-reared channel catfish in Virginia, Washington, D. C. and the eight Standard Metropolitan Areas in Virginia and its surrounding states. As can be seen in these tables there seems to be a large market potential for farm-reared channel catfish existing in Virginia and the Washington, D. C. area.

Market Definitions

In order to understand the context from which this market estimation procedure was extracted, a few terms must first be defined. The reference to the word market in the following definitions by Mitchell and Usry (1967:6-7) refers not to the standard connotation of the word "market" (place of exchange between buyer and seller) but to levels of consumption and the different stages of growth for these levels.

"Latent" Market

The "latent" market is defined as that market in which all the catfish that can be grown are consumed (Mitchell and Usry, 1967:6). This is an existing market which is not consuming farm-raised channel catfish due to the lack of supply and distribution (Mitchell and Usry, 1967:6).

"Competitive" Market

The "competitive" market is defined as that market which will undergo rapid growth in consumption throughout its phase, but will become increasingly competitive for producers as fish farm acreage increases (Mitchell and Usry, 1967:7).

"Mature" Market

The "mature" market is that market which will grow only according to population growth. This market is estimated to come into existence when per capita consumption of channel catfish reaches approximately seven pounds (Mitchell and Usry, 1967:6).

Definition of Standard Metropolitan Area

The total market potential for channel catfish was calculated for the eight Standard Metropolitan Areas (SMA) in Virginia and its surrounding states (Table 7). A Standard Metropolitan Area is defined as a group of contiguous counties featuring at least one central city of 50,000 inhabitants or more or "twin cities" with a combined population of 50,000 or more (Anonymous, 1971b). The eight SMA's in Virginia are listed in Appendix Table I and designated by the Appendix Table I numbers on the map in Appendix Figure I.

Table 5. Virginia market potential figures for 1970

Population by Age Groups		Fish-Eating Populace 40% of Population	"Latent" Market* Channel Catfish Consumption Dressed Weight lbs. annually	"Mature" Market** Channel Catfish Consumption Dressed wt. lbs. annually
1-9	850,080	340,032	391,036.8	3,400,320
10-65	3,432,702	1,373,081	3,089,434.5	27,461,621
65 over	365,712	146,285	168,228.9	1,462,850
TOTAL	4,648,494	1,859,398	3,648,700.2	32,324,790

* Channel catfish consumption dressed weight:
"latent" market equals one-half fish-eating
populace times individual consumption from
page 27.

Channel catfish consumption live weight:
"latent" market equals dressed weight divided by
0.6.

** Channel catfish consumption dressed weight:
"mature" market equals fish-eating populace times
individual consumption from page 27.

Channel catfish consumption live weight:
"mature" market equals dressed weight divided by
0.6.

Table 6. Washington, D. C. market potential figures for 1970

	Population by Age Groups	Fish-Eating Populace 40% of Population	"Latent" Market* Channel Catfish Consumption Dressed Weight lbs. annually	"Mature" Market**Channel Catfish Consumption Dressed wt. lbs. annually
1-9	123,957	49,583	57,020.4	495,830
10-64	561,750	224,700	505,575.0	4,494,000
65 over	70,803	28,321	32,569.1	283.210
TOTAL	756,510	302,604	595,164.5	5,273,040

* Channel catfish consumption dressed weight:
"latent" market equals one-half fish-eating populace
times individual consumption from page 27.

Channel catfish consumption live weight: "latent"
market equals dressed weight divided by 0.6.

** Channel catfish consumption dressed weight: "mature"
market equals fish-eating populace times individual
consumption from page 27.

Channel catfish consumption live weight: "mature"
market equals dressed weight divided by 0.6.

Table 7. Standard Metropolitan Areas of Virginia and surrounding states, market potential figures for 1970

	Population by Age Groups	Fish-Eating Populace 40% of Population	"Latent" Market* Channel Catfish Consumption Dressed Weight lbs. annually	"Mature" Market** Channel Catfish Consumption Dressed wt. lbs. annually
1-9	606,648	242,659	279,057.8	2,426,590
10-64	2,536,600	1,010,640	2,282,940.0	20,292,800
65 over	267,704	107,082	123,144.3	1,070,820
TOTAL	3,410,952	1,364,381	2,685,142.1	23,790,210

* Channel catfish consumption dressed weight:
"latent" market equals one-half fish-eating
populace times individual consumption from page 27.

Channel catfish consumption live weight: "latent"
market equals dressed weight divided by 0.6.

** Channel catfish consumption dressed weight:
"mature" market equals fish-eating populace times
individual consumption from page 27.

Channel catfish consumption live weight: "mature"
market equals dressed weight divided by 0.6.

National Forecast

Forecasts of the channel catfish farming industry, nationwide, are presented in Table 8. The table lists estimated consumption potential, production, production acreage and average production per acre. The table also indicates the general periods of time in which each of the three market phases ("latent", "competitive" and "mature") is expected to begin and conclude.

"Competitive" Market in Virginia

Market potential figures for the "competitive" phase were not calculated for Virginia. The procedure for estimating market potential, used in this paper, relies heavily upon population data, which has been broken down into age groups. It would be difficult to calculate these figures since Virginia does not make projections of its population by age groups. Table 8 estimates though that this phase is to begin in 1971 and continue up to about the year 2005.

"Mature" Market in Virginia

The "mature" market potential figures for Virginia were calculated using 1970 population data for Virginia which is broken down into age groups. Calculations for the "mature" market were made to indicate the amount of growth that could be achieved between the "latent" and

Table 8. National forecast of the channel catfish farming industry

Year	Potential Consumption (millions of pounds)	U.S. Production (millions of pounds)	Acres (thousands)	Average Production (lbs. per acre)
All the catfish that can be grown is absorbed by the latent market				
1966	18	18	15	1,200
1967	33	33	22	1,500
1968	72	72	40	1,800
1969	130	130	65	2,000
1970	207	207	90	2,300
Competitive market phase with the market undergoing vigorous growth				
1971	268	299	115	2,600
1972	322	334	115	2,900
1973	386	384	120	3,200
1974	463	473	135	3,500
1975	556	551	145	3,800
1976	667	656	160	4,100
1977	800	792	180	4,400
1978	960	964	205	4,700
1979	1,150	1,150	230	5,000
1980	1,300	1,300	245	5,300
1985	1,900	1,900	340	5,600
1990	2,300	2,260	390	5,800
1995	2,700	2,730	455	6,000
2000	3,100	3,000	500	6,000
2005	3,500	3,570	595	6,000
Mature market where growth is closely related to population growth				
2010	3,900	3,840	640	6,000
2015	4,100	4,260	710	6,000
2020	4,300	4,260	710	6,000

Source: Mitchell and Usry, 1967:9

"mature" phases. The "mature" market figures represent the lower boundary estimates because, age group projections are necessary but not available for consumption projections. This market should be reached around the year 2010 (Mitchell and Usry:9).

Present Market

Total production of wild catfish in the U. S. was 33.0 million pounds (dressed weight) in 1967 with imports around 4.0 million pounds (dressed weight) (Jones, 1969a:53-54). Total production of farm-reared channel catfish in 1971 is estimated to be around 45 million pounds (live weight) (Annoymous, 1971a). The major portion of this farm-reared channel catfish is believed to be sold on the live fish market, as has been previously done. Of the total amount of farm-reared channel catfish produced in 1965 and 1967, 90% of this production was sold on the live fish market with only 10% entering the food fish market (Madewell and Carroll, 1969:5; Schubert, 1968:III-1).

The present national market for channel catfish can be divided along geographical lines into three distinct market zones: "primary", "secondary" and "tertiary" (Schubert, 1968:III-6). These three market zones also divide the state of Virginia into three distinct market zones as indicated in Figure 1. The

white area represents the "primary" market, the cross hatched section shows the "secondary" market and the hatched sections represent the "tertiary" market area.

The "primary" market area, accounts for an estimated 80 to 85 percent of the total catfish consumption in the United States (Schubert, 1968:III-5). In this market area the channel catfish is consumed by a wide cross section of the population, with the price of the product usually a secondary consideration as long as channel catfish are priced similar to fowl, meat, and other fish of comparable quality and consumer appeal. Consequently, the demand for catfish is relatively inelastic for moderate price changes (Schubert, 1968:III-4).

The "secondary" market area, indicated by the cross hatched area in Figure 1, includes all areas in the state in which catfish is known to be consumed, but to a considerably lesser extent than that consumed in the "primary" market area (Schubert, 1968:III-4). The "tertiary" market area, includes the remaining areas in the state in which there is no appreciable demand for catfish at present (Schubert, 1968:III-5).

The population in the "secondary" and "tertiary" market areas consume less because they believe catfish to be of poor quality. Perhaps 75 per cent or more of

the catfish consumed in these areas is done so by blacks (Schubert, 1968:III-5). There is a possibility that this negative attitude towards catfish is due in part to the prevalence of poorer quality species (bullcats and channel catfish from polluted waters) in these areas (Schubert, 1968:III-5). Many people in these areas have never tasted catfish and without a major effort to change the image through promotional programs, the attitude towards catfish is expected to persist for sometime (Schubert, 1968:53).

Importing and Exporting of Catfish

Table 9 indicates the relative export and import positions for commercially caught catfish in Virginia and its surrounding states (Schubert, 1968:III-4). The data used to distinguish an import area from export area cover all varieties of catfish (Schubert, 1968:III-12). However, the amounts landed include only commercially caught catfish and do not include any sizable amounts of catfish landed and consumed by sports fishermen (Schubert, 1968:III-12). It should be noted that even though there has been no designation as to varieties, channel catfish comprise by far the largest portion of landings, particularly in the southern states (Schubert, 1968:III-12). These data also do not include commercially raised catfish which only comprise a small portion of the food fish

Table 9. Commercial catfish landings, population ratios and designation of export vs. import states, 1965

State	Market Area*	1965 Resident Populations (millions)	Landings of commercially caught catfish in 1965	Pounds landed per 1000 residents**	Export-Import Designation***
Maryland	S-T	3.52	292	82.9	E-1
West Virginia	P-S-T	1.81	-	--	I-2
Virginia	P-S-T	4.46	1754	393.3	E-1
Kentucky	P	3.18	1189	374.9	E-2
Tennessee	P	3.85	2093	543.6	E-1
North Carolina	P	4.91	1230	250.5	E-2

* P = Primary, S = Secondary, T = Tertiary

** Data on landings not available for 1964 or 1965; thus the ratios were computed on the basis of 1963 landings; not believed to have changed significantly during the last two years.

*** The export-import designations are as follows:
 E-1 = Exporting more than 1/2 of their catch
 E-2 = Exporting less than 1/2 of their catch

Import States:

I-1 = Importing less than 1/2 of their consumption
 I-2 = Importing more than 1/2 of their consumption

market (Schubert, 1968:III-12). This is especially true of Virginia, which presently has no commercial catfish farming operation.

It should also be noted that eventhough a state may be classified as an export or import area for catfish, it is possible that an export state could be importing some fish (Schubert, 1968:III-12). This is particularly true for catfish since the commercial landing of catfish is a seasonal operation.

The fact that Virginia and all the immediate states surrounding Virginia except West Virginia are considered export states, is not a valid argument for not developing a farm-reared channel catfish industry in Virginia, at least from a marketing standpoint. The catfish being taken in these areas are generally of poor quality (Schubert, 1968:III-7). Also the amount of catfish being taken each year from natural waters is declining due in part to destruction of habitat, pollution, and siltation (Schubert, 1968:III-7). In fact the markets to which Virginia does export its catfish may be possible outlets for commercially farm-raised channel catfish as natural catfish supplies continue to dwindle.

The fact that Virginia and most of the surrounding states are designated export areas for commercially

landed catfish could be of even less concern if farm-raised channel catfish were treated as a new product. Through promotion and consumer education, with emphasis being placed on the superior qualities of the new product (taste, standards of quality, convenience, packaging, branding and constant supply) product differentiation between farm-reared channel catfish and natural channel catfish may be enhanced in the mind of the consumer. Then the present market for natural catfish could possibly become the market for farm-reared channel catfish in both import and export areas.

Market Considerations for Virginia

As was indicated in Tables 5, 6 and 7 there seems to be a large market potential for farm-raised channel catfish in Virginia and its surrounding areas. It must be noted though, that these figures are potential figures and should not be regarded as guaranteed sales. These markets will have to be developed. That is, the potential consumer needs to be informed, educated and made aware that this product exists. The product then must be made available to the consumer at both a reasonable price and convenience to him, in accordance with product quality.

Table 8 indicates that the industry, on a national scale, is moving from the "latent" market phase to the

"competitive" market phase with the "latent" phase ending somewhere around 1971 (Mitchell and Usry, 1967:9). In the "competitive" phase the industry will undergo rapid growth and the supply of farm-raised channel catfish will approach the current consumption, at present day prices. This means that markets will be extremely competitive, with prices paid for catfish expected to fall in the near future.

Although many farmers raising catfish have been able to make good profits, their success has been due primarily to the present shortage of farm-reared channel catfish (Madewell and Carroll, 1969:9). Higher prices are now being paid for channel catfish sold on the live market (fingerlings, broodstock stocking for pay lakes, etc.), than for channel catfish sold to the food fish market. However, the growth potential for the live fish market is believed to be somewhat limited (Madewell and Carroll, 1969:9).

Considering these facts (more competition, limited live market and lower prices) if Virginia is to go into the catfish farming industry it should do so as early as possible and be prepared to move mainly into the food fish market, which is to be the major outlet for the industry in the future (Jones, 1969b:4) and (Jones, 1969a:51-52). It is not uncommon for a farmer to get

negative returns his first or even second year. Until some level of experience is gained and the operation is run on sound management principles, this can be expected. This is another reason to start production as early as possible before competition becomes so intense that it could be many years before an incoming farmer could be competitive.

It can generally be said that the larger the population, the larger the market potential for farm-raised channel catfish, when using Mitchell and Usry's market estimation procedure. In order to reach this market potential, one of two methods may be followed: mass distribution or concentration upon heavily populated areas (Virginia's eight SMA's).

In mass distribution one is trying to make the product available to as many people as possible. This means large numbers of outlets (which are costly and require sophisticated organizational structures) would be necessary. In concentrating upon the highly populated areas you may not reach the entire market area but the distribution costs are much lower.

Forty-five percent of Virginia's market population is located in the "primary" market area. Of the 55% of the people located in the "secondary" and "tertiary" market areas only 29% (Appendix Table II and III), of

this population are catfish consuming blacks (Schubert, 1968:III-5). If a policy of mass distribution is followed throughout the state, besides high distribution costs, high promotional outlays may be incurred because of the poor image catfish have in the "secondary" and "tertiary" market areas.

Sixty-four percent of Virginia's entire market population is located in the eight SMA's of Virginia. This means that one could probably reach over half of the market population by being concerned with only these areas instead of trying to maintain or supply outlets in every county and city in Virginia. It must be noted though that only 43% of the SMA population is located in the "primary" market area. Of the 57% in the "secondary" area only 38% (Appendix Table IV), of this population is black. Blacks are the largest consumers of channel catfish in this market area at the present time (Schubert, 1968:III-5).

In other words if a policy of mass distribution were followed then high distributional and promotional outlays may both be necessary. If one applies mass distribution to only the "primary" market area distribution costs will remain high, but promotion costs will be lower because the product is already accepted in this area. However one can only reach, at a maximum, 45% of the potential market.

On the other hand, if one concentrates upon highly populated areas, distribution costs will be lower and one may possibly reach a high proportion of the potential market but promotion costs will be high, in order to develop the "secondary" and "tertiary" market areas. There is a tradeoff between promotion costs on one side and distribution costs on the other.

PRODUCT FEASIBILITY

This section of the report will mainly concern itself with determining what the present fisheries industry structure in Virginia is and how well it could absorb the various catfish products that could be produced in this state. The general requirements for the production of catfish products will be discussed and also how well these general requirements could be met by a catfish farming industry in Virginia.

Present Industry Structure in Virginia

The present industry structure in Virginia is one which is made up of a large number of wholesalers who deal in fishery products.^{2/} Many of the wholesalers are small volume dealers. Both large and small wholesalers supply most of the retail outlets in the state, with much of the catch handled by the large wholesalers being exported to midwestern markets.

The attitude of most of the small wholesalers indicates that they would not be willing to deal with or promote a new product such as farm-reared channel catfish, let alone pay the prices currently required to make the

^{2/} The following structure discussion is based on the expert opinion of Dr. George J. Flick, Assistant Professor in Food Science and Technology at VPI & SU, related October 22, 1971.

production profitable. However, about 15 firms in the state are large volume dealers, who combined, process a major portion of the fishery products for the state. The attitude of these firms is somewhat more progressive towards the introduction of new products, and they should be considered as potential outlets for farm-reared channel catfish in this state. These dealers are listed in Table 10, along with their present location and type of operation.

Lists have also been compiled of all Virginia wholesale dealers in fishery products, the live fish dealers and places where catfish fingerlings can be purchased. These lists are in Appendix Tables V, VI, and VII.

Feasible Products for Virginia

The ten products that were described in the product description section of this report will now be discussed as to the possibility of their being produced and marketed in Virginia. Those products which fall into the category of the live fish market will first be considered, followed by the food fish products. Table 11 gives a synopsis of the general requirements that should be met in order to successfully engage in each type of channel catfish production marketing.

Table 10. Largest dealers in fishery products in Virginia in their respective fields

Type and Firm	<u>Location</u>
<u>Processors</u>	
Menzel Brothers (catfish)	Toana, Virginia
Hazelwood Brothers (catfish)	Lanexa, Virginia
<u>Further Processing</u>	
Mr. Frosty Seafoods, Inc.	Newport News, Virginia
<u>Fish Distributors (assorted products)</u>	
Washington Fish Exchange	Arlington, Virginia (moving to Alexandria, Virginia)
Carmine Foods, Inc.	Richmond, Virginia
Park's Seafood	Portsmouth, Virginia
*L. M. Sandler & Sons	Norfolk, Virginia
Frigid Freeze	Roanoke, Virginia
Harrisonburg Fruit and Produce	Harrisonburg, Virginia
Richmond Restaurant Service	Richmond, Virginia
Penneva Frozen Foods	Bristol, Virginia
<u>Distributors (Fresh)</u>	
L. D. Amory, Inc.	Hampton, Virginia
Ballard Fish and Oyster Co.	Norfolk, Virginia
Fass Brothers, Inc.	Hampton, Virginia
<u>Retail</u>	
Parker	Roanoke, Virginia

* (Possibly has catfish at present)

Source: Dr. George Flick, Assistant Professor of Food Science and Technology, VPI & SU, 1971.

Table 11. Markets for the commercial catfish grower

Market Picture	Production Picture
<p>I. Hatchery Operation-Selling Fingerlings and Brood fish:</p> <p>A. Excellent profit potential</p> <ol style="list-style-type: none"> 1. Fingerlings sell \$.01 per inch, and up 2. Brood fish @ \$1.00-\$1.50 per pound <p>B. Advertising required</p> <ol style="list-style-type: none"> 1. Trade publication 2. Word of mouth 	<p>A. Specialized knowledge needed</p> <p>B. Greater mortality risk incurred</p> <p>C. High initial construction cost</p> <p>D. Handling facilities needed</p> <p>E. Specialized equipment needed</p>
<p>II. Fish Farm - Pay Lake Operation:</p> <p>A. Good price potential \$.40 - \$.60 per pound</p> <p>B. Secondary profits available</p> <ol style="list-style-type: none"> 1. Entrance fees--\$1 per person 2. Concessions average \$.25 per person 	<p>A. Facilities for public needed</p> <p>B. Higher liability risks incurred</p> <p>C. Need to locate near public (preferably near heavily populated areas)</p> <p>D. Management personnel for pay lake needed</p>
<p>III. Fish Farm Operation - Selling to Pay Lakes:</p> <p>A. Average to good profit potential (\$\$.40 - \$.60 per pound live, less if broker or hauler used)</p> <p>B. Advertising required</p> <ol style="list-style-type: none"> 1. Trade publications 2. Personal contact 	<p>A. Average to large size operation desirable</p> <p>B. Summer harvesting needed</p> <p>C. Transportation system needed</p>

Table 11. (Continued)

Market Picture	Production Picture
C. Contractual agreements needed	D. Transportation risks incurred E. Handling facilities needed
Local "Combination Market" (limited growth potential)	
IV. Fish Farm Operation - Selling to Local Market:	
A. Will support limited number of growers	A. Local transportation system may be needed
1. \$.50 lb. live	B. Summer harvesting needed
2. \$.95 lb. dressed	C. Handling facilities needed
B. Able to sell from farm	D. Sales personnel needed
C. Local advertising required	E. Processing facilities needed
	F. Health standards must be met
V. Fish Farm - Selling to Processor:	
A. Level of profit dependent upon size of fish farm operation (\$.30 to \$.40 per pound at pond site)	A. Predictable supply must be assured to processor
B. Contractual agreements needed	B. Fish must be able to attain marketable size
	C. Must be able to harvest according to processor's schedule
	D. Efficient operation needed
VI. Fish Farm Processing Operation - Selling Fresh and Frozen Product Direct to Restaurants and Retail Outlets on a Regional Scale:	
A. Profit potential for efficient volume producer (Est. \$.75-\$.95 per pound dressed)	A. Totally efficient operation mandatory
B. Volume sales required	B. Economical use of resources required

Table 11. (Continued)

Market Picture	Production Picture
<ul style="list-style-type: none"> C. Contractual agreements advisable D. Sales staff required E. Market knowledge needed F. Trade advertising required G. Product "image" must be established H. Best market prices paid between November-April 	<ul style="list-style-type: none"> C. Continuous harvesting needed D. Holding facilities needed E. Processing and freezing needed F. Long haul transportation needed G. Public health standards must be met
<p>VII. Fish Farm Processing Operation - Selling to Brokers and Distributors:</p>	
<ul style="list-style-type: none"> A. Efficiency and volume will allow good profit (\$.70 - \$.79 per pound dressed) B. Volume sales required C. Contractual agreements advisable D. Industry wide contracts needed E. Product "image" must be advertised F. Best market prices paid between November-April 	<ul style="list-style-type: none"> A. Large operation needed B. Economical uses of resources necessary C. Continuous harvesting needed D. Holding facilities needed E. Processing facilities needed F. Health standards must be met

Source: Donahue, 1969:63-64.

Live Fish Markets

The production of brood fish and fingerlings is considered to be an infeasible operation for Virginians at this time. This business is not for the beginner in fish farming. Experience or special training in spawning and other hatchery operations is required to help insure a predictable and marketable crop (Jones, 1969b:4). This operation also requires a substantial capital outlay and there is a higher degree of risk (mortality) in these operations than with other fish farming operations. Since Virginia does not have any commercial catfish farming operations in existence, it seems unlikely that the required experience needed to maintain a broodfish and fingerling operation would be available in this state, at present. The populace in the current area under consideration for fish farming, Pittsylvania county and its surrounding areas, would probably not be able to afford the capital required for broodfish and fingerlings under such risky conditions.

On the other hand, fee-fishing ponds can be considered feasible as an income supplement on a limited scale for Virginians as long as some simple guidelines are followed. The recommended requirement for operating a successful fee-fishing area is location within close proximity of a metropolitan area (Summerfelt, 1968). A

study conducted in Illinois indicated that 63.7% of the fishermen using such recreational areas, travelled 25 miles or less (Summerfelt, 1968). A successful fee-fishing recreational area may also have to provide rest room facilities, electricity, landscaped areas, picnic grounds, benches, hard surface paths and diversions for younger children, depending upon the amount of competition for the recreational dollar of the metropolitan inhabitants (Summerfelt, 1968).

Fee-fishing ponds can be separated into two operations: catch-out ponds and put-and-take ponds. Catch-out ponds refer to those in which the fishing is done in the ponds where the fish were raised (Summerfelt, 1968). Put-and-take ponds refer to those operations in which the fish are raised at some other location and shipped in. The catch-out ponds are easier to operate, but they often cannot be located near the heavily populated areas (Summerfelt, 1968). The only suitable catfish production area in Virginia, is in the southern portion of the state and this area has only a few large metropolitan areas.

Fee-fishing ponds offer limited potential for Virginians because there are only a limited number of heavily populated areas and these areas could be satisfied by a small number of put-and-take ponds. Once

these populations centers have been satisfied the growth potential for this type of operation would become very limited. There are also many natural fishing sites within these areas, which could offer more preferable alternatives than a fee-fishing system, at this time.

With the limited potential for fee-fishing operations in Virginia, the market for live channel catfish for recreational purposes is also limited. If production of farm-reared channel catfish were to become widespread this market could easily be saturated. The live fish market cannot support a high production level of farm-reared channel catfish in Virginia now and will allow only limited growth for such an industry in the future.

Food Fish Market

The food fish market is the only market capable of absorbing the potential volume of an expanding farm-reared channel catfish industry, in Virginia. The products and markets for food fish that should be gone into depend a great deal upon the size of the farm-reared channel catfish industry that develops in this state.

If the size remains small, then the local markets within immediate areas of production could provide an outlet for the limited number of producers. This low scale operation could supply products in two forms:

round and processed fish. The products would be iced, for preserving, before immediate delivery or sale. The specific markets most likely to be considered as outlets, on this scale of production, would be local restaurants, fresh fish retail stores, fish peddlers, and on-farm roadside sales to home consumers and social clubs (Jones, 1969b:3). This type of situation could provide an opportunity for small scale processing as indicated in Table 12. This marketing structure will work only when production is on a scale of two or three producers per area, and is probably the best structure to follow in these circumstances as long as production remains at low levels.

In the event that interest by pond owners and tenants runs high and production is on a medium to large scale, then the local marketing structure would not be able to absorb the amount of channel catfish that would be supplied, especially if everyone in the area harvested their crop at the same time. In these circumstances large scale processing, irradiation or freezing processes, and distribution facilities would be needed.

It has been estimated that a minimum production of one million pounds of catfish (dressed weight) must be reached during the production year to justify the

Table 12. Returns from hand processing channel catfish

<u>Costs</u>	
Bought 672 pounds @ 40¢ per pound	\$ 268.80
Delivery costs, 200 miles @ 15¢ per mile	30.00
Salary for driver	15.00
Dressing fish, 4 people took 4-1/2 hrs. @ \$1.25 per hr. (fish dressed out 59%)	22.52
Total Costs	<u>\$ 336.32</u>
 <u>Gross Returns</u>	
396.5 pounds of fish sold for 95¢ per pound	<u>\$ 376.67</u>
<u>Net Returns</u>	\$ 40.35

Source: Madewell and Carroll, 1969:29

use of a mechanical fish cleaner (Miller and Nash, 1969: 53). If hand processing is used, then the processing facility can be adjusted fairly easily as volume and demand for catfish products increases, but the cost of hand processing is greater than mechanical processing volumes. The cost of producing a million pounds of product with a mechanical processor, operated at full capacity, is approximately \$.10 per pound, while the cost of producing the same quantity of fish with hand processing is approximately \$.12 to \$.13 cents per pound (Miller and Nash, 1969:53).

The organizations which could handle the processing of farm-reared channel catfish could take two forms: private processors of seafoods in the state already established and/or private farmer cooperative processing plants.

The leading processors of seafood products already established in the state (Table 11) may be able to provide for processing and marketing of the farm-reared channel catfish. On the other hand a farmers' cooperative could be formed to handle the processing of the farm-reared channel catfish produced by its members, coordinate production with current market conditions, and facilitate in developing an organized market structure.

Besides handling the processing of the channel catfish a farmers' cooperative may be able to perform other functions which would benefit the industry's development. The cooperative may also be able to (Schubert, 1968:V-3 to 4):

1. produce fingerlings for supply to its members,
2. purchase feed, chemicals and any necessary equipment at wholesale prices for its members,
3. contract construction of ponds and wells,
4. provide technical assistance to fish farmers,
5. assist in harvesting and transporting fish to the central processing facility,
6. market and transport the processed fish to market outlets, and
7. make contracts with potential market outlets.

All these factors make a cooperative effort seem desirable, provided the leadership and organizational abilities necessary for its establishment exist.

The markets that would most likely be able to handle the large production volumes would be the large restaurant and supermarket chains both in and outside the

state. The leading food merchandising organizations in the U. S. may also be able to provide markets capable of absorbing large quantities of products. The eleven leading food merchandising organizations (Mitchell and Usry, 1967:11-12), which might be considered, are: Swift and Company, Armour and Company, National Dairy Products Corporation, General Foods Corporation, Borden Company, Ralston-Purina Company, Corn Products Company, Beatrice Foods Company, Campbells Foods Company, National Biscuit Company and Standard Brands Sales Company.

In any event the food fish market seems to be the most promising and feasible for absorbing farm-reared channel catfish products on any scale of production and providing an opportunity for an expanding industry.

RECOMMENDATIONS

1. Conduct a survey in the potential production areas of the state to determine the amount of interest there is in raising catfish.
2. Investigate the formation of a farmers' cooperative which could coordinate channel catfish production with current market situations, make contacts with potential market outlets, and facilitate in developing an organized market structure for a farm-reared channel catfish industry within the state. Concentrate efforts in the area of food fish markets with the specific products produced and production methods depending mainly upon the estimated amount of channel catfish production to be expected.
3. Provided a large industry is expected do a promotion study in the hopes of developing a promotion strategy which would facilitate the expansion of a channel catfish industry within the state, especially in the state's "secondary" and "tertiary" areas. Estimate the cost of such a promotion strategy.
4. Study the distribution costs of servicing market outlets, on a policy of mass distribution, and compare these distribution costs with the promotion

costs needed to develop the markets in heavily populated areas to determine which alternative would be most favorable, distribution costs or promotion costs.

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APPENDIX

Table I. Standard Metropolitan Areas (SMA's) in Virginia and surrounding states in 1970

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- | | |
|---|--|
| <p>1. <u>Bristol-Johnson City-Kingsport - Va.-Tenn.</u>
 A) Carter, Tennessee
 B) Sullivan, Tennessee
 C) Washington, Tennessee
 D) Bristol, Virginia</p> | <p>5. <u>Petersburg-Hopewell</u>
 A) Dinwiddie
 B) Hopewell
 C) Petersburg
 D) Prince George</p> |
| <p>2. <u>Danville</u>
 A) Danville
 B) Pittsylvania</p> | <p>6. <u>Richmond</u>
 A) Chesterfield
 B) Hanover
 C) Henrico
 D) Richmond</p> |
| <p>3. <u>Newport News-Hampton</u>
 A) Hampton
 B) Newport News
 C) York</p> | <p>7. <u>Roanoke</u>
 A) Roanoke
 B) Roanoke City
 C) Salem</p> |
| <p>4. <u>Norfolk-Portsmouth</u>
 A) Chesapeake
 B) Norfolk
 C) Portsmouth
 D) Virginia Beach</p> | <p>8. <u>District of Columbia</u>
 A) District of Columbia
 B) Montgomery, Maryland
 C) Prince Georges,
 Maryland
 D) Alexandria, Virginia
 E) Arlington, Virginia
 F) Fairfax City,
 Virginia
 G) Falls Church,
 Virginia
 H) Loudoun, Virginia
 I) Prince William,
 Virginia</p> |
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Source: Anonymous, 1971b.

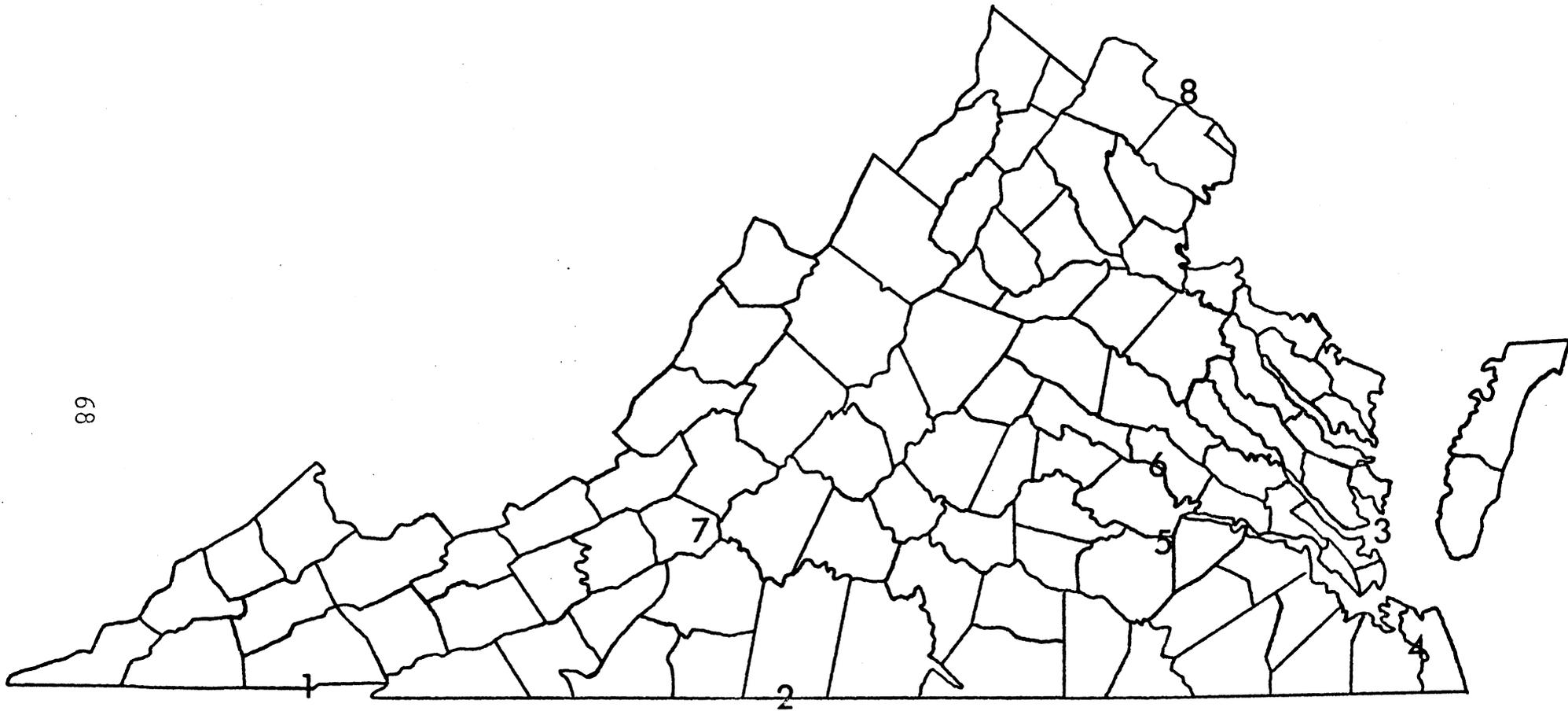


Fig. I. Map of Virginia showing the location of the eight Standard Metropolitan Areas in Virginia (Anonymous, 1971b).

Table II. Populations of counties and independent cities in "secondary" market area by race, 1970

County or Independent City	Black	White	Other
Albemarle	5,045	32,591	144
Alexandria*	15,644	94,223	1,061
Arlington	10,121	161,286	2,877
Augusta	2,019	42,135	66
Caroline	7,021	6,715	189
Charles City	4,536	1,081	541
Charlottesville*	5,884	32,711	285
Culpepper	4,410	13,784	24
Essex	3,188	3,903	8
Fairfax	15,856	435,741	3,424
Fairfax City*	370	21,507	93
Falls Church*	152	10,532	88
Fauquier	5,892	20,417	66
Fluvanna	2,748	4,866	7
Fredericksburg*	2,468	11,939	43
Gloucester	3,220	10,821	18
Goochland	4,375	5,679	15
Green	560	4,684	4
Hampton*	30,619	89,376	784
Hanover	6,723	30,676	80
Henrico	10,106	143,812	446
Harrisonburg*	667	13,887	51
Highland	11	2,515	3
James City	6,309	11,447	97
King and Queen	2,783	2,657	51
King George	2,127	5,883	29
King William	3,184	4,199	144

Table II. (Continued)

County or Independent City	Black	White	Other
Lancaster	3,558	5,563	5
Louisa	5,415	8,573	16
Madison	1,757	6,861	20
Matthewes	1,621	5,545	2
Middlesex	2,312	3,971	12
New Kent	2,338	2,917	45
Newport News*	29,208	97,887	1,082
Northumberland	3,592	5,632	15
Orange	2,910	10,871	11
Page	551	16,026	4
Prince William	6,244	104,134	724
Rappahannock	886	4,324	9
Richmond	2,141	3,692	8
Richmond (city)*	104,766	143,857	88
Rockingham	1,169	46,615	106
Shenandoah	379	22,458	15
Spotsylvania	3,572	12,813	39
Stafford	2,357	22,165	65
Staunton*	2,535	21,914	55
Warren	963	14,312	26
Waynesboro*	1,093	15,565	49
Westmoreland	5,337	6,784	21
York	4,803	28,162	238
TOTAL	355,485	1,843,811	

Black = 19% of population in the secondary area

Source: U. S. Department of Commerce, 1971b.

* Independent city

Table III. Populations of counties and independent cities in "tertiary" market area by race, 1970

County or Independent City	Black	White	Other
Accomack	7,441	6,949	52
Clarke	1,257	6,826	19
Frederick	509	28,361	23
Loudoun	4,637	32,454	59
Northampton	10,854	18,086	64
Winchester City*	1,308	13,316	19
TOTAL	26,006	106,228	

Blacks = 24% of population in "tertiary" market area

Source: U. S. Department of Commerce,
1971b.

* Independent city

Table IV. Populations of Standard Metropolitan Areas (SMA's) in "secondary" market area by race, 1970

Standard Metropolitan Area	Black	White	Other
<u>Newport News-Hampton</u>			
Hampton	30,619	89,376	784
Newport News	39,208	97,887	1,082
York	4,803	28,162	238
TOTAL	74,630	217,529	
Blacks = 25% of total population			
<u>Richmond</u>			
Chesterfield	8,651	68,012	192
Hanover	6,723	30,676	80
Henrico	10,106	143,812	446
Richmond	104,766	143,857	998
TOTAL	130,246	388,073	
Blacks = 25% of total population			
<u>District of Columbia</u>			
District of Columbia	537,712	209,272	9,526
Montgomery, Maryland	DATA NOT PUBLISHED AT PRESENT		
Prince Georges, Maryland	DATA NOT PUBLISHED AT PRESENT		
Alexandria, Virginia	15,644	94,223	1,061
Arlington, Virginia	10,121	161,286	2,877
Fairfax City, Virginia	370	21,507	93
Falls Church, Virginia	152	10,532	88

Table IV. (Continued)

Standard Metropolitan Area	Black	White	Other
<u>District of Columbia (Cont)</u>			
Loudoun, Virginia	4,637	32,454	59
Prince William, Virginia	6,244	104,134	724
TOTAL	574,880	647,836	
Blacks = 47% of total population			
OVERALL TOTAL	779,756	1,253,438	
Blacks = 38% of total population in SMA's in "secondary" market area			

Source: U. S. Department of Commerce, 1971b,
c.

Table V. Wholesale dealers in fishery products,
Virginia 1968

Firm	Office Address	Products
Alexandria Seafood and Poultry Market	203 E. Curtis Ave., Alexandria	Fish & shellfish
Washington Fish Exchange	1701 Jefferson Davis Drive, Arlington	Fresh & frozen fish and shellfish
E. T. Saunders	Backbay	Freshwater fish, live carp
Battery Park Fish and Oyster Co.	Battery Park	Fresh fish, *shucked oysters, *oyster-shell lime
Henry Owens & Sons	Bavon	Fresh fish, hard crabs
Cook's Cold Storage, Inc.	Bena	Cold storage
Cook's Frozen Seafoods, Inc.	Bena	*Frozen seafood specialties
R. A. Pitts	Bowlers	Fresh fish & shellfish
J. W. Ferguson	Butylo	Fresh fish & shellfish, *shucked oysters
D. L. Edgerton	Cape Charles	Fish, conchs, bait, freezer
N. C. Haynes	Charles City	Fresh fish & dressed catfish
J. C. Smith	Charles City	Fresh fish & dressed catfish
Chincoteague Fish Co.	Chincoteague	Fish

Table V. (Continued)

Firm	Office Address	Products
D. L. Edgerton	Chincoteague	Fish, cold storage
Kambarn Brothers Company	Chincoteague	Fish & shellfish
Russell Fish Co.	Chincoteague	Fish
G. W. Wyatt	Claremont	Fresh fish, dressed catfish
G. F. Pearson	Colonial Beach	Fresh fish, *shucked oysters
Herbert Wilkerson & Sons	Colonial Beach	Fresh fish, *shucked oysters
W. E. Wilkerson	Colonial Beach	Fresh fish, *shucked oysters
Rice Oyster Co.	Farnham	Fresh fish, *shucked oysters
Carroll Haynie	Fairport	Hard & soft crabs fresh fish
W. H. Allen & Sons	Grimstead	Hard & soft crabs fresh fish, steamed conchs
Gwynn's Island Seafood Co.	Grimstead	Fresh fish & shellfish, *fresh-cooked crab meat
L. D. Amory	Ft. S. King St., Hampton	Fresh fish, *frozen bait
Fass Brothers, Inc.	48 Water St., Hampton	Fresh fish
Hampton Roads Seafoods	E. Sunset Road, Hampton	Fresh fish

Table V. (Continued)

Firm	Office Address	Products
Johnson Brothers, Inc.	Sunset Road, Hampton	Fresh fish
Phillips Seafood	509 Bassette St., Hampton	Fresh fish & shellfish, *fresh-cooked crab meat
Sam Rust Seafood Company	102 N. Mallory St., Hampton	Fresh fish & shellfish
W. H. Sparer	Massenburg Lane, Hampton	Fresh fish & shellfish
Harryhogan Packing Co.	Harryhogan	Fresh fish, *shucked oysters
F. R. Brown	Hayes	Fresh fish, shell oysters, hard crabs
John M. Haywood	Hayes	Fresh fish, & shellfish
Cornwell Seafood Company	Irvington	Fresh fish & shellfish
Virginia Seafoods, Inc.	Irvington	Steamed oysters, *frozen packaged fish & shellfish
Commercial Freezers	Kilmarnock	Freezer service
J. P. Dize	Kilmarnock	*Shucked oysters, fresh fish
Rappahannock Oyster Co.	Kilmarnock	Fresh fish, soft crabs, *shucked oysters, *fresh-cooked crab meat & frozen packaged oysters

Table V. (Continued)

Firm	Office Address	Products
Simons Seafoods	Kilmarnock	Fresh fish & shellfish
F. W. Haywood	Lancaster	Fresh fish
W. R. Pittman & Sons	Lancaster	Hard & soft crabs fresh fish, *shucked oysters
Hazelwood Brothers	Lanexa	Fresh fish, dressed catfish, dressed snapper turtle
Randy's Seafoods, Inc.	Manassas	*Frozen packaged fish & shellfish *frozen fish sticks
Virginia Trout Co.	Monterey	Mountain trout, fresh & frozen shell oysters, fresh fish, hard & soft crabs
R. A. Chatham & Sons	Montross	*Shucked oysters fresh fish
Hundley Brothers	Morattico	*Shucked oysters fresh fish
Faunce Seafoods	Mt. Holly	Shell oysters, hard & soft crabs fresh fish
Nomini Ice & Storage Co.	Mt. Holly	Cold storage
Nomini Seafood Co., Inc.	Mt. Holly	Fresh fish, hard & soft crabs

Table V. (Continued)

Firm	Office Address	Products
Chesapeake Foods Products	Mundy Point	Fresh fish, *canned alewives & alewife roe, *salted & pickled alewives
Chesapeake Seafoods	New Point	Fresh fish, *shucked oysters
Henry Owens & Sons	New Point	Fresh fish, shellfish
B. C. Burton	Boat Harbor, Newport News	Fresh fish & shellfish
Frosty Cold Storage, Inc.	Boat Harbor, Newport News	Cold storage
Mason Bros.	2807 Chesnut Ave., Newport News	Fish & shellfish
Mr. Frosty Seafoods	Ft. Jefferson, Newport News	Frozen packaged fish & shellfish & fish sticks
Ballard Fish Oyster Co.	West End-South Hampton Ave., Norfolk	*Frozen packaged fish & shellfish *shucked oysters fresh fish
Jones Cold Storage Corp.	1215 E. Water St., Norfolk	Cold storage
Old Dominion Fish Corp.	801 Brambleton Ave., Norfolk	Fish & shellfish
Norfolk Fish Co.	815 Brambleton Ave., Norfolk	Fresh fish
Southgate Foods, Inc.	2842 Cromwell Road, Norfolk	Cured fish

Table V. (Continued)

Firm	Office Address	Products
Sterling Oyster Co.	4226 Granby St., Norfolk	Fresh fish & shellfish
Virginia Seafood Company	3347 Chesapeake Blvd., Norfolk	Fresh fish & shellfish
Pecan Point Food Prod., Inc.	729 Pecan Point Road, Norfolk	Fresh & frozen seafoods
Gough & Reamy	Ophelia	Fresh fish, hard & soft crabs
Burleigh L. Bell	Oyster	Fish, *shucked oysters
C. & D. Seafood	Oyster	Hard clams, fish *shucked oysters
Granville McCready	Oyster	Hard clams, hard crabs, fish
H. Allen Smith	Oyster	Fish, hard clams, bait, *shucked oysters
C. B. Dix	Palmer	Fresh fish
Haywood Seafoods	Perrin	Fresh fish, hard crabs, shell oysters, clams
John King	Perrin	Fresh fish
M. & E. Seafood Packing Co.	Perrin	Fresh fish, *shucked oysters
York River Seafood Co., Inc.	Perrin	Fresh fish, clams fresh-cooked crab meat, *crab scrap & steamed conchs

Table V. (Continued)

Firm	Office Address	Products
E. F. Dryden	Poquoson Avenue, Poquoson	Fresh fish & clams
Crosby Forrest Seafoods	417 Messick Ave., Poquoson	Fresh fish, clams shell oysters
E. C. Smith	421 Messick Ave., Poquoson	Fresh fish & shellfish, *fresh- cooked crab meat
W. G. Mitchem	Port Haywood	Shell oysters, fresh fish, crabs & clams
Park Seafood Co.	New Market Bldg., Portsmouth	Fresh fish & shellfish & frozen seafood specialties
Cockrell's Ice & Seafood	Reedville	Fresh fish, & shellfish, fresh & frozen crab bait, cold storage
T. C. Slaughter	Reedville	Fresh fish, *canned alewives & alewife roe, *fish scrap & fish oil, *canned pet food
J. W. Ferguson	Remlik	Fresh fish, *shucked oysters, *frozen breaded oysters, *frozen breaded soft clams
M. S. Carter	Rescue	Fresh fish
Rescue Seafood Co.	Rescue	Fresh fish & shellfish

Table V. (Continued)

Firm	Office Address	Products
T. L. Broun, Inc.	1014 Hull St., Richmond	Fish & shellfish
Carmine Foods, Inc.	2004 Dabney Rd., Richmond	Fresh fish & shellfish, diamond back terrapin, *frozen breaded oysters, *breaded shrimp, *breaded scallops, *fish sticks, *crab cakes
Chesapeake Bay Seafood	N. 18th St., Richmond	Fish & shellfish
P. T. Hastings	423 N. 6th St., Richmond	Fish & shellfish
Hermitage Ice & Storage	Hermitage Road & Leigh St., Richmond	Cold storage
R. P. Martin Seafood Co.	110 N. 18th St., Richmond	Fish & shellfish
Norfolk Fish Market	402 1/2 E Marshall, Richmond	Fish & shellfish
Richmond Cold Storage Co.	17th at Clay, Richmond	Cold Storage
John H. Lewis	Saxis	Hard clams, hard crabs, fish, oysters
W. E. Shackelford	Severn	Fish and shellfish
Shackelford & Schlifer Seafoods	Severn	Clams, oysters, fresh fish
Tennis Seafoods	Smithfield	Fresh fish

Table V. (Continued)

Firm	Office Address	Products
W. B. Bines	Tappahannock	Fresh fish & shellfish
Rappahannock Products Inc.	Tappahannock	Fresh fish, fish bait, freezer
Copes Ice Company	Tasley	Cold storage, bait
Menzel Brothers	Toano	*Frozen dressed snapper turtle, fresh fish, dressed catfish
J. W. Hurley & Sons	Urbanna	Fresh fish & shellfish
Belanga Brothers	Virginia Beach	Fresh fish
Hiram Gallup	Virginia Beach	Fresh fish
Long Creek Fish Co.	Virginia Beach	Fresh fish & shellfish
L. M. Sandler &	1600 Hogeman Road, Virginia Beach	Fresh & frozen fish & shellfish
Stormont Seafood Market	Virginia Beach	Fresh fish & shellfish
Wachapreague Seafood Co.	Wachapreague	Fish
W. F. Morgan & Sons	Weems	Fresh fish, *shucked oysters
Diggs Seafood Co.	West Point	Fresh fish, hard crabs
Hudson Seafoods	West Point	Fresh fish, hard crabs

Table V. (Continued)

Firm	Office Address	Products
Standard Products Co., Inc.	White Stone	*Canned pet food, *plant food
Ballard Brothers Oyster Co.	Willis Wharf	Fish, *shucked oysters
Frank C. Shattuck Co.	801 N. Kent St., Winchester	*Frozen fish & shellfish

Source: U. S. Department of the Interior,
1968.

*Produced by the firm

Table VI. Virginia dealers in trout and pond fishes in 1970

		Species Handled
Charles City	J. C. Smith, Route # 1, 23030	Catfish
Craigsville	Casta Line Trout Farm 24430	Trout
Maurertown (Shennendoah Co.)	Orndorffs Rainbow Trout Farm, Star Route, 22644	Trout
Monterey	Virginia Trout Co. Box 2, 24465	Rainbow trout, brook trout, brown trout
Munden	Ernest Grimstead 23457	Bass, bluegill
New Castle	W. P. Adams, Route # 1, Box 23 24127	Trout
Virginia Beach	Willie P. Davis, Shipps Cabin Road Hills Landing, Back Bay Station, 23457	Bass, bluegill
Virginia Beach	Murden's Club Horn Point Club Road, Back Bay Station, 23457	Bass, bluegill
Virginia Beach	E. T. Saunders Back Bay Station 23457	Catfish
Yorktown	Dixie Fisheries W. Sulik, 23490	Catfish

Source: U. S. Department of the Interior,
1970.

Table VII. Commercial sources of channel catfish fingerlings, 1969

Name & Address	Size- Inches	Cost* per Fish	Months Normally Available	Shipping Charge One-way
<u>TENNESSEE</u>				
Anderson, Roy Anderson Live Bait Company Lexington, Tennessee	2-3	15¢	Early Spring	Will ship in plastic bags
Creswell's Holiday Lakes 426 Taylor Street Milan, Tennessee	4-10	3-10¢	Nov.- April	Ship up to 1,000 miles 20-50¢ mile
Crystal Enterprises Route 2 Linden, Tennessee	3-6	3-6¢	Oct.- April	20¢/mile
Dodd, Frank Highway 22 South Huntingdon, Tennessee	-	-	Oct.- ?	Depends on distance & quantity
Duke, Dade Route 4 Dickson, Tennessee	-	-	Fall & Winter	--
Nethery, G. B. 717 Front Street Humboldt, Tennessee	-	-	All year	Pick up at hatchery
Sammons, Julius Whiteville, Tennessee	-	-	Oct.- March	--

Table VII. (Continued)

Name & Address	Size- Inches	Costs* per Fish	Months Normally Available	Shipping Charge One-way
Sanford, Robert Route 2 Obion, Tennessee	2-8	10-25¢	Sept.-Oct. March- April	Pick up at hatchery
Thigpen, George Loretto, Tennessee	3-7	8-10¢	Nov.- April	20¢/mile; less for large orders
<u>KENTUCKY</u>				
Matter, Robert Rt. 2 Glascow, Kentucky	3-6	10-12¢	Oct.- April	Fee for large orders if not too far
Sulik, W. Rt. 3 Shelbyville, Kentucky	7-10 10-16	15¢ 30¢	March- June	Fee for large orders if not too far
Thomas, Kendall Barlow, Kentucky	3-5 6-9	6¢ 10¢	All year	Fee for large orders; ships in plastic bags

Source: Virginia Polytechnic Institute and State
University, 1971.

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A FEASIBILITY STUDY FOR THE SALE OF CULTURED
CATFISH IN VIRGINIA AND WASHINGTON, D. C.

Richard James Pfeifer

ABSTRACT

This thesis provides estimates of the market potential for farm-reared channel catfish in Virginia and Washington, D. C., the production costs and estimated returns of two small catfish farm enterprises, the present fisheries industry structure in Virginia, and the present channel catfish products and their feasibility for Virginia. The market potential for farm-reared channel catfish for Washington, D. C. and Virginia combined is estimated to be around 4,244,000 pounds (dressed weight) annually. The net returns generated by the two fish farm enterprises studied ranged from -\$63.49/1.5 acre to \$189.53/1.5 acre and the rates of return ranged from -8.9% to 27.4% at a \$.30 per pound (live weight) price level. The present fish industry in Virginia is composed of a large number of wholesalers of various sizes who supply most of the retailers in the state. Most of the small wholesalers would not be receptive toward catfish products. However, some of the larger wholesalers may be willing to deal in catfish. In conclusion the food fish market seems to be the most feasible for absorbing farm-reared

channel catfish products and for providing an opportunity for an expanding farm-reared channel catfish industry in Virginia.