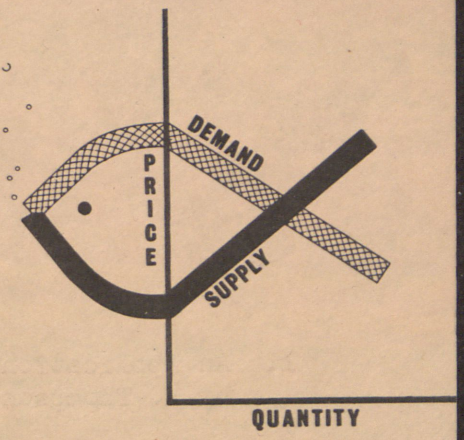


SOME ECONOMIC CHARACTERISTICS

OF POND-RAISED CATFISH ENTERPRISES

by

J. E. Greenfield

Working Paper No. 23

June 1969

US
BUREAU OF COMMERCIAL FISHERIES
DIVISION OF ECONOMIC RESEARCH

WORKING PAPER SERIES

1. An Application of an Investment Model to Channel Catfish Farming by R. Thompson and F. Mange.

2. The Development of Catfish as a Farm Crop and an Estimation of Its Economic Adaptability to Radiation Processing by D. Nash and M. Miller.

3. Design Study: An Optimum Fishing Vessel for Georges Bank Groundfish Fishery by A. Sokoloski (Project Monitor).

4. The Relation between Vessel Subsidy Percentages and the Rate of Return on Investment for Various Technologies and Scale Levels: The Haddock Fishery by D. Nash, A. Sokoloski and F. Bell (Project Monitors).

5. An Economic Justification for Recommended Legislative Changes in the 1964 Fishing Fleet Improvement Act by F. Bell, E. Carlson, D. Nash and A. Sokoloski.

6. The Economic Impact of Current Fisheries Management Policy on the Commercial Fishing Industry of the Upper Great Lakes by D. Cleary.

7. Cost and Earnings in the Boston Large Trawler Fleet by B. Noetzel and V. Norton.

8. Some Elements of An Evaluation of the Effects of Legal Factors on the Utilization of Fishery Resources by A. Sokoloski.

9. A Report on the Economics of Polish Factory Trawlers and Freezer Trawlers, by B. Noetzel.

10. An Inventory of Demand Equations for Fishery Products by D. Nash and F. Bell.

11. Industry Analysis of West Coast Flounder and Sole Products and an Estimation of Its Economic Adaptability to Radiation Processing by D. Nash and M. Miller.

12. Bio-Economic Model of a Fishery (Primarily Demersal) by E. Carlson.

13. The Factors behind the Different Growth Rates of U. S. Fisheries by F. Bell.

(continued on inside back cover)

SOME ECONOMIC CHARACTERISTICS OF POND-RAISED CATFISH ENTERPRISES

J. E. Greenfield
Regional Economist

United States Department of the Interior
Bureau of Commercial Fisheries
5 Research Drive
Ann Arbor, Michigan 48103

June 1969

Some Economic Characteristics Of Pond-Raised Catfish Enterprises

by

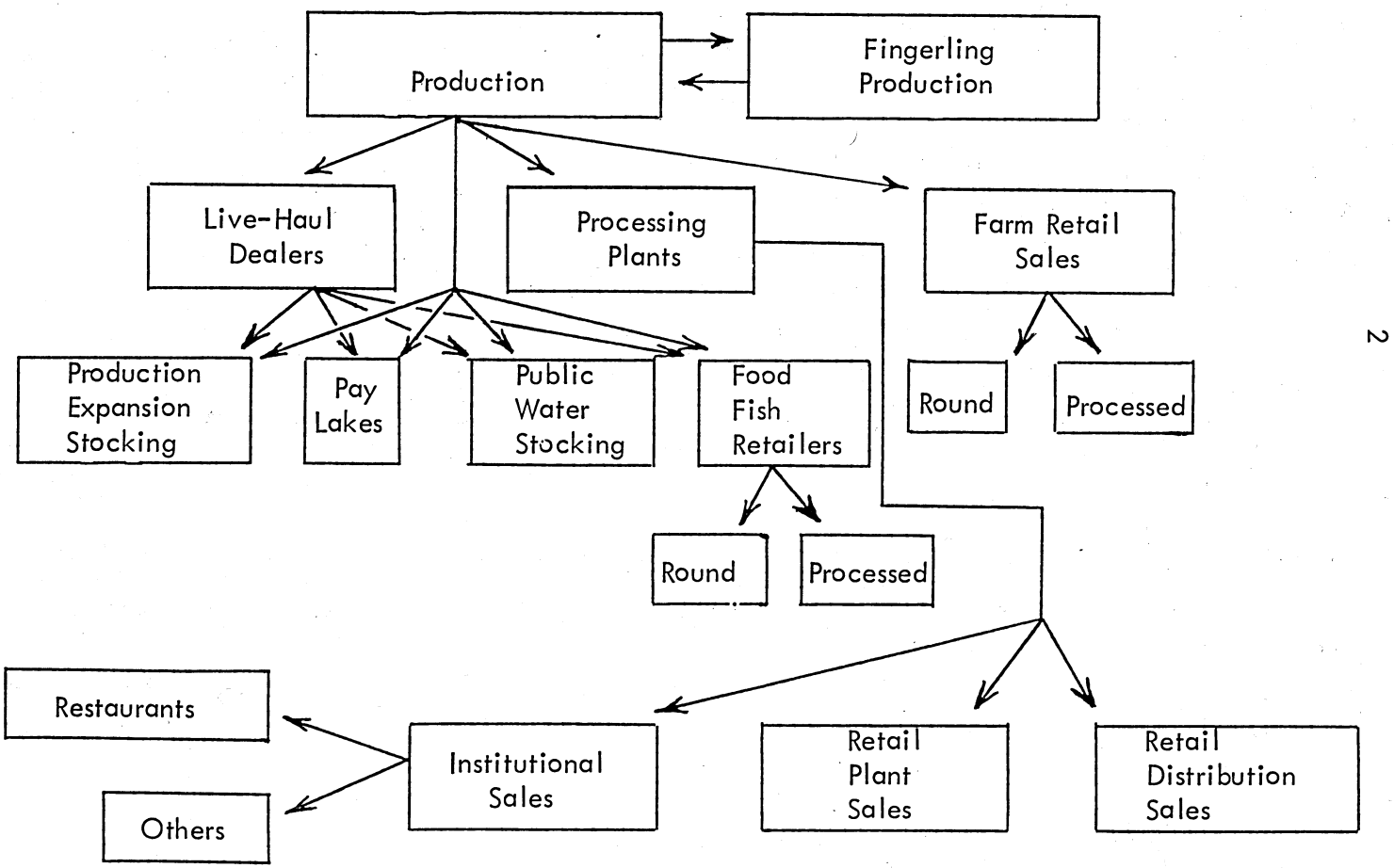
J. E. Greenfield

The surge of recent interest in the commercial production of pond-raised catfish has, in part, been generated by reports of the industry's high profit potential. The purpose of this report is to describe the economic and business realities of the industry as it presently exists in the Central Mississippi River Delta States of Arkansas, Louisiana, and Mississippi. Much of the cost information and appreciation for the sensitivity of profit to the many risk and cost factors can be transferred to other catfish production enterprises under similar conditions.

Chart I may be helpful in putting the production function in the proper relationship to the rest of the industry structure. This report is limited to the production level only and does not cover the associated businesses of brood fish and fingerling production, live hauling, processing, pay lake operation, or live or processed fish marketing.

Chart I

Catfish Industry Structure



Sharp changes are in progress at the present time regarding product flow immediately beyond farm production. As recently as 1967 approximately 90 percent of farm production was sold through live-haulers while the remaining 10 percent was retailed by a few marketing-conscious farmers. In 1968 farm retail sales expanded somewhat to about 15 percent as more farmers discovered the potential strength of roadside markets. The first processing plant also came on stream and accounted for almost 10 percent of the total production. The current 1969 season will see five processors taking 50-70 percent of the total production. These shifts are superimposed upon a rapid increase in total production, particularly in 1969. Because of the rapid expansion in acreage and the discovery that more than one growing season is required to produce a marketable crop, perhaps 70 percent of the acreage in intensive catfish culture at the end of 1968 had never been harvested.

A great deal has been written about catfish production costs, reflecting vastly different pictures of profitability. Wide variation does, in fact, exist. Fish farming generally requires a higher level of management than conventional agriculture, in the sense that the technology lies mainly in the realm of art rather than science.

Chart II

The Catfish Market (Live Weight)

Year	Live Fish	Local Retail Food Uses	Commercial Food Processing	Total
1967	9.7 m̄ lbs. 90 %	1.1 m̄ lbs. 10 %	0 m̄ lbs. 0 %	10.8 m̄ lbs. 100 %
1968	9.8 m̄ lbs. 82 %	1.8 m̄ lbs. 15 %	.4 m̄ lbs. 3 %	12.0 m̄ lbs. 100 %
1969e	9.0 m̄ lbs. 34 %	1.6 m̄ lbs. 6 %	15.9 m̄ lbs. 60 %	26.5 m̄ lbs. 100 %

e - Estimated

Moreover, it requires quite different management skills from conventional agriculture. At this early stage of development, catfish production enterprises reflect a wide range of native management competence, varied experience with newly acquired management skills, and diverse combinations of production facilities. A word about this particular analysis, its foundation, and major points of departure from most other studies seems relevant.

First, it is based on average management.

> Many previous studies were based on data provided by experienced cooperators who had already developed superior management skills, particularly in fish farming technology.

Second, it recognizes the large working capital requirement and includes interest thereon as a production expense.

> This factor is often overlooked by both producers and analysts alike. Many farmers have run into capital rationing problems by employing most of their credit capacity in fixed investment and underestimating working capital requirements.

Third, it acknowledges the reality of periods during the growing season when fish cannot be fed safely.

> Although the central Delta offers a 180 day feeding season potential, hot summer weather and cool, rainy spring and fall weather reduces the number of actual feeding days to perhaps 150.

Fourth, it is based on at least two fundamentally different kinds of production facilities.

> Like many other analyses, this analysis includes economic data for a typical, older production unit employing five to 15 acre ponds. It also includes, however, data for one kind of larger unit more commonly constructed at present, a group of four, 40 acre ponds served by one 10 inch well.

Capital Structure

Although there is an infinite range of cost structures and productivities represented among current catfish producers, considerable insight can be gained from the analysis of two different kinds of catfish enterprises under the assumption of average management. Both are frequently found in the Delta at present. Chart III reflects both these capital investment situations, expressed on a per acre basis. Although total working capital of $500 will be required before the crop is harvested, the average outstanding balance for the year is only $200.

Chart III

Capital Structure
(Per Acre)

	160 Acre, 4 Pond Unit [1]		120 Acre, 10 Pond Unit [2]	
	Gross	Net [3]	Gross	Net [4]
Original Land Value	$ 250	$ 258	$ 250	$ 292
Added Investment				
Pond Construction	$ 125		$ 140	
Well System	44		38	
Buildings & Equipment	12		12	
Tractor & Machinery	31		31	
Total	$ 212	$ 218	$ 221	$ 258
Total Fixed Investment	$ 462	$ 476	$ 471	$ 550
Average Annual Working Capital Balance	$ 200	$ 200	$ 206	$ 206

[1] Based on four, 40 acre ponds constructed on flat land and serviced by one 10 inch well.

[2] Based on 10, 10 acre ponds constructed on flat land and serviced by one 8 inch well.

[3] After allowing for five acres in levees and building.

[4] After allowing for 20 acres in levees and building.

Total fixed investment, for this type of construction on flat Delta land, ranges from $300 to $800 per acre. Approximately half of a typical $500 per acre investment is the value of the unimproved land. An average price for suitable land without cotton or rice allotment is currently about $250 per acre. Pond construction for square 40 acre ponds can be contracted for $125 per acre or about half the total investment in improvements. A 10 inch well, complete with pump, distribution system and drainage system will average about $7,000 and be adequate to fill and sustain 160 acres, 4 feet deep. This budget does not include fish handling vats or breeding facilities. Neither of these requirements for production-marketing integration are as yet typical.

Cost, Income and Profit Potential

Some producers in the southern areas of the Delta are able to grow a crop of marketable fish in one growing season. This is not the case with the majority of producers, however. Most require a full 180 feeding days to take a 4 inch fingerling to 1.25 pounds. Since only about 150 feeding days are available in the best years, about 1.3 years are required to produce a crop. Many growers, particularly those whose fingerlings were highly variable in size or who did not achieve complete harvest of the previous crop, find it necessary to grow fish over a full two years.

It is highly inefficient to harvest a crop where half or more of the fish are below minimum commercial market size and must be returned for further feeding. Oversized fish are highly marketable as brood stock and a two year season assures the producer of a minimum number of undersized fish. A 1.25 pound fish is considered the minimum size for the live-haul market and ideal for the process market.

Chart IV reflects the typical profit picture, under average management, for a four pond, 160 acre unit, and for a 10 pond, 120 acre unit. The first seven items of growing expense are associated with the fish crop itself and can be prorated to an annual basis when the crop is produced over more than one year. The next three items are expenses related to the time period, not the crop, and are incurred each year the crop is in the water. The effect of the length of the growing period is considerable. Doubling the growing period from one to two years reduces profit $80 per acre and $60 per acre (87 percent) on the 160 and 120 acre units, respectively.

The length of the growing period is actually an index of feeding efficiency and is a more meaningful indicator than feed conversion ratios per se. There appears to be more response to variations in feeding systems than to variations in the commercial feed rations alone. Natural and planted food in the form of algae, plankton, minnows, and other fish

Chart IV

Annual Profit Analysis
(per acre)

Type of Operation	160 Acre, 4 Pond Unit			120 Acre, 10 Pond Unit		
Growing Period	1 Yr.	1-1/3 Yrs.	2 Yrs.	1 Yr.	1-1/3 Yrs.	2 Yrs.
Fingerlings (1,200 @ 4¢)	$ 48	$ 36	$ 24	$ 48	$ 36	$ 24
Chemicals	25	19	12	25	19	12
Feed (180 days, 25 lbs/A, $95/ton)	214	161	107	214	161	107
Labor	40	30	20	50	38	25
Water Pumping	8	6	4	8	6	4
Fuel & Miscellaneous Supplies	4	3	2	4	3	2
Harvesting (2.1¢/lb.)	30	22	15	56	42	28
Maintenance & Taxes	25	25	25	25	25	25
Depreciation	13	13	13	15	15	15
Interest on Working Capital	14	14	14	14	14	14
Total	$421	$329	$236	$459	$359	$256
Income (93% survival, 1-1/4 lb. ave. wgt. 38¢/lb.)	$530	$398	$265	$530	$398	$265
Profit (Before Tax)	$ 109	$ 69	$ 29	$ 69	$ 37	$ 9
Return on Investment (Before Tax)	23%	14%	6%	13%	7%	2%
Cost of Production						
Not Including Interest on Investment	.302	.315	.338	.329	.343	.367
Including Interest on Investment	.325	.346	.385	.356	.380	.421
Including Interest on Investment and 20% Tax on Profit	.341	.359	.394	.366	.386	.424

are a significant factor effecting overall performance. Time and method of feeding also seem important to rate of gain. Catfish weighing one pound or more become efficient predators on minnows and at least one producer grows fish to heavier weights a second year with about one-third the normal amount of commercial feed. He adds two to three pounds of fathead minnows the second year and provides adequate breeding areas for natural reproduction.

Return on Investment

The length of the growing period is not the only variable with significant leverage on the profitability of the enterprise. Chart V reflects the impact variations in land value, cost of fingerlings, harvesting costs, and stocking rate have on the rate of return on fixed investment.

The range of variation used for each cost factor in Chart V reflects the actual range of variation found among Delta producers. The extremely wide range of variation in the cost of fingerlings is indicative of the low cost of rearing achieved by skilled managers and the high price reflects what some growers must pay for commercially raised fingerlings when they are scarce or must be transported great distances.

Chart V

Return on Investment
(Before Tax and Not Including Interest on Fixed Investment)

Land Value	4 Pond, 160 Acre Unit	10 Pond, 120 Acre Unit
$ 150 per acre	18 %	8 %
* 250	14	7
350	12	6
Growing Period		
1 Year	23 %	13 %
* 1-1/3 Years	14	7
2 Years	6	2
Cost of Fingerlings (4")		
1¢ each	20 %	11 %
* 4¢	14	7
8¢	7	0
Harvesting Costs		
1.0¢ per pound	17 %	** 11 % (2.0¢)
* 2.1¢	14	7 (4.0¢)
5.0¢	8	1 (7.0¢)
Stocking Rate		
1,600 per acre	28 %	19 %
* 1,200	14	7
1,000	7	1

* Typical value under average management.
** Higher minimum harvesting costs for 10 pond, 120 acre unit.

Harvesting costs also vary greatly, depending upon whether or not the pond must be drained. Many older ponds are of irregular shape, have uneven bottoms, or are filled with stumps and debris. Although small farm livestock ponds are seldom used in the Delta for intensive production, harvesting costs for this type of impoundment could exceed 10 cents per pound.

An entrepreneur of poor management ability, with production performance near the bottom of the range for each production variable, would benefit most from reducing the length of his growing season if he operated four, 40 acre ponds. The same manager would benefit most from reducing his cost of fingerlings if he were operating 10, 12 acre ponds. If the same individual were already of average management ability, he would benefit most from increasing his stocking rate on either a four, 40 acre pond unit or a 10, 12 acre pond unit. Chart VI portrays the different responses in return on investment that accrues to two different levels of management performance on the five most important production variables for both four, 40 acre and 10, 12 acre pond units.

Chart VI

Impact of Improvement in Management Skill in Five Major Cost Areas

Production Factor	Range of Management Ability			Increase in Return on Investment From			
				Increase from Poor to Average		Increase from Average to Superior	
	Poor	Average	Superior	4 Pond 160a Unit	10 Pond 120a Unit	4 Pond 160a Unit	10 Pond 120a Unit
Land Value	$350/a	$250/a	$150/a	17%	17%	29%	14%
Growing Period	2 yrs.	1-1/3 yrs.	1 yr.	133	250	64	86
Cost of Fingerlings	3¢ ea.	4¢ ea.	1¢ ea.	100	700	42	57
Harvesting Costs	5¢/lb.	2.1¢/lb.	1¢/lb.	88	600	21	57
Stocking Rate	1000/a	1200/a	1600/a	100	600	100	171

Profit Potential

Chart VII illustrates what the 160 acre, four pond production unit is capable of producing under just one of the many possible combinations of superior management practice.

Chart VII

Potential Annual Profit
Under Superior Management

Growing Expense	One Year Growing Period
Fingerlings (1,200,8",2¢)	$ 24
Chemicals	30
Feed (150 days, 30 lb./A,$85/ton)	191
Labor (Self-Feeders)	50
Water Pumping	8
Fuel and Miscellaneous Supplies	4
Harvesting (1¢/lb.)	14
Maintenance and Taxes	25
Depreciation (Self-Feeders)	15
Interest on Working Capital ($170)	12
Total	$373
Income (93% survival, 1-1/2 lb. ave., 1,674 lb/acre, 38¢/lb.)	$636
Profit (Before Tax)	$263
Return on Investment (Before Tax)	55%
Cost of Production	
Not Including Interest on Investment	22¢/lb.
Including Interest on Investment	24¢/lb.
Including Interest on Investment and 20% Tax on Profit	33¢/lb.

This case is different from the one presented for average management in that it assumes a level of management that is able to:

(1) grow large, 8 inch fingerlings for an average cost of 2 cents each.

(2) produce a crop of larger fish averaging 1.5 pounds by starting with larger fingerlings and by the use of self-feeders in one 180 day season. This is sufficient time for 150 actual feeding days at an average daily feeding rate of 30 pounds per acre.

(3) buy feed at $85 per ton.

(4) harvest fish at a cost of 1 cent per pound.

These conditions are actually obtained by a few growers at present. They result in somewhat higher labor and depreciation charges but lower working capital requirements. The program results in a return on investment of 55 percent, almost four times greater than the 14 percent return on investment obtained with the same facilities under average management conditions. Cost of production is correspondingly reduced from 34.5 cents per pound to 24.0 cents per pound before tax and interest on investment.

Price Sensitivity

The average price throughout 1968 in the Delta of 38 cents per pound was based on a typical price of 35 cents per pound at the farm level for processing use and 40 cents per pound to live-haulers. This price yields a return on investment of about 14 percent for average management. A 1 cent change in price produces about a 4.5 percent change in return on investment. Under average management, a decline in price of 4 cents to 34 cents per pound reduces return on investment to a level just sufficient to recover the cost of capital. Any decline in price in excess of 6 cents per pound reduces the return on investment to where an actual loss is incurred on operations. Chart VIII reflects the economic consequences, in terms of return on investment, of a range of prices, assuming average management on a four pond, 160 acre unit. Prices in the 44 cent range have been paid on occasion as recently as the spring of 1969. Prices in the 24 cent range are already being discussed as within the realm of possibility using Latin American production sites.

Chart VIII

Price Sensitivity

Price Per Pound	Profit Per Acre	Return on Fixed Investment
$ .44	$ 131	28%
.42	110	23
.40	89	19
.38	69	14
.36	48	10
.34	27	6
.32	6	1
.30	-15	-3
.28	-36	-8
.26	-57	-12
.24	-78	-16

Summary

Catfish farming continues to grow because it offers Delta farmers the potential for a higher rate of return than conventional crop, and even livestock, enterprises. As with almost all business opportunities, there is correspondingly greater business and biological risk associated with higher profit potentials. The production of edible size catfish lies somewhere between conventional farm crops and still more exotic aquaculture enterprises such as bait minnow, goldfish, trout and catfish fingerling production with regard to both risk and profit opportunity.

Under average management conditions, a 7 cent decline in price (18 percent) would be sufficient to erase all profit and reduce return on investment to zero. By the same token, an increase in price of equal magnitude would increase the rate of return on investment to 30 percent. Since the industry is new and in a state of market development and change, price risk represents a major dimension to the investor's decision.

(continued from inside front cover)

14. A Price Incentive Plan for Distressed Fisheries by A. A. Sokoloski and E. W. Carlson.

15. Demand and Prices for Shrimp by D. Cleary.

16. Industry Analysis of Gulf Area Frozen Processed Shrimp and an Estimation of Its Economic Adaptability to Radiation Processing by D. Nash and M. Miller.

17. An Economic Evaluation of Columbia River Anadromous Fish Programs by J. A. Richards.

18. Economic Projections of the World Demand and Supply of Tuna, 1970 - 90 by F. Bell.

19. Economic Feasibility of a Seafood Processing Operation in the Inner City of Milwaukee by D. Cleary.

20. The 1969 Fishing Fleet Improvement Act: Some Advantages of its Passage by the Division of Economic Research.

21. An Economic Analysis of Policy Alternatives for Managing the Georges Bank Haddock Fishery by L. W. Van Meir.

22. Some Analyses of Fish Prices by F. Waugh and V. Norton.

23. Some Economic Characteristics of Pond-Raised Catfish Enterprises by J. E. Greenfield

24. Elements Crucial to the Future of Alaska Commercial Fisheries by D. Nash, A. Sokoloski, and D. Cleary.

25. Effects on the Shrimp Processing Industry of Meeting the Requirements of Wholesome Fishery Products Legislation by D. Nash and M. Miller.

The goal of the Division of Economic Research is to engage in economic studies which will provide industry and government with costs, production and earnings analyses; furnish projections and forecasts of food fish and industrial fish needs for the U. S.; develop an overall plan to develop each U. S. fishery to its maximum economic potential and serve as an advisory service in evaluating alternative programs within the Bureau of Commercial Fisheries.

In the process of working towards these goals an array of written materials have been generated representing items ranging from iterim discussion papers to contract reports. These items are available to interested professionals in limited quantities of offset reproduction. These "Working Papers" are not to be construed as official BCF publications and the analytical techniques used and conclusions reached in no way represent a final policy determination endorsed by the U. S. Bureau of Commercial Fisheries.