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Costs of Small-Scale Catfish Production for Direct Sales

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Catfish farming is a major aquaculture enterprise in the United States. Experts suggest that a commercial farm with a business plan based on sales to a processing plant should have at least 150 water acres (e.g., 15 10-acre ponds), which requires an investment of more than $750,000. Clearly, this is more money than many people can invest. Large farms can take advantage of economies of scale that result in lower per-unit production costs and higher per-unit profit margins than are usually found in small operations. However, large farms typically sell the bulk of production to processors and receive wholesale prices for their catfish.

Some farmers might prefer to manage small, but profitable, operations. This budget was developed for an owner/manager who seeks to raise catfish profitably on a small scale. If the owner's goal is to raise fish as a hobby or to recover only a portion of his/her costs, then some of the costs included in this budget can be ignored. However, to be a viable business over the long run requires that the owner make sufficient profit to justify his/her time. This requires careful consideration of all costs, not just selected ones.

Small-scale catfish production is defined in this publication as a farm of fewer than 20 water acres. The budget focuses on production costs with only a brief description of marketing costs. However, small production systems must target markets other than processing plants. They may sell some fish to processors when prices are high, but in general a small operation must sell fish at retail prices (e.g., direct to consumers) to make a profit. The manager of a successful small-scale catfish farm must spend as much time on developing a marketing plan and projecting realistic costs as on planning the production system.

Marketing costs will vary with the resources, location, and personality of the farmer. Local knowledge is essential for the success of a small-scale operation. A business based on local sales of fresh fish can be a profitable venture. If a small processing facility is nearby, it may be possible to contract processing or to sell to the plant. Otherwise, it will be necessary to market directly to end consumers. Direct marketing requires interaction with customers and successful direct marketing requires a person who enjoys dealing with the public. Options can include fee-fishing, pond-bank sales, sales in farmers' markets, community-supported agriculture ventures, and others. Profits are made by selling fish, not by raising them, so marketing is critical to the financial success of a small business. SRAC Publication No. 350, *Small-Scale Marketing of Aquaculture Products,* provides more information on niche marketing of aquaculture products.

Profitable businesses of any size require careful planning and analysis. Each farm situation is different, so the budget presented here is designed as a template of the types of costs and returns that can be expected. The sample budget shows costs typical of the delta region in Mississippi and Arkansas; costs may be different in other regions of the U.S. Individuals must evaluate their own resources and abilities objectively and critically before making conclusions as to the potential profitability of the business. Prospective farmers must decide whether the potential income is satisfactory and whether they are willing to spend the time and effort required for the fish

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farm to be profitable. Spending time on the fish enterprise means giving up time spent on other activities.

Risks can be greater with small businesses and there is a tendency to overlook a number of important costs when planning small-scale production systems. Careful thought needs to be given to the availability of land, equipment, capital, labor, and skills for the enterprise, and to whether land and equipment are already used for other purposes. If one later decides to stop production, how easy will it be to get out of the business? Ponds and holding vats are permanent structures that are not easily converted to cash. Fish farming equipment is specialized and may be hard to sell. Careful planning and attention to all aspects of the business will help ensure success.

Production facilities

Catfish can be raised in levee or watershed ponds or in cages in ponds unsuitable for commercial production (e.g., ponds with stumps or no drains). Because most catfish are raised in ponds, cost estimates in this publication are based on producing catfish in small earthen levee or watershed ponds. Information on cage culture is available in SRAC Publication Nos. 160 through 166.

Producing fish for direct sales generally requires several small ponds because there must be a regular supply of market-sized fish. Frequent harvests from the same pond are not advisable because harvesting stresses fish and can put them off feed for several days. With several ponds a producer can rotate harvesting among them and reduce the chance that all fish will have off-flavor problems at a given time.

Cost estimates for a small levee pond facility

Production costs in this fact sheet were calculated for a base scenario and for several alternative scenarios. The base scenario consists of six 2-acre levee ponds. While this is just one of the designs for a small-scale facility, it illustrates the costs to supply a direct sales market while producing fish in an economically optimal manner. Land and pond construction costs can vary widely. Prospective small-scale catfish growers should project realistic costs for the locations of their farms. On-farm storage for equipment, feed, and fuel is assumed to be available.

Pond construction

This budget assumes that an adequate supply of suitable quality water can be obtained from a shallow well. The six 2-acre ponds are built in a block with each pond having a water surface area of 165 feet by 528 feet. The central levee is 16 feet wide and all other levees are 12 feet wide. Internal slopes are 4:1 (4 horizontal feet to each vertical foot) and external levees have 3:1 slopes. Freeboard (height of levee above the waterline) is 1 foot; 10 percent is added to total yardage to allow for compaction over time. Tractor-drawn pans should be used in construction rather than bulldozers, and proper construction procedures are critical. Poorly built ponds are impossible to repair well and are usually very difficult to manage.

Feed storage

Small-scale farms typically must purchase bagged feed from local agricultural supply stores because feed mills are unlikely to deliver small quantities of bulk feed to isolated farms. Bagged feed usually costs 15 percent more than bulk feed.

Water supply

A 4-inch submersible well that yields 250 gallons per minute (gpm) is used to fill ponds and maintain water levels. This rate of flow would fill one 2-acre pond in 7 to 8 days. If a marketing building is constructed, the well could provide water to the holding vats (although in this budget the total cost of the well is charged out to fish production).

Equipment

An all-terrain vehicle is used for feeding and checking ponds (100 percent charged to the fish operation) and is operated for 2 hours per day in summer (364 hours) and 30 minutes per day in winter (91 hours). A trailer is used to transport feed to the ponds, for hand feeding. A tractor for cutting grass and for emergency aeration is budgeted at 25 percent of time (200 hours per year). This means that the farm should have other enterprises that will pay for the other 75 percent of ownership costs for the tractor. A 250-foot seine with a mesh size of 1 ⅞ inch and a live car with 2-inch mesh are included for harvesting.

Production practices

Fish will be raised in multiple-batch production. Since it takes about 18 months to raise fish to the size needed for the live market, the first year is an atypical, start-up year. A producer may want to purchase stockers (large fingerlings at least 8 inches long) for the first year so that sales will bring revenue in sooner.

The budget presented in this fact sheet is for the system in full operation, from the second year onward. After the first year, ponds will be stocked each spring with 3,750 5-inch fingerlings per acre. These fingerlings should grow to ⅓ pound each by fall and to market size the following

year. The expected marketable yield, after the first year, is 4,500 pounds of 1.75-pound fish per acre.

Survival is estimated to be 70 percent. The feed conversion ratio (FCR) is estimated at 2.2:1 (2.2 pounds of feed to produce 1 pound of fish) using a 28 to 32 percent floating catfish pellet. While experimental trials have demonstrated an FCR of 1.3 to 1.5, direct sales typically require fish to be sold in smaller quantities over time. Thus, fish probably will be held for a time waiting to be sold and will need to be fed periodically to maintain weight. That is why a higher and more conservative estimate of FCR was used in the budget.

A permanent 3-horsepower electric paddlewheel aerator in each pond (1.5 horsepower per acre) is placed on a timer and run nightly during the summer, with one spare electric aerator available. A tractor-powered (PTO) aerator provides emergency aeration. Labor is charged at $7.25 per hour and is based on 3 hours daily for 6 months (546 hours) and 30 minutes per day for the remainder of the year (91 hours). The farmer may provide all or most of this labor, but full labor costs are included in the budget to accurately reflect production costs as well as to value the farmer's time and efforts.

Production costs

Long-term investment costs include land, ponds, and water supply (Table 1). Land costs are estimated at $33,750, pond construction costs at $24,000, and water supply at $17,500 for a total investment cost of $75,250 ($6,271 per water acre). Equipment costs total $45,453, or $3,788 per acre (Table 2). Operating costs (feed, fingerlings, etc.) are $47,228 for the farm or $3,936 per acre (Table 3). Operating costs alone add up to $0.87 per pound of fish raised (Table 3). Ownership costs (including interest on the investment, depreciation, and taxes) total $23,958 annually for the six 2-acre ponds. The total of fixed costs and operating costs (total costs) are estimated to be $71,186 per year, or $1.32 per pound of fish produced. Prospective catfish farmers should develop business proposals using their own costs.

The average price paid by processors has averaged $0.90 per pound over the past 5 years, while prices received for live fish sales have ranged from $1.00 to $1.50 per pound. The sample budget (Table 3) shows why selling to a processor is not an option for small-scale operations. A small-scale catfish business must be designed and oper-

Table 1. Long-term investment cost for six 2-acre catfish ponds.

Item	Unit	Unit cost ($)	Quantity	Cost ($)	Useful life (yr)	Annual depreciation ($)
Land	acres	2,250	15	33,750	n.a.	n.a.
Pond construction	acres	2,000	12	24,000	10	2,400
Water supply (250 gpm)	total	17,500	1	17,500	10	1,750
TOTAL				**75,250**		**4,150**

Table 2. Equipment cost for six 2-acre ponds, estimated useful life of equipment, and annual depreciation.

Item	Description	Quantity	Unit cost ($)	Total cost ($)	Useful life (yr)	Annual depreciation ($)
ATV	4-wheel drive, all-terrain vehicle (660 cc)	1	8,000	8,000	7	1,143
Aerators	electric, paddlewheel, 3-hp (3-phase)	7	3,000	21,000	5	4,200
Electrical service connections		7	230	1,610	10	161
Paddlewheel	PTO, tractor-powered	1	3,000	3,000	10	300
Timers	for aerators	6	50	300	3	100
Oxygen meter		1	900	900	7	129
Water test kit		1	250	250	5	50
Mower	rotary cutter (6-foot)	1	1,365	1,365	10	137
Tractor	57-hp (25% time, $23,500)	1	5,875	5,875	10	588
Seine	1⅞-in, 250 feet x 9 feet, 3-foot x 5-foot tunnel with frame	1	1,825	1,825	5	365
Live car	10 feet x 30 feet, 2-in, half length of typical live car	1	600	600	5	120
Seine stakes		8	16	128	10	13
Other	waders, dipnets	1	600	600	2	300
Total equipment investment and annual depreciation				**45,453**		**7,606**

Table 3. Annual costs and returns for six 2-acre catfish ponds.

Item	Unit	Quantity	Unit price	Cost ($)	Your cost
Operating costs					
Fingerlings (5 inches each)	fish	45,000	0.075	3,375	_____
Feed	ton	59.4	460	27,324	_____
Labor	hour	1,035	7.25	7,504	_____
Gas & diesel	acre	12	91	1,092	_____
Electricity	acre	12	222	2,664	_____
Repairs and maintenance	acre	12	97	1,164	_____
Plankton control	acre	12	14.4	173	_____
Depredation	acre	12	6.25	75	_____
Telephone	acre	12	10.5	126	_____
Office supplies	acre	12	11	132	_____
Insurance	acre	12	25.3	304	_____
Interest (9 months)	total	43,933	0.075	3,295	_____
Total operating costs	dollars			47,228	_____
Ownership costs					
Interest on investment					
Land, ponds and well (10% APR)	total	75,250	0.1	7,525	_____
Equipment (10% APR)	total	45,453	0.1	4,545	_____
Annual depreciation				–	
Ponds, water supply	total	4,150	1	4,150	_____
Equipment	total	7,606	1	7,606	_____
Taxes	acres	12	11	132	_____
Total ownership costs				23,958	_____
Total costs				**71,186**	_____
Break-even price					
Above operating cost				0.87	_____
Above total cost				1.32	_____

Table 4. Summary of costs and break-even prices for four small-scale catfish production scenarios.

		Extensive, low-density production	
Item	Base scenario	With permanent aeration	With emergency aeration only
Levee ponds			
Total operating costs	$47,228	$25,178	$22,627
Total ownership costs	$23,958	$23,957	$17,205
Total costs	$71,186	$49,124	$39,831
Break-even price above total variable costs	$0.87	$1.40	$1.26
Break-even price above total costs	$1.32	$2.73	$2.21
Watershed ponds			
Total operating costs	$48,775	$26,726	$24,184
Total ownership costs	$15,853	$15,853	$12,831
Total costs	$64,628	$42,579	$37,015
Break-even price above total variable costs	$0.90	$1.48	$1.34
Break-even price above total costs	$1.20	$2.37	$2.06

ated to supply live fish markets and capture the higher prices possible in live markets.

Extensive culture option

It is possible to raise catfish at lower densities, reducing overall operating costs. However, the total weight of fish produced will be less if fewer fish are stocked per acre (in spite of the faster growth of fish at lower densities). Since the cost per pound of fish produced is sensitive to the overall yield of fish produced, lower densities often result in greater costs per pound of fish produced.

A scenario was developed that used a stocking density of 1,200 fish per acre (rather than the 3,750 fish per acre stocked in intensive production). Using the reported yield of 1,500 pounds per acre for this stocking density on small-scale farms, the total marketable weight produced on the 12-acre farm would be 18,000 pounds, one-third the weight of fish produced in the base scenario. The cost analysis for this scenario included both ownership and operating (electric) costs for ponds with permanent electric aeration supplemented with emergency (PTO) aeration. The extensive culture option resulted in operating costs that were 47 percent lower than those of the base scenario (Table 4), due primarily to the lower costs of fingerlings and feed that result from the lower stocking density. However, because of the high fixed costs as compared to the lower yield, the break-even price above total costs increased by 107 percent to $2.73 per pound of fish sold for ponds with permanent aeration.

For the extensive, low-density scenario, if permanent aeration equipment and electricity are not used, the cost per pound would decrease to $2.21 per pound. This is still $0.89 per pound more than the break-even price of the base scenario with the higher stocking rate, but without accounting for the risk of losing one or more entire ponds because of the inability to add oxygen during oxygen depletion events.

Cost estimates for a small watershed pond facility

Watershed ponds are common throughout the southern region. They are filled by rainfall running off the land. Construction costs and the suitability of watershed ponds for catfish production vary widely with the topography of the land and other conditions. Thus, only general cost estimates can be discussed. Individuals must develop their own site-specific cost estimates.

For the scenario presented here, general costs were estimated for two 6-acre watershed ponds, each constructed with a single levee. Thus, pond construction costs would be less than those for levee ponds that require four levees. The cost of the land itself was not included in this analysis. General production practices and equipment were estimated to be the same as for levee ponds. However, one 10-horsepower aerator was assumed per pond instead of the 3-horsepower aerators in the levee pond base scenario. The only additional operating expense was that associated with controlling wild fish, which are common problems in watershed ponds.

Break-even prices above total costs for the watershed pond were $1.20 per pound for the base scenario (Table 4). If the pond required more than one levee to be constructed, the cost per pound would increase by approximately $0.01 per pound for each additional levee.

Additional cost analyses were developed for the extensive production system (yields of 1,500 pounds per acre) with and without aeration. The pattern of break-even prices was the same as that for the levee ponds (Table 4). The extensive culture options had much higher break-even prices than the base scenario. Without electric aerators, the break-even price of extensive culture was $0.86 per pound more than that of the base scenario in watershed ponds.

Effects of higher feed prices

Catfish feed prices have been volatile in recent years. Sensitivity analyses were developed to increase the price of bagged feed to $575 per ton. For each $25-per-ton increase in feed price, the cost to produce catfish would increase by $0.03 to $0.04 per pound.

Marketing costs

No one makes a profit by raising catfish. Profits are obtained when the farmer sells catfish at a price higher than the cost of production. So although this publication focuses on production costs, prospective farmers must carefully consider all costs that will be incurred in selling fish, including costs associated with marketing.

The two principal options for catfish sales are to sell to a processing plant or directly to end consumers. If there is a small, local processing facility, it may be possible to contract for custom processing services on a per-pound basis. Wholesale prices are typically $0.30 to $0.40 per pound less than the retail prices consumers pay.

Direct sales options include: 1) pond-bank sales; 2) operating fee-fishing or pay-lake ponds; 3) sales in a farmers' market; or 4) joining a group engaged in community-supported agriculture.

The costs of marketing the product will vary with these different sales options. Pond-bank sales have the lowest marketing costs. Equipment required to sell fish

on the pond bank will include: 1) certified scales; 2) cages with walkways to hold fish for sale days; and 3) nets, baskets, and buckets to move fish from holding cages and weigh them for sale. Operating a fee-fishing or pay lake requires investment in various amenities that enhance the recreational fishing experience. These may include the sale or rental of fishing rods and tackle; bait; containers for packaging fish to take home; refreshments; beach umbrellas; ice; and the capability of processing fish for customers as requested. To sell in a farmers' market or as part of a community-supported agriculture group, the farmer must purchase a transport tank for hauling fish to market as well as ice, packaging, certified scales, dipnets, and baskets. These costs can add $0.03 to $0.10 per pound of additional costs.

Hidden costs of small-scale catfish production

A number of other cost factors are frequently ignored in discussions of small-scale aquaculture production. Assuming that the owner/operator wants to make a profit, such hidden costs might determine whether or not he or she is willing to continue in the business.

One hidden cost might be the tractor. If the farmer does not have a tractor, one will have to be purchased. If the farmer does not have a use for 75 percent of the tractor's time, 100 percent of the tractor's value will have to be charged to the catfish business, driving costs even higher. These types of opportunity costs must be thought through carefully before investing in a small-scale catfish farm.

Using existing ponds

If an individual already owns land and ponds suitable for fish production and does not include these costs in the budget, then production costs would decrease to $1.10 per pound for the base scenario with levee ponds. Ponds can sometimes be leased to a fishing club or used for fee fishing or other uses. The revenue that might be earned from other uses, as well as repairs and depreciation over time, must also be considered as costs of raising catfish in existing ponds.

Risk issues

All farming activities entail risk, and some have higher risks than others. On small-scale farms, fish losses may represent a larger proportion of the total crop than on larger farms. Farmers must carefully evaluate their ability to absorb such losses.

While there is less risk of dissolved oxygen problems in ponds with lower densities, not having permanent aeration in each pond is extremely risky. Without aeration, serious losses could occur even if fish are stocked at low densities. Can you afford to risk losing all your fish during a week of cloudy weather, or in the fall when a sudden cold snap kills the plankton bloom or a cold rain causes ponds to turn over? Farmers who depend upon emergency aeration only (e.g., a tractor-powered paddlewheel) must regularly monitor ponds throughout the night during the production season or risk losing fish.

The profitability of a business does not mean that the enterprise is worth doing. High risks and low returns may not be attractive enough to make the enterprise worth an individual's time and effort. While some individuals may be content with relatively low returns, others may require a higher level of return to feel satisfied with the enterprise. All factors must be carefully considered before making an investment in small-scale catfish production.

This publication compares the costs of small-scale catfish production in several scenarios in both levee and watershed ponds. The most profitable (least cost) alternative is to stock 3,750 fish per acre and have permanent, electric paddlewheel aerators. However, the costs of this option are greater than those of larger catfish farms. To be profitable, catfish produced on a small scale will need to be sold in niche markets where the price is high enough to more than offset the costs of production.

Sources of information

There are many other SRAC publications that can be helpful in planning and operating a small-scale catfish business. SRAC publications can be found at *http://srac.tamu.edu*.

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