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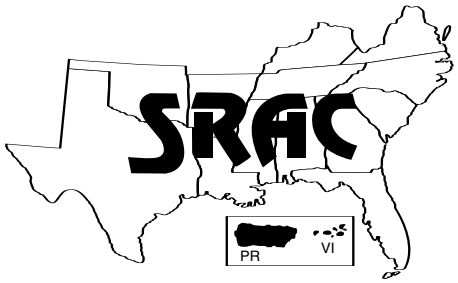

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Revision

Production Enterprise Budget for Golden Shiners

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Baitfish farming is a large aquacultural industry in the United States, with a farm-gate value of $38 million in 2005 and retail sales 10 to 15 times that value. Of the dozen or more fish species raised as bait, golden shiner is the most common. This budget was developed for a golden shiner operation.

Several major changes in baitfish production have occurred since the last version of this budget was published by the Southern Regional Aquaculture Center in 1996. Golden shiner producers have adopted tank hatching of eggs, and hatchery costs are now included. While the unit cost of water has increased, the new hatcheries have improved production efficiencies and reduced water consumption, as ponds are drained less frequently. Given the threat posed by emerging diseases such as Spring Viremia of Carp Virus (SVCV), Viral Hemorrhagic Septicemia (VHS), and heterosporis, and the problems associated with aquatic nuisance species (ANS), reputable baitfish operations have adopted biosecurity and fish health inspection measures to protect their farms. These measures have added to production costs. Most Arkansas acreage is inspected under International Organization of Animal Health (OIE) standards. These farms are participating in a voluntary, fee-based program in which state inspectors monitor farms and fish health documents before issuing certificates. It is likely that baitfish operations in other states will take similar measures. Costs for biosecurity measures, veterinarians, fish health inspections and certification fees are now included in this budget.

An enterprise budget provides annual costs and return information and capital investment requirements for a particular crop. This budget is based on recommended management practices and conservative estimates of baitfish yield, prices and costs. It includes the full costs for land, capital, facilities, equipment, hired labor and supplies required for starting a new golden shiner farm. Individual farmers will have different costs and yields.

Market determines price

The markets for baitfish are highly specialized. Supply chains frequently involve wholesalers and distributors who have relationships with baitfish farmers that have lasted for several generations. It is often difficult to break into such a market, given the high level of customer service provided by the baitfish industry and these long-standing supply chain relationships.

The following budget is based on an assumed price of baitfish, as well as the assumption that baitfish produced will be sold. In reality, market demand is highly variable and farmers are often left with unsold fish, often fish of less desirable sizes. For this reason, assumed yields may appear low when compared to results from experimental ponds, but have been selected to approximate actual fish sales per acre, rather than fish produced. Costs include all those related to the level of fish produced in the pond whether sold or not, but revenue is generated only from the fish sold.

Price is determined by fish species and size and by market conditions and structure. The quantity of baitfish an individual producer can sell will depend upon the contacts developed with potential buyers. A farmer who is considering starting a baitfish enterprise should thoroughly investigate market conditions and potential before beginning production.

This budget was developed for a representative, 160-water-acre baitfish farm divided into sixteen 10-acre ponds (on 180 acres of land). Most golden shiner farms in Arkansas are larger than 160 acres; farms in other areas of the

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country are often relatively small. Annual costs and returns were developed for the entire farm.

Production cycle

The budget assumes a typical production cycle for golden shiners, with a growing season of approximately 200 days. There is great variation in production practices among farms, so the following is a generalized overview. Of the 16 ponds, three are drained each year and refilled for use as nursery ponds. The remaining 13 are used for grow-out production. In late April to early May, eggs are collected from brood fish in grow-out ponds. Separate brood ponds are not used on baitfish farms. Instead, selected grow-out ponds that contain mature fish are used for spawning. Three hundred spawning mats are placed on 50 floating racks along the edge(s) of the brood pond. Mats with eggs are moved to the hatchery in a covered pickup bed, and selected mats are placed in tanks for egg incubation.

A 16-tank hatchery building produces approximately 10 million fry in each 5-day cycle (assuming 625,000 fry per tank). Under ideal conditions, the hatchery could produce sufficient fry to stock all three nursery ponds within 15 days. However, spring temperatures often fluctuate widely so a 4-week spawning period was selected for the budget. Water from the system supplying the shed is used to fill a 3,000-gallon reservoir. A pump sends 12 gallons per minute (gpm) of water from the reservoir to the hatchery tanks through an additional sand filter, a heater and an oxygen saturator. Water in the hatching tanks must be heated 8 to 10 °F above the well water temperature of approximately 65 °F.

After 4 to 5 days in the hatchery, 1- to 2-day-old fry are ready for stocking. Nursery ponds are filled with a shallow layer of well water just before stocking. If necessary, and when legal, an insecticide may be applied with a spray rig. Fertilizer is occasionally applied as well, although many old ponds do not require additional nutrients.

Fry numbers are estimated volumetrically and fry are placed in plastic bags for transportation to nursery ponds in the back of a pickup truck. Each nursery pond is stocked with 1 million fry per acre. There is an average 70 percent survival rate to the juvenile stage. Juveniles are transferred to grow-out ponds. Fry stocking rates are much lower if juveniles will not be transferred. Approximately 1 week after fry stocking, water from (an) adjacent pond(s) is pumped over the levee into the nursery pond, completely filling the pond with plankton-rich water. In some cases, filling is completed with well water, without the week-long delay. Fry are fed twice daily with 32 percent crude protein minnow meal until they are 3 to 4 weeks old, when the feed form is switched to a crumbled pellet. After another 3 to 4 weeks, the fish are fed a 32 percent crude protein fish feed in the form of pellets.

Beginning 6 to 10 weeks after fry stocking, quantities of juvenile golden shiners (typically 0.2- to 1.2-g fish) are gently harvested from nursery ponds and transferred to grow-out ponds at rates of 50,000 to 300,000 per acre, depending upon anticipated markets. After the first year, these ponds will have residual populations of last year's crop. This production practice has been termed "polysizing," and it is analogous to the multiple-batch production of catfish. Ponds are drained in rotation, so that this year's nursery pond will become a grow-out pond the following year, and each pond is drained every 5 years on average.

Fish are fed daily and aeration is supplied nightly during the summer months at a rate of 0.5 hp per acre. A trailer-mounted feeder with an electronic scale is used. While expensive, the scale provides the farmer with the accurate feeding records essential for estimating inventory. Bulk feed is stored in a 15-ton bin, and half-load (10-ton) lots are purchased. Farm activities also include water quality monitoring, phytoplankton bloom management, levee mowing and bird scaring.

Typically, fish are partial-harvested for sale each week from one or more grow-out ponds. Sinking pellets are fed in one or more locations to attract and concentrate fish. After fish congregate, a boat deploying a seine circles the fish and the seine is brought in to concentrate the fish. The necessary quantity of fish is loaded by buckets onto a hauling truck and the rest of the fish are released. The 1-ton, flatbed farm truck is equipped with a 2-compartment hauling tank, each with an oxygen diffuser for aeration. Harvested fish are hauled to vats in the holding shed for acclimation, grading and eventual transport to market.

The holding shed consists of a 30-foot by 75-foot metal building covering eight cinderblock vats on a concrete slab. Each vat has the internal dimensions of 5 feet wide by 20 feet long by 2.5 feet deep, with a capacity of 1,500 gallons. A well supplies water to the aeration tower of a cinderblock reservoir, from which it is pumped through a sand filter and into the vats. A low-pressure blower aerates the vats through circles of porous hose. A generator supplies electricity to run the blower in an emergency. A small office/break room and a storage room are housed at one end of the holding shed.

Oxygen in the form of compressed gas is used instead of liquid oxygen (LOX). While the unit cost of the gas is considerably higher, LOX dewars for use on farm trucks often must be purchased instead of leased because of the potential for damage. Oxygen continually vents from the LOX units when not in use, and a small farm is unlikely to use enough oxygen each day to justify the use of LOX unless the farm also adds oxygen saturators to holding vats.

The average yield of baitfish—pounds sold divided by pond acreage—was assumed to be 450 pounds per acre. At an average price of $4.00 per pound, the total revenue, or gross receipts, would be $288,000, or $1,800 per acre. In experimental studies, yields in excess of 1,500 pounds per acre can be obtained. However, a potential producer would be imprudent to base his or her expectations upon yields from research ponds. High yields from these small ponds typi-

cally consist of medium-sized minnows, while the market usually demands small (crappie) and large (jumbo) minnows as well. The 2006 Census of Aquaculture found 58,306 acres in baitfish production across the U.S. in 2005, with gross sales of $38.018 million or $652 per acre. Assuming a farm-gate price of $3.50 per pound, the average yield was 186 pounds per acre.

Enterprise budgets provide a snapshot of costs and returns for a typical farm using an assumed, specific management system. Prospective baitfish farmers must adapt these budgets to their specific farm situations. This golden shiner enterprise budget was developed with the following assumed conditions.

- Flat land suitable for pond construction and a suitable groundwater source are available.
- All ponds, facilities and equipment are constructed and purchased new.

Market prices were for Lonoke, Arkansas. Costs for farms to be developed in other locations will vary, depending on factors such as what the farmer brings to the venture, local costs and personal choices. For example, some farmers choose to install redundant systems—extra pumps, blowers, heaters, etc.—to reduce the risk of equipment failure. Others may or may not have spare items on hand. Wells vary considerably in cost, depending on depth and capacity. Construction costs vary with location, and transportation charges can be considerable. For example, delivery of a feed bin may cost $1.00 per mile. Farmers make different equipment choices as well. For example, in this budget we have specified a 15-foot, bat-wing rotary cutter at an estimated cost of $9,700. A 6-foot rotary cutter can be purchased for about $1,500, but increasing labor and fuel costs, plus the ease of mowing next to ponds, justifies the choice of the more expensive unit.

Capital investment in real estate and equipment

Table 1 lists the long-term capital investment costs of real estate (land, ponds and buildings) required for a 160-water-acre farm composed of sixteen 10-acre ponds. Note that a 160-water-acre farm requires 180 acres of land, but that per acre estimates are based on acres in production ponds, or water-acres. A total of $786,400 is required for real estate for this farm. This equates to $4,915 per acre. An additional $261,896 ($1,637 per acre) is required to purchase the equipment needed (Table 2). Annual depreciation is calculated for items that have a definable useful life. Items such as land are not depreciable because if properly maintained, land will continue to be useable for an indefinite period. Valves, pipes and equipment will wear out and must be replaced. Most of the equipment needed is for the ponds, followed by the holding shed, and then the hatchery.

Variable costs

Table 3 itemizes the variable costs for a 160-acre baitfish farm with a hatchery. Variable costs are those expenses related directly to the quantity of baitfish produced for market. The feed used in this budget is a 32 percent protein floating pellet (bulk) or bagged feed in the form of meal and crumbles for feeding fry in the nursery ponds. Liquid fertilizer (11-37-0) is applied at 2 gallons per acre. One full-time employee is hired to assist the owner with feeding, harvesting, grading, loading and pond maintenance at an annual salary of $20,800. In addition, a seasonal worker is hired annually for 3.5 months to assist with egg collection, hatchery operation, fry stocking and juvenile transfer ($400 per

Table 1. Long-term investment costs of real estate.

Item	Description	Unit	Price/unit ($)	Quantity	Total cost ($)	Years of useful life	Annual depreciation ($)
Land		acre	2,000	180	360,000	n.a.	n.a.
Holding shed							
Metal building on slab	30-ft x 75-ft open area for vats,enclosed office, bathroom	each	30,000	1	30,000	20	1,500
Vats	1,500-gal, cinderblock	each	800	8	6,400	20	320
Ponds	16, 10-acre earthern ponds	acre	1,500	160	240,000	20	12,000
Wells		each	25,000	4	100,000	15	6,667
Gravel		total	20,000	1	20,000	10	2,000
Hatchery							
Building	30-ft x 30-ft, 16-tank hatchery	each	30,000	1	30,000	20	1,500
TOTAL					786,400		23,987

Table 2. Equipment required for a 160-acre baitfish farm with hatchery.

Item	Description	Quantity	Unit cost ($)	Total cost ($)	Useful life (yr)	Annual depreciation ($)
Equipment for ponds						
Feed bin and footing	15-ton (for 10-ton half-loads)	1	3,925	3,925	10	393
Feeder (1-ton, gas)	trailer mounted, gas blower, digital scale	1	13,000	13,000	15	867
Boat	16-ft	1	2,300	2,300	10	230
Boat trailer	for 16-ft boat	1	1,000	1,000	10	100
Trolling motor	motor, 2 batteries, dual charger	1	515	515	5	103
Paddlewheel aerator	PTO, sidewinder	1	3,500	3,500	10	350
Electric aerators	5-hp	16	3,500	56,000	7	8,000
Trailer sprayer	60-gal, 5.5-hp gas engine, pump, hose	1	1,500	1,500	10	150
Tractor	60-hp, 100% used in baitfish production	1	20,000	20,000	15	1,333
Rotary cutter	15-ft, bat-wing, chain guards	1	9,700	9,700	7	1,386
Chemical kit	water quality testing	1	246	246	2	123
Dissolved oxygen meter	meter with probe	1	800	800	4	200
Buckets	5-gal	20	5	100	1	100
Truck	1-ton, flatbed, 4WD, dual rear wheels	1	35,500	35,500	5	7,100
Truck	pickup, ½-ton, 2WD, tow package	1	25,000	25,000	5	5,000
Fish-hauling tank	2 compartments, 300 gal each	1	5,500	5,500	10	550
Regulator, flow meters, hose & diffusers	for hauling tank	1	585	585	5	117
Oxygen cylinders	251-cu ft	8	220	1,760	7	251
Waders	various sizes	4	105	420	1	420
Seines	400-ft, ⅛-in delta, 6 ft deep	1	2,260	2,260	4	565
	50-ft, 1/16-in polyester, 6 ft deep	2	250	500	2	250
	50-ft, 3/16-in delta, 6 ft deep	2	280	560	2	280
Seine reel	7-ft, pull-type	1	6,000	6,000	10	600
Relift pump	1,700 gpm, water transfer	1	10,000	10,000	10	1,000
Subtotal				**200,671**		**29,468**
Equipment for hatchery						
Spawning mats	latex-coated coconut fiber	300	5	1,500	2	750
Pressure washer	gas	1	300	300	5	60
Spawning racks in ponds	6 mats/rack	50	30	1,500	5	300
Plastic tanks and stands	14 mats/tank; 224 to 300 mats	16	500	8,000	10	800
High-pressure pump	supply hatchery from reservoir, ¾-hp	2	590	1,180	2	590
Reservoir tank	3,000-gal	1	1,500	1,500	5	300
Sand filter	swimming pool	1	500	500	5	100

Table 2. Equipment required for a 160-acre baitfish farm with hatchery (continued).

Item	Description	Quantity	Unit cost ($)	Total cost ($)	Useful life (yr)	Annual depreciation ($)
Heaters	electric	2	400	800	7	114
Pipes, valves, fittings	for tanks	16	20	320	10	32
Blower	low-pressure	1	570	570	5	114
Oxygen saturator	commercial	1	920	920	5	184
Air filling kit (regulator, hose, nozzle)	for oxygen to fill fry bags, local sales	1	135	135	10	14
Camper top	for pickup	1	450	450	5	90
Ivermectin applicator gun	formalin application	1	45	45	5	9
Platform truck (wheeled cart)	to move basins	1	450	450	10	45
Basins (cut-off drums)	fry collection from tanks	4	60	240	7	34
Miscellaneous	for 16 tanks	16	30	480	10	48
Subtotal				**18,890**		**3,584**
Equipment for holding shed						
Office furnishings	desk, chair, file cabinets	1	1,000	1,000	10	100
Computer, printer/scanner/fax	desktop	1	1,300	1,300	5	260
Air conditioner/heater	for office	1	400	400	5	80
Well	300-ft	1	25,000	25,000	15	1,667
Aeration tower	tier of screen panels inside frame	1	500	500	20	25
Reservoir tank	cinderblock on slab, below aeration tower	1	2,700	2,700	20	135
Pump	1.5-hp, two-speed	2	550	1,100	5	220
Sand filters	swimming pool-type	2	500	1,000	5	200
Air blower	1.5-hp	2	665	1,330	5	266
Air blower accessories	pressure switch, check valves, muffler, filter	1	285	285	5	57
Pipe, valve, tubing, diffuser hose	for vat air supply	8	35	280	5	56
Miscellaneous	for 8 vats	8	200	1,600	20	80
Grader box	large	1	320	320	10	32
Grader baskets	large	6	190	1,140	10	114
Drag graders	aluminum, flange on edge to fit vats	5	500	2,500	10	250
Generator	8,000-watt	1	1,200	1,200	10	120
Scale	hanging	2	225	450	5	90
Dipnets	various sizes	10	23	230	2	115
Subtotal				**42,335**		**3,867**
TOTAL				**261,896**		**36,919**

week). Electricity and fuel (gas and diesel) are needed for aerators, blowers and utilities for the holding shed and hatchery, and for trucks and tractors. Pumping costs are based on filling three ponds completely each year and replacing 1 foot of water in each pond annually (net losses to seepage and evaporation). An average water depth of 4 feet is assumed. Repair and maintenance costs were adapted from Engle (2007). Baitfish inspection and certification costs include a $1 per acre certification fee, $300 in veterinary fees, $2,000 for fish diagnostic testing at a commercial laboratory, and $100 for delivery of fish to the laboratory.

Interest on operating capital is a charge for use of the capital required to purchase these production inputs. Even if a farmer did not borrow funds from a commercial lender, this charge represents income that could have been earned by investing that money in a bank or some other investment opportunity.

Total variable costs for the 160-acre baitfish farm with a hatchery are $118,983 or $744 per acre. Utilities (electricity, fuel and pumping), labor and feed are the most important variable costs. Feed accounts for 21 percent of total variable costs, labor 22 percent, and utilities 23 percent.

Income above variable costs represents the direct or cash cost. It gives an idea of short-term viability but does not measure profits because fixed costs are not included.

Fixed costs

Table 3 itemizes the annual fixed costs for a 160-acre baitfish farm with a hatchery. Fixed costs are those costs that a farmer will have whether or not any baitfish are produced. Depreciation, for example, is a charge that represents the amount of money that would have to be earned each year by the enterprise to eventually replace all the equipment when it wears out. It is not a cash cost, but if the equipment cannot be replaced, the farmer will eventually go out of business. The straight-line method was used to calculate depreciation. Interest is charged on all investment capital even if none of the capital was borrowed. These interest charges represent what that investment capital would have earned if it had been invested in something else.

Annual fixed costs are $163,720 ($1,023 per acre). Interest on the investment and annual depreciation are the two largest components of annual fixed costs. Annual fixed costs are 58 percent of total annual costs. The annual fixed cost per acre is greater than the $578 to $773 per acre estimated as the annual fixed costs of catfish production. Golden shiner production has higher fixed costs per acre than catfish production because of the investment in holding facilities and the hatchery.

Total costs

Total costs are calculated by adding total fixed costs to total variable costs. Total costs are $282,703 ($1,767 per acre). These total annual costs are less than those for catfish production.

Net returns

Net returns are calculated by subtracting total annual costs from gross receipts. In this budget, net returns were calculated to the operator's labor and management. Annual net returns for the farm are $5,297 ($33 per acre). These net returns represent the average long-term expected profitability of the golden shiner enterprise. The break-even price to cover variable costs is $1.65 per pound, and the break-even price to cover total cost is $3.93 per pound. Break-even yield to cover variable costs is 186 pounds per acre, and to cover total costs it is 442 pounds per acre.

Most baitfish farms are managed by the owner, who is not usually paid a regular salary from the farm. There often is an additional 10 to 15 hours per week of unpaid labor by family members who do the bookkeeping and assist as needed in the farm business. These are real costs that must be considered. The "net returns to operator and family labor and management" are what the owner and family earn from the business.

Risks in golden shiner production

Like any other business, golden shiner production entails various types of risk. Fish may be lost to disease, birds or water quality problems. Market conditions can fluctuate and affect both the demand for and sometimes the price of golden shiners. This enterprise budget was developed with conservative estimates of yield, price and costs.

The ability of a golden shiner enterprise to withstand changes in yield or market price is measured by the break-even prices and yields. The break-even price shows that the price of golden shiners can fall no lower than $3.93 per pound for the business to cover all its costs. If the price falls to $1.65 per pound, the business can cover its variable costs and survive the short term (one production season), but it is not profitable and will not survive in the long run. The break-even yield similarly shows that if the yield of golden shiners falls to 442 pounds per acre the business will still cover all costs. However, marketable yields below 442 pounds per acre will result in losses for the farm. The extent of the financial losses will be proportionate to how far yields fall below the break-even yield.

Start-up considerations

As with any business, start-up costs in the first year will be higher than in subsequent years. It is important to account for these higher costs in planning the farm business. For the baitfish farm, all 16 ponds must be filled with water and brooders must be purchased for the first year. After the first year, fish from the farm will be used as brooders. In subsequent years, three ponds are drained each year and refilled for use as nursery ponds, and the other 13 are kept in production.

Pumping up all ponds in the first year will cost $20,000 to $40,000, depending on local aquifers. Brooders purchased in the spring would be stocked at 300 pounds per acre in one 10-acre pond at a cost of $12,000. However, if the

Table 3. Annual costs and returns for a 160-acre baitfish farm with hatchery.

Item	Unit	Quantity	Price or cost/unit ($)	Value or cost ($)
Gross receipts				
Baitfish	lb	72,000	4	288,000
Variable costs				
Feed				
Minnow meal and crumbles	ton	9	289	2,601
Floating pellets	ton	90	245	22,050
Sinking feed for baiting	ton	2	245	490
Fertilizer, salt, disinfectants (for vats, hatcheries, ponds)	total	1	3,800	3,800
Formalin	55 gal	1	350	350
Potassium permanganate	55-lb drum	1	105	105
Labor				
1 full-time, year-round	week	52	400	20,800
1 full-time, 3.5 months	week	14	400	5,600
Electricity	acre	160	74	11,840
Fuel (gas & diesel)	acre	160	74	11,840
Pumping (from well, three ponds a year)	acre	30	120	3,600
Repairs and maintenance	acre	160	97	15,520
Oxygen	cylinder	60	25	1,500
Bags to move fry, 18-in x 32-in, 3-mil poly shipping bags	box	0.5	60	30
Baitfish inspection/certification	total	1	2,560	2,560
Bird depredation	acre	160	6.25	1,000
Telephone	acre	160	17	2,720
Office supplies	acre	160	11	1,760
Interest on operating capital	dollars	108,166	0.10	10,817
Total variable costs				**118,983**
Income above variable costs				**169,017**
Fixed costs				
Farm insurance	acre	160	43.6	6,976
Legal/accounting		160	18.8	3,008
Interest on investment				
Land	dollars	360,000	0.1	36,000
Holding shed	dollars	36,400	0.1	3,640
Ponds	dollars	240,000	0.1	24,000
Hatchery	dollars	30,000	0.1	3,000
Equipment	dollars	261,896	0.1	26,190
Annual depreciation on equipment				
For holding shed	dollars			3,867
For ponds	dollars			29,468
For hatchery	dollars			3,584
Annual depreciation on real estate	dollars			23,987
Total fixed costs				163,720
Total cost				282,703
Net returns to operator and family labor and management				5,297
Net returns/water-acre				33
Break-even price (per lb sold)	To cover variable costs		total	1.65
	To cover total costs		total	3.93
Break-even yield	To cover variable costs		total	29,746
			per water-acre	186
	To cover total costs		total	70,676
			per water-acre	442

first pond could be built in the fall, smaller, less expensive fish could be purchased, stocked and grown to brood size for spawning the following spring. Alternatively, golden shiners can be stocked lightly (10 to 15 pounds per acre) in all ponds and wild-spawned the first year at a cost of $8,000. Thus, start-up costs in the first year will be $28,000 to $52,000 higher than in subsequent years.

Effect of farm size

Baitfish farming has become more capital intensive in recent years as new hatchery and pond technology has become available. Greater use of capital has resulted in greater productivity overall, but also creates greater economies of scale. When there are economies of scale, increasing farm size spreads the fixed costs associated with the greater amounts of investment capital over more pounds of production, and the production cost per pound goes down. In Arkansas, the average size of baitfish farms has increased because larger farms can produce baitfish at a lower cost per pound and be more competitive in the market place. Larger farms also can supply all the varied sizes and types of baitfish that a buyer wants. This gives larger farms a competitive market advantage as well.

Conclusion

This enterprise budget for golden shiner production is for a hypothetical 160-water-acre farm. Prospective baitfish farmers should use their own estimates of costs in this budget to evaluate the financial feasibility of starting a new farm. It is essential to develop a realistic and comprehensive business and marketing plan before investing in baitfish production.

References

Engle, C.R. 2007. Arkansas catfish production budgets. MP466, Cooperative Extension Program, University of Arkansas at Pine Bluff, Pine Bluff, Arkansas.

SRAC fact sheets are reviewed annually by the Publications, Videos and Computer Software Steering Committee. Fact sheets are revised as new knowledge becomes available. Fact sheets that have not been revised are considered to reflect the current state of knowledge.

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