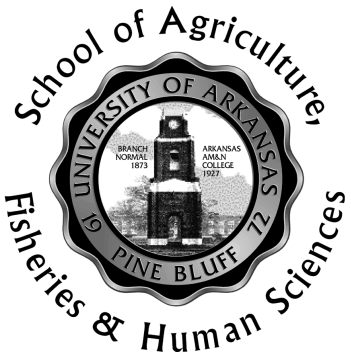
ETB260

Costs of Raising

Largemouth Bass Fingerlings



COOPERATIVE EXTENSION PROGRAM
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Acknowledgments: The authors thank the private farmers and public hatchery managers for taking time to respond to the survey. Anita Kelly, George Selden and Justin Grimm-Greenblatt provided helpful comments on an earlier draft of this bulletin.

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Costs of Raising Largemouth Bass Fingerlings

Introduction

Black bass are the most popular sportfish among freshwater anglers outside the Great Lakes area (USFWS 2006). In response to its popularity as a sportfish, management of bass populations has included supplemental stocking programs. Propagation of largemouth bass fingerlings for stock enhancement was reported in the U.S. as early as 1893 (Worth 1895) and is a priority program in a number of states. Overall, however, the number of non-commercial (public, state, federal or tribal) facilities producing largemouth bass for recreation, restoration or conservation purposes decreased by 21% from 119 in 1997 (USDA 2000) to 94 in 2005 (USDA 2006), according to the most recent aquaculture census data available. Forty-eight percent of the non-commercial facilities for bass were in the north central region while 37% were in the southeast region of the U.S. Arkansas led the nation in numbers of largemouth bass produced by state hatcheries, followed by Oklahoma (USDA 2006).

In addition to public hatcheries, private fish farms also raise largemouth bass in the U.S. The majority of these farmers sell bass to pay lake and farm pond owners for recreational fishing. In contrast to the decreasing trend in the number of public hatcheries raising largemouth bass, the number of private fish farms raising largemouth bass in the U.S. increased from 136 farms with sales of $4.45 million in 1997 (USDA 1998) to 192 farms with sales of $10.63 million in 2002 (USDA 2006). The north central (37%) and southern (32%) regions had the highest numbers of largemouth bass farms. Although Ohio had the largest number of private farms raising largemouth bass, Arkansas led the nation in volume of largemouth bass sales from private farms, followed by California.

There have been few comprehensive economic analyses on the costs of producing largemouth bass fingerlings. Robinette (1999) showed that fingerling costs constituted 39% of the total costs of raising largemouth bass and 48%-51% of variable costs. By contrast, the cost of catfish fingerlings composed only 7% of the total cost and 9% of the variable costs for raising catfish (Engle 2007). Thus, the cost of fingerlings contributed proportionately more to the cost of raising bass than it does for the cost of fingerlings in catfish production. Identification of ways to reduce the cost of producing largemouth bass fingerlings would be a clear benefit to state and federal hatcheries as well as to public and private largemouth bass producers.

When natural resource agencies need estimates of production costs, they have tended to rely on the replacement values reported by Southwick and Loftus (2003) from self-reporting surveys. However, these surveys have not itemized costs or otherwise provided a detailed standardized cost analysis. Thus, it is difficult to reconcile differences such as the reported cost of $1.22 to $2.03 for 6-8 inch largemouth bass reported in Southwick and Loftus (2003) (*Table 1*) with the estimated $1.01 to $1.04 cost per 6-8 inch bass reported by Robinette (1999).

In spite of the importance of largemouth bass for supplemental stocking and the increase in private-farm production of largemouth bass fingerlings, we have not found a comprehensive economic analysis of fingerling bass production that compares costs across production technologies. The objectives of this study were (1) to characterize production practices for largemouth bass fingerling production on both private farms and public hatcheries; and (2) to estimate and

compare production costs for largemouth bass fingerlings of different sizes raised with either forage or pelleted feed. Results of this analysis should provide guidance for managers of both private farms and public hatcheries. It should also point to lines of research with the greatest potential to reduce costs of producing largemouth bass fingerlings.

Table 1. Estimates of replacement values for largemouth bass fingerlings by size.

Fingerling Size	Cost in Southeast Region			Costs Across Nation		
Inches	$/fish	$/inch	$/lb[a]	$/fish	$/inch	$/lb
1	$0.35	$0.35	$778	$0.38	$0.38	$844
2	$0.46	$0.23	$225	$0.44	$0.22	$121
3	$0.64	$0.21	$52	$0.79	$0.26	$65
4	$0.81	$0.20	$28	$0.89	$0.22	$30
5	$0.98	$0.20	$18	$1.20	$0.24	$22
6	$1.22	$0.20	$12	$1.68	$0.28	$17
7	$1.66	$0.24	$10	$2.32	$0.33	$14
8	$2.03	$0.25	$8	$2.57	$0.32	$10

[a]Length-weight relationships of largemouth bass (Piper et al. 1982) were used to convert costs per fish to costs per pound.
SOURCE: Southwick and Loftus (2003).

Survey of Largemouth Bass Fingerling Growers in Southern States

Survey Design

Two surveys were conducted, one of managers of public hatcheries and the second of private farmers that raise largemouth bass fingerlings. Given that the production goals and objectives are distinct for public facilities as compared to private farms, differences in production practices may also differ. Both surveys were conducted only in southern states[1] because climate variation would likely affect production performance. The list frame for private farms that raise largemouth bass was developed by contacting extension specialists in all southern states to request names and addresses of private producers of largemouth bass fingerlings. For the public hatchery survey, the state chiefs of fisheries were contacted to identify public hatcheries in each state in the study area. Questionnaires were developed, pre-tested with both public hatcheries and private farms, revised and then mailed to all those identified in the study area.

Of the 114 private farms in the list frame, 20 did not raise largemouth bass and seven were returned to sender with incorrect addresses, for a sampling universe of 87 (*Table 2*). Of these, 19 completed questionnaires were returned for a response rate of 22%. Of the 40 public hatcheries identified in the list frame, two did not raise largemouth bass and one had an incorrect address, resulting in a sampling universe of 37. Of these, 28 completed questionnaires were returned, for a response rate of 76%. Overall, responses were received from private farms in 11 states and from public hatcheries in 14 states.

[1]Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, Missouri, Oklahoma, North Carolina, South Carolina, Tennessee, Texas and Virginia.

Table 2. Response rate on survey of largemouth bass fingerling producers, private and public, in southern U.S., 2007.

Category	Private Farms		Public Hatcheries	
	Number	%	Number	%
Questionnaires mailed	114	100	40	100
Do not raise largemouth bass	20	18	2	5
Return to sender	7	6	1	2
Sampling universe[a]	87	76	37	92
Completed questionnaires	19	22	28	76

[a]The number of respondents who did not raise largemouth bass and those returned due to lack of forwarding addresses was subtracted from the number of questionnaires mailed to obtain the sampling universe.

Survey Results

Survey respondents raised both the northern and Florida strains of largemouth bass, but more respondents raised the northern strain of largemouth bass (47% of private farms and 36% of public hatcheries) (*Table 3*). However, the Florida strain was relatively more common on public (32%) hatcheries than on private farms (16% of private farms).

Farm sizes varied widely among survey respondents (*Table 4*). Private farms that raised largemouth bass ranged in size from 40 acres to 2,300 acres, with a mean of 521 acres. Public hatcheries ranged in size from 27 acres to 980 acres, with a mean of 230 acres. The average number of vats per facility was 21 for private farms (ranging from 4 to 45) and 17 (ranging from 6 to 74 vats) per facility for public hatcheries. The total area in ponds used for largemouth bass averaged 19 acres for private farms, with a range of 2.5 to 450 acres. Public hatcheries averaged 14 acres (ranging from 0.5 to 42 acres) for largemouth bass. Of the total acreage in bass production on private farms, 55% was used to hold broodfish, 35% for fingerling production and 10% for fry. The proportions of pond space used were different on public hatcheries, with 33% for holding broodfish and 67% for fingerling production.

Average pond size used for holding broodfish was 14 acres on private farms, but only 0.9 acre on public hatcheries (*Table 5*). Fingerlings and yearlings were raised in ponds that averaged 2.6 acres (range of 0.25 to 7.7 acres) on private farms and 0.8 acre (range of 0.35 to 1.75 acres) on public hatcheries.

The majority of respondents (74% of private farms and 71% of public hatcheries) spawned largemouth bass in ponds (*Table 6*). None of the private farms used prepared nesting sites, whereas 25% of the public hatcheries that relied on pond spawning did. Spawning mats were used on 14% of private farms and 15% on public hatcheries that spawned bass in ponds. Only one private farm (as compared to six public hatcheries) spawned largemouth bass in raceways or vats. An additional 16% of private farms and 10% of public hatcheries did not spawn largemouth bass, but purchased fry from other hatcheries. One private farm and one public hatchery wild spawned largemouth bass in ponds with other fish.

Nearly half of all respondents used forage fish (47% of private farms and 50% of public hatcheries) (*Table 7*). However, more than twice as many (68%) private farm respondents used pelleted feeds, as compared to public hatcheries (32%).

Pellet sizes used ranged from 0.06 to 0.25 inch, although high percentages of respondents did not answer the question on pellet sizes used (84% of private farms and 96% of public hatcheries). The most frequently used protein levels were 40%-45% protein (37% of private farms and 14% of public hatcheries) (*Table 8*).

Table 3. Strain of largemouth bass raised on private farms and public hatcheries, survey of largemouth bass fingerling producers in southern U.S., 2007.

Strain	Private Farms		Public Hatcheries		Total	
	Number	%	Number	%	Number	%
Northern	9	47	10	36	19	40
Florida	3	16	9	32	12	26
Both	2	10.5	7	25	9	19
Cross	2	10.5	1	4	3	6
No answer	3	16	1	4	4	9
Total	19	100	28	101[a]	47	100

[a]Percentages do not add to 100 due to rounding.

Table 4. Mean area of facilities used for production of largemouth bass fingerlings on private farms and public hatcheries, survey of largemouth bass fingerling producers in southern U.S., 2007.

Facilities	Unit	Private Farms		Public Hatcheries	
		Value	Range	Value	Range
Total farm area[a]	acre	521	40-2,300	230	27-980
Water area	acre	214	4-942	45	12-165
Land area	acre	337	3-1,500	193	30-912
Vats					
Number	no.	21	4-45	17	6-74
Volume	ft^3	748	134-6,000	374	1,600
Ponds used for bass					
Total area	acre	19[b]	2.5-450	14	0.5-42
Proportion for broodfish	%	55	7-100	33	0-69
Proportion for fingerlings	%	35	8-100	67	31-100

[a]One farm reported using a recirculating system (RAS) instead of ponds.
[b]The farm with the RAS used one vat for bass and one other farm bought fry and raised them in vats.

Table 5. Average sizes of ponds (acres) used for largemouth bass fingerling production, survey of largemouth bass fingerling producers in southern U.S., 2007.

Use	Private Farms			Public Hatcheries		
	n	Mean	Range	n	Mean	Range
Broodstock	5	14	0.5-50	5	0.9	0.5-1.25
Fingerling/yearling rearing	6	2.6	0.25-7.7	6	0.8	0.35-1.75

Table 6. Spawning methods used by private farms and public hatcheries for largemouth bass, survey of largemouth bass fingerling producers in southern U.S., 2007.

Method	Private Farms		Public Hatcheries	
	Number	%	Number	%
Pond spawning	14	74	20	71
Prepared nesting sites	0	0	5	25
No prepared nesting sites	14	100	15	75
Spawning mats	2	14	3	15
No specified method	12	86	12	60
Raceways/vats	1	5	6	20
20 pair/gallon	0	0	1	17
Spawning mats	0	0	2	33
No specified method	1	100	3	50
Do not spawn, buy fry	3	16	3	10
Wild spawn in ponds with other fish	1	5	1	13

Table 7. Types of feed fed to largemouth bass, survey of largemouth bass fingerling producers in southern U.S., 2007.

Feed Type	Private Farms		Public Hatcheries	
	Number	%	Number	%
Forage fish[a]				
Yes	9	47	14	50
No	10	53	11	39
No answer	0	0	3	11
Pelleted feed				
Yes	13	68	9	32
No	6	32	16	57
No answer	0	0	3	11

[a]Types of forage fish mentioned include shad, bluegills, gambusia and bream on private farms and threadfin shad, golden shiners, fathead minnows, bluegill, redear, coppernose, goldfish, tilapia, grass carp and koi carp on public hatcheries.

Table 8. Protein percentages of feeds used by private farms and public hatcheries, survey of largemouth bass fingerling producers in southern U.S., 2007.

Percent Protein	Private Farms		Public Hatcheries	
	Number	%	Number	%
<40%	1	5	3	11
40%-45%	7	37	4	14
>45%	2	11	3	11
No answer	9	47	18	64

The most common size of largemouth bass fingerling produced was 1-2 inches (26% of private farms and 62% of public hatcheries) (*Table 9*). The second-most frequent size produced was 2-3 inches on private farms and 3-5 inches on public hatcheries. Both private farms and public hatcheries produced sizes of bass that ranged from fry to greater than 10 inches.

The survey showed wide disparity in rearing practices, such as stocking and harvesting rates, fertilization, feeding, yields and survival rates (*Table 10*). Those hatcheries (both private and public) that produced 2-inch fingerlings from fry did so primarily in fertilized ponds. Anecdotal comments mentioned that survival and yield were due directly to the quality of the zooplankton bloom achieved with fertilization practices. Yields of fry to 2 inches averaged 142 lb/acre on private farms and 179 lb/acre on public hatcheries (*Table 10*). Survival rates reported for fry to 2 inches averaged 71% on private farms and 70% on public hatcheries, resulting in average numbers of 2-inch bass harvested of 37,116 fish/acre on private farms and 57,828 fish/acre from public hatcheries. Overall, survival rates of fry to 2-inch fingerlings ranged from 0% to 123%.

Fingerlings of 4 inches were produced with forage only, or primarily with feed. Yields of 4-inch bass fed on forage were higher (300 lb/acre) on private farms than on public hatcheries (160 lb/acre). Feed-trained fingerling yields averaged 200 lb/acre on private farms and 71 lb/acre on public hatcheries. Average reported survival rates of 4-inch fingerlings produced averaged 74% to 85% and were similar for private farms and public hatcheries with forage or with feed. Numbers harvested of 4-inch bass raised on forage were 8,000/acre on private farms and 7,900/acre on public hatcheries. Feed-trained fish harvested per acre averaged 17,500 fish/acre on private farms and 3,000 fish/acre on public hatcheries.

The majority of larger bass stockers (6-8 inches) were raised on feed. Reported yields were 2,000 to 2,140 lb/acre on private farms and 403 to 1,058 lb/acre on public hatcheries. Average survival rates of 6-inch bass ranged from 78% to 80%, with numbers of fish harvested ranging from 4,744 to 20,000 fingerlings per acre. However, average survivals reported for 8-inch bass raised on forage were 28% as compared to 74% to 84% on feed.

Table 9. Sizes of largemouth bass fingerlings produced, survey of largemouth bass fingerling producers in southern U.S., 2007.

Size	Private Farms		Public Hatcheries	
Inches	Number	%	Number	%
Fry	1	4	1	2
1-2	6	26	28	62
2-3	4	17	2	4
3-5	3	13	7	16
6-8	1	4	4	9
8-10	2	9	1	2
>10	2	9	1	2
Unknown/no answer	4	17	1	2

Table 10. Mean yields, number harvested and survival of fingerling largemouth bass on private farms and public hatcheries, by size of fingerling harvested and management practice, survey of largemouth bass fingerling producers in southern U.S., 2007.

Size Category	Management Strategy	Private		Public	
		Mean	Range	Mean	Range
YIELD		- lb/acre -			
Fry – 2 inches	Fertilization	142	75-200	179	18-429
4 inches	Forage	300	200-400	160	50-256
	Feed	200	150-250	71	47-95
6 inches	Feed	2,000	1,500-3,000	403	153-694
8 inches	Forage	n.a.	n.a.	162	2-321
	Feed	2,140	Only 1 obs.	1,058	428-2,900
NUMBERS					
Fry – 2 inches	Fertilization	37,116	10,000-100,000	57,828	0-120,000
4 inches	Forage	8,000	7,000-9,000	7,900	4,900-10,800
	Feed	17,500	15,000-20,000	3,000	2,000-4,000
6 inches	Feed	20,000	Only 1 obs.	4,744	2,071-9,800
8 inches	Forage	n.a.	n.a.	756	11-1,500
	Feed	10,000	Only 1 obs.	8,500	2,000-22,000
SURVIVAL RATES					
Fry – 2 inches	Fertilization	71%	25%-100%	70%	0%-123%
4 inches	Forage	n.a.	n.a.	85%	75%-90%
	Feed	74%	65%-90%	80%	Only 1 obs.
6 inches	Feed	80%	75%-90%	78%	65%-89%
8 inches	Forage	n.a.	n.a.	28%	5%-50%
	Feed	74%	50%-90%	84%	68%-100%
STOCKING RATES					
Fry – 2 inches	Fertilization	52,276		82,611	
4 inches	Forage	9,412		9,294	
	Feed	23,649		3,750	
6 inches	Feed	25,000		6,082	
8 inches	Forage	2,700		-	
	Feed	13,514		10,119	
FEED FED					
4 inches		400 lb/ac		142 lb/ac	
6 inches		4,000 lb/ac		806 lb/ac	
6 – 8 inches		4,280 lb/ac		2,116 lb/ac	

Cost Analysis

Economic engineering techniques were used to develop bioeconomic spreadsheet models of largemouth bass fingerling production. Survey results documented considerable variation in production techniques from farm to farm and between private farms and public hatcheries. Standard enterprise budgeting techniques (Engle 2010; Kay et al. 2011) were used to develop spreadsheet cost analyses for each of the following production phases/management scenarios: (1) broodstock holding; (2) pond spawning; (3) raceway spawning; (4) rearing fry to 2 inches following transfer of fry from spawning pond; (5) feed training; (6) rearing fingerlings to 4 inches on forage fish; (7) rearing feed-trained fingerlings to 4 inches on pelleted feed; and (8) rearing feed-trained fingerlings to 6 inches on pelleted feed. Four pond sizes (1 acre, 5 acre, 10 acre and 15 acre) were modeled for each production phase/management scenario based on the range of pond sizes identified in the survey.

Cost analyses were developed separately for private farms and public hatcheries due to the differences in production parameter values identified in the survey. Costs and relevant assumptions are presented for each production phase/management scenario under separate subheadings. Survey results were used where possible and secondary data used as necessary to complete the analyses.

Broodfish Management

Costs to hold broodfish were estimated based on holding broodfish throughout the non-spawning months of the year (10 months) at a stocking rate of 666 fish/acre, based on survey results. With an average size of 3 lb each, the resulting biomass of broodfish was 2,000 lb/acre. Broodfish were fed a pelleted feed at 2% of body weight a day for 285 days per year. According to survey results, public hatcheries held broodfish at a much lower density (150 fish/acre; 450 lb/acre) on forage alone with no feeding. This results in a much higher cost to hold broodfish ($92 to $94 per broodfish). However, some hatcheries reduced their costs of holding broodfish by using "extra" fish produced as forage while still others harvested broodfish from the wild without incurring the costs of holding them on the hatchery. The costs vary substantially with these various options, and sensitivity analyses were used to explore these effects.

Both organic (cottonseed meal) and inorganic fertilizer were applied three times a year (twice in spring and once in the fall) at 50 lb/acre/application of cottonseed meal and 25 lb/acre/application of inorganic fertilizer. Copper sulfate was assumed to be used for control of filamentous algae. Costs associated with labor, utilities, repairs and maintenance, bird depredation, office supplies and fixed costs were adapted from Stone et al. (2008).

Total variable costs accounted for 88% to 90% of the total costs of holding broodfish (*Table 11*). The single largest cost of broodfish maintenance was the cost of feed (87% of total variable cost). Annual depreciation of broodfish was the second largest cost. The cost was based on a purchase price of $7 per broodfish and a useful spawning life of three years each. The cost of holding broodfish decreased from $13,478/acre to $13,178/acre as the size of the holding pond increased from 1 to 15 acres, largely due to the lower fixed costs per acre of larger pond sizes. The annual costs of holding broodfish averaged $20 per 3-lb broodfish.

Table 11. Broodfish holding costs for ponds of 1 acre, 5 acres, 10 acres and 15 acres.

Item	Description	Unit	Cost/ unit	Quantity/ acre	Pond Size			
					1 acre	5 acres	10 acres	15 acres
Variable Costs								
Fertilizer								
Cottonseed meal	3 applications/yr	lb/acre/application	0.212	150	32	159	318	477
Inorganic	3 applications/yr	lb/acre/application	0.54	75	41	203	405	608
Feed	1/8 inch pellet	lb/ac/yr	0.6	11,400[a]	6,840	34,200	68,400	102,600
Shipping feed		lb	0.3	11,400[a]	3,420	17,100	34,200	51,300
Plankton control	copper sulfate	lb/ac/application	1.54	10.8	17	83	166	249
Labor	$165/acre/yr	$/acre/month	$13.75	10	138	688	1,375	2,063
Electricity	$96/ac/yr	$/ac/month	$8.00	10	80	400	800	1,200
Fuel	$130/ac/yr	$/ac/month	$10.83	10	108	542	800	1,200
Pumping	$211/ac/yr	$/ac/month	$17.58	10	176	879	1,758	2,637
Repairs and maintenance	$97/ac/yr	$/ac/month	$8.08	10	81	404	808	1,212
Bird depredation		acre/month	0.52	10	5	26	52	78
Office supplies		acre/month	0.92	10	9	46	92	138
Interest on operating capital			0.0083[b]		908	4,542	9,085	13,627
Total Variable Costs					11,854	59,271	118,542	177,813
Fixed Costs								
Telephone		acre/month	1.42	10	14	71	142	213
Farm insurance		acre/month	3.63	10	36	181	363	544
Legal/accounting		acre/month	1.57	10	15	78	157	235
Broodstock[c]								
Annual depreciation		$/pond	1.00	777	777	3,885	7,770	11,655
Interest on average investment		$/pond	1.00	116.55	117	583	1,166	1,748
Ponds								
Annual depreciation					322	1,068	1,499	1,830
Interest on average investment					161	534	750	915
Equipment								
Annual depreciation					184	922	1,842	2,764
Interest on average investment					63	314	627	941
Total Fixed Costs					1,624	7,305	13,653	19,853
Total Costs					13,478	66,577	132,195	197,667
Total Costs Per Acre					13,478	13,315	13,220	13,178
Cost Per Lb of Broodstock					6.74	6.66	6.61	6.59
Cost Per Brood Fish					20.24	19.99	19.85	19.79

[a]Broodstock were fed 2% of body weight (based on survey results of private farms) for 285 days per year. Public hatcheries held broodfish at 450 lb/ac on forage alone, for a much higher cost per fish unless forage was “free.” Others harvested broodfish from the wild at “no cost.”
[b]Monthly rate, based on 10% Annual Percentage Rate.
[c]Broodstock were assumed to be held at 2,000 lb/ac.

Pond Spawning

Pond spawning was assumed to occur for two months of the year, in March and April. For spawning, broodfish were assumed to be stocked at 50 pairs per acre, or 100 fish/acre. The cost per broodfish was taken from Table 11 and entered into the cost spreadsheet as a variable cost because the number of broodfish needed would vary directly with the amount of production. Broodfish holding costs for 10-acre ponds were used for private farm costs and for 1-acre ponds for public hatcheries due to the different pond sizes used to hold broodfish in the survey. Additional sensitivities were run to assess the effects of varying costs of holding broodfish. Nesting boxes were included in the cost analysis. Other types of costs (fertilizer, labor, utilities, repairs and maintenance) were similar to those used for holding broodfish in ponds. At the end of the spawning period, broodfish were assumed to be moved back to the holding ponds.

The cost of spawning largemouth bass in ponds ranged from $2,790 to $2,740/acre on private farms and from $2,830/acre to $2,780/acre on public hatcheries as the pond size increased from 1 acre to 15 acres each (*Table 12*). The cost of fry produced ranged from $0.055 to $0.057 per fry. There was little difference in the cost per fry between private farms and public hatcheries. The greatest cost was that of the broodfish, composing 71% to 73% of total costs. This was followed by the cost of nesting boxes. Total variable costs composed 96% to 97% of total costs.

Raceway/Vat Spawning

Survey results showed that some hatcheries have begun to spawn largemouth bass in either vats or raceways. Isaac and Staats (1994) concluded that raceway spawning can produce more fry from the same number of broodfish than pond spawning. Vat spawning techniques were adapted from survey results and from recommendations reported by Mayes et al. (1993) and Isaac et al. (1998). A two-week spawning period per pair of broodfish was used, with broodfish rotated every two weeks. Broodfish were also assumed to be injected with human chorionic gonadotropin (HCG). Spawning mats were placed in each raceway. Other variable and fixed costs were adapted from Hinshaw et al. (in preparation).

Overall, the cost of spawning fry produced in raceways was estimated to be $0.00054/fry (*Table 13*). The greatest cost was that of holding the broodfish (47% of total costs) followed by feed (24% of total costs) and then depreciation on equipment (13% of total costs).

Rearing Fry to 2 Inches Following Transfer From Spawning Pond

Fry transfer to nursery ponds was a common practice on both private farms and public hatcheries and was the most common management scenario for public hatcheries. Tidwell et al. (2000) recommended transferring fry to nursery ponds when large numbers could be seen in spawning ponds. Nursery ponds were assumed to be fertilized with cottonseed meal and inorganic fertilizer, with fry reaching 2 inches in 2 months. Yield values were taken from Table 10.

On private farms, the costs per acre were $3,464 to $3,414 with per-fingerling costs of $0.09 each. On public hatcheries, total costs per acre to rear fry in ponds were higher and ranged from $5,281 to $5,231/acre, with costs per 2-inch fingerling of $0.09 each (*Table 14*). The difference in cost per acre was due to the higher stocking rate of fry on public hatcheries. However, since the yield of fingerlings on public hatcheries was higher than on private farms, the overall cost per fingerling produced was similar. The greatest cost item was that of the fry stocked (83% to 89% of total costs), followed by fertilizer costs (5% to 8% of total costs).

Table 12. Pond spawning annual costs for ponds of 1 acre, 5 acres, 10 acres and 15 acres.

Item	Description	Unit	Cost/ unit	Quantity/ acre	Total Cost			
					1 acre	5 acres	10 acres	15 acres
Variable Costs								
Fertilizer, every other week								
Cottonseed meal	4 applications/yr	lb/acre/application	0.212	200	42.4	212	424	636
Inorganic fertilizer	4 applications/yr	lb/acre/application	0.54	100	54	270	540	810
Feed	1/8 inch	lb	0.6	13.5	8	40	81	121
Shipping feed		lb	0.3	13.5	4	20	40	61
Algae control	copper sulfate	lb	1.54	10.8	17	83	166	249
Nesting boxes		box	5	85	425	2,125	4,250	6,375
Labor	165/ac/yr	$/ac/month	13.75	2	27	137	275	412
Electricity	$96/ac/yr	$/ac/month	$8.00	2	16	80	160	240
Fuel	$130/ac/yr	$/ac/month	$10.83	2	22	108	217	325
Pumping	$211/ac/yr	$/ac/month	$17.58	2	6	29	59	88
Repairs and maintenance	$97/ac/yr	$/ac/month	$8.08	2	16	81	162	242
Bird depredation		$/ac/month	0.52	2	1	5	10	16
Office supplies		$/ac/month	0.92	2	2	9	18	28
Interest on operating capital			0.0083[a]	2	11	53	106	159
Total Variable Costs					651	3,254	6,509	9,763
Fixed Costs								
Telephone		$/ac/month	1.42	2	3	14	28	43
Farm insurance		$/ac/month	3.63	2	7	36	73	109
Legal/accounting		$/ac/month	1.57	2	3	16	31	47
Ponds								
Annual depreciation	2 months				54	178	250	305
Interest on average investment	2 months				27	89	125	153
Pond Equipment								
Annual depreciation					31	154	307	461
Interest on average investment					11	52	105	157
Total Fixed Costs					122	473	786	1,075
Private Farms								
Broodfish costs[c]		$/broodfish	19.85	100	1,985	9,925	19,849	29,774
Additional interest on operating capital			0.0083[a]		33	165	329	494
Total costs					2,790	13,817	27,474	41,106
Total costs per acre					2,790	2,763	2,747	2,740
Cost per fry					0.056	0.055	0.055	0.055
Public Hatcheries								
Broodfish costs[b]		$/broodfish	20.24	100	2,024	10,119	20,237	30,356
Additional interest on operating capital			0.0083[a]		34	168	336	504
Total costs					2,830	14,014	27,868	41,698
Total costs per acre					2,830	2,803	2,787	2,780
Cost per fry					0.057	0.056	0.056	0.056

[a]Monthly rate, based on 10% Annual Percentage Rate.
[b]Broodstock were held in smaller ponds on public hatcheries. Costs per broodfish for 1-acre ponds were used for public hatcheries.
[c]Broodstock were held in larger ponds on private farms. Costs per broodfish for 10-acre ponds were used for private farms.

Table 13. Vat/raceway annual costs of spawning.					
Item	**Description**	**Unit**	**Cost/unit**	**Quantity**	**Total Cost**
Variable Costs					
Broodfish costs	Holding costs[a]	broodfish	20	240.00	4,800
Feed		lb	4	600	2,400
Spawning mats		each	5	120	600
Spawning hormone		thousand IU	0.10896	1,309	143
Labor		$/hr	6.9	168	1,159
Electricity		$/month	160	2	320
Fuel		$/month	216	2	432
Pumping		$/month	183	2	366
Repairs and maintenance		$/month	162	2	324
Office supplies		$/month	18	2	36
Interest on operating capital		dollars	0.0083[b]	5,780	96
Total Variable Costs					5,876
Fixed Costs					
Telephone		$/month	28	2	56
Farm insurance		$/month	73	2	146
Legal/accounting		$/month	31	2	62
Raceways					
Annual depreciation					1,067
Interest on average investment					1,067
Equipment					
Annual depreciation					1,346
Interest on average investment					564
Total Fixed Costs					4,252
Total Costs					10,128
Cost Per Pound of Fry		pound of fry		54,119	0.19
Cost Per Fry		fry			0.00054

[a]10 months, w/feeding forage fish.
[b]Monthly rate, based on 10% Annual Percentage Rate.

Table 14. Fry rearing to 2 inches, annual costs in ponds of 1 acre, 5 acres, 10 acres and 15 acres.

Item	Description	Unit	Cost/ unit	Quantity/ acre	Pond Size			
					1 acre	5 acres	10 acres	15 acres
Fertilizer, twice a week for 3 weeks, then 1/week								
Cottonseed meal	11 applications/yr		0.212	550	117	583	1,166	1,749
Inorganic fertilizer	11 applications/yr		0.54	275	148	742	1,485	2,227
Labor	$165/ac/yr	$/ac/month	13.75	2	27	137	275	412
Electricity	$96/ac/yr	$/ac/month	$8.00	2	16	80	160	240
Fuel	$130/ac/yr	$/ac/month	$10.83	2	22	108	217	325
Pumping	$211/ac/yr	$/ac/month	$17.58	2	35	176	352	527
Repairs and maintenance	$97/ac/yr	$/ac/month	$8.08	2	17	81	162	242
Bird depredation		$/ac/month	0.52	2	1	5	10	16
Oxygen	cylinder	$/ac/month	25	0.0313	2	8	16	23
Bags to move fry	box	$/ac/month	60	0.0003	0.04	0.18	0.36	0.54
Office supplies		$/ac/month	0.92	2	2	9	18	28
Interest on operating capital			0.0083[a]		6	32	64	96
Total Variable Costs, excluding fry costs					392	1,962	3,925	5,887
Fixed Costs								
Telephone		acre/month	1.42	2	3	14	28	43
Farm insurance		acre/month	3.63	2	7	36	73	109
Legal/accounting		acre/month	1.57	2	3	16	31	47
Ponds								
Annual depreciation	2 months				54	178	250	305
Interest on average investment	2 months				27	89	125	153
Equipment								
Annual depreciation	2 months				31	154	307	461
Interest on average investment	2 months				11	52	105	157
Total Fixed Costs					135	539	919	1,274
Private Farms								
Fry			0.055	52,276	2,889	14,446	28,891	43,337
Additional interest on operating capital			0.0083[a]		48	240	480	719
Total costs					3,464	17,187	34,214	51,217
Total costs per acre					3,464	3,437	3,421	3,414
Cost per lb[b]					24	24	24	24
Cost per fish[b]					0.093	0.093	0.092	0.092
Public Hatcheries								
Fry			0.057	82,611	4,676	23,378	46,756	70,134
Additional interest on operating capital			0.0083[a]		78	388	776	1,164
Total costs					5,281	26,268	52,376	78,459
Total costs per acre					5,281	5,254	5,238	5,231
Cost per lb[b]					29	29	29	29
Cost per fish[b]					0.091	0.091	0.091	0.090

[a]Monthly rate, based on 10% Annual Percentage Rate.
[b]Average yields reported in the survey were 179 lb/ac (57,828 fingerlings/ac) on public hatcheries and 142 lb/ac (37,116 fingerlings/ac) on private farms.

Feed Training Costs

Survey results showed that 68% of private hatcheries and 32% of public hatcheries raised feed-trained bass. Feed-training costs were developed from information from Tidwell et al. (2000), Davis and Locke (1997) and Robinette (1999) because the survey did not provide sufficient detail from which to estimate costs. Fingerlings were assumed to be transferred to vats for feed training. Feed used during training included krill, krill meal, crumbles and pelleted feeds increasing up to a 0.1-inch pellet. Labor was estimated based on feeding three times a day and frequent grading and transfer of larger fingerling sizes.

Total costs per vat to feed-train bass were $1,052 for 1,500-gallon vats (*Table 15*). Feed training added $0.0187/fingerling to the cost of producing fingerlings. The costs of krill and krill meal were the greatest costs (77% of total costs) followed by labor.

Rearing Fingerlings to 4 Inches on Forage

Costs to rear fingerlings on forage fish were estimated separately for private farms and for public hatcheries because private farms obtained higher yields. On private farms (that averaged high yields), the costs/acre were decreased slightly with pond size ($13,071/acre to $13,021/acre) and the cost/fingerling was $1.63 each (*Table 16*). Hatcheries that have access to supplies of forage fish at no cost would reduce their costs of production by 92%. Total costs per acre to rear largemouth bass to 4 inches on forage on public hatcheries were $13,077/acre to $13,027/acre across the various pond sizes. Ninety-two percent of the cost was the cost of the forage itself; thus, there were few economies of scale and the cost/acre did not decrease greatly with larger pond sizes. The cost per fingerling on public hatcheries was $1.58 to $1.59 each. Farms and hatcheries that have a source of forage fish at no cost could reduce the cost per fingerling to $0.11 for private farms and $0.04 on public hatcheries.

Rearing Feed-Trained Fingerlings to 4 Inches on Feed

Feed-trained fingerlings were fed on pellets that began at 0.1 inch and increased up to 0.14-inch pellets. On private farms, total costs per acre were $2,433/acre to $2,383/acre, with a per-fingerling cost of $0.14 per fish. Feed accounted for 16% to 17% of total costs. On public hatcheries, total costs decreased from $778/acre to $728/acre as pond size increased from 1 acre to 15 acres (*Table 17*). Public hatchery total cost/acre was lower than on private farms due to the lower feeding rates. Feed costs accounted for 18% to 20% of total costs. The cost per fingerling ranged from $0.26 to $0.24 each, higher than on private farms due to the lower yields.

Rearing Feed-Trained Fingerlings to 6 Inches on Feed

The final cost analysis estimated the costs of raising bass fingerlings to a market size of 6 inches (*Table 18*). This required 6 months of growout, with higher amounts of feed used. Assumptions were based on yield values taken from survey responses (*Table 10*) and other literature (Robinette 1999). Private farm costs were $5,447/acre to $5,597/acre with fingerling costs of from $0.27 to $0.28 per fingerling. Public hatchery costs were $3,214 to $3,364/acre, lower than on private farms due to lower quantities of feed fed. Costs per fingerling on public hatcheries ranged from $0.68 per fingerling to $0.71 per fingerling.

Table 15. Feed training annual costs.

Item	Description	Unit	Cost/unit	Quantity	Total Cost
Variable Costs					
Feed					
	krill	lb	19.09	187	3,467
	krill meal	lb	9	3,345	3,014
	crumbles	lb	0.68	322	219
	3/32 inch pellet	lb	0.68	56	38
	1/18 inch pellet	lb	0.65	56	36
Shipping feed		lb	0.3		0
Labor		$/hr	6.9	96	662
Electricity		$/month	160	0.5	80
Fuel		$/month	216	0.5	108
Pumping		$/month	183	0.5	92
Repairs and maintenance		$/month	162	0.5	81
Oxygen		$/month	25	0.5	13
Bags to move fry		$/month	60	0.5	30
Office supplies		$/month	18	0.5	9
Interest on operating capital		dollars	0.0083[a]		33
Total Variable Costs					7,881
Fixed Costs					
Telephone		$/month	28	0.5	14
Farm insurance		$/month	73	0.5	36
Legal/accounting		$/month	31	0.5	15
Vats					
Annual depreciation					13
Interest on average investment					13
Holding shed					
Annual depreciation					62
Interest on average investment					62
Equipment					
Annual depreciation					223
Interest on average investment					96
Total Fixed Costs					537
Total Costs					8,418
Total Costs Per Vat					1,052
Cost Per Lb					6.54
Cost Per Fish					0.0187

[a]Monthly rate, based on 10% Annual Percentage Rate.

Table 16. Rearing fingerlings to 4 inches with forage, annual costs in ponds of 1 acre, 5 acres, 10 acres and 15 acres.

Item	Description	Unit	Cost/ unit	Quantity	Pond Size			
					1 acre	5 acres	10 acres	15 acres
Variable Costs								
Forage		lb	4	3,000	12,000	60,000	120,000	180,000
Fertilizer, 4 applications	total							
Cottonseed meal	4 applications/yr	acre/application	0.212	200	42	212	424	636
Inorganic fertilizer	4 applications/yr	acre/application	0.54	100	54	270	540	810
Labor	$165/ac/yr	$/ac/month	13.75	2	28	138	275	413
Electricity	$96/ac/yr	$/ac/month	$8.00	2	16	80	160	240
Fuel	$130/ac/yr	$/ac/month	$10.83	2	22	108	217	325
Pumping	$211/ac/yr	$/ac/month	$17.58	2	35	176	352	527
Repairs and maintenance	$97/ac/yr	$/ac/month	$8.08	2	16	81	162	242
Bird depredation		$/ac/month	0.52	2	1	5	10	16
Oxygen		$/ac/month	25	0.0313	2	8	16	23
Bags to move fry		$/ac/month	60	0.0003	0.04	0.18	0.36	0.54
Office supplies		$/ac/month	0.92	2	2	9	18	8
Interest on op. capital			0.0083[a]		203	1,014	2,028	3,042
Total Variable Costs					12,420	62,101	124,202	186,303
Fixed Costs								
Telephone		acre/month	1.42	2	3	14	28	43
Farm insurance		acre/month	3.63	2	7	36	73	109
Legal/accounting		acre/month	1.57	2	3	16	31	47
Ponds								
Annual depreciation					54	178	250	305
Interest on average investment					27	89	125	153
Equipment								
Annual depreciation					31	154	307	461
Interest on average investment					11	52	105	157
Total Fixed Costs					122	473	786	1,075
Private Farms								
Fry		per acre	0.055	9,412	520	2,601	5,202	7,803
Additional interest on operating capital			0.0083[a]		9	43	86	130
Total costs					13,071	65,218	130,276	195,310
Total costs per acre					13,071	13,044	13,028	13,021
Cost per lb[b]					44	43	43	43
Cost per fish[b]					1.63	1.63	1.63	1.63
Public Hatchery								
Fry		per acre	0.057	9,294	526	2,630	5,260	7,890
Additional interest on operating capital			0.0083[a]		9	44	87	131
Total costs					13,077	65,248	130,335	195,399
Total costs per acre					13,077	13,050	13,034	13,027
Cost per lb[b]					82	82	81	81
Cost per fish[b]					1.59	1.58	1.58	1.58

[a]Monthly rate, based on 10% Annual Percentage Rate.
[b]Average yields reported in the survey were 160 lb/ac (7,900 fingerlings/ac) on public hatcheries and 300 lb/ac (8,000 fingerlings/ac) on private farms.

Table 17. Rearing feed-trained fingerlings to 4 inches, annual costs in ponds of 1 acre, 5 acres, 10 acres and 15 acres.

Item	Description	Unit	Cost/ unit	Quantity	Pond Size			
					1 acre	5 acres	10 acres	15 acres
Variable Costs								
Fertilizer								
Cottonseed meal	1	acre/application	0.212	50	10.6	53	106	159
Inorganic fertilizer	1	acre/application	0.54	25	13	67	135	202
Labor	$165/ac/yr	$/ac/month	13.75	2	27	137	275	412
Electricity	$96/ac/yr	$/ac/month	$8.00	2	16	80	160	240
Fuel	$130/ac/yr	$/ac/month	$10.83	2	22	108	217	325
Pumping	$211/ac/yr	$/ac/month	$17.58	2	35	176	352	527
Repairs and maintenance	$97/ac/yr	$/ac/month	$8.08	2	17	81	162	242
Bird depredation		$/ac/month	0.52	2	1	5	10	16
Oxygen	cylinder		25	0.0313	2	78	16	23
Bags to move fry	box	acre/month	60	0.0003	0.036	0.18	0.36	0.54
Office supplies		$/ac/month	0.92	2	2	9	18	28
Interest on operating capital		dollars	0.0083[a]		2	12	24	36
Total Variable Costs					147	737	1,475	2,212
Fixed Costs								
Telephone		$/ac/month	1.42	2	3	14	28	43
Farm insurance		$/ac/month	3.63	2	7	36	73	109
Legal/accounting		$/ac/month	1.57	2	3	16	31	47
Ponds								
Annual depreciation					54	178	250	305
Interest on average investment					27	89	125	152
Equipment								
Annual depreciation					31	154	307	461
Interest on average investment					11	52	4	157
Total Fixed Costs					135	539	818	1,274
Private Farms								
Fry		per acre	0.055	23,649	1,307	6,535	13,070	19,605
Feed training			0.0187		442	2,211	4,422	6,633
Feed	3/32 inch	lb	0.65	133.33	160	800	1,600	2,400
	1/8 inch	lb	0.6	266.67	120	600	1,200	1,800
Shipping feed		lb	0.3	400	120	600	1,200	1,800
Additional interest on operating capital			0.0083[a]		35	176	351	527
Total costs					2,433	12,031	23,895	35,750
Total costs per acre					2,433	2,406	2,390	2,383
Cost per lb[b]					12.17	12.03	11.95	11.92
Cost per fish[b]					0.14	0.14	0.14	0.14
Public Hatcheries								
Fry		per acre	0.057	4,750	269	1,344	2,688	4,033
Feed training			0.0187		89	444	888	1,332
Feed	3/32 inch	lb	0.65	47.33	57	284	568	852
	1/8 inch	lb	0.6	94.67	43	213	426	639
Shipping feed		lb	0.3	142	43	213	426	639
Additional interest on operating capital			0.0083[a]		8	40	81	121
Total costs					778	3,756	7,345	10,924
Total costs per acre					778	751	734	728
Cost per lb[b]					11	11	10	10
Cost per fish[b]					0.26	0.25	0.24	0.24

[a]Monthly rate, based on 10% Annual Percentage Rate. [b]Average yields reported in the survey were 71 lb/ac (3,000 fingerlings/ac) on public hatcheries and 200 lb/ac (17,500 fingerlings/ac) on private farms.

Table 18. Rearing feed-trained fingerlings to 6 inches, annual costs in ponds of 1 acre, 5 acres, 10 acres and 15 acres.

Item	Description	Unit	Cost/ unit	Quantity	Pond Size			
					1 acre	5 acres	10 acres	15 acres
Variable Costs								
Fertilizer								
Cottonseed meal	1	lb/acre/application	0.212	50	11	53	106	159
Inorganic fertilizer	1	lb/acre/application	0.54	25	13	67	135	202
Labor	$165/ac/yr	$/ac/month	13.75	6	82	412	825	1,237
Electricity	$96/ac/yr	$/ac/month	$8.00	2	16	80	160	240
Fuel	$130/ac/yr	$/ac/month	$10.83	2	22	108	217	325
Pumping	$211/ac/yr	$/ac/month	$17.53	2	35	175	351	526
Repairs and maintenance	$97/ac/yr	$/ac/month	$8.08	2	16	81	162	242
Bird depredation		$/ac/month	0.52	6	3	16	31	47
Oxygen	cylinder	$/ac/month	25	0.0313	5	23	47	70
Bags to move fry	box	$/ac/month	60	0.0003	0.11	0.54	1.08	1.62
Office supplies		$/ac/month	0.92	6	6	28	55	83
Interest on operating capital			0.0083[a]		10	52	104	156
Total Variable Costs					219	1,097	2,193	3,290
Fixed Costs								
Telephone		acre/month	1.42	6	9	43	85	128
Farm insurance		acre/month	3.63	6	22	109	218	327
Legal/accounting		acre/month	1.57	6	9	47	94	141
Ponds								
Annual depreciation					161	534	749	915
Interest on average investment					81	267	375	457
Equipment								
Annual depreciation					92	461	921	1,382
Interest on average investment					32	157	314	471
Total Fixed Costs					405	1,617	2,756	3,821
Private Farms								
Fry		per acre	0.055	13,514	747	3,734	7,469	11,203
Feed training		per fish	0.0187		253	1,263	2,527	3,790
Feed	3/32 inch	lb	0.65	1,426.7	1,712	8,560	17,120	25,680
	1/8 inch	lb	0.6	2,853.3	1,284	6,420	12,840	19,260
Shipping feed			0.3	4,280	1,284	6,420	12,840	19,260
Additional interest on operating capital			0.0083[a]		50	249	498	747
Total costs					5,597	27,577	54,676	81,701
Total costs per acre					5,597	5,515	5,468	5,447
Cost per pound[b]					2.62	2.58	2.55	2.55
Cost per fish[b]					0.28	0.28	0.27	0.27
Public Hatcheries								
Fry		per acre	0.057	10,119	573	2,864	5,727	8,591
Feed	3/32 inch	lb	0.65	705	458	2,292	4,585	6,877
	1/8 inch	lb	0.6	1,411	846	4,232	8,464	12,696
Shipping feed			0.3	2,116	635	3,174	6,348	9,522
Feed training		per fish	0.0187		189	946	1,892	2,838
Additional interest on operating capital			0.0083[a]		38	190	379	569
Total costs					3,364	16,412	32,344	48,204
Total costs per acre					3,364	3,282	3,234	3,214
Cost per pound[b]					8.35	8.14	8.03	7.97
Cost per fish[b]					0.71	0.69	0.68	0.68

[a]Monthly rate, based on 10% Annual Percentage Rate.

[b]Average yields reported in the survey were 1,058 lb/ac (8,500 fingerlings/ac) on public hatcheries and 2,140 lb/ac (10,000 fingerlings/ac) on private farms.

Effect on Fingerling Costs of Raceway Spawning

Spawning largemouth bass broodstock in raceways reduced the overall cost of producing bass fingerlings by 0% to 911% (*Table 19*). The cost reductions were greatest for producing 2-inch fingerlings because the cost of fry was the greatest cost component for that scenario.

Effect on Fingerling Costs of Using Forage Instead of Feed for Broodfish

The cost of largemouth bass fingerlings increased by 0% to 242% when broodfish were fed purchased forage fish (*Table 20*). The greatest effect of feeding broodfish with purchased forage on fingerling production costs was on the cost of producing 2-inch fingerlings, and the least effect was on production of 4-inch bass on forage fish. Those hatcheries that have a ready source of forage fish at no direct cost to the farm or hatchery could save from 0% to 32% of the cost of producing largemouth bass fingerlings (*Table 21*).

Table 19. Costs per largemouth bass fingerling when broodfish were spawned in raceways instead of ponds for various management strategies and pond sizes.

Strategy	1 acre		5 acres		10 acres		15 acres	
	$/fing.	% change	$/fing.	% change	$/fing.	% change	$/fing.	% change
2 inch								
Private	0.015	-520	0.014	-564	0.014	-557	0.014	-557
Public	0.010	-810	0.009	-911	0.009	-911	0.009	-900
4 inch, forage								
Private	1.57	-4	1.56	-4	1.56	-4	1.56	-4
Public	1.59	0	1.58	0	1.58	0	1.58	0
4 inch, feed								
Private	0.06	-133	0.06	-133	0.06	-133	0.06	-133
Public	0.17	-53	0.16	-56	0.15	-60	0.15	-60
6 inch								
Private	0.24	-17	0.24	-17	0.23	-17	0.23	-17
Public	0.58	-22	0.57	-21	0.56	-21	0.55	-24

Table 20. Costs per largemouth bass fingerling when broodfish were fed forage, purchased for various management strategies and pond sizes.

Strategy	1 acre		5 acres		10 acres		15 acres	
	$/fing.	% change	$/fing.	% change	$/fing.	% change	$/fing.	% change
2 inch								
Private	0.304	+227	0.303	+226	0.303	+228	0.303	+228
Public	0.308	+238	0.308	+238	0.308	+238	0.308	+242
4 inch, forage								
Private	1.81	+10	1.81	+10	1.80	+10	1.80	+10
Public	1.59	0	1.58	0	1.58	0	1.58	0
4 inch, feed								
Private	0.34	+143	0.34	+143	0.34	+143	0.34	+143
Public	0.50	+92	0.49	+96	0.48	+100	0.48	+100
6 inch								
Private	0.38	+36	0.38	+36	0.38	+41	0.38	+41
Public	1.04	+46	1.03	+49	1.02	+50	1.01	+49

Table 21. Costs per largemouth bass fingerling when broodfish were fed forage fish available at no cost.

Strategy	1 acre		5 acres		10 acres		15 acres	
	$/fing.	% change	$/fing.	% change	$/fing.	% change	$/fing.	% change
2 inch								
Private	0.065	-30	0.064	-31	0.064	-30	0.063	-32
Public	0.066	-27	0.065	-29	0.065	-29	0.065	-28
4 inch, forage								
Private	1.61	-1	1.61	-1	1.60	-2	1.60	-2
Public	1.59	0	1.58	0	1.58	0	1.58	0
4 inch, feed								
Private	0.11	-21	0.11	-21	0.11	-21	0.11	-21
Public	0.23	-12	0.22	-12	0.22	-8	0.21	-12
6 inch								
Private	0.27	-4	0.26	-7	0.26	-4	0.26	-4
Public	0.67	-6	0.65	-6	0.64	-6	0.64	-6

Summary and Conclusions

The costs of producing largemouth bass fingerlings varied greatly across the management scenarios, as follows:

- Pond-spawned fry cost $0.055 to $0.057 per fry
- Raceway-spawned fry cost $0.0054 per fry
- 2-inch bass fingerlings cost $0.09 per fingerling
- Feed training cost $0.0187 per fingerling
- 4-inch fingerlings raised on forage cost $1.58 to $1.63 per fingerling
- 4-inch fingerlings raised on feed cost $0.14 per fingerling on private farms and $0.24 to $0.26 on public hatcheries
- 6-inch fingerlings cost $0.27 to $0.28 per fingerling on private farms and $0.68 to $0.71 on public hatcheries

The production costs were similar for private farms and public hatcheries where management practices were similar. However, private farms that raised feed-trained fingerlings stocked at higher rates and obtained greater yields than did public hatcheries. The greater yields resulted in reductions in the cost per fingerling.

The least-cost fingerling was 2-inch fingerlings raised primarily in fertilized ponds. However, the cost per fingerling of 4-inch feed-trained fingerlings was only $0.05 per fingerling more when raised at the densities and feeding rates used on private farms. Raising 4-inch fingerlings on forage resulted in a more than 100-fold increase in the cost per 4-inch fingerling.

The costs estimated in this analysis are substantially lower than those reported by Southwick and Loftus (2003). It should be noted that the Southwick and Loftus (2003) values are intended for use as replacement values following fish kills and were not developed with standardized cost budgeting methods. It should also be noted that different facilities will likely have differing costs. It would be best for facilities to attempt to track costs annually at their facilities using the cost analysis framework developed in this analysis. However, it can be difficult to apportion costs across various species and sizes raised on facilities that produce a large number of species and sizes of fish.

This analysis is the first to present a comprehensive comparison of production costs of largemouth bass fingerling production. Given the variation in management practices and in production parameter values such as yield and survival, there appears to be substantial need for additional research on optimizing largemouth bass fingerling production strategies. Reducing the variability of yields and survival, particularly in the early production stages, would have a substantial effect on reducing costs of producing 2-inch fingerlings. Raceway spawning methods also appear to have the potential to reduce costs of producing largemouth bass fingerlings. Results of this analysis should be of value to farmers and hatchery managers to make decisions on the most cost-effective production methods for their farms and hatcheries.

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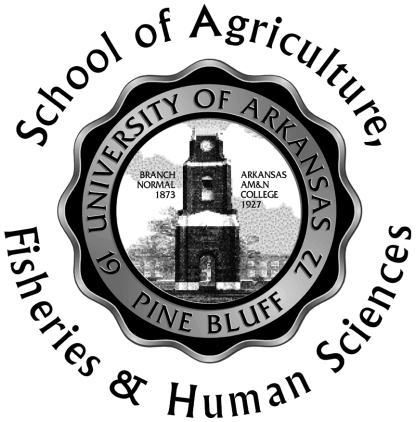

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Printed by University of Arkansas Cooperative Extension Service Printing Services.

ETB260-PD-4-13N