

# THE AQUACULTURE INDUSTRY OF ARKANSAS IN 1979

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*Abstract:* A survey of previous Arkansas fish farmer certificate holders was conducted during 1978-79 through the use of renewal questionnaires, telephone conversations, and personal contacts. This survey was compared to similar surveys from preceding years. Approximately 65.3 percent of the 13,540 intensively farmed hectares in 1978-79 was devoted to the production of bait fish, while 28.1 percent was utilized in food fish production. Total area in bait fish production has remained virtually unchanged since 1975-76, but the value of the bait fish industry has increased by 7.0 percent. A 30.8 percent increase in area intensively farmed for food fish has resulted in a 17.0 percent increase in food fish value since 1975. Area devoted to catfish fingerling production increased 130.2 percent over the 1975-76 survey, while the total value of catfish fingerlings increased 70.8 percent. The aquaculture industry of Arkansas appears to be a relatively stable industry that is flexible enough to absorb mild fluctuations in various production values over an extended period of time.

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In 1968, Meyer et al. (1968) conducted 1 of the first surveys on the commercial production of fish in Arkansas. Since that time, the fish farming industry has shifted from a "new industry" type of growth (Meyer et al. 1971, Bailey et al. 1974) and currently fluctuates according to the rule of supply and demand (Bailey et al. 1978). Changes in the industry have been monitored periodically during the last 13 years as part of the Commercial Fisheries Industry Survey, partially funded as a Public Law 88-309 Project by the National Marine Fisheries Service.

Since Arkansas is located in the middle of the fish belt (Hulsey 1965), changes in fish production values for the state should reflect national trends in the warm water production of fish. The current survey documents the changes in the industry from 1 July 1975 to 30 June 1979.

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## METHODS

Each year the Arkansas Game and Fish Commission's Fiscal Division contacts previous fish farmer certificate holders by means of a renewal notice. In 1977, several questions pertaining to the production acreage of various species of fish were incorporated into this notice. Although it was not mandatory for a person to answer these questions in order to have his fish farmer certificate renewed, most applicants were quite frank and listed the acreage of each species of fish they planned to grow in 1978-79. A telephone survey was conducted during the summer of 1979 in an attempt to verify the acreage that each responding farmer had actually had in production and to obtain further information on yields and current market prices. The projected 1978-79 acreage of a responding farmer was deemed valid and used in calculating the total acreage in production when the farmer could not be contacted by telephone.

An effort was also made during this telephone survey to contact any applicant who had not responded to the renewal notice questions. Fish farming permit applicants, who did not respond to these questions and who could not be reached by telephone, were visited by their respective district fishery biologists when possible. Any fish farmer not contacted by one of the above methods was not included in the survey. All values were obtained in English units, tabulated and then converted to metric units. Yields per hectare and prices per kilogram represent weighted means calculated for reporting fish farmers.

## RESULTS AND DISCUSSION

Four hundred ninety-eight prospective fish farmers were contacted during this survey. One hundred three of these were no longer in business or had erroneously applied for a fish farming certificate, leaving 395 bonafide fish farmers. Bait fishes were raised by 124 of these farmers; food fishes were grown by 257 farmers; and fingerlings, ornamentals and miscellaneous fishes were raised by 73 farmers. Several farmers raised fish from more than 1 of these major categories on the same farm. Acreage and production values supplied by applicants are believed to be reasonably accurate.

Bait fish production accounts for 65.3 percent of the intensively farmed water in Arkansas (Table 1). Total area in bait fish production has remained virtually unchanged since 1975-76 (Tables 2 and 3) with the exception of an unusually large increase in 1977-78 (Table 4). The principal species raised for bait in order of importance continue to be the golden shiner (*Notemigonus crysoleucas*), fathead minnow (*Pimephales promelas*) and goldfish *Carassius auratus*). Production of Israeli carp (*Cyprinus carpio*), the nearly scaleless variety of the common carp, as a bait fish is of minor significance.

Average production of golden shiners has decreased by 73 kg per hectare since 1975-76 as the result of a shift to a "natural" type of production. This management program utilizes a fertilizer created bloom without supplemental feeding, resulting in lower production costs. The shift in golden shiner production methods has resulted in a 6.9 percent decrease in total minnow harvest since 1975-76 although the area in bait fish farming increased by 3.0 percent. Prices for the 3 major species of bait fishes have all increased since 1975-76 as a result of inflationary pressures. The value of the bait fish industry has increased by 7.0 percent since 1975-76. The price used for goldfish is an average of the weighted mean for feeder (aquaria) goldfish and the weighted mean for trotline size goldfish assuming an equal production ratio.

Food fish are produced on 28.1 percent of the intensively farmed water in Arkansas (Table 1). Intensively farmed waters differ from extensively farmed waters in that fish production is the primary concern under the intensive situation and of secondary importance in an extensive situation. Examples of extensively farmed waters include private lakes, some fee fishing lakes and irrigation reservoirs that are licensed as fish farms for various reasons and are often only partially harvested. Extensively farmed waters have decreased by 30.1 percent since 1975-76 (Table 2) mainly as a result of a 54.6 percent decrease in non-intensive fee fishing operations. Food fish were raised intensively and extensively on 42.2 percent of the total area devoted to fish farming in 1978-79.

Intensively farmed food fish species include the channel catfish (*Ictalurus punctatus*), blue catfish (*Ictalurus furcatus*), bigmouth buffalo (*Ictiobus cyprinellus*) and rainbow trout (*Salmo gairdneri*). A wide variety of species are present in extensively farmed ponds.

Bailey et al. (1978) documented a 31.3 percent decrease in total area devoted to intensive food fish production and a 35.7 percent decrease in total production by weight from mid 1972 to mid 1976. A reversal of this trend occurred from mid 1975 to mid 1979 with a 30.8 percent increase in the area intensively farmed for food fish and a 35.2 percent

Table 1. Commercial fish production in Arkansas - 1 July 1978 to 30 June 1979.

	Hectare	kg/ Hectare	Total kg	Price/ kg	Total Value
<i>Bait Fishes</i>					
Golden Shiner	7,346	357	2,623,382	\$ 3.81	\$ 9,985,591
Fathead Minnows	1,033	449	463,954	3.85	1,786,400
Goldfish	449	734	329,642	4.95	1,631,894
Israeli Carp	12	337	4,227	2.20	9,300
Totals	8,840		3,421,205		\$ 13,413,185
<i>Food Fishes</i>					
Catfish	2,615	2,555	6,680,593	\$ 1.43	\$ 9,554,204
Buffalo	372	1,179	438,570	.59	260,537
Buffalo (Polyculture with Catfish)	597	410	244,691	1.19	290,723
Trout	8	5,989	48,480	4.20	203,732
Cage Trout	---	---	36,360	2.97	108,000
Cage Catfish	---	---	126,578	1.43	181,025
Raceway Trout	---	---	45,450	4.09	186,000
Extensive Farming All Species <sup>1</sup>	2,718	1,598	4,342,950	1.32	5,733,267
Fee Fishing (Intensive) Catfish	207	602	124,729	1.43	178,380
Fee Fishing (Intensive) Trout	4	13,364	48,677	\$ 3.85	\$ 187,425
Fee Fishing (Non-Intensive) All Species <sup>1</sup>	582	---	---	---	5,525
Totals	7,103		12,137,078		\$ 16,883,293

Table 1. (cont.).

	Hectare	kg/ Hectare	Total kg	Price/ kg	Total Value
<i>Ornamentals</i>	36	1,684	61,358	\$ 8.80	\$ 540,000
<i>Fingerlings and Miscellaneous</i>					
Largemouth Bass	1	9,884 <sup>2</sup>	12,000 <sup>3</sup>	\$ 1.05 <sup>4</sup>	\$ 12,600
Catfish	803	2,138	1,716,890	2.66	4,570,818
White Amur	28	674	19,089	7.70	147,000
White Amur and Silver Carp	16	1,123	18,180	6.60	120,000
Trout Fingerlings	---	---	1,364	6.60	9,000
Crayfish	12	20,590 <sup>2</sup>	249,990 <sup>3</sup>	.03 <sup>4</sup>	7,500
Freshwater Shrimp	1	898	727	11.00	8,000
Totals	861		1,756,250 +261,990 fish		\$ 4,874,918
GRAND TOTALS	16,840		17,375,891 kg +261,990 fish		\$ 35,711,396

<sup>1</sup>These totals should not be included with comparing intensive culture of 1978-79 to that of previous years.

<sup>2</sup>Fish/ha

<sup>3</sup>Fish

<sup>4</sup>Price/Fish

Table 2. Commercial fish production in Arkansas - 1 July 1975, to 30 June 1976<sup>1</sup>

	Hectare	kg/ Hectare	Total kg	Price/ kg	Total Value
<i>Bait Fishes</i>					
Golden Shiner	7,279	430	3,130,869	\$ 3.39	\$ 10,608,400
Fathead Minnows	963	337	324,513	3.56	1,156,700
Goldfish	344	663	218,160	3.48	758,400
Totals	8,586		3,673,542		\$ 12,523,500
<i>Food Fishes</i>					
Channel Catfish	2,758	1,854	5,113,080	\$ 1.32	\$ 6,749,900
Blue Catfish	11	592	6,227	1.61	10,000
Buffalo	32	1,179	38,178	.57	21,800
Buffalo (Polyculture with Catfish)	---	410	55,131	.62	34,000
Trout	3	5,615	18,180	3.30	60,000
Cage Trout	---	---	36,542	2.03	74,400
Cage Catfish	---	---	294,380	1.32	388,000
Raceway Trout	---	---	46,586	2.11	98,600
Raceway Catfish	---	---	2,045	1.10	2,250
Extensive Farming All Species <sup>2</sup>	3,434	1,598	5,488,350	1.19	6,577,040
Fee Fishing (Intensive) Catfish	96	602	57,494	1.96	112,500
Fee Fishing (Intensive) Trout	7	13,364	97,354	3.17	308,900
Fee Fishing (Non-Intensive) All Species <sup>2</sup>	1,283	---	---	---	12,200
Totals	7,624		11,253,547		\$ 14,429,590

Table 2. Cont.

	Hectare	Number/ Hectare	Total Number	Price/ Fish	Total Value
<i>Ornamentals</i>	38	1,990	74,902	\$ 10.83	\$ 811,000
<i>Fingerlings and Miscellaneous</i>					
Largemouth Bass	1	9,884	17,500 <sup>3</sup>	\$ 1.05	\$ 18,450
Channel Catfish	349	84,291	29,404,500	.09	2,675,800
White Catfish	4	49,420	200,000	.20	40,000
White Amur	117	1,448	170,000	1.00	170,000
Trout	---	---	50,000	.15	7,300
Crayfish	15	16,257	250,000	.03	7,500
Totals	486		30,092,000		\$ 2,919,050
Grand Totals	16,734		15,001,991 kg + 30,092,000 fish		\$ 30,683,140

<sup>1</sup>After Bailey et al. (1978).

<sup>2</sup>These totals should not be included when comparing intensive culture of 1975-76 to that of previous years.

<sup>3</sup>This includes polyculture.

Table 3. Commercial fish production in Arkansas - July 1976, to 30 June 1977.

	Hectare	kg/ Hectare	Total kg	Price/ kg	Total Value
<i>Bait Fishes</i>					
Golden Shiner	7,279	430	3,130,869	\$3.52	\$ 11,021,760
Fathead Minnows	926	337	311,969	3.56	1,111,968
Goldfish	344	633	218,160	3.48	758,400
Totals	8,549		3,660,998		\$ 12,892,128
<i>Food Fishes</i>					
Channel Catfish	2,558	1,854	4,743,149	\$ 1.32	\$ 6,261,563
Blue Catfish	11	592	6,227	1.61	10,000
Buffalo	12	1,179	14,317	.57	8,190
Buffalo (Polyculture with Catfish)	---	410	55,131	.62	34,000
Trout	3	5,615	18,180	3.30	60,000
Cage Trout	---	---	36,542	2.05	74,400
Cage Catfish	---	---	294,380	1.32	388,000
Raceway Trout	--	---	46,586	2.11	98,600
Raceway Catfish	---	---	2,045	1.10	2,250
Extensive Farming All Species	3,434	1,598	5,485,815	1.19	6,517,800
Fee Fishing (Intensive) Catfish	96	602	57,494	1.96	112,500
Fee Fishing (Intensive) Trout	7	13,364	97,354	\$ 3.17	\$ 308,900
Totals	6,121		10,857,220		\$ 13,876,223

Table 3. Cont.

	Hectare	Number/ Hectare	Total Number	Price/ Fish	Total Value
<i>Ornamentals</i>	38	1,990	74,902	\$10.82	\$ 811,000
<i>Fingerlings and Miscellaneous</i>					
Largemouth Bass	1	9,884	12,000	\$1.05	\$ 12,600
Channel Catfish	349	84,291	29,404,500	.09	2,675,800
White Amur	117	1,448	170,000	1.20	204,000
Trout	---	---	50,000	.15	7,500
Totals	467		29,586,500		\$ 2,899,900
Grand Totals	15,175		14,593,120 kg +20,586,500 fish		\$ 30,479,251

<sup>1</sup>After Henderson and Woodriddle (1977).



Table 4. Commercial fish production in Arkansas - 1 July 1977, to 30 June 1978<sup>1</sup>.

	Hectare	kg/ Hectare	Total kg	Price/ kg	Total Value
<i>Bait Fishes</i>					
Golden Shiners	9,669	391	3,778,744	\$ 3.41	\$ 12,886,805
Fathead Minnows	845	466	394,022	3.39	1,335,080
Goldfish	465	1,134	527,443	4.51	2,379,005
Israeli Carp	6	348	2,113	3.74	7,905
Totals	10,985		4,702,322		\$ 16,608,795
<i>Food Fishes</i>					
Catfish	2,098	1,998	4,192,360	\$ 1.50	\$ 6,272,398
Buffalo	385	767	295,213	.44	129,907
Buffalo (Polyculture with Catfish)	72	225	16,180	.97	15,644
Cage and Raceway Trout	---	---	47,723	3.89	185,850
Cage Catfish	---	---	136,350	1.43	195,000
Totals	2,555		4,687,826		\$ 6,798,799
<i>Ornamentals</i>					
	61	1,684	102,944	\$ 8.80	\$ 906,000
<i>Fingerlings and Miscellaneous</i>					
Largemouth Bass	4	9,884 <sup>2</sup>	40,000 <sup>3</sup>	\$ 1.05 <sup>4</sup>	\$ 42,000
Channel Catfish	1,039	1,741	1,808,387	\$ 2.66	\$ 4,814,409
White Amur	58	561	32,497	7.70	250,250
White Amur and Silver Carp Fing.	22	1,123	24,543	6.60	162,000

Table 4. Cont.

	Hectare	kg/ Hectare	Total kg	Price/ kg	Total Value
Crayfish (Bait)	14	20,591 <sup>2</sup>	283,322 <sup>3</sup>	\$ .03 <sup>4</sup>	8,500
Totals	1,137		1,865,427 +323,322 fish		\$ 5,277,159
Grand Totals	14,738		11,358,519 kg +323,322 fish		\$ 29,590,753

<sup>1</sup>After Henderson et al. (1978).

<sup>2</sup>Fish/ha

<sup>3</sup>Fish

<sup>4</sup>Price/fish

increase in intensive production by weight. A major factor in these increases has been the renewal of buffalo production both alone and in polyculture with catfish. Food fish prices have increased somewhat since 1975-76 (Table 2) and this combined with increased production resulted in a total value for 1978-79 food fish 17.0 percent greater than that of 1975-76.

Private cage culture operations that appeared so promising in 1975-76 (Bailey et al. 1978) have apparently suffered from mismanagement and financial problems. While the weight of cage produced trout has remained relatively stable since 1975-76 (Tables 1, 2, 3 and 4), the weight of cage produced channel catfish has decreased by 57.1 percent during this period. At least 1 large Arkansas cage culture operation has gone out of business since 1975-76.

Intensive fee fishing trout waters have declined by 50.0 percent since 1975-76, while waters in intensive trout farming have increased by 150.0 percent. Evidently, some trout farmers have abandoned the fee fishing method of harvest in favor of harvesting their own crop and, thereby, obtaining an average of \$0.41 per kilogram more for their fish.

The area in ornamental fish production increased steadily from 1975-76 through 1977-78 (Tables 2, 3 and 4), but decreased to near 1975-76 values in 1978-79 (Table 1). Production area of some fancy goldfish may have erroneously been listed under the goldfish bait category by some farmers resulting in the unusual decline in ornamental fish production values.

The area devoted to catfish fingerling production increased 130.2 percent over the 1975-76 evaluation (Tables 1 and 2). Since most farmers reported their production by weight instead of numbers, the 1978-79 production figures cannot be directly compared to those of 1975-76, but according to increases in hectarage the 1978-79 production is approximately double that of 1975-76. The total value of 1978-79 catfish fingerlings increased by 70.8 percent over that of 1975-76 channel catfish fingerlings. Trout fingerling production has also increased since 1975-76 with the total value of the fish increasing by 23.2 percent.

The production of white amur as a weed control agent has continued to decline since 1976-77, probably as a result of importation bans by various states and the increasing numbers of producers in other states allowing their use. A tripling in white amur prices since 1975-76 has kept the total value of the 1978-79 crop at a level comparable to that of 1975-76. Another "Chinese carp", the silver carp (*Hypophthalmichthys molitrix*), is currently produced in polyculture with the white amur (Tables 1 and 4). According to Henderson (1975), "the presence of silver carp will enhance the water quality of certain aquatic systems and at the same time produce a usable source of protein in the form of fish flesh."

Two acres of freshwater shrimp (*Macrobrachium rosenbergii*) were raised by a fish farmer on an experimental basis in 1978-79 and the results were quite promising. These shrimp were assigned an estimated value of \$11.00 per kilogram on the basis of saltwater shrimp prices. The only other crustacean cultured in Arkansas was the red swamp crayfish (*Procambarus clarkii*), which was raised on a limited basis for bait.

The fish farming industry for Arkansas appears to be a relatively stable industry that is capable of absorbing mild fluctuations in various production values over an extended period of time. For example, a major shift in food fish production from extensively farmed waters to intensively farmed waters is presently occurring as the demand for food fish increases. The production of bigmouth buffalo has also increased as demand for a less expensive product has increased. The flexibility of the fish farming industry in reducing overhead as in golden shiner production, and in the production of a new species of fish (i.e. silver carp), also adds to this stability.

Although the industry may be stable, the same problems still confront the beginning fish farmer as during the last 20 years. Bailey (1978) listed these as "nutrition, diseases, construction costs, water management, marketing, crop land allocation, and the large initial investment capital required." Great steps have been made in such areas as nutrition and diseases, while problems have occurred in other areas (i.e. construction costs). The fact that many fish farmers are able to overcome these problems is evidenced by the \$35.7 million 1978-79 total value of the industry in Arkansas.

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