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Service

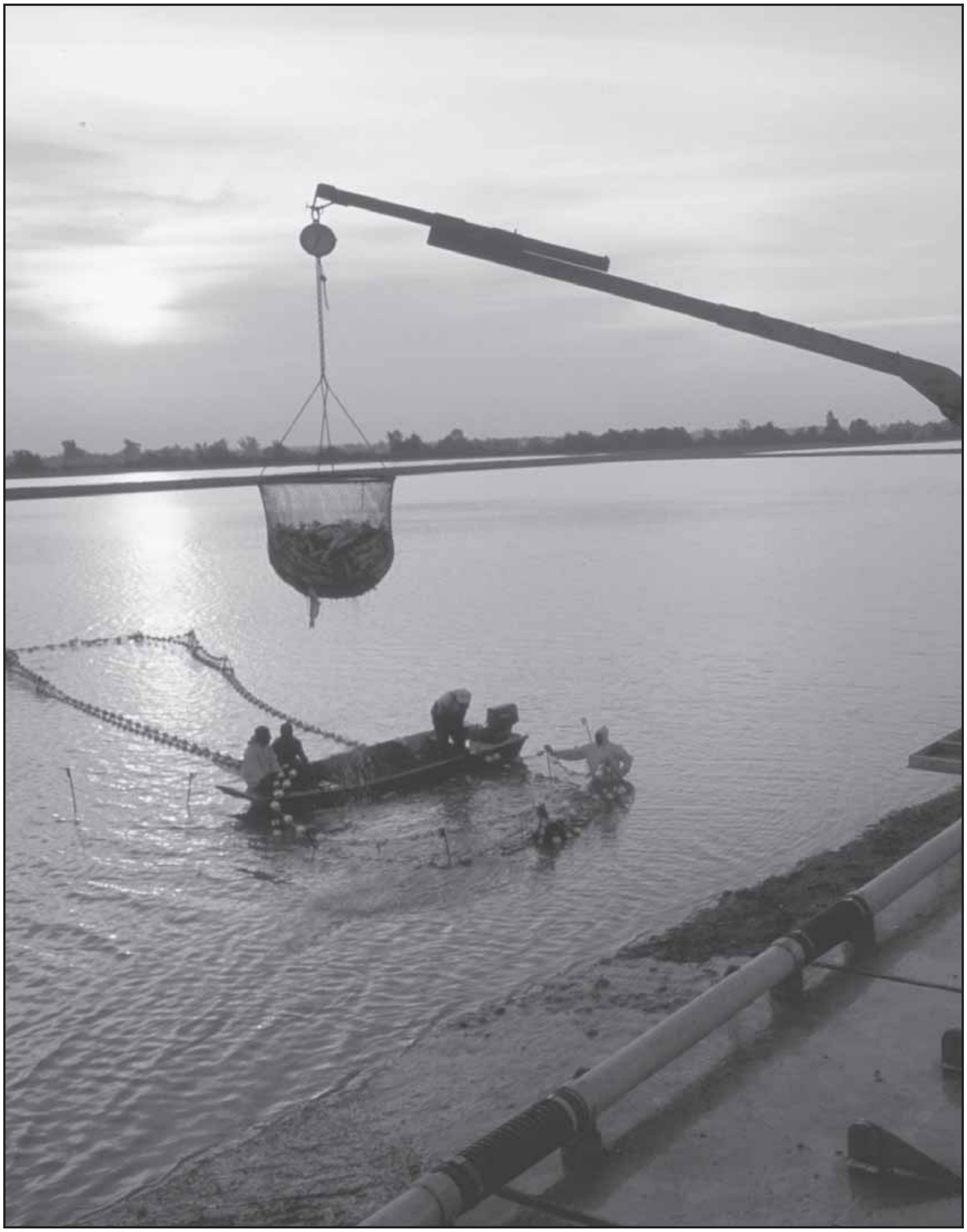
Veterinary
Services

National
Animal Health
Monitoring
System

November 2003

Catfish 2003

Part II: Reference of Foodsize Catfish Health and Production Practices in the United States, 2003



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The Catfish 2003 study was a cooperative effort among representatives of producer organizations, universities, State and Federal catfish health and production personnel, and others allied with the industry. We want to thank everyone who helped determine the direction and objectives of this study.

Thanks also to the National Agricultural Statistics Service (NASS) enumerators who visited the operations and collected the data. Their hard work and dedication to the National Animal Health Monitoring System (NAHMS) are invaluable. The roles of the producer, Area Veterinarian in Charge (AVIC), NAHMS Coordinator, and NASS enumerators were critical in providing quality data for Catfish 2003 reports. Thanks also to the personnel at the Centers for Epidemiology and Animal Health (CEAH) for their efforts in generating and distributing valuable reports from Catfish 2003 data.

All participants are to be commended, particularly the producers whose voluntary efforts made the Catfish 2003 study possible.

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Introduction

Sponsored by the USDA:APHIS: Veterinary Services (VS), the National Animal Health Monitoring System (NAHMS) undertook its first national study of the catfish industry with the Catfish ’97 study. Catfish 2003 is the second NAHMS catfish study, and like its predecessor it was designed to provide both participants and the industry with valuable information on health and management practices on U.S. catfish operations.

This report is the second in a series of reports documenting Catfish 2003 results. Specific objectives of Catfish 2003 are described in Section II: Methodology. The USDA’s National Agricultural Statistics Service (NASS) collaborated with VS to query catfish producers in four participating States: Alabama, Arkansas, Louisiana, and Mississippi. These four States represented the nation’s major catfish producing States, accounting for: 73.4 percent of all U.S. catfish operations on January 1, 2003; 95.5 percent of the total national catfish sales in 2002; and 95.5 percent of the water surface acres to be used for catfish production from January 1 through June 30, 2003. From January 2 through February 14, 2003, NASS enumerators attempted to administer a questionnaire to all known catfish producers, either by phone or through a personal visit. There were 739 respondents to the questionnaire in the four participating States: (Alabama = 223, Arkansas = 157, Louisiana = 67, Mississippi = 292) with an overall response rate of 79.0 percent. All NAHMS Catfish 2003 publications are based upon data collected from these producers via this one collection period. The major publications are:

Part I: Reference of Fingerling Catfish Health and Production Practices in the United States, 2003 focuses on aspects of disease and production of catfish fingerlings.

Part II: Reference of Foodsize Catfish Health and Production Practices in the United States, 2003 focuses on aspects of disease and production of foodsize fish.

The methodology used in Catfish 2003 is documented in the last section of the report.

Further information on NAHMS studies and reports are available online at: www.aphis.usda.gov/vs/ceah/cahm

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Terms Used in This Report

Algal toxins: Algae-produced chemicals that can kill fish.

Brake: A forested wetland dominated by cypress or swamp tupelo, usually in an oxbow lake.

ESC: Enteric Septicemia of Catfish, an economically important bacterial disease of catfish; also known as hole-in-head disease.

Fee fishing: Recreational fishing allowed on farms where anglers are charged by the fish or by the pound.

Fry: Newly hatched fish less than an inch in length.

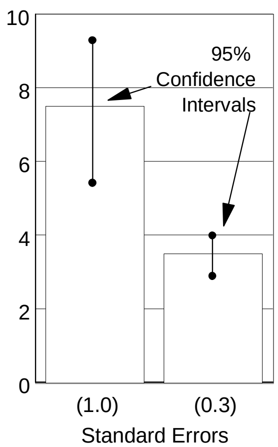
Growout: Raising fingerlings to harvest size (generally 1.25 to 3.0 pounds).

Ich (pronounced "ick"): Also known as white spot disease, *Ichthyophthirius multifilis* is a parasitic disease of fish noted by white spots on skin.

Multibatch: A method of production in which ponds are incompletely harvested and then restocked with fingerlings. This method is considered continuous production and sometimes called multiple batch.

Operation average: The average value for all operations: A single value for each operation is summed over all operations reporting divided by the number of operations reporting. For example, operation average horsepower of fixed aeration (shown on page 15) is calculated by summing reported horsepower per acre over all operations divided by the number of operations.

Examples of a 95% Confidence Interval



Population estimates: Estimates in this report are provided with a measure of precision called the standard error. A 95 percent confidence interval can be created with bounds equal to the estimate, plus or minus two standard errors. If the only error is sampling error, the confidence intervals created in this manner will contain the true population mean 95 out of 100 times. In the example at the left, an estimate of 7.5 with a standard error of 1.0 results in limits of 5.5 to 9.5 (two-times the standard error above and below the estimate). The second estimate of 3.4 shows a standard error of 0.3 and results in limits of 2.8 and 4.0. Alternatively, the 90 percent confidence interval would be created by multiplying the standard error by 1.65 instead of 2. In general, when comparing point estimates between categories, estimates with confidence levels that overlap are not considered different. Most estimates in this report are rounded to the nearest tenth. If rounded to 0, the standard error was reported. If there were no reports of the event, no standard error was reported.

Raceway: A structure with a continual flow of water built to hold fish.

Regions
East: Alabama, Eastern Mississippi
West: Arkansas, Louisiana, Western Mississippi (Delta)

Renovation: The draining and drying of ponds, followed by the use of accumulated sediments to rebuild levees.

Sample profile: Information that describes characteristics of the sites from which Catfish 2003 data were collected.

Satiation: Feeding until fish will not consume any more feed.

Single batch: All fish are stocked at a single time and the pond is not restocked until all the fish have been harvested (see multibatch as a comparison).

Size of operation: Operations were divided into four categories based on the total surface acres of foodsize fish ponds on the operations as of January 1, 2003 (1 to 19, 20 to 49, 50 to 149 and 150 or more total surface acres).

Vaccination: The only vaccine currently in use in the catfish industry is for ESC. Fingerlings are vaccinated by being immersed in a bath containing the ESC vaccine.

Section I: Population Estimates

A. Production Phases and Pond Characteristics

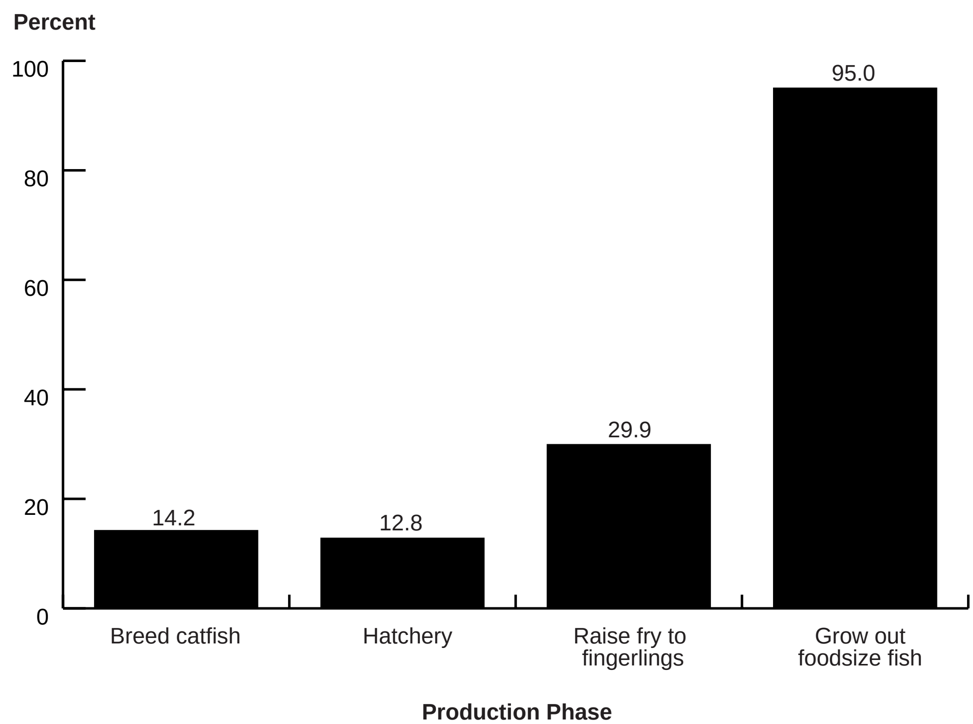
1. Distribution of production phases

Most operations (95.0 percent) produced foodsize fish in 2002; these operations will hereafter be described as foodsize fish operations. The percentage of operations that produced foodsize fish did not vary between the East and West regions.

a. Percentage of all catfish operations by phase of production and by region:

	Percent Operations					
	Region					
	East		West		All Operations	
Production Phase	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Breed catfish	11.3	(0.8)	17.5	(1.2)	14.2	(0.7)
Hatchery	9.2	(0.7)	16.9	(1.2)	12.8	(0.7)
Raise fry to fingerlings	18.2	(1.0)	43.3	(1.4)	29.9	(0.9)
Grow out foodsize fish	94.8	(0.6)	95.3	(0.6)	95.0	(0.4)

Percent of All Catfish Operations by Phase of Production



2. Foodsize fish ponds and surface acres

Operations in the West region were larger in terms of both average number of foodsize fish ponds (25.3) and average total surface acres (290.2 acres) than operations in the East region, which averaged 13.0 ponds and 130.9 total surface acres. Average pond size was 11.0 surface acres.

a. Average total surface acres of foodsize fish operations, by region:

	Operation Average					
	Region					
	East		West		All Operations	
Ponds/Acres	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**
Number of ponds	13.0	(1.9)	25.3	(1.2)	18.8	(1.1)
Total surface acres	130.9	(20.9)	290.2	(14.1)	205.6	(12.7)

3. Average foodsize fish pond size

a. Average size in surface acres of foodsize fish ponds*:

Average Size	Standard Error
11.0	(0.1)

*Calculated based on those producers reporting both the number of ponds and total surface acres

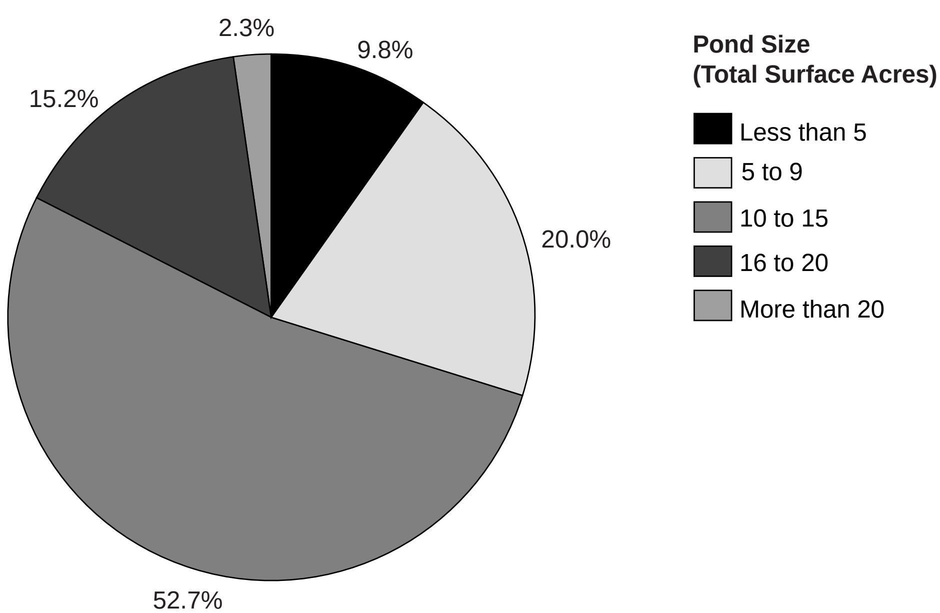
4. Foodsize fish pond size

The majority of ponds (52.7 percent) had 10 to 15 surface acres. One-fifth of all ponds were 5 to 9 surface acres. Only 2.3 percent of all ponds were larger than 20 surface acres.

a. Percentage of all foodsize fish ponds by size of pond (surface acres).

Pond Size (Surface Acres)	Percent Ponds	Standard Error
Less than 5	9.8	(0.8)
5 to 9	20.0	(0.8)
10 to 15	52.7	(1.7)
16 to 20	15.2	(1.6)
More than 20	2.3	(0.6)
Total	100.0	

Percent of All Foodsize Fish Ponds by Size of Pond (Total Surface Acres)



Most growout operations had at least one pond with either 10 to 15 surface acres (74.5 percent of operations) or 5 to 9 surface acres (60.9 percent of operations).

b. Percentage of foodsize fish operations with any foodsize fish ponds by pond surface acres:

Surface Acres	Percent Operations	Standard Error
Less than 5	32.8	(0.9)
5 to 9	60.9	(1.0)
10 to 15	74.5	(0.8)
16 to 20	27.5	(0.9)
More than 20	8.1	(0.6)

5. Water source

Well water was used for 98.9 percent of all foodsize ponds in the West region, while the majority of ponds (67.5 percent) in the East region were filled using surface water.

a. Percentage of foodsize ponds by water source and by region:

	Percent Ponds					
	Region					
	East		West		All Operations	
Water Source	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Well (levee, pond)	27.2	(2.7)	98.9	(0.2)	72.5	(2.1)
Surface water (watershed pond, stream, spring)	67.5	(2.8)	1.0	(0.2)	25.5	(1.9)
Other	5.3	(0.6)	0.1	(0.0)	2.0	(0.3)
Total	100.0		100.0		100.0	

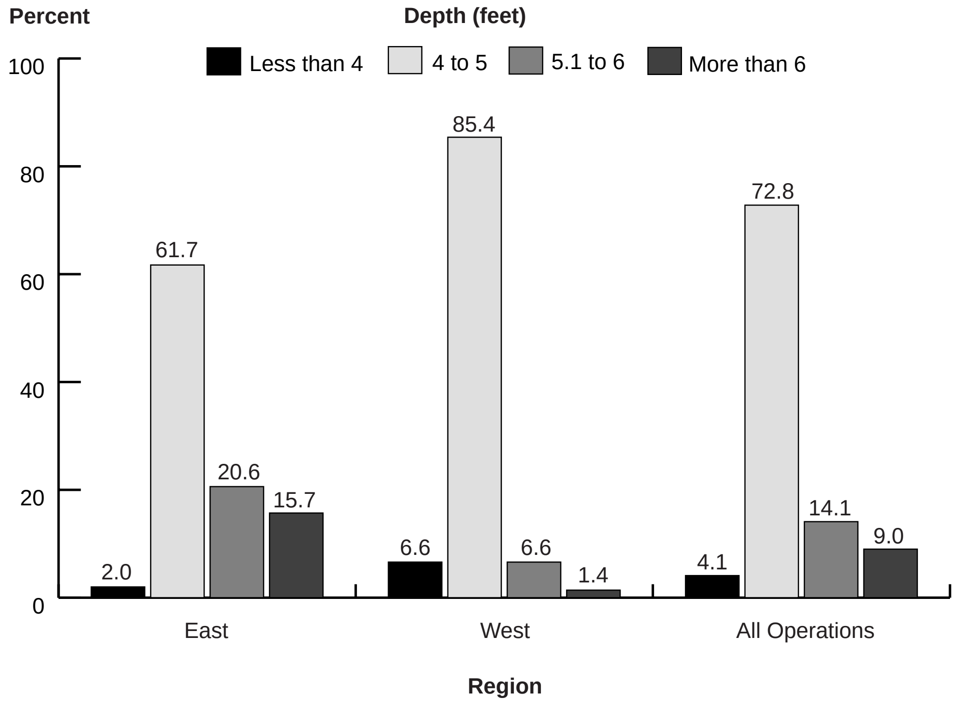
6. Pond water depth

In both regions, the water in the majority of ponds averaged 4 to 5 feet deep. A higher percentage of operations in the East region than the West region had ponds with average water depths greater than 5 feet (36.3 and 8.0 percent of operations, respectively). Greater pond water depths in the East region may reflect the fact that operations in the East region use watershed ponds more commonly than operations in the West region (table A.5.a) because of the hilly terrain typically found in the East region.

a. Percentage of foodsize fish operations by average pond water depth and by region:

	Percent Operations					
	Region					
	East		West		All Operations	
Average Pond Water Depth (Feet)	**Percent**	**Std. Error**	**Percent**	**Std. Error**	**Percent**	**Std. Error**
Less than 4	2.0	(0.4)	6.6	(0.8)	4.1	(0.4)
4 to 5	61.7	(1.3)	85.4	(1.1)	72.8	(0.8)
5.1 to 6	20.6	(1.1)	6.6	(0.7)	14.1	(0.7)
More than 6	15.7	(0.9)	1.4	(0.3)	9.0	(0.5)
Total	100.0		100.0		100.0	

Percent of Foodsize Fish Operations by Average Pond Water Depth and By Region



Maximum pond water depths were greater than 6 feet on more than half (56.9 percent) of all foodsize fish operations. This result was strongly influenced by the high percentage of operations in the East region (85.1 percent) that had maximum pond depths exceeding 6 feet.

b. Percentage of foodsize fish operations by ***maximum*** pond water depth and by region:

	Percent Operations					
	Region					
	East		**West**		**All Operations**	
Maximum Pond Water Depth (Feet)	**Percent**	**Std. Error**	**Percent**	**Std. Error**	**Percent**	**Std. Error**
Less than 4	0.0	(--)	0.4	(0.1)	0.2	(0.1)
4 to 5	2.3	(0.4)	32.8	(1.4)	16.5	(0.7)
5.1 to 6	12.6	(0.8)	42.1	(1.5)	26.4	(0.9)
More than 6	85.1	(0.9)	24.7	(1.3)	56.9	(0.9)
Total	100.0		100.0		100.0	

B. Production Pond Management

1. Levee management

Most growout operations (94.1 percent) used vegetation on levee sides to control erosion. A slightly smaller percentage of growout operations (86.2 percent) used gravel on levee tops to improve vehicle access.

a. Percentage of foodsize fish operations that use the following measures for erosion control or improving vehicle access:

Erosion Control	Percent Operations	Standard Error
Vegetation on levee sides	94.1	(0.4)
Gravel on levee tops	86.2	(0.6)
Either measure used	94.1	(0.4)

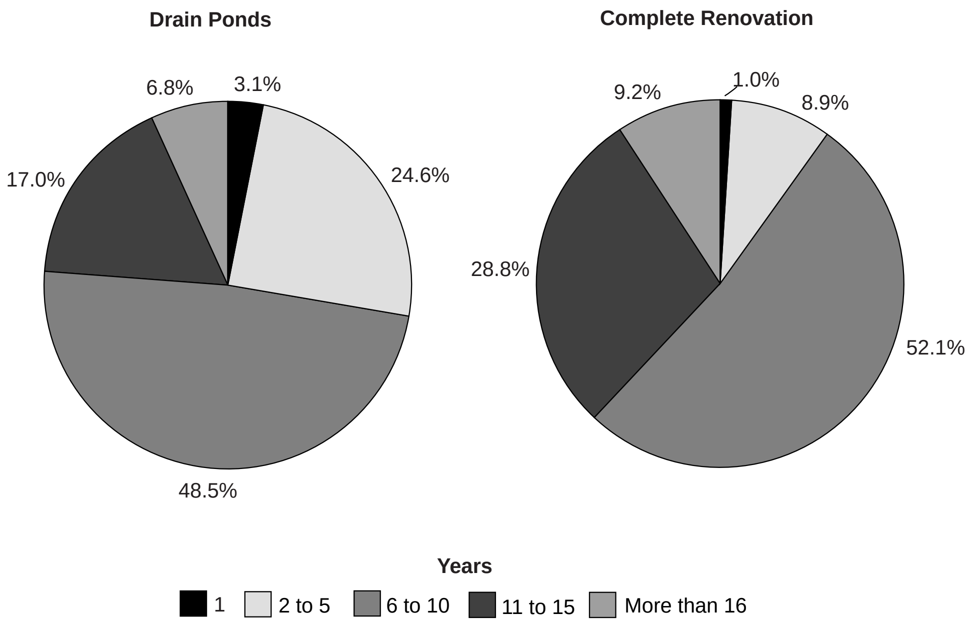
2. Draining and renovation

As operation size increased so did the interval between draining foodsize fish ponds. Over 50 percent of growout operations with less than 20 surface acres drained their ponds at least every 5 years. Conversely, nearly 75 percent of growout operations with 50 to 149 surface acres and over 75 percent of growout operations with 150 surface acres or more waited at least 6 years between draining ponds. This difference may reflect the use of well water by large operations and the use of surface water by small- to intermediate-sized operations. In the NAHMS Catfish '97 study, the average number of years between draining ponds also increased as operation size increased (Part II, table A.4.b). Catfish '97 also reported that operations with 1 to 19, 20 to 49, 50 to 149, and 150 or more surface acres averaged 2.9, 5.1, 6.5, and 8.8 years, respectively, between draining ponds. A similar pattern was observed for complete renovations.

a. Percentage of foodsize fish operations by number of years between draining foodsize fish ponds or complete renovation, and by size of operation:

	Percent Operations									
	Size of Operation (Foodsize Surface Acres)									
	1-19		20-49		50-149		150 or More		All Operations	
Years	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Drain Ponds										
1	9.8	(2.0)	7.8	(2.3)	1.2	(0.5)	0.8	(0.3)	3.1	(0.5)
2 to 5	49.1	(3.1)	31.8	(3.3)	24.2	(2.1)	14.6	(1.6)	24.6	(1.2)
6 to 10	30.9	(2.8)	43.4	(3.7)	58.4	(2.5)	49.4	(2.5)	48.5	(1.4)
11 to 15	7.9	(2.1)	9.7	(2.0)	13.5	(1.7)	24.5	(2.3)	17.0	(1.2)
16 or more	2.3	(0.8)	7.3	(1.8)	2.7	(0.9)	10.7	(1.6)	6.8	(0.8)
Total	100.0		100.0		100.0		100.0		100.0	
Complete Renovation										
1	6.8	(1.6)	2.5	(0.8)	0.0	(--)	0.0	(--)	1.0	(0.2)
2 to 5	31.2	(3.5)	10.5	(1.9)	8.3	(1.3)	4.3	(2.1)	8.9	(0.7)
6 to 10	39.9	(3.9)	49.8	(4.0)	63.2	(2.5)	48.4	(2.4)	52.1	(1.5)
11 to 15	15.3	(3.2)	28.8	(3.7)	20.0	(2.2)	37.0	(2.4)	28.8	(1.4)
16 or more	6.8	(1.6)	8.4	(2.2)	8.5	(1.4)	10.3	(1.6)	9.2	(0.9)
Total	100.0		100.0		100.0		100.0		100.0	

Percent of Foodsize Operations by Number of Years Between Draining Fish Ponds or Complete Renovation



b. Operation average number of years between draining ponds or complete renovation, by size of operation

	Operation Average Number Years									
	Size of Operation (Foodsize Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Pond Management	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**
Drain	6.1	(0.3)	8.2	(0.4)	8.7	(0.2)	10.7	(0.2)	9.1	(0.1)
Complete renovation	8.7	(0.4)	10.8	(0.3)	10.3	(0.2)	12.0	(0.2)	11.0	(0.1)

3. Water level management

Releasing water in the fall is a management tool used for decreasing erosion. Slightly over 60 percent of operations reduced water level either by actively releasing water or allowing the level to drop without intervention.

a. Percentage of foodsize fish operations by water level management practice used in the fall, by region:

	Percent Operations					
	Region					
	East		West		All Operations	
Water Level Management Practice	**Percent**	**Std. Error**	**Percent**	**Std. Error**	**Percent**	**Std. Error**
Release water to lower levels	14.7	(1.0)	30.7	(1.4)	22.2	(0.9)
Allow level to drop without intervention	46.0	(1.3)	29.6	(1.3)	38.4	(1.0)
Maintain water level (do not let water level drop)	39.3	(1.3)	39.7	(1.5)	39.4	(1.0)
Total	100.0		100.0		100.0	

4. Monitoring dissolved oxygen

Slightly over 20 percent of operations with between 20 and 149 surface acres used automated sensors for monitoring dissolved oxygen. A higher percentage of the largest operations tended to rely on hand monitors. Dissolved oxygen was not monitored regularly by 39.0 percent of operations with 1 to 19 surface acres.

a. Percentage of foodsize fish operations by primary method used for monitoring dissolved oxygen in foodsize fish ponds during 2002, by size of operation:

	Percent Operations									
	Size of Operation (Foodsize Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Method	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Automated sensors	9.0	(1.5)	22.9	(1.9)	22.4	(1.4)	11.5	(1.1)	17.2	(0.7)
Hand monitor (oxygen meter)	47.4	(2.2)	70.5	(2.0)	77.1	(1.4)	87.9	(1.2)	75.1	(0.8)
Other	4.6	(0.8)	0.8	(0.3)	0.0	(--)	0.6	(0.3)	1.0	(0.2)
Did not regularly monitor dissolved oxygen levels	39.0	(2.1)	5.8	(1.0)	0.5	(0.2)	0.0	(--)	6.7	(0.4)
Total	100.0		100.0		100.0		100.0		100.0	

5. Horsepower of fixed aeration

a. Operation average horsepower of fixed aeration per surface acre of foodsize ponds, by size of operation:

Average Horsepower									
Size of Operation (Foodsize Surface Acres)									
1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Avg. Hp.	**Std. Error**	**Avg. Hp.**	**Std. Error**	**Avg. Hp.**	**Std. Error**	**Avg. Hp.**	**Std. Error**	**Avg. Hp.**	**Std. Error**
1.6	(0.1)	2.1	(0.0)	2.0	(0.0)	2.0	(0.0)	1.9	(0.0)

6. Emergency aerators

The number of emergency aerators (PTOs) increased as operation size increased. However, larger operations had fewer PTOs per pond than smaller operations (table B.6.b)

a. Average number of emergency aerators (power take-offs or PTOs) on foodsize fish operations, by size of operation:

Average Number Aerators									
Size of Operation (Foodsize Surface Acres)									
1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Avg.	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**
2.2	(0.2)	2.4	(0.1)	5.7	(0.1)	19.9	(1.4)	9.1	(0.5)

Emergency aerator (PTO)

b. Average number of emergency aerators (power take-offs or PTOs) *per pond* on foodsize operations, by size of operation:

Average Number Aerators									
Size of Operation (Foodsize Surface Acres)									
1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Avg.	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**
0.65	(0.05)	0.54	(0.02)	0.64	(0.02)	0.44	(0.04)	0.48	(0.03)

7. Snail control

A higher percentage of growout operations in the West region (19.0 percent) reported snail problems in growout ponds in 2002 than operations the East region (7.2 percent).

a. Percentage of foodsize fish operations that had snail problems in any foodsize fish ponds in 2002, by region:

Percent Operations					
Region					
East		West		All Operations	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
7.2	(0.8)	19.0	(1.3)	12.7	(0.7)

A higher percentage of growout operations in the West region than the East region used some snail control measure (24.2 and 16.2 percent, respectively). However, the percentages of growout operations that used specific snail control measures did not differ substantially between regions.

b. Percentage of foodsize fish operations that used the following measures to control snails in foodsize ponds, by region:

	Percent Operations					
	Region					
	East		West		All Operations	
Snail Control Measure	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Lime	11.8	(0.9)	10.2	(1.1)	11.1	(0.7)
Copper	11.4	(0.9)	14.8	(1.2)	13.0	(0.7)
Weed control	4.7	(0.6)	4.5	(0.7)	4.6	(0.5)
Biological control	1.0	(0.3)	2.8	(0.7)	1.8	(0.4)
Other	0.0	(--)	1.5	(0.4)	0.7	(0.2)
Any	16.2	(1.0)	24.2	(1.3)	19.9	(0.8)

C. Water Quality and Treatments

1. Chloride level

The average chloride level during summer on all operations was 110.4 parts per million (ppm). The average summer chloride level was higher in the East region (129.1 ppm) than the West region (80.7 ppm).

a. Operation average chloride level in foodsize fish ponds in parts per million, by region:

Average Levels (ppm)					
Region					
East		**West**		**All Operations**	
Average	**Standard Error**	**Average**	**Standard Error**	**Average**	**Standard Error**
129.1	(6.5)	80.7	(2.6)	110.4	(4.1)

2. Salt usage

Salt is added to catfish ponds to prevent disease problems related to ammonia and nitrite. Over half of all growout operations routinely added salt to maintain a desired chloride level. Nearly two out of three operations (64.1 percent) in the East region added salt, compared to less than one out of two operations (41.6 percent) in the West region. A high percentage of operations (39.2 percent) in the West region did not add salt to ponds.

a. Percentage of foodsize fish operations by use of salt in foodsize fish ponds, by region:

	Percent Operations					
	Region					
	East		**West**		**All Operations**	
Salt Usage	**Percent**	**Std. Error**	**Percent**	**Std. Error**	**Percent**	**Std. Error**
Routinely added salt to maintain desired chloride level	64.1	(1.2)	41.6	(1.3)	53.5	(0.9)
Added salt only in response to health problems	19.0	(1.0)	19.2	(1.1)	19.1	(0.8)
Did not add salt	16.9	(0.8)	39.2	(1.2)	27.4	(0.7)
Total	100.0		100.0		100.0	

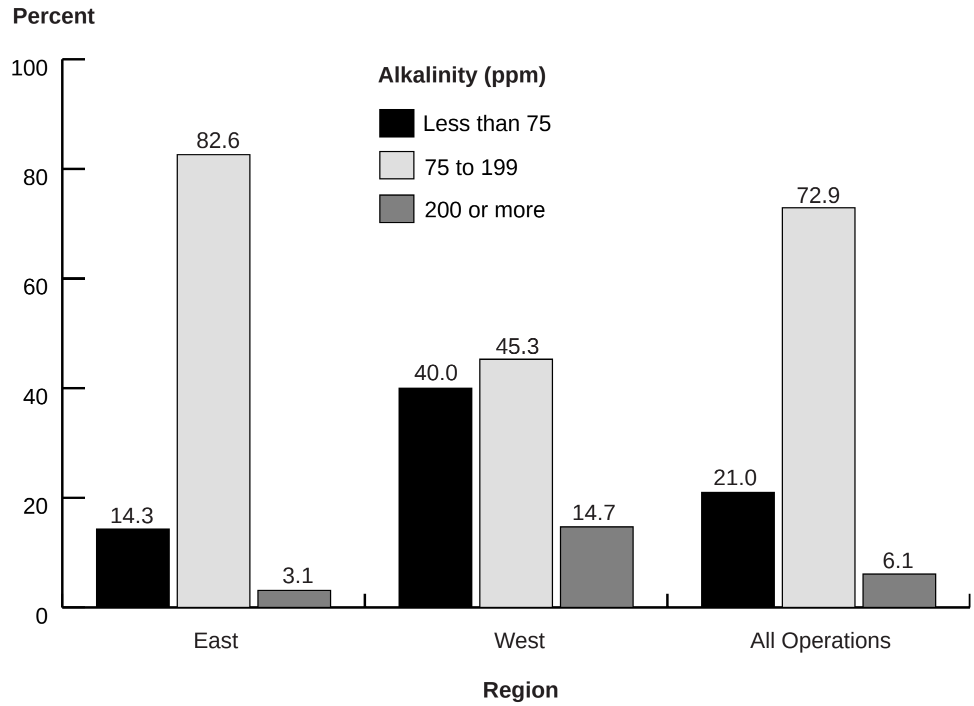
3. Alkalinity

Adequate alkalinity, a measure of water's buffering capacity, is essential in avoiding problems associated with low pH, un-ionized ammonia, and some dissolved metals. A higher percentage of operations in the East region than the West region reported alkalinity levels between 75 and 199 ppm (82.6 and 45.3 percent, respectively). A higher percentage of operations in the West region than the East region reported alkalinity levels of less than 75 ppm (40.0 and 14.3 percent, respectively).

a. Percentage of foodsize fish operations by alkalinity of the water used in foodsize fish ponds by region:

	Percent Operations					
	Region					
	East		West		All Operations	
Alkalinity (ppm)	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Less than 75	14.3	(1.2)	40.0	(3.0)	21.0	(1.2)
75 to 199	82.6	(1.3)	45.3	(3.1)	72.9	(1.3)
200 or more	3.1	(0.6)	14.7	(1.7)	6.1	(0.6)
Total	100.0		100.0		100.0	

Percent of Foodsize Fish Operations by Alkalinity of the Water Used in Foodsize Fish Ponds, and by Region



b. Operation average alkalinity (ppm) of water used in foodsize fish ponds, by region:

Region					
East		West		All Operations	
Average Alkalinity	Standard Error	Average Alkalinity	Standard Error	Average Alkalinity	Standard Error
102.0	(1.2)	103.1	(5.1)	102.3	(1.6)

4. Adding calcium to water

A large percentage of operations (70.0 percent) did not add calcium to ponds. The percentage of operations not adding calcium was higher in the West region (87.2 percent) than the East region (54.9 percent). Almost a fourth of East region operations routinely added calcium to maintain a desired alkalinity and hardness.

a. Percentage of foodsize fish operations by method of adding calcium to ponds to maintain alkalinity, and by region:

	Percent Operations					
	Region					
	East		West		All Operations	
Calcium	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Routinely add calcium to maintain a desired alkalinity and hardness	23.6	(1.1)	3.4	(0.6)	14.2	(0.7)
Add calcium only in response to health problems	21.5	(1.1)	9.4	(0.9)	15.8	(0.7)
Do not add calcium to ponds	54.9	(1.3)	87.2	(1.0)	70.0	(0.9)
Total	100.0		100.0		100.0	

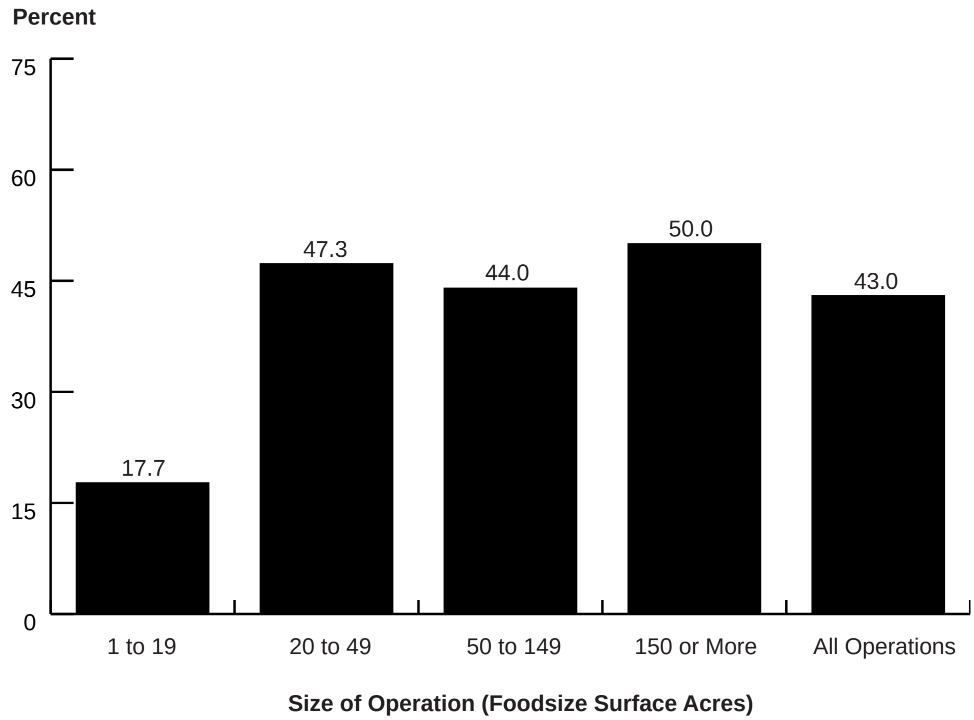
5. Water quality testing

A lower percentage of operations with less than 20 acres (17.7 percent) tested water quality at least once a month than did operations with 20 or more acres (44.0 to 50.0 percent). Similarly, almost half of smaller operations never tested water quality. The NAHMS Catfish ’97 study posed a similar question to producers (Part II, table A.1.a). The percentage of operations that did not test water quality is directly comparable. Overall, 25.2 percent of operations in 1997 said they never tested water quality, compared to 15.6 percent of operations in 2003. The most substantial change was a reduction from 1997 to 2003 in the percentage of operations with 20 to 49 acres that did not test water quality (21.3 percent of operations in 1997 compared to 11.8 percent of operations in 2003), and in the 50 to 149 acres size group (25.0 percent of operations in 1997 compared to 9.9 percent of operations in 2003). Also, 22.7 percent of the operations in 2003 tested only in response to health problems, while in 1997 only 9.7 percent of operations tested only in response to health problems.

a. Percentage of foodsize fish operations by frequency of water quality testing in foodsize fish ponds, and by size of operation:

	Percent Operations									
	Size of Operation (Foodsize Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Water Quality Testing	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Once a month or more often	17.7	(1.9)	47.3	(2.2)	44.0	(1.7)	50.0	(1.9)	43.0	(1.0)
Less often than once a month	11.1	(1.5)	23.7	(1.9)	19.8	(1.4)	17.7	(1.4)	18.7	(0.8)
In response to health problems only	22.7	(1.8)	17.2	(1.6)	26.3	(1.4)	22.5	(1.5)	22.7	(0.8)
Not tested	48.5	(2.2)	11.8	(1.4)	9.9	(0.9)	9.8	(1.1)	15.6	(0.6)
Total	100.0		100.0		100.0		100.0		100.0	

Percent of Foodsize Fish Operations that Tested Water Quality in Foodsize Fish Ponds Once a Month or More Often, by Size of Operation



For operations that did test water quality, approximately two-thirds or more tested ammonia, chloride, or nitrite one to two times per month. Testing of these water quality parameters occurred 3 to 4 times per month on about one-fourth of operations.

b. For operations that did water quality testing on foodsize fish ponds, percentage of operations by number of times per month foodsize fish ponds were tested:

	Percent Operations					
	Water Quality Testing					
	Ammonia		Chloride		Nitrite	
Times Per Month	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
0	3.7	(0.7)	3.8	(0.6)	1.2	(0.3)
1 to 2	65.6	(1.5)	72.9	(1.5)	66.2	(1.5)
3 to 4	29.6	(1.5)	23.3	(1.4)	30.0	(1.5)
5 to 7	0.0	(--)	0.0	(--)	0.8	(0.2)
8 or more	1.1	(0.5)	0.0	(--)	1.8	(0.5)
Total	100.0		100.0		100.0	

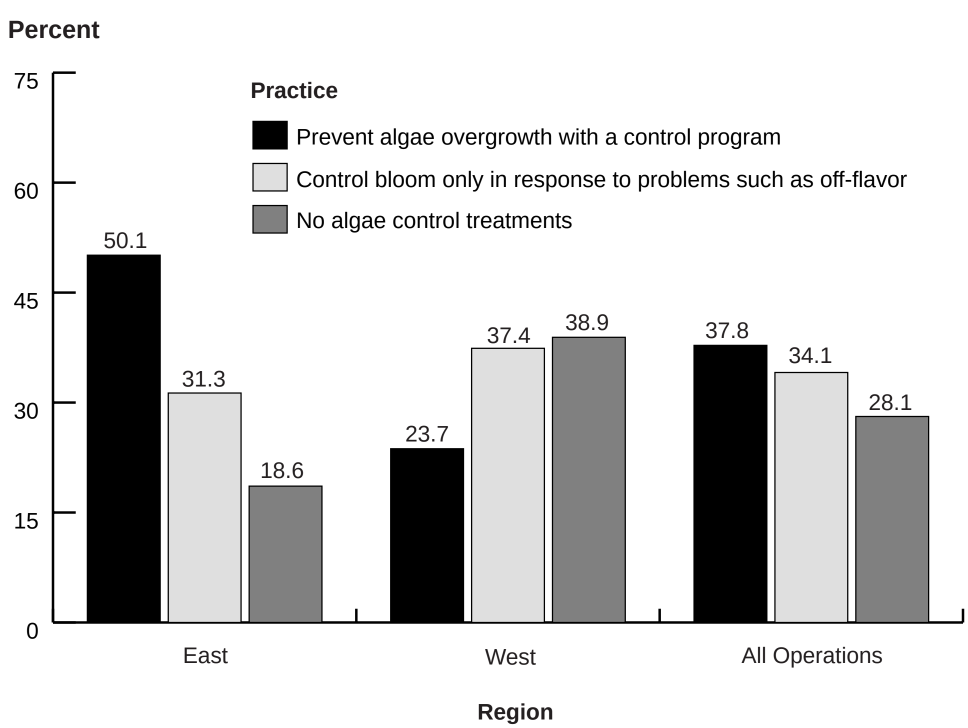
6. Algae management

Algae control programs were used by a higher percentage of operations in the East region (50.1 percent) than the West region (23.7 percent). A higher percentage of operations in the West region than the East region also did not implement any algae control treatment (38.9 and 18.6 percent, respectively).

a. Percentage of foodsize fish operations by algae management practice and by region:

	Percent Operations					
	Region					
	East		West		All Operations	
Algae Management Practice	**Percent**	**Std. Error**	**Percent**	**Std. Error**	**Percent**	**Std. Error**
Prevent algae overgrowth with a control program	50.1	(1.3)	23.7	(1.4)	37.8	(1.0)
Control bloom only in response to problems such as off-flavor	31.3	(1.3)	37.4	(1.5)	34.1	(1.0)
No algae control treatments	18.6	(0.9)	38.9	(1.3)	28.1	(0.8)
Total	100.0		100.0		100.0	

Percent of Foodsize Fish Operations by Algae Management Practice and by Region



Operations with 150 or more surface acres that used algae control programs included 77.1 percent of their ponds in a control program. Operations with less than 150 acres tended to include a higher percentage of their ponds in a control program, although this may reflect that they likely have fewer ponds to manage.

b. For operations that used algae control programs, operation percentage of foodsize fish ponds included in a control program, by size of operation:

Percent Foodsize Fish Ponds									
Size of Operation (Foodsize Surface Acres)									
1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Pct.	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
98.6	(0.8)	94.0	(1.2)	90.1	(1.5)	77.1	(6.3)	80.4	(5.0)

For operations with algae control programs, 80.3 and 72.5 percent used copper sulfate and Diuron®, respectively. Biological control was practiced by 26.1 percent of operations with algae control programs.

c. For operations that used algae control programs, percentage of operations by control method:

Algae Control Method	**Percent Operations**	**Standard Error**
Copper sulfate ($CuS0_4$) or other copper formulation	80.3	(1.4)
Diuron	72.5	(1.4)
Biological (i.e., threadfin or gizzard shad)	26.1	(1.5)
Other	10.4	(1.0)

Most operations started their algae control programs after April and ended the programs by November.

d. For foodsize fish operations that used an algae control program, percentage of operations by beginning and ending month of the program in 2002:

	Percent Operations			
	Beginning Month		Ending Month	
Month	Percent	Standard Error	Percent	Standard Error
January	4.1	(0.7)	0.0	(--)
February	2.0	(0.5)	0.0	(--)
March	12.7	(1.3)	0.4	(0.1)
April	24.7	(1.5)	0.0	(--)
May	34.7	(1.8)	0.0	(--)
June	17.6	(1.4)	0.0	(--)
July	3.7	(0.7)	2.5	(0.5)
August	0.5	(0.2)	5.9	(0.9)
September	0.0	(--)	27.4	(1.6)
October	0.0	(--)	45.5	(1.8)
November	0.0	(--)	13.2	(1.2)
December	0.0	(--)	5.1	(0.8)
Total	100.0		100.0	

e. For operations that used an algae control program, percentage of operations by number of weeks between algae control treatments:

Frequency	Percent Operations	Standard Error
Once a week or more often	56.6	(1.8)
Every 2 to 3 weeks	35.9	(1.8)
Every 4 to 5 weeks	3.9	(0.6)
Every 6 weeks or longer	3.6	(0.7)
Total	100.0	

D. Stocking Practices

1. Genetic lines

Unknown catfish lines were stocked by 65.3 percent of operations. The Goldkist line was stocked by 28.4 percent of foodsize fish operations. The newly introduced NWAC103 line was stocked by 5.9 percent of all foodsize fish operations. Some operations stocked more than one genetic line, so totals sum to more than 100.

a. Percentage of foodsize fish operations that had any of the following line(s) of fish present on January 1, 2003, by size of operation:

	Percent Operations									
	Size of Operation (Foodsize Surface Acres)									
	1-19		20-49		50-149		150 or More		All Operations	
Line	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
NWAC103	3.6	(0.8)	4.3	(0.9)	5.3	(0.8)	8.4	(1.0)	5.9	(0.5)
Kansas	9.3	(1.5)	6.2	(1.1)	7.5	(1.0)	6.1	(0.9)	7.0	(0.5)
Goldkist	11.5	(1.6)	39.5	(2.2)	31.5	(1.6)	25.2	(1.7)	28.4	(0.9)
Norris	0.0	(--)	0.0	(--)	1.0	(0.3)	0.0	(--)	0.3	(0.1)
Hybrid channel X blue catfish	5.0	(1.0)	3.4	(0.8)	0.5	(0.1)	1.7	(0.5)	2.1	(0.3)
Unknown line	55.2	(2.3)	58.5	(2.2)	67.5	(1.6)	71.7	(1.8)	65.3	(1.0)
Other line	25.3	(1.9)	13.2	(1.6)	5.4	(0.8)	6.3	(1.0)	10.0	(0.6)

A higher percentage of foodsize fish operations in the West region (75.3 percent) stocked unknown fish lines compared to operations in the East region (56.7 percent). Goldkist and Kansas lines were stocked by a higher percentage of operations in the East region (36.7 percent and 9.4 percent, respectively) than in the West region (18.8 percent and 4.3 percent, respectively).

b. Percentage of foodsize fish operations that had any of the following line(s) of fish present on January 1, 2003, by region:

	Percent Operations			
	Region			
	East		**West**	
Line	**Percent**	**Std. Error**	**Percent**	**Std. Error**
NWAC103	5.8	(0.7)	5.9	(0.7)
Kansas	9.4	(0.8)	4.3	(0.6)
Goldkist	36.7	(1.3)	18.8	(1.2)
Norris	0.3	(0.1)	0.4	(0.1)
Hybrid channel X blue catfish	3.3	(0.5)	0.7	(0.1)
Unknown line	56.7	(1.3)	75.3	(1.3)
Other	12.2	(0.8)	7.5	(0.9)

To estimate the percentage of fish from each line stocked, the percentage of fish stocked by line was weighted by the January 1, 2003, inventory. Fish from unknown lines represented 64.4 percent of all fish stocked. Goldkist represented the next highest percentage (22.4 percent) of fish stocked.

c. Percentage of foodsize fish by line(s) of fish present on January 1, 2003, by region:

	Percent Foodsize Fish					
	Region					
	East		West		All Operations	
Line	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
NWAC103	7.2	(2.2)	1.4	(0.3)	2.4	(0.5)
Kansas	9.6	(2.0)	1.1	(0.3)	2.6	(0.5)
Goldkist	38.5	(6.0)	19.1	(3.6)	22.4	(3.3)
Norris	0.2	(0.1)	0.0	(0.0)	0.1	(0.0)
Hybrid channel X blue catfish	2.4	(0.8)	0.9	(0.3)	1.2	(0.3)
Unknown line	32.7	(3.8)	71.2	(3.8)	64.4	(3.5)
Other	9.4	(2.7)	6.3	(1.5)	6.9	(1.4)
Total	100.0		100.0		100.0	

The percentage of operations that purchased fry from another source increased in general as operation size increased. A higher percentage of 1- to 19-acre and 150-or-more-acre operations produced at least some of their own fingerlings, compared to the 20- to 49-acre and 50- to 149-acre operations. Fingerlings were purchased from another operation by a higher percentage of 20- to 49-acre and 50- to 149-acre operations than 1- to 19-acre and 150-or-more-acre operations.

d. Percentage of foodsize fish operations that stocked any fish into foodsize fish ponds, by source and by size of operation:

	Percent Operations									
	Size of Operation (Foodsize Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Source	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Purchased as fry from another source	5.5	(1.2)	7.8	(1.1)	17.6	(1.2)	28.3	(1.8)	17.5	(0.8)
Purchased as fingerlings from another operation	66.7	(2.1)	84.7	(1.6)	75.5	(1.4)	54.7	(2.0)	69.4	(0.9)
Produced by this operation	34.3	(2.1)	11.0	(1.5)	11.0	(1.1)	27.9	(1.8)	19.6	(0.8)

Two-thirds of all fish stocked were purchased as fingerlings from another operation. The percentage of fish purchased as fry from another source increased as operation size increased. As with the percentage of operations (table D.1.d), the percentage of fish stocked that were produced by the operation was highest on 1- to 19-acre and 150-or-more-acre operations.

e. Operation average percentage of fish stocked into foodsize fish ponds in 2002, by source and by size of operation:

	Average Percent Fish Stocked									
	Size of Operation (Foodsize Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Source	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Purchased as fry from another source	5.5	(1.2)	6.4	(1.0)	15.9	(1.1)	24.1	(1.6)	15.2	(0.7)
Purchased as fingerlings from another operation	63.5	(2.1)	83.0	(1.7)	73.5	(1.5)	50.3	(1.9)	66.6	(0.9)
Produced by this operation	31.0	(2.0)	10.6	(1.5)	10.6	(1.1)	25.6	(1.8)	18.2	(0.8)
Total	100.0		100.0		100.0		100.0		100.0	

2. Selection criteria for fingerlings or stockers

A fingerling producer's reputation was rated as an important selection criterion by the highest percentage (84.0 percent) of producers. Price was identified as important by 72.6 percent of operations. Almost one-third of producers said that distance from the source was not an important selection criterion.

a. Percentage of foodsize fish operations by importance of selection criterion for fingerlings or stockers:

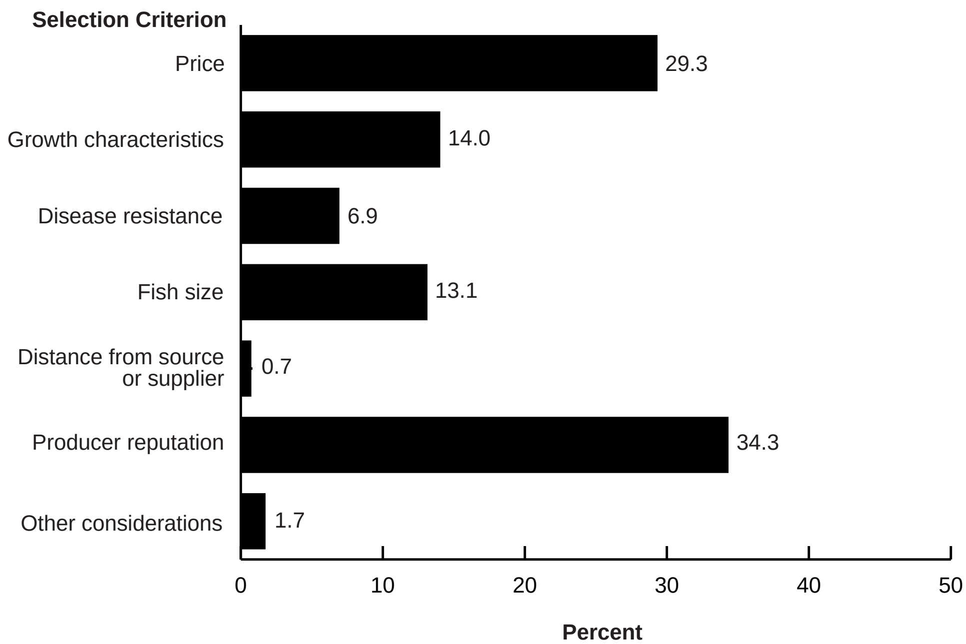
	Percent Operations						
	Important		Somewhat Important		Not Important		Total
Selection Criterion	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.
Price	72.6	(0.9)	21.7	(0.8)	5.7	(0.5)	100.0
Growth characteristics	70.0	(0.9)	22.4	(0.8)	7.6	(0.6)	100.0
Disease resistance	65.3	(1.0)	25.5	(0.9)	9.2	(0.6)	100.0
Fish size	67.1	(0.9)	26.7	(0.9)	6.2	(0.5)	100.0
Distance from source or supplier	28.4	(0.9)	38.8	(1.0	32.8	(1.0)	100.0
Producer reputation	84.0	(0.8)	10.1	(0.6)	5.9	(0.5)	100.0
Other considerations	9.3	(0.6)	2.8	(0.3)	87.9	(0.6)	100.0

The ***most*** important criterion for selecting fingerlings or stockers for stocking was producer's reputation (34.3 percent of operations). Price was identified as the most important criterion by 29.3 percent of operations. Distance was rarely the most important criterion (0.7 percent of operations). In the NAHMS Catfish '97 study, producer reputation was the most important selection criterion for 34.9 percent of operations; fish size was the most important criterion for 25.3 percent of operations; and 19.1 percent of operations reported price as their most important criterion. The increase in the percentage of operations in 2003 that identified price as the most important factor likely reflects the current economic status of the industry.

b. Percentage of foodsize fish operations by the ***most*** important criterion for selection of fingerlings or stockers:

Selection Criterion	Percent Operations	Standard Error
Price	29.3	(0.9)
Growth characteristics	14.0	(0.7)
Disease resistance	6.9	(0.5)
Fish size	13.1	(0.7)
Distance from source or supplier	0.7	(0.2)
Producer reputation	34.3	(1.0)
Other considerations	1.7	(0.2)
Total	100.0	

Percent of Foodsize Fish Operations by the Most Important Criterion for Selecting Fingerlings or Stockers



3. Fish vaccinated for ESC

At least some fish stocked during the past 3 years were vaccinated against Enteric Septicemia of Catfish (ESC) by 15.8 percent of operations. A higher percentage of operations in the East region than the West region stocked some ESC-vaccinated fish (20.3 and 10.7 percent, respectively) during the same 3-year period. In the NAHMS Catfish ’97 study, 11.3 percent of operations reported stocking some fish vaccinated against ESC. The relatively large standard error (1.9 percent) associated with the 1997 estimate makes it difficult to infer that the percentage of operations stocking vaccinated fish has changed, although vaccination appears to be higher in the East region in 2003 than it was industry-wide in 1997.

a. Percentage of foodsize fish operations that stocked any fish vaccinated for ESC during the past 3 years, by region:

Percent Operations					
Regions					
East		West		All Operations	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
20.3	(1.1)	10.7	(1.0)	15.8	(0.8)

A smaller percentage of operations (9.9 percent) with 1 to 19 acres stocked any fish vaccinated for ESC during the last 3 years, compared to the other operation sizes.

b. Percentage of foodsize fish operations that stocked any fish vaccinated for ESC during the past 3 years, by size of operation:

Percent Operations							
Size of Operation (Foodsize Surface Acres)							
1-19		20-49		50-149		150 or More	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
9.9	(1.4)	19.0	(1.7)	15.7	(1.2)	16.5	(1.5)

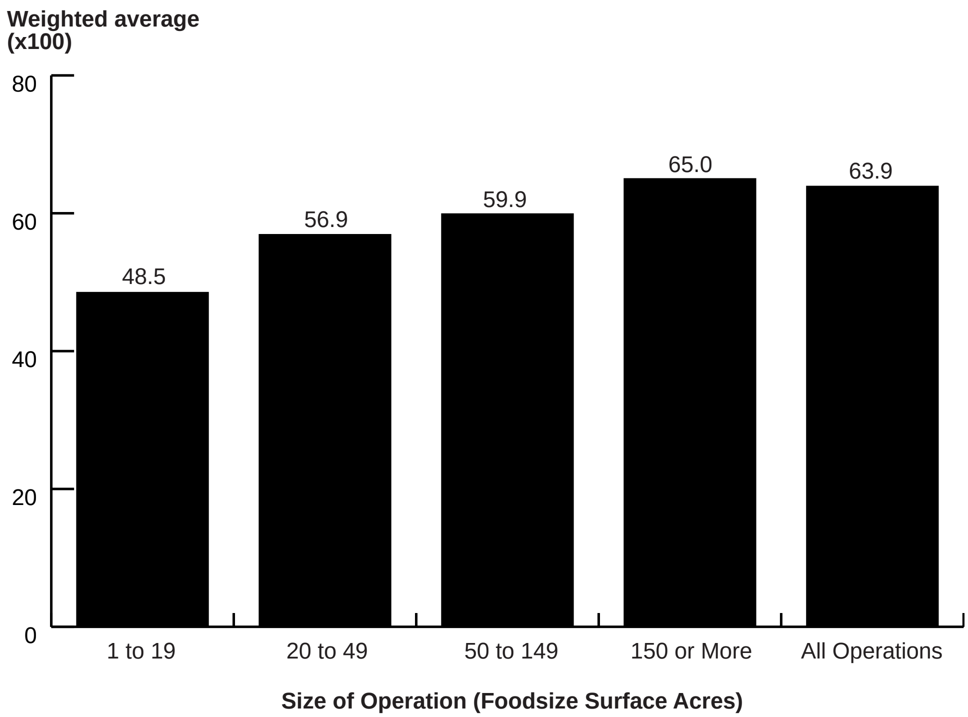
4. Stocking practices

The operation average (unweighted) fingerling stocking rate was 5,752 fingerlings per acre. The reported stocking rate per acre weighted by the reported number of foodsize fish acres over all operations resulted in a stocking rate of 6,390 fingerlings per acre. This weighted average is higher than the operation average because larger operations with more acreage stocked at higher levels. The operation average stocking rate for fingerlings in 1996 was 6,069, while the weighted average was 7,327 (Part II, table B.3.a). Thus, it appears that stocking rates have declined in 2002 compared to 1996. The greatest changes were on operations with 50 or more surface acres. In 1996, the operation average and weighted average stocking rates for operations with 50 to 149 acres were 6,651 and 6,889, respectively, compared to 6,019 and 5,988, respectively, in 2002. Similarly, in 1996 the unweighted and weighted average stocking rates for operations with 150 or more acres were 7,716 and 7,566, respectively, compared to 6,053 and 6,499, respectively, in 2002. This apparent decline is in contrast to the response in 1996 where 89.0 percent of operations reported either increased or static stocking rates over the prior 3 years (Part II, table B.3.b).

a. Operation average and weighted average stocking rate (fish typically stocked per surface acre) for foodfish ponds, by size of operation:

	Average Number Fish Typically Stocked Per Acre									
	Size of Operation (Foodsize Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Source	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**
Operation average	4,296	(136)	5,681	(87)	6,019	(61)	6,053	(61)	5,752	(38)
Weighted average	4,845	(221)	5,690	(118)	5,988	(81)	6,499	(209)	6,390	(178)

Operation Weighted Average Stocking Rate (Fish Typically Stocked per Surface Acre) for Foodfish Ponds, by Size of Operation



A relatively high percentage of operations with 1 to 19 acres stocked less than 2,000 fingerlings per acre and 2,000 to 4,000 per acre (18.8 and 34.5 percent, respectively). Conversely, over 80 percent of all operations with at least 20 surface acres stocked more than 4,000 fish per acre.

b. Percentage of foodsize fish operations by fingerling stocking rates in foodsize fish production ponds, and by size of operation:

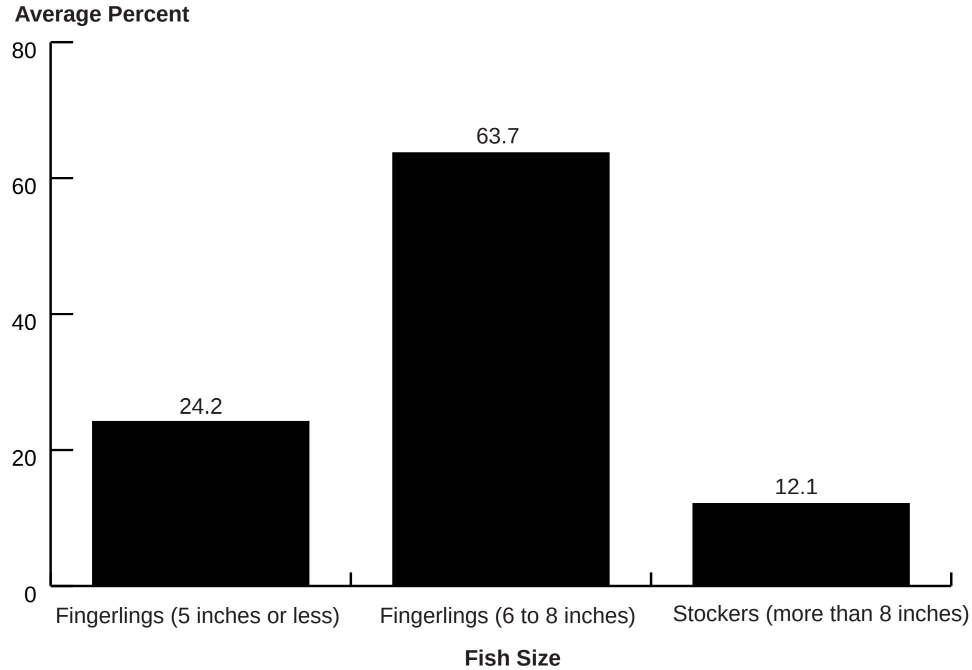
	Percent Operations									
	Size of Operation (Foodsize Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Stocking Rates (Per Acre)	**Pct.**	**Std. Err.**	**Pct.**	**Std. Err.**	**Pct.**	**Std. Err.**	**Pct.**	**Std. Err.**	**Pct.**	**Std. Err.**
Less than 2,000	18.8	(1.8)	2.6	(0.6)	1.6	(0.4)	0.6	(0.3)	3.6	(0.3)
2,001 to 4,000	34.5	(2.2)	17.1	(1.6)	9.3	(1.1)	12.3	(1.4)	14.9	(0.7)
4,001 to 6,000	22.5	(2.2)	50.6	(2.3)	55.4	(1.7)	49.2	(2.0)	48.4	(1.0)
6,001 to 8,000	15.3	(2.0)	25.2	(2.0)	26.3	(1.5)	31.7	(1.9)	26.5	(0.9)
More than 8,000	8.9	(1.5)	4.5	(0.9)	7.4	(0.9)	6.2	(0.8)	6.6	(0.5)
Total	100.0		100.0		100.0		100.0		100.0	

Producers reported on average that nearly two-thirds of their fish stocked were in the 6- to 8-inch size category.

c. Operation average percentage of fish stocked in foodfish ponds, by fish size and by size of operation:

	Operation Average Percent									
	Size of Operation (Foodsize Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Fish Size	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**
Fingerlings (5 inches or less)	30.6	(2.0)	14.9	(1.4)	24.4	(1.2)	27.5	(1.5)	24.2	(0.8)
Fingerlings (6 to 8 inches)	54.3	(2.2)	81.1	(1.6)	66.4	(1.3)	53.5	(1.5)	63.7	(0.8)
Stockers (more than 8 inches)	15.1	(1.6)	4.0	(0.9)	9.2	(0.8)	19.0	(1.3)	12.1	(0.6)
Total	100.0		100.0		100.0		100.0		100.0	

Operation Average Percent of Fish Stocked in Foodfish Ponds, by Fish Size



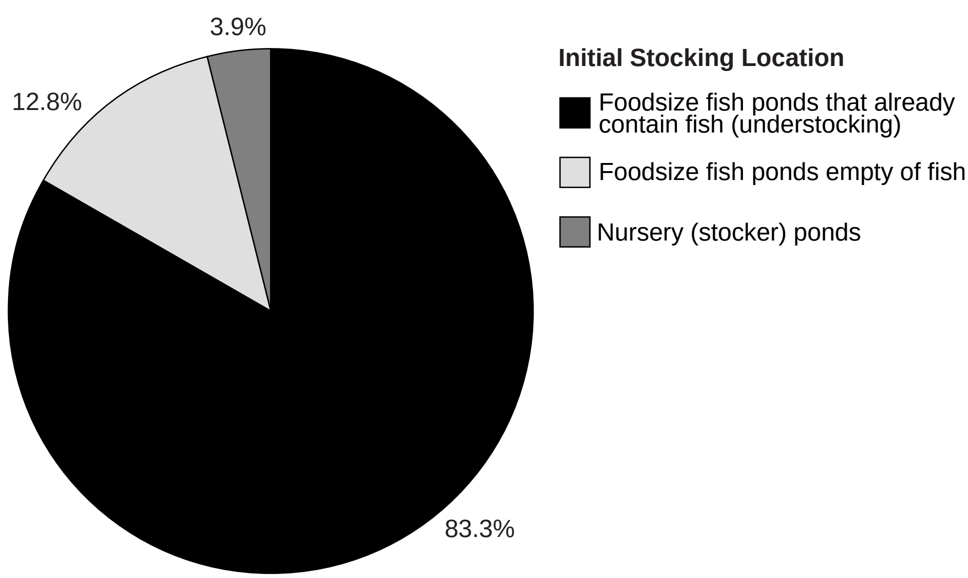
5. Fingerlings stocked

Most fingerlings stocked in 2002 (operation average 83.3 percent) were stocked directly into foodsize fish ponds that already contained fish. Producers reported that a similar percentage of fish to be stocked in 2003 would go directly into foodsize fish ponds that already contain fish. A small percentage of fingerlings (3.9 percent) was placed in nursery ponds in 2002 and a similar percentage (3.5 percent) was planned for 2003.

a. Operation average percentage of fingerlings stocked in 2002 (and average percentage planned to be stocked in 2003) by initial stocking location:

	Operation Average Percent			
Initial Stocking Location	**2002 Percent**	**Std. Error**	**2003 Percent**	**Std. Error**
Foodsize fish ponds that already contain fish (understocking)	83.3	(0.7)	83.5	(0.7)
Foodsize fish ponds empty of fish	12.8	(0.6)	13.0	(0.7)
Nursery (stocker) ponds	3.9	(0.4)	3.5	(0.4)
Total	100.0		100.0	

Operation Average Percent of Fingerlings Stocked in 2002, by Initial Stocking Location



6. Fish to be vaccinated for ESC

The percentage of operations that planned to vaccinate at least some fish intended for stocking in 2003 was similar to the percentage of operations that stocked any vaccinated fish in the past three years (table D.3.a).

a. For operations that planned to stock fish in 2003, percentage of operations that planned to vaccinate at least some fish in 2003, by region:

Percent Operations					
Region					
East		West		All Operations	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
23.6	(1.3)	8.4	(0.9)	16.8	(0.8)

For operations that planned on stocking in 2003, the operation average percentage of fish to be vaccinated was 11.9 percent.

b. For operations that planned to stock fish and vaccinate in 2003, operation average percentage of fish to be vaccinated:

Operation Average Percent					
Region					
East		West		All Operations	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
17.2	(1.0)	5.4	(0.6)	11.9	(0.6)

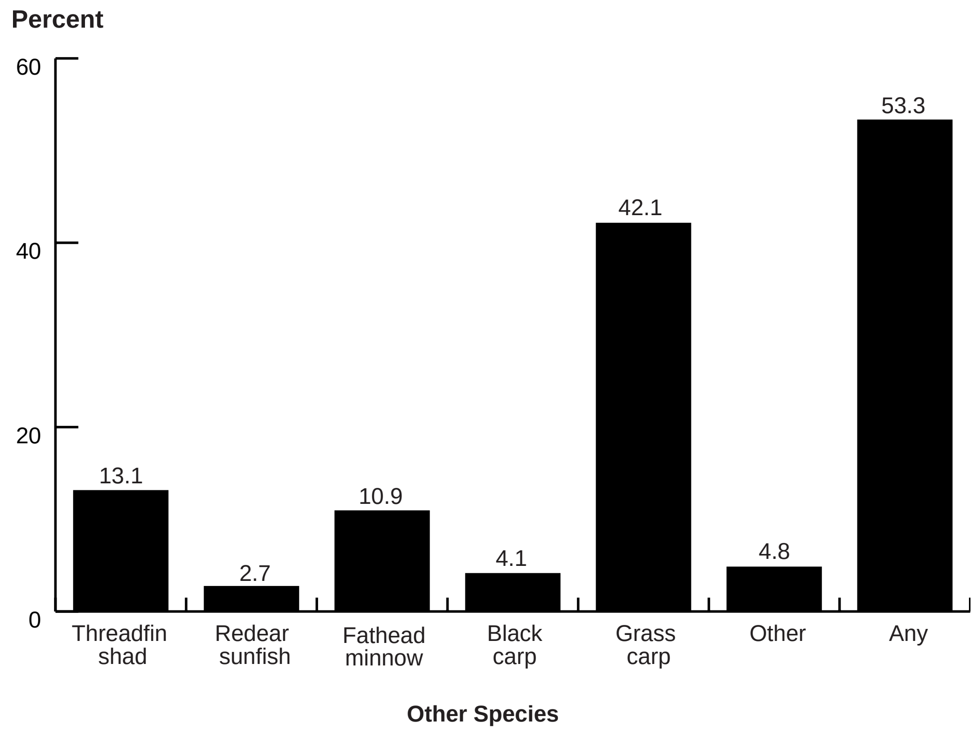
7. Other fish stocked in production ponds

Grass carp were stocked in production ponds by a much higher percentage of foodsize fish operations (42.1 percent) than threadfin shad (13.1 percent) and fathead minnows (10.9 percent). More than half of all operations stocked at least one other fish species in production ponds in addition to catfish. There were no obvious trends in stocking of other species relative to operation size.

a. Percentage of foodsize fish operations that stocked other species into ponds used for catfish production, by size of operation:

	Percent Operations									
	Size of Operation (Foodsize Surface Acres)									
	1-19		20-49		50-149		150 or More		All Operations	
Other Species	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Threadfin shad	7.7	(1.4)	6.7	(1.3)	17.5	(1.2)	14.8	(1.2)	13.1	(0.6)
Redear sunfish	4.6	(0.8)	3.1	(1.0)	1.1	(0.4)	3.4	(0.7)	2.7	(0.3)
Fathead minnows	7.1	(1.1)	6.2	(1.1)	14.7	(1.1)	11.5	(1.0)	10.9	(0.5)
Black carp	3.7	(0.9)	3.9	(1.1)	3.3	(0.5)	5.3	(0.8)	4.1	(0.4)
Grass carp	42.7	(2.2)	33.0	(2.2)	41.2	(1.6)	48.8	(2.0)	42.1	(1.0)
Other	11.9	(1.4)	1.0	(0.5)	5.4	(0.9)	3.5	(0.7)	4.8	(0.4)
Any	53.7	(2.2)	37.3	(2.2)	55.9	(1.6)	60.5	(2.0)	53.3	(1.0)

Percent of Foodsize Fish Operations that Stocked Other Species into Ponds Used for Catfish Production



E. Feeding Practices

1. Tons of feed fed

Overall, operations fed an average of 4.3 tons of feed per acre during 2002. In general, the average decreased as operation size increased. Operations with 49 or fewer surface acres fed at a higher rate per acre than operations with 50 or more acres. The average tons of feed fed per operation reported in Catfish ‘97 (Part II, table C.2.a) was not substantially different from the average tons fed per operation reported in Catfish 2003, because of the large variability associated with the estimates. However, in all operation sizes, feed fed was higher in the 2003 study than in the 1997 study. The overall average tons of feed fed was 715.6 tons in 1996 versus 903.8 tons in 2002. In contrast to the 2003 results, the average tons of feed fed per acre reported in 1997 increased as operation size increased. The overall average tons of feed fed per acre in 1996 was 4.9.

a. Average tons of feed fed (and average tons fed per acre) during 2002, by size of operation:

	Operation Average									
	Size of Operation (Foodsize Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Tons of Feed Fed	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**
Average per operation	49.0	(8.5)	177.2	(17.4)	396.6	(7.5)	2,231.8	(145.1)	903.8	(48.6)
Average per acre	5.3	(0.9)	5.4	(0.5)	4.7	(0.1)	4.2	(0.3)	4.3	(0.2)

2. Feed conversion ratio

Feed conversion, the average pounds of feed fed per pound of fish harvested, was calculated by three different methods: 1) Producers reported their estimated feed conversion and operation average was calculated. 2) The reported feed conversion was weighted by pounds of fish harvested in 2002. 3) Gross average was an actual calculation of the total pounds fed in 2002 divided by the total pounds harvested in 2002. The three methods were in close agreement. Operations with 1 to 19 acres consistently had the lowest feed conversions. Operations with 150 or more acres had the highest feed conversions, with the exception of operations with 20 to 49 acres, which had a feed conversion of 2.5 when using the gross average method. The gross average method would provide a high estimate of feed conversion if producers delayed harvesting fish because of low fish prices or some other reason. The overall feed conversion values for the weighted average and the gross average from Catfish ’97 (2.35 and 2.33, respectively) (Part II, table C.2.b) were very similar to Catfish 2003 values. The unweighted operation average was lower in 1997 compared to 2003 (2.01 and 2.2, respectively). The largest increases in operation average values occurred on operations with 49 or fewer acres.

a. Average pounds of feed fed per pound of fish harvested during 2002, by size of operation:

	Average Pounds									
	Size of Operation (Foodsize Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Average	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**
Operation average	1.9	(0.0)	2.2	(0.0)	2.1	(0.0)	2.3	(0.0)	2.2	(0.0)
Weighted average	2.0	(0.0)	2.1	(0.0)	2.1	(0.0)	2.3	(0.0)	2.3	(0.0)
Gross average*	2.0	(0.1)	2.5	(0.2)	2.2	(0.0)	2.4	(0.1)	2.3	(0.0)

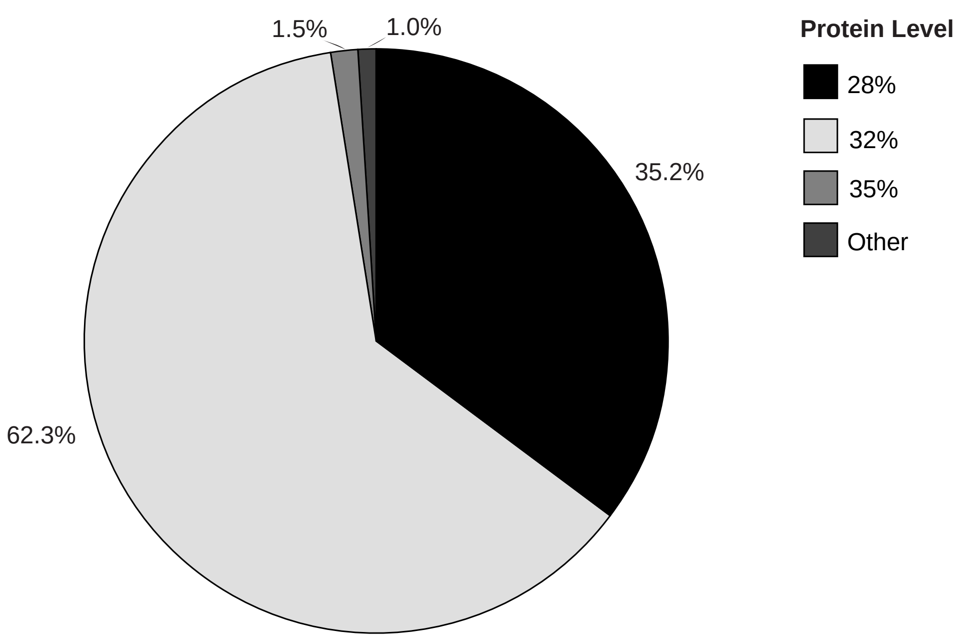
*Annual feed divided by foodsize fish pounds harvested

3. Protein in feed

a. Percentage of foodsize fish operations by percentage protein feed fed to foodsize fish:

Protein Level (Percent)	Percent Operations	Standard Error
28	35.2	(0.9)
32	62.3	(1.0)
35	1.5	(0.3)
Other	1.0	(0.1)
Total	100.0	

Percent of Foodsize Fish Operations by Percent Protein Feed Fed to Foodsize Fish



4. Seasonal feeding practices

Feeding practices in 2002 changed by season. From March to April, the majority of operations fed on alternate days, either to satiation (37.8 percent of operations) or with a maximum feeding limit (22.8 percent of operations). From May to August the majority of operations fed daily, with 39.9 percent of operations feeding to satiation and 31.4 percent feeding to a maximum limit. From September to October, operations tended to shift back to the alternate day feeding found in the spring, but with a slightly higher percentage of operations maintaining a daily feeding schedule either to satiation (17.1 percent) or to the maximum limit (18.5 percent).

a. Percentage of foodsize fish operations by seasonal feeding frequency most commonly used in 2002 for foodsize fish:

	Percent Operations					
	March-April		May-August		September-October	
Feeding Frequency	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Every day to satiation	12.5	(0.6)	39.9	(1.0)	17.1	(0.8)
Every day but with a maximum feeding limit	13.7	(0.7)	31.4	(0.9)	18.5	(0.8)
Fed on alternate days to satiation	37.8	(1.0)	16.5	(0.7)	35.0	(1.0)
Fed on alternate days with a maximum feeding limit	22.8	(0.9)	9.2	(0.6)	19.0	(0.8)
Other	13.2	(0.7)	3.0	(0.3)	10.4	(0.6)
Total	100.0		100.0		100.0	

5. Winter feeding practices

During winter, almost a third of foodsize fish operations did not feed fish at least once a week. However, over half of operations reported feeding fish four or more times per week. In Catfish ‘97, only 12.5 percent of operations reported that they did not feed fish at least once a week during winter (Part II, table D.1.a).

a. Percentage of foodsize fish operations by average number of days per week foodsize fish were fed from December through February:

Average Days per Week	Percent Operations	Standard Error
0	30.1	(0.9)
1 to 3	9.7	(0.6)
4 or more	53.1	(1.0)
No foodfish on hand in winter	7.1	(0.4)
Total	100.0	

6. Maximum feed fed to foodsize fish

The highest percentage of operations fed the most feed to foodsize fish in all their ponds in August (45.0 percent of operations) and July (29.8 percent of operations).

a. Percentage of foodsize fish operations by month when the most feed was fed to foodsize fish in all ponds:

Month	Percent Operations	Standard Error
February	0.2	(0.1)
April	0.9	(0.2)
May	3.6	(0.3)
June	9.4	(0.5)
July	29.8	(0.9)
August	45.0	(1.0)
September	10.3	(0.6)
October	0.8	(0.2)
Total	100.0	

During the month in which the highest amount of feed was fed, the operation average daily pounds fed per acre in all ponds was 108.4 pounds. Operations with 1 to 19 acres had a lower daily average (83.3 pounds per acre) than the larger operations.

b. Operation average pounds of feed per acre fed per day to foodsize fish in all ponds during the highest feeding month, by size of operation:

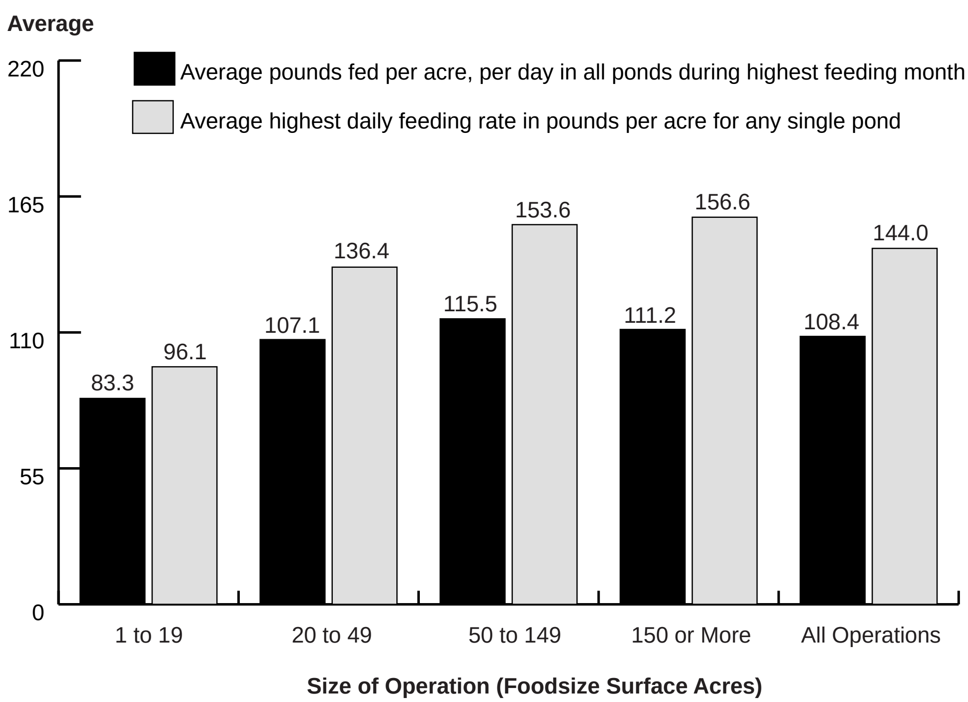
Operation Average (lbs per acre)									
Size of Operation (Foodsize Surface Acres)									
1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Average	**Std. Error**	**Average**	**Std. Error**	**Average**	**Std. Error**	**Average**	**Std. Error**	**Average**	**Std. Error**
83.3	(3.6)	107.1	(2.3)	115.5	(1.4)	111.2	(1.4)	108.4	(0.9)

For all operations, the highest daily feeding rate for any single pond averaged 144.0 pounds per acre. The average highest daily feeding on operations with 50 to 149 acres and 150 or more acres (153.6 and 156.6 pounds per acre, respectively) was higher than the amounts fed on operations with 1 to 19 acres and 20 to 49 acres (96.1 and 136.4 pounds per acre, respectively).

c. Operation average highest daily feeding rate in pounds per acre for any single pond, by size of operation:

Operation Average Highest Daily Feeding Rate (in lbs)									
Size of Operation (Foodsize Surface Acres)									
1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Average	**Std. Error**	**Average**	**Std. Error**	**Average**	**Std. Error**	**Average**	**Std. Error**	**Average**	**Std. Error**
96.1	(4.4)	136.4	(2.9)	153.6	(2.0)	156.6	(2.5)	144.0	(1.3)

Operation Average Pounds of Feed Per Acre Fed Per Day in All Ponds During the Highest Feeding Month (and Operation Average Highest Daily Feeding Rate in Pounds Per Acre for Any Single Pond) by Size of Operation



F. Harvesting Practices

1. Pounds of fish harvested

Overall, operations harvested an average of 3,698 pounds of fish per acre in 2002. Pounds harvested per acre decreased as operation size increased, although the average pounds per acre harvested on operations with 1 to 19 acres was variable (standard error 984). Harvest rates may have been affected by prices, with some operations harvesting fewer fish in 2002 than usual.

a. Operation average pounds of fish harvested per acre in 2002, by size of operation:

Operation Average (lbs per Acre)									
Size of Operation (Foodsize Surface Acres)									
1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Average	**Std. Error**	**Average**	**Std. Error**	**Average**	**Std. Error**	**Average**	**Std. Error**	**Average**	**Std. Error**
5,153	(984)	4,324	(124)	4,151	(92)	3,585	(221)	3,698	(187)

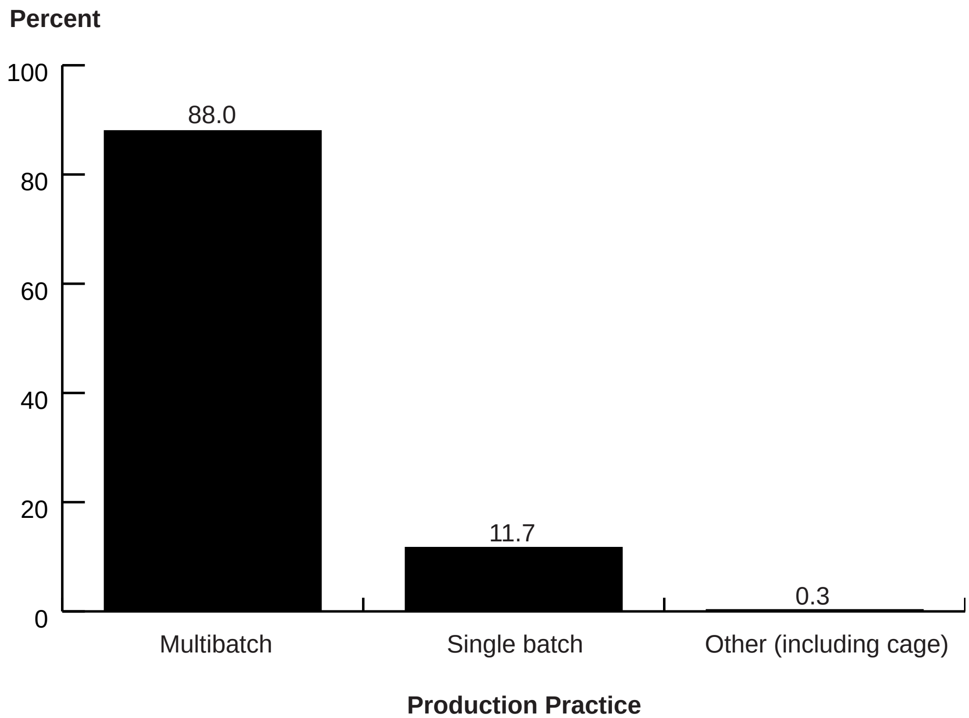
2. Foodfish production method

Multibatch harvested fish represented the highest percentage of fish harvested (operation average 81.4 percent of fish; weighted percentage 88.0 percent). Single-batch harvested fish represented a much smaller percentage of the harvest. In Catfish ’97, the operation average and weighted average percentage of multibatch harvested fish were 77.3 and 89.2 percent, respectively (Part II, tables E.1.a and b), which is very similar to 2003 study values. As in 2003, single-batch harvest represented most of the remaining harvest in the 1997 study.

a. Operation average percentage of fish harvested (and percentage of pounds of fish harvested), by production practice:

	Percent Harvest			
Production Practice	**Operation Average**	**Standard Error**	**Percent Fish**	**Standard Error**
Multibatch	81.4	(0.7)	88.0	(1.7)
Single batch	14.6	(0.7)	11.7	(1.7)
Other (including cage)	4.0	(0.3)	0.3	(0.1)
Total	100.0		100.0	

Percent of Pounds of Fish Harvested, by Production Phase



3. Type of seining crew

A higher percentage of operations with 20 to 49 and 50 to 149 acres depended on custom harvest crews (65.4 and 66.1 percent, respectively) than operations with 1 to 19 and 150 or more acres (30.0 and 47.2 percent, respectively). The majority of operations with 1 to 19 acres (44.9 percent) depended on “other” methods, primarily fee fishing (angling). A relatively high percentage of operations with 150 or more acres (34.3 percent) relied on in-house seining crews.

a. Percentage of foodsize fish operations by type of seining crew that primarily harvested fish and by size of operation:

	Percent Operations									
	Size of Operation (Foodsize Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Seining Crew	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
In-house	25.1	(1.8)	19.8	(1.7)	16.7	(1.2)	34.3	(1.8)	24.1	(0.8)
Custom harvest	30.0	(2.2)	65.4	(2.0)	66.1	(1.5)	47.2	(2.0)	55.1	(0.9)
Other	44.9	(2.2)	14.8	(1.5)	17.2	(1.2)	18.5	(1.0)	20.8	(0.6)
Total	100.0		100.0		100.0		100.0		100.0	

4. Number of ponds harvested

Foodsize fish were harvested from 76.1 percent of all foodsize fish ponds in 2002. Operations with 150 or more acres harvested fish from 74.8 percent of their ponds; however, these operations had the highest standard error (4.8 percent). This relatively high standard error implies that there was substantial variability in the percentage of ponds harvested on the largest operations.

a. Percentage of ponds where foodsize fish were harvested during 2002, by size of operation:

Percent Ponds									
Size of Operation (Foodsize Surface Acres)									
1-19		**20-49**		**50-149**		**150 or More**		**All Operations**	
Percent	**Std. Error**	**Percent**	**Std. Error**	**Percent**	**Std. Error**	**Percent**	**Std. Error**	**Percent**	**Std. Error**
72.8	(3.1)	77.2	(2.2)	82.4	(0.9)	74.8	(4.8)	76.1	(3.7)

Harvesting a production pond

G. Disease

1. Familiarity with emerging fish health problems

Visceral toxicosis of catfish is a newly recognized problem, which is reflected in the relatively high percentage of producers (54.7 percent) who had merely heard the name or didn't know the disease. Nearly two-thirds of producers were very or somewhat familiar with algal toxins.

a. Percentage of foodsize fish operations by familiarity with the following fish health problems:

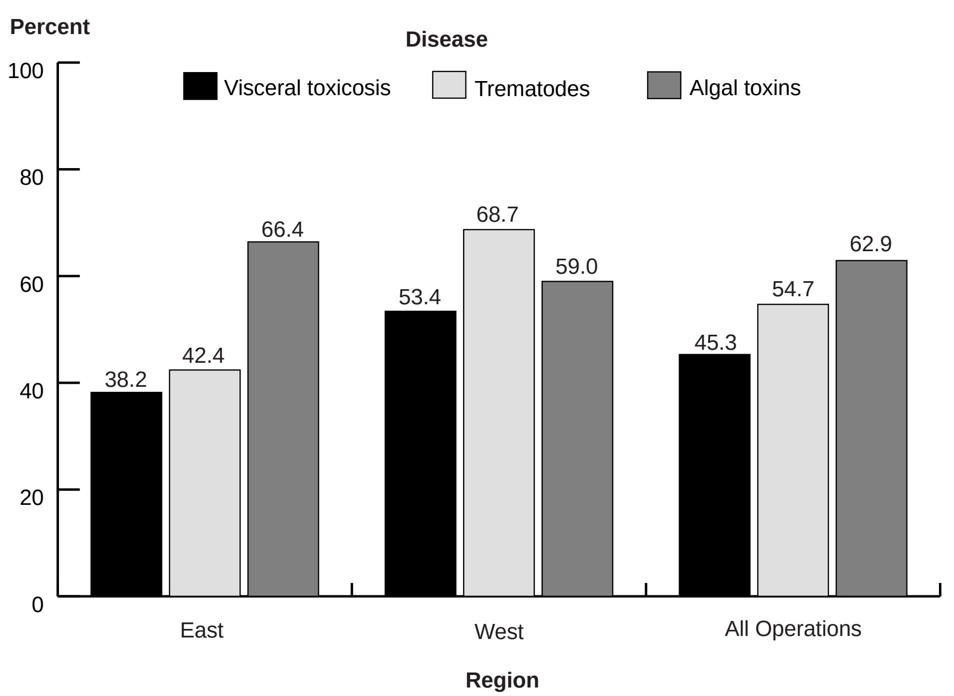
	Percent Operations						
	Very Familiar		Somewhat Familiar		Heard Name/Don't Know		Total
Disease	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**
Visceral toxicosis of catfish	11.6	(0.7)	33.7	(1.0)	54.7	(1.0)	100.0
Trematodes	15.0	(0.7)	39.7	(1.0)	45.3	(0.9)	100.0
Algal toxins	22.6	(0.8)	40.3	(1.0)	37.1	(1.0)	100.0

A higher percentage of operations in the West region were very or somewhat familiar with visceral toxicosis and trematodes than operations in the East region. This result corresponds with the emergence of these problems primarily in Arkansas, Louisiana and Western Mississippi.

b. Percentage of foodsize fish operations that were very or somewhat familiar with the following fish health problems, by region:

	Percent Operations					
	Region					
	East		West		All Operations	
Disease	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Visceral toxicosis of catfish	38.2	(1.3)	53.4	(1.5)	45.3	(1.0)
Trematodes	42.4	(1.3)	68.7	(1.1)	54.7	(0.9)
Algal toxins	66.4	(1.2)	59.0	(1.5)	62.9	(1.0)

Percent of Foodsize Fish Operations that Were Very or Somewhat Familiar with the Following Fish Health Problems, by Region



2. Health problems related to algal toxins

Of operations that were very or somewhat familiar with algal toxins, 38.4 percent reported that in the last 3 years they had fish health problems related to algal toxins. A higher percentage of operations in the East region reported fish health problems related to algal toxins than operations in the West region.

a. For operations somewhat or very familiar with algal toxins, percentage of operations that in the last 3 years had fish health problems related to algal toxins, by region:

Percent Operations					
Region					
East		West		All Operations	
Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
44.4	(1.6)	30.6	(1.9)	38.4	(1.2)

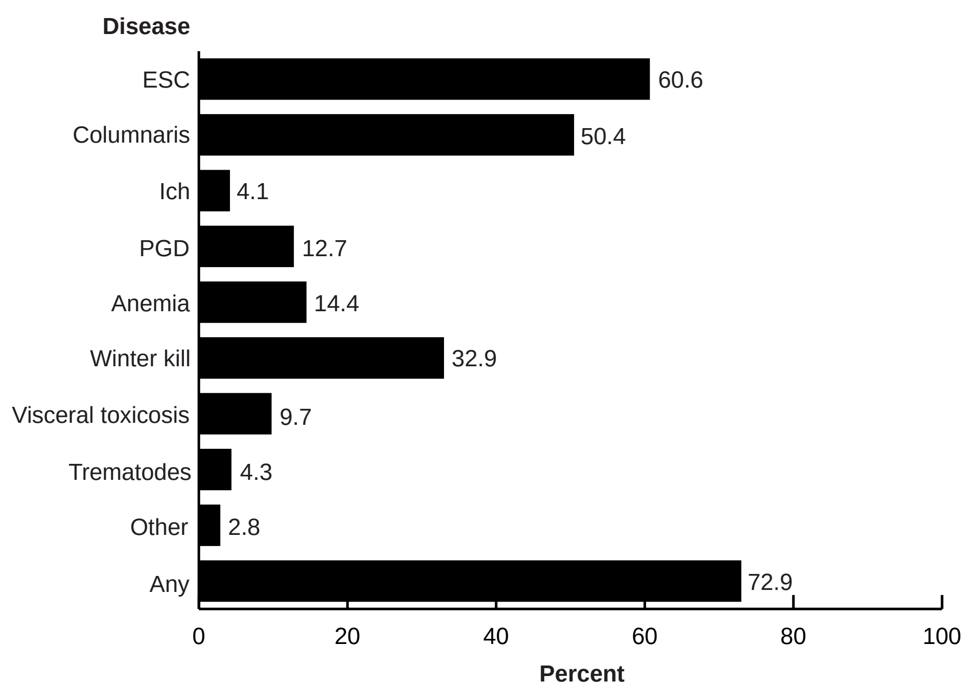
3. Disease outbreaks in 2002

The three most prevalent diseases reported were: enteric septicemia of catfish (60.6 percent of operations); columnaris (50.4 percent of operations); and winter kill (32.9 percent of operations). With the exceptions of ich, proliferative gill disease (PGD), and trematodes, the percentage of operations with any of the listed disease problems increased as operation size increased. A higher percentage of operations with 150 or more acres reported problems with trematodes than operations with 149 or fewer acres. Catfish ’97 reported disease information comparable to Catfish 2003 data (Part 1, table B.1.a). In Catfish ‘97, enteric septicemia of catfish (ESC) and columnaris (reported in combination in Part I of the study) were reported by 78.1 percent of operations. ESC was reported alone in the second Catfish ’97 report (Part II, table F.1.a), where 56.0 percent of operations reported ESC outbreaks, similar to the percentage of ESC outbreaks reported in 2002. In 1997, 35.8 percent of operations experienced problems with winter kill, compared to 32.9 percent in 2003. PGD was reported by a slightly higher percentage of operations in 1997 (19.8 percent) than in 2003 (12.7 percent). Much of the change from 1997 to 2003 in the percentage of operations reporting PGD problems occurred on operations with 150 or more acres, where 40.9 percent of operations in 1997 and 24.9 percent of operations in 2003 reported PGD problems. A higher percentage of operations reported problems with anemia in 2003 (14.4 percent) compared to 1997 (8.4 percent). Ich problems were unchanged. Visceral toxicosis and trematodes were not included in Catfish ‘97 because they were not identified as disease problems at the time.

a. Percentage of foodsize fish operations that experienced any outbreaks of the following diseases in 2002, by size of operation:

	Percent Operations Size of Operation (Foodsize Surface Acres)									
	1-19		20-49		50-149		150 or More		All Ops.	
Disease	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
ESC	29.4	(2.3)	59.4	(2.2)	60.5	(1.6)	75.3	(1.6)	60.6	(0.9)
Columnaris	17.4	(2.0)	45.6	(2.3)	54.6	(1.7)	63.6	(1.9)	50.4	(1.0)
Ich	6.5	(1.2)	1.7	(0.5)	4.1	(0.6)	4.7	(0.8)	4.1	(0.4)
PGD	5.5	(1.3)	3.8	(1.0)	9.7	(1.0)	24.9	(1.8)	12.7	(0.7)
Anemia	2.7	(0.9)	6.0	(1.0)	11.5	(1.1)	28.1	(1.9)	14.4	(0.8)
Winter kill	10.9	(1.7)	23.7	(2.0)	35.4	(1.6)	45.9	(2.0)	32.9	(1.0)
Visceral toxicosis of catfish	4.2	(1.2)	7.3	(1.5)	8.9	(0.9)	14.4	(1.5)	9.7	(0.7)
Trematodes	2.6	(0.8)	0.0	(0.0)	1.0	(0.3)	11.6	(1.4)	4.3	(0.5)
Other	2.8	(1.0)	1.6	(0.4)	2.8	(0.6)	3.6	(0.7)	2.8	(0.4)
Any	39.8	(3.5)	72.0	(2.7)	75.9	(1.8)	84.7	(1.6)	72.9	(1.0)

Percent of Foodsize Fish Operations that Experienced Any Outbreaks of the Following Diseases in 2002



The East region had a higher percentage of operations that reported ESC and columnaris problems than operations in the West region. However, a higher percentage of operations in the West region experienced problems with PGD, anemia, winter kill, and trematodes than operations in the East region.

b. Percentage of foodsize fish operations that experienced any outbreaks of the following diseases in 2002, by region:

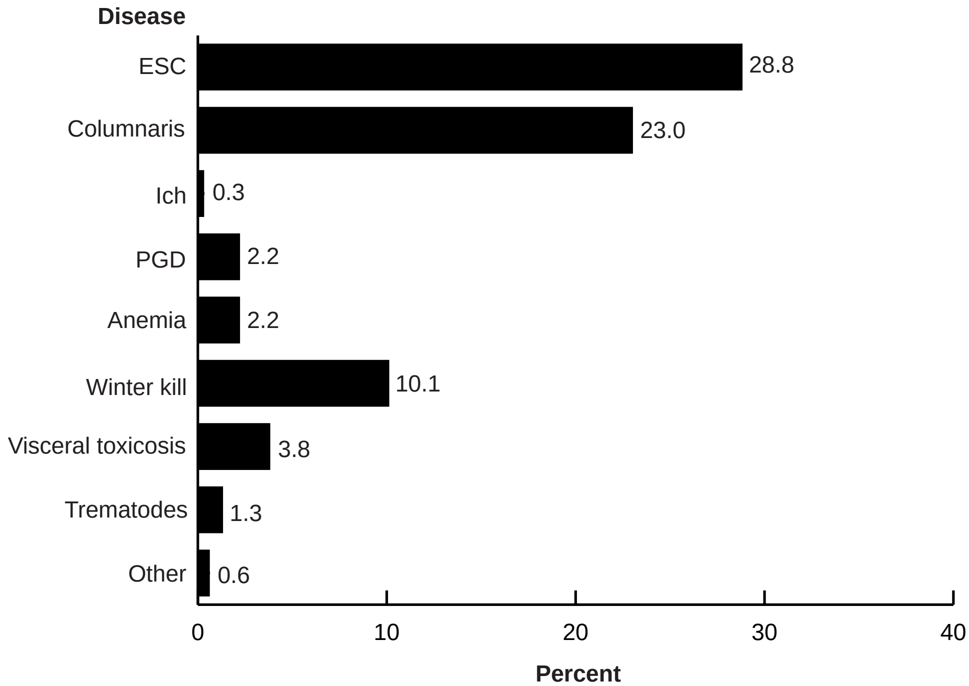
	Percent Operations			
	Region			
	East		West	
Disease	**Percent**	**Std. Error**	**Percent**	**Std. Error**
ESC	65.1	(1.2)	54.9	(1.5)
Columnaris	57.8	(1.3)	41.7	(1.5)
Ich	3.0	(0.5)	5.5	(0.6)
PGD	8.6	(0.7)	17.6	(1.3)
Anemia	11.8	(0.9)	17.4	(1.3)
Winter kill	28.7	(1.2)	37.8	(1.5)
Visceral toxicosis of catfish	7.9	(0.8)	11.8	(1.1)
Trematodes	1.0	(0.3)	8.4	(1.0)
Other	3.0	(0.5)	2.5	(0.5)
Any	76.9	(1.3)	68.1	(1.7)

The three diseases that occurred on the highest percentage of operations (ESC, columnaris, and winter kill) also occurred in the highest percentage of ponds (28.8, 23.0, and 10.1 percent, respectively). The remaining diseases occurred in less than 5 percent of ponds. In Catfish '97 (Part I, table B.2.a), 42.1 percent of ponds had problems with the combination of ESC/columnaris. Winter kill was reported in 21.0 percent of ponds in 1997, approximately twice the 2003 percentage of 10.1 percent. As with the percentage of operations, PGD declined over the period in the percentage of ponds that were affected (5.3 percent versus 2.2 percent).

c. Percentage of foodsize fish ponds that experienced any outbreaks of the following diseases in 2002, by size of operation:

	Percent Ponds									
	Size of Operation (Foodsize Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Ops.**	
Disease	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
ESC	17.4	(1.9)	33.9	(2.7)	27.7	(1.3)	29.1	(3.2)	28.8	(2.5)
Columnaris	8.4	(1.1)	24.1	(1.6)	21.7	(1.1)	23.7	(2.8)	23.0	(2.2)
Ich	3.3	(0.9)	0.4	(0.1)	0.7	(0.1)	0.2	(0.0)	0.3	(0.0)
PGD	2.0	(0.4)	2.4	(1.1)	3.0	(0.4)	2.0	(0.3)	2.2	(0.3)
Anemia	1.6	(0.6)	1.5	(0.2)	2.0	(0.2)	2.3	(0.3)	2.2	(0.2)
Winter kill	6.0	(1.0)	15.9	(2.8)	12.1	(0.8)	9.4	(1.1)	10.1	(0.9)
Visceral toxicosis of catfish	1.7	(0.5)	4.2	(0.1)	3.5	(0.5)	3.9	(1.2)	3.8	(0.9)
Trematodes	1.5	(0.4)	0.0	(--)	0.2	(0.1)	1.6	(0.3)	1.3	(0.3)
Other	2.2	(0.9)	1.4	(0.4)	0.8	(0.2)	0.5	(0.2)	0.6	(0.2)

Percent of Foodsize Fish Ponds that Experienced Any Outbreaks of the Following Diseases in 2002



ESC, columnaris, and visceral toxicosis were reported in a higher percentage of ponds in the East region than the West region. The relatively high percentage of operations reporting outbreaks of visceral toxicosis of catfish may be due to the recent emergence of the disease and the potential for confusing it with algal toxins. PGD and winter kill occurred in a higher percentage of ponds in the West region than the East region. Trematode problems occurred in a slightly higher percentage of ponds in the West region (1.8 percent) than the East region (0.5 percent).

d. Percentage of foodsize fish ponds that experienced any outbreaks of the following diseases in 2002, by region:

	Percent Ponds			
	Region			
	East		**West**	
Disease	**Percent**	**Std. Error**	**Percent**	**Std. Error**
ESC	47.0	(3.5)	17.8	(1.2)
Columnaris	42.3	(2.8)	11.4	(0.9)
Ich	0.4	(0.1)	0.3	(0.0)
PGD	1.6	(0.3)	2.6	(0.3)
Anemia	2.8	(0.5)	1.9	(0.2)
Winter kill	6.6	(1.0)	12.2	(1.1)
Visceral toxicosis of catfish	7.2	(1.9)	1.8	(0.3)
Trematodes	0.5	(0.2)	1.8	(0.4)
Other	0.6	(0.1)	0.7	(0.3)

Although Ich outbreaks were not reported by many operations or in many ponds (tables G.3.a and c), when an outbreak did occur a high percentage of losses were reported as severe (42.4 percent of operations). Similarly, PGD, anemia, and visceral toxicosis of catfish occurred in a small percentage of ponds but a relatively high percentage of the outbreaks were reported as severe (35.4, 41.8, and 33.2 percent of operations, respectively). Although ESC and columnaris were more prevalent diseases, a lower percentage of operations characterized their average loss per outbreak as severe (10.0 and 14.5 percent, respectively).

e. For operations that experienced fish losses in foodsize fish ponds due to the following disease outbreaks in 2002, percentage of operations by severity of average loss (in pounds of fish per operation) per outbreak:

	Percent Operations						
	Average Loss per Outbreak (in lbs)						
	Light (Less than 200)		**Moderate** (200-2,000)		**Severe** (More than 2,000)		**Total**
Disease Outbreak	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**
ESC	50.5	(1.4)	39.5	(1.4)	10.0	(0.8)	100.0
Columnaris	49.0	(1.5)	36.5	(1.5)	14.5	(1.1)	100.0
Ich	44.3	(4.6)	13.3	(3.0)	42.4	(4.9)	100.0
PGD	37.9	(3.0)	26.7	(2.7)	35.4	(2.9)	100.0
Anemia	32.3	(2.7)	25.9	(2.9)	41.8	(3.1)	100.0
Winter kill	40.6	(1.9)	33.1	(1.9)	26.3	(1.8)	100.0
Visceral toxicosis of catfish	42.6	(3.6)	24.2	(3.1)	33.2	(3.6)	100.0
Trematodes	41.4	(5.8)	40.0	(5.7)	18.6	(4.7)	100.0
Other	22.6	(6.1)	41.2	(6.1)	36.2	(6.2)	100.0

Although ESC and columnaris accounted for low percentages of outbreaks considered severe (table G.4.e), the impact of the high percentage of ponds affected (table G.4.c) resulted in relatively high percentage of ponds with average outbreaks characterized as severe (2.7 and 3.0 percent). In contrast, winter kill occurred on a smaller percentage of ponds (table G.4.c) but the percentage of winter kill outbreaks considered severe was higher than those for ESC and columnaris. These percentages resulted in an equivalent percentage of all ponds that had severe outbreaks of winter kill (2.7 percent) as compared to ESC and columnaris. Operations in Catfish ’97 reported severe outbreaks of ESC/columnaris in 8.7 percent of ponds (Part I, table B.2.b). A direct comparison with Catfish 2003 is not possible since it is unknown which ponds had severe outbreaks. The percentage of ponds with severe outbreaks of PGD decreased slightly (1.6 percent in 1996 compared to 0.6 percent in 2002). The percentage of ponds with severe outbreaks of anemia increased slightly from 1996 (0.2 percent) to 2002 (0.7 percent). The percentage of ponds with severe Ich or winter kill problems did not change from 1996 to 2002.

f. Percentage of all foodsize fish ponds by severity of average loss (in pounds of fish per operation) per outbreak of the following diseases in 2002:

	Percent Ponds								
	Average Loss per Outbreak (in lbs)								
	None		**Light** (Less than 200)		**Moderate** (200-2,000)		**Severe** (More than 2,000)		**Total**
Disease Outbreak	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**
ESC	71.2	(2.5)	16.9	(2.9)	9.2	(0.9)	2.7	(0.6)	100.0
Columnaris	77.0	(2.2)	7.3	(0.6)	12.7	(2.6)	3.0	(0.6)	100.0
Ich	99.7	(0.0)	0.2	(0.0)	0.0	(0.0)	0.1	(0.0)	100.0
PGD	97.8	(0.3)	0.6	(0.1)	1.0	(0.2)	0.6	(0.1)	100.0
Anemia	97.8	(0.2)	0.7	(0.1)	0.8	(0.2)	0.7	(0.1)	100.0
Winter kill	89.9	(0.9)	3.8	(0.5)	3.6	(0.5)	2.7	(0.5)	100.0
Visceral toxicosis of catfish	96.2	(0.9)	0.7	(0.1)	2.4	(0.9)	0.7	(0.2)	100.0
Trematodes	98.7	(0.3)	0.5	(0.2)	0.7	(0.2)	0.1	(0.0)	100.0
Other	99.4	(0.2)	0.4	(0.2)	0.1	(0.0)	0.1	(0.0)	100.0

4. Ponds with more than four disease outbreaks

a. Percentage of foodsize fish operations (and percentage of ponds) that had more than four disease outbreaks in 2002:*

Percent Ops.	Standard Error	Percent Ponds	Standard Error
32.0	(5.1)	2.4	(0.5)

*Outbreaks can be from a single disease or multiple diseases

5. Use of medicated feed

Medicated feed was fed to foodsize fish on 11.0 percent of operations. The percentage of operations that fed medicated feed increased as operation size increased.

a. Percentage of foodsize fish operations that fed medicated feed to foodsize fish during 2002, by size of operation:

Percent Operations Size of Operation (Foodsize Surface Acres)									
1-19		20-49		50-149		150 or More		All Operations	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
6.1	(1.1)	8.7	(1.2)	10.3	(1.0)	15.4	(1.6)	11.0	(0.7)

Terramycin and Romet® were fed by 7.8 and 5.3 percent of operations, respectively. No operations with 1 to 19 acres fed Romet, and 12.6 percent of operations with 150 or more acres fed terramycin.

b. Percentage of operations that fed any terramycin or Romet during 2002, by size of operation:

	Percent Operations Size of Operation (Foodsize Surface Acres)									
	1-19		20-49		50-149		150 or More		All Ops.	
Feed	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
Terramycin	6.1	(1.1)	4.4	(0.9)	6.2	(0.8)	12.6	(1.5)	7.8	(0.6)
Romet	0.0	(--)	5.1	(0.9)	5.7	(0.8)	7.2	(1.2)	5.3	(0.5)

The average tons of terramycin fed (11.4) on all operations was higher than the average tons of Romet fed (6.0). The average tons of terramycin fed did not increase as operation size increased. Operations with 150 or more acres fed more Romet than the other operation sizes.

c. For foodsize fish operations that fed medicated feed to foodsize fish during 2002, operation average tons of medicated feed fed, by size of operation:

	Operation Average Tons									
	Size of Operation (Foodsize Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Ops.**	
Medicated Feed	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**
Terramycin	9.4	(2.0)	14.6	(3.5)	8.5	(0.9)	12.7	(1.5)	11.4	(0.9)
Romet	0.0	(--)	4.0	(0.3)	3.4	(0.4)	9.2	(1.4)	6.0	(0.6)

6. Diagnostic laboratory testing

a. Percentage of operations that submitted any foodsize fish samples to a diagnostic laboratory for testing during 2002, by region:

Percent Operations					
Region					
East		**West**		**All Operations**	
Percent	**Standard Error**	**Percent**	**Standard Error**	**Percent**	**Standard Error**
29.7	(1.2)	38.5	(1.4)	33.8	(0.9)

For operations that submitted samples, the highest percentage of operations (76.6 percent) submitted at least some samples in order to confirm the cause of a disease outbreak. A higher percentage of operations in the West region submitted some samples for early detection testing (54.0 percent) and for identifying unknown causes (65.5 percent) than operations in the East region (34.8 and 43.5 percent, respectively).

b. Of foodsize fish operations that submitted samples for testing during 2002, percentage of operations by reason for diagnostic testing and by region:

	Percent Operations					
	Region					
	East		West		All Operations	
Submission Reason	**Percent**	**Std. Error**	**Percent**	**Std. Error**	**Percent**	**Std. Error**
Early problem detection	34.8	(2.4)	54.0	(2.8)	45.0	(1.9)
Confirming cause of outbreak	75.6	(2.1)	77.4	(2.0)	76.6	(1.5)
Identifying unknown causes	43.5	(2.5)	65.5	(2.5)	55.2	(1.8)
Other	4.3	(1.0)	4.5	(0.8)	4.4	(0.6)

For operations that ***did not*** submit any samples for testing, the primary reasons for not submitting samples were: they did not have any substantial disease problems (54.8 percent of operations); and they already knew what the disease was (32.9 percent of operations). Inconvenience, lack of information usefulness, lack of awareness of services, and cost did not appear to be important reasons for not submitting samples.

c. Of foodsize fish operations that ***did not*** submit samples to a diagnostic laboratory for testing during 2002, percentage of operations by reason(s) for ***not*** testing and by region:

	Percent Operations					
	Region					
	East		**West**		**All Operations**	
Reasons	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Inconvenient	3.2	(0.5)	2.8	(0.5)	3.0	(0.4)
Information rarely of use (does not help control disease)	1.4	(0.4)	6.6	(0.9)	3.7	(0.5)
Already knew what the disease was	38.5	(1.6)	25.8	(1.7)	32.9	(1.1)
Unaware of available services	0.8	(0.2)	0.0	(--)	0.5	(0.1)
Too costly	0.4	(0.1)	0.6	(0.2)	0.5	(0.1)
No substantial disease problems	50.6	(1.6)	60.2	(1.8)	54.8	(1.2)
Other	5.1	(0.7)	4.0	(0.6)	4.6	(0.5)
Total	100.0		100.0		100.0	

7. Record keeping

Written or computerized records of some kind were kept by 86.6 percent of foodsize fish operations. A larger percentage of operations kept harvesting, stocking, and feeding records (80.9, 78.5, and 79.0 percent, respectively) than other types of records.

a. Percentage of foodsize fish operations that kept the following types of written or computerized records, by region:

	Percent Operations					
	Regions					
	East		West		All Operations	
Records Kept	Percent	Std. Error	Percent	Std. Error	Percent	Std. Error
Stocking	79.6	(1.0)	77.3	(1.2)	78.5	(0.8)
Harvesting	81.9	(1.0)	79.7	(1.2)	80.9	(0.8)
Disease	22.8	(1.1)	30.7	(1.4)	26.5	(0.9)
Feeding	81.2	(1.0)	76.5	(1.3)	79.0	(0.8)
Water quality	54.0	(1.3)	42.0	(1.5)	48.4	(1.0)
Breeding	3.3	(0.4)	18.1	(1.2)	10.2	(0.6)
Other	6.6	(0.6)	4.1	(0.6)	5.5	(0.4)
Any	87.4	(0.8)	85.6	(1.0)	86.6	(0.7)

H. Off-Flavor

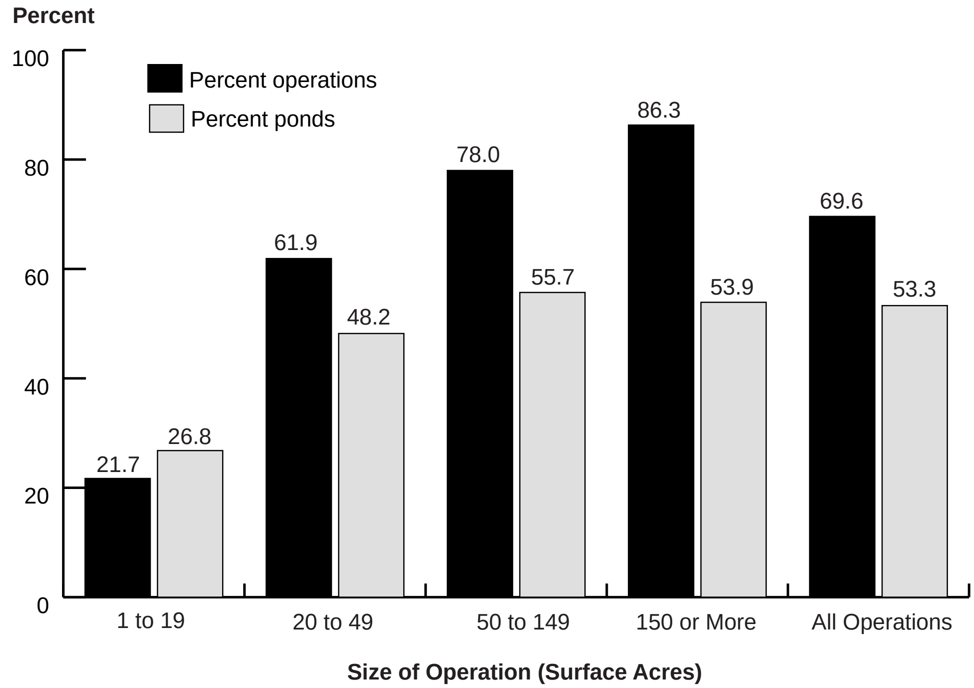
1. Delayed harvest

During 2002, off-flavor problems delayed harvest on 69.6 percent of all operations and 53.3 percent of all ponds on these operations where foodsize fish were harvested. The percentage of operations with delays due to off-flavor increased as operation size increased. Harvest was delayed on 26.8 percent of ponds on operations with 1 to 19 surface acres.

a. Percentage of operations (and percentage of ponds on operations where foodsize fish were harvested) that experienced any harvest delays in 2002 because of off-flavor problems, by size of operation:

Size of Operation (Surface Acres)	Percent Operations	Standard Error	Percent Ponds	Standard Error
1 to 19	21.7	(2.1)	26.8	(4.1)
20 to 49	61.9	(2.1)	48.2	(2.4)
50 to 149	78.0	(1.3)	55.7	(1.6)
150 or more	86.3	(1.2)	53.9	(2.6)
All operations	69.6	(0.8)	53.3	(1.9)

Percent of Operations (and Percent of Ponds on Operations Where Foodsize Fish Were Harvested) that Experienced any Harvest Delays in 2002 Because of Off-Flavor Problems, by Size of Operation



The percentage of operations that had any harvest delays due to off-flavor did not differ substantially between the East and the West regions. However, a slightly higher percentage of ponds had harvest delays in the East region compared to the West region.

b. Percentage of operations (and percentage of ponds on these operations where foodsize fish were harvested) that experienced any harvest delays because of off-flavor problems in 2002, by region:

Region	Percent Operations	Standard Error	Percent Ponds	Standard Error
East	68.7	(1.1)	59.2	(1.2)
West	70.6	(1.2)	50.8	(2.4)

2. Duration of off-flavor episodes

During 2002, the shortest off-flavor episode was 7 to 14 days for 43.2 percent of operations and 15 to 30 days for 35.1 percent of operations. The longest off-flavor episode was over 30 days for most operations (82.9 percent). The overall average duration of off-flavor episodes was 15 to 30 days on 40.1 percent of operations and 31 to 60 days on 28.2 percent of operations.

a. For operations with ponds that had delayed harvests in 2002, percentage of operations by ponds with the shortest and longest delays, and average number of days of off-flavor episodes:

	Percent Operations					
	Pond with Shortest Delay		Pond with Longest Delay		Average Delay	
Days of Off-Flavor	**Percent**	**Std. Error**	**Percent**	**Std. Error**	**Percent**	**Std. Error**
1 to 6	8.2	(0.6)	1.0	(0.2)	4.0	(0.4)
7 to 14	43.2	(1.3)	2.1	(0.3)	11.2	(0.8)
15 to 30	35.1	(1.2)	14.1	(0.9)	40.1	(1.3)
31 to 60	8.9	(0.7)	21.4	(1.0)	28.2	(1.2)
61 to 100	2.5	(0.4)	10.5	(0.8)	9.3	(0.7)
More than 100	1.3	(0.3)	24.1	(1.1)	6.2	(0.6)
Ongoing	0.8	(0.2)	26.8	(1.1)	1.0	(0.2)
Total	100.0		100.0		100.0	

3. Treatment of delayed ponds

The percentage of all ponds that had off-flavor that were treated with either diuron only (27.2 percent) or a combination of diuron and copper sulfate (32.6 percent) did not differ substantially from the percent of ponds that did not receive any treatment (28.1 percent). However, a higher percentage of ponds with off-flavor on operations with 19 or fewer acres did not receive any treatment (64.3 percent), while a high percentage of ponds on operations with 20 to 49 acres received a treatment combination of diuron and copper sulfate (64.8 percent).

a. For ponds that had delayed harvests, percentage of ponds that were treated with the following chemicals, by size of operation:

	Percent Ponds									
	Size of Operation (Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Ops.**	
Chemical	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
Diuron only	1.9	(0.8)	6.9	(1.3)	17.9	(1.6)	31.0	(3.1)	27.2	(2.3)
Copper sulfate only	14.8	(3.9)	17.2	(2.5)	15.8	(1.1)	10.9	(1.6)	12.1	(1.3)
Both diuron and copper sulfate	19.0	(4.5)	64.8	(3.2)	39.8	(1.9)	29.1	(3.8)	32.6	(2.9)
No treatment	64.3	(6.8)	11.1	(1.7)	26.5	(1.6)	29.0	(2.3)	28.1	(1.7)
Total	100.0		100.0		100.0		100.0		100.0	

I. Wild Bird Issues

1. Distance to bodies of water, other operations, and cormorant roosting sites

Over three-fourths of foodsize fish operations were located within 5 miles of fish production ponds on another operation. Cormorant roosting sites were within 5 miles of 42.0 percent of operations.

a. Percentage of foodsize fish operations by distance of operation from the following items:

	Percent Operations						
	Distance						
	Within 5 Miles		More than 5 Miles		Did not Know		Total
Items	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**
Brake	59.4	(0.9)	23.1	(0.8)	17.5	(0.7)	100.0
Lake	42.4	(1.0)	45.6	(1.0)	12.0	(0.7)	100.0
River	42.2	(1.0)	47.4	(1.0)	5.4	(0.4)	100.0
Other wetlands	47.4	(1.0)	28.0	(0.9)	24.6	(0.9)	100.0
Cormorant roosting sites	42.0	(1.0)	34.9	(0.9)	23.1	(0.8)	100.0
Fish production ponds on another operation	77.6	(0.7)	15.7	(0.7)	6.7	(0.4)	100.0

2. Bird dispersal

A high percentage of foodsize fish operations (93.6 percent) had at least some cormorants visit daily during winter. A higher percentage of operations in the West region (31.2 percent) reported 100 to 500 cormorants and more than 500 cormorants (28.0 percent) per day compared to operations in the East region (12.2 percent and 7.3 percent, respectively).

a. Percentage of foodsize fish operations by number of cormorants that, on average, visit the operation each day during winter, and by region:

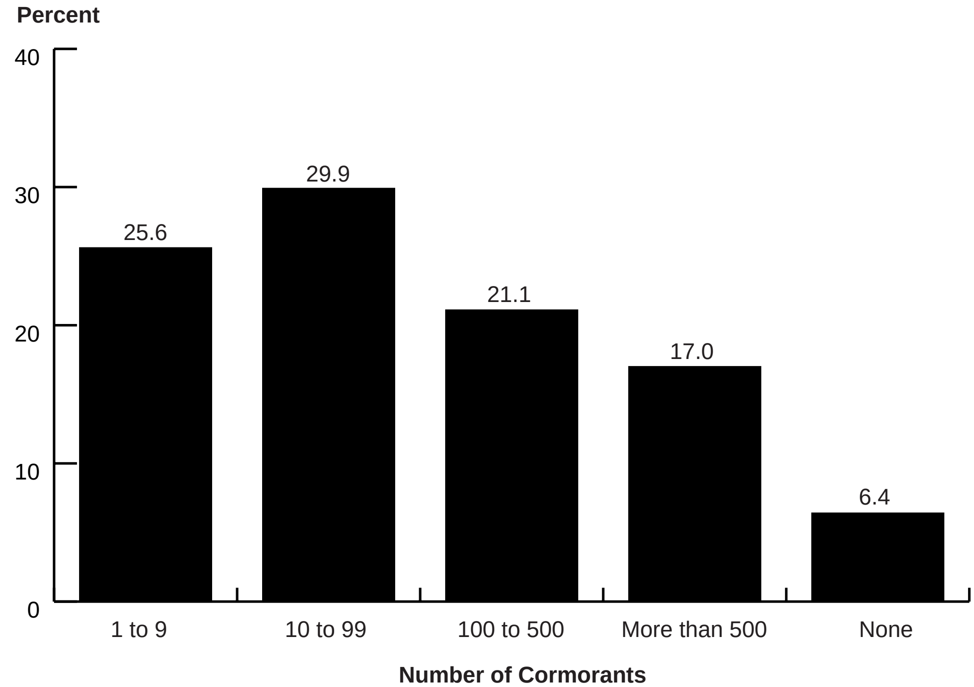
	Percent Operations					
	Region					
	East		West		All Operations	
Number of Cormorants	**Pct. Ops.**	**Std. Error**	**Pct. Ops.**	**Std. Error**	**Pct. Ops.**	**Std. Error**
1 to 9	37.1	(1.3)	12.3	(0.9)	25.5	(0.8)
10 to 99	33.3	(1.3)	26.3	(1.3)	30.0	(0.9)
100 to 500	12.2	(0.9)	31.2	(1.4)	21.1	(0.8)
More than 500	7.3	(0.7)	28.0	(1.4)	17.0	(0.8)
None	10.1	(0.7)	2.2	(0.4)	6.4	(0.4)
Total	100.0		100.0		100.0	

The percentage of operations that had any cormorants visit each day during winter increased as operation size increased. Similarly, as operation size increased the percentage of operations with more birds increased. For example, only 4.0 percent of operations with 1 to 19 acres reported more than 500 cormorants per day, while 32.1 percent of operations with 150 or more acres reported more than 500 cormorants per day.

b. Percentage of foodsize fish operations by number of cormorants that, on average visited the operation each day during winter, and by size of operation:

	Percent Operations									
	Size of Operation (Surface Acres)									
	1-19		**20-49**		**50-149**		**150 or More**		**All Ops.**	
Number of Cormorants	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**	**Pct.**	**Std. Error**
1 to 9	46.3	(2.2)	46.0	(2.2)	21.4	(1.4)	7.9	(0.9)	25.6	(0.8)
10 to 99	16.0	(1.8)	37.4	(2.1)	36.7	(1.6)	23.8	(1.6)	29.9	(0.9)
100 to 500	4.7	(0.9)	5.4	(1.1)	23.5	(1.3)	35.7	(1.9)	21.1	(0.8)
More than 500	4.0	(1.0)	5.1	(1.0)	15.3	(1.2)	32.1	(1.9)	17.0	(0.8)
None	29.0	(1.9)	6.1	(1.1)	3.1	(0.6)	0.5	(0.2)	6.4	(0.4)
Total	100.0		100.0		100.0		100.0		100.0	

Percent of Foodsize Fish Operations by Number of Cormorants that, on Average, Visited the Operation Each Day During Winter



Active bird dispersal was practiced on 78.1 percent of all foodsize fish operations. The percentage of operations dispersing birds in the West region (86.7 percent) was higher than in the East region (70.6 percent).

c. Percentage of foodsize fish operations that actively dispersed birds, by region:

Percent Operations					
Regions					
East		West		All Operations	
Percent	Standard Error	Percent	Standard Error	Percent	Standard Error
70.6	(1.2)	86.7	(0.9)	78.1	(0.7)

The percentage of operations that actively dispersed birds increased as operation size increased:

d. Percentage of foodsize fish operations that actively dispersed birds, by size of operation:

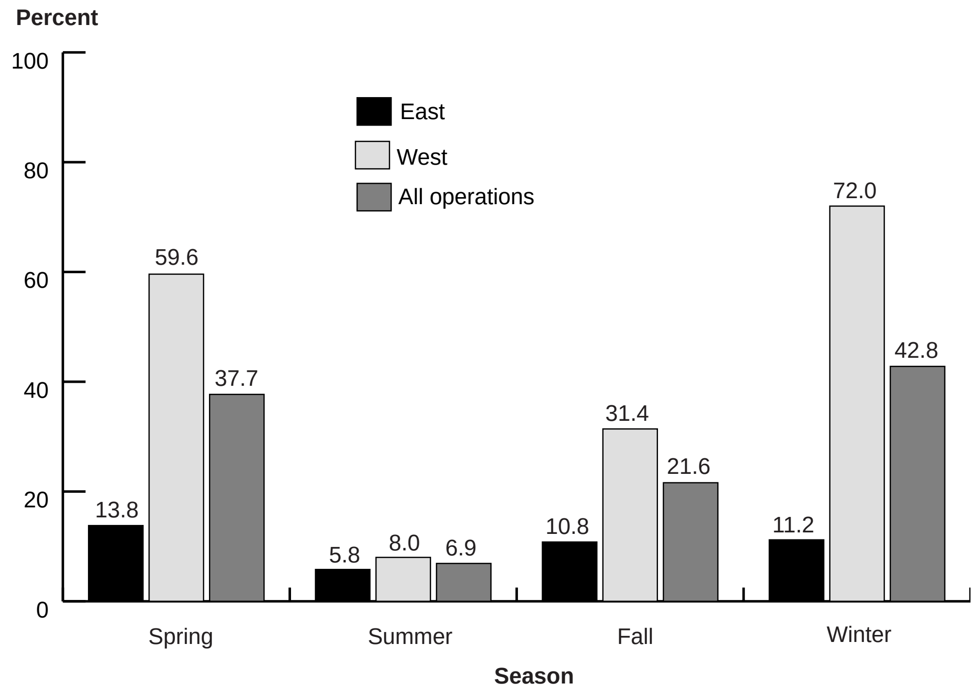
Percent Operations							
Size of Operation (Surface Acres)							
1-19		20-49		50-149		150 or More	
Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error	Pct.	Std. Error
34.3	(2.2)	66.0	(2.1)	88.3	(1.1)	93.7	(0.8)

The greatest amount of bird dispersal activity (person-hours per week) occurred during winter (42.8 hours per week) followed by spring (37.7 hours per week) and fall (21.6 hours per week). Operations in the East region expended fewer hours in all seasons than operations in the West region, most notably in the nonsummer months.

e. For foodsize fish operations that actively dispersed birds, operation average person-hours per week devoted to bird dispersal activities on foodsize fish operations, by season and by region:

	Operation Average Hours					
	Regions					
	East		West		All Operations	
Season	Average	Std. Error	Average	Std. Error	Average	Std. Error
Spring	13.8	(1.4)	59.6	(11.0)	37.7	(5.7)
Summer	5.8	(0.9)	8.0	(0.5)	6.9	(0.5)
Fall	10.8	(1.4)	31.4	(1.8)	21.6	(1.1)
Winter	11.2	(1.4)	72.0	(11.0)	42.8	(5.7)

For Foodsize Fish Operations that Actively Disperse Birds, Operation Average Person-Hours Per Week Devoted to Bird Dispersal Activities on Foodsize Fish Operations, by Season



Operations with 150 or more acres expended more effort (person-hours per week) in all seasons compared to operations with fewer than 150 acres.

f. For foodsize fish operations that actively dispersed birds, average person-hours per week devoted to bird dispersal activities on foodsize fish operations, by season and by size of operation:

	Operation Average Hours							
	Size of Operation (Surface Acres)							
	1-29		**20-49**		**50-149**		**150 or More**	
Season	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**	**Avg.**	**Std. Error**
Spring	11.3	(1.4)	8.2	(1.1)	17.5	(0.6)	75.5	(15.0)
Summer	4.9	(0.8)	2.4	(0.6)	5.8	(0.5)	10.4	(1.2)
Fall	9.3	(1.2)	7.0	(0.7)	15.2	(0.6)	36.5	(2.8)
Winter	12.3	(1.5)	6.9	(0.9)	19.8	(0.7)	87.1	(15.0)

Section II. Methodology

A. Needs Assessment

NAHMS develops study objectives by exploring existing literature and contacting industry members about their informational needs and priorities during a needs assessment phase. The planning for the Catfish 2003 study involved an extensive effort to obtain input from representatives of producer organizations, universities, State and Federal catfish health and production personnel, and others allied with the industry. In addition to contacting individuals for their input, a formal focus group was convened at the Thad Cochran National Warmwater Aquaculture Center to identify broad study objectives and to begin a prioritization of topics. Also, after a presentation describing the national study at the 2002 Catfish Farming Trade Show, a short survey was distributed to attendees. The results from the survey were summarized for inclusion as input into the study planning.

Specific objectives for the NAHMS Catfish 2003 study:

1. Investigate foodsize fish production practices. Management practices for foodsize fish are continually evolving, as producers refine their methods and adjust to changes in market demands. Areas of investigation to meet this objective include: stocking practices (use of stocker ponds, stocking size, strain of fish, and timing of stocking); feeding practices (protein level, seasonal feeding especially in the fall); pond management (draining, pond size, and maintenance schedule); and general practices (aeration, oxygen and water quality monitoring, harvesting).

2. Describe fingerling production practices, specifically brood stock management, hatchery management, vaccination practices, fingerling pond management, fingerling stocking, and feeding practices.

3. Address a broad range of fish health related issues including: estimation of operation/pond level prevalence of reported foodsize fish disease problems (columnaris, enteric septicemia, proliferative gill disease, winter kill, ich, anemia, visceral toxicosis of catfish, and trematodes); fingerling disease problems (columnaris, enteric septicemia, channel catfish virus, ich); control practices; treatment practices; and risk factors. Assess the effects of predation by birds in terms of the direct loss to producers and for potential association with disease problems.

4. Quantify the magnitude of the problem of off-flavor in terms of the percentage of ponds annually affected by off-flavor and the duration of off-flavor episodes. Assess the use of diuron and copper sulfate as pond treatments.

B. Sampling and Estimation

1. State selection

National Agricultural Statistics Service (NASS), USDA publishes catfish production estimates annually (published in February) for 13 States. NAHMS contracts with NASS to provide a statistically reliable sample from their sample frames. A goal for NAHMS national studies is to include States that account for at least 70 percent of the animal and producer populations in the United States. The initial review of States identified four major States (AL, AR, LA, and MS) with 95.5 percent of the inventory (as measured by sales) and 73.4 percent of all U.S. catfish operations on January 1, 2003.

2. Operation selection

Operations were selected in the four participant States (Alabama, Arkansas, Louisiana, and Mississippi) via NASS. Essentially all catfish producers on the list sampling frame were selected. This list frame provided complete coverage of catfish producers in the four States on January 1, 2003. There were 936 operations selected for the study.

3. Population inferences

Inferences from data collection cover the population of producers with any catfish in the four States. These states accounted for 73.4 percent of all catfish operations in the United States as of January 1, 2003, and 95.5 percent of all catfish sales in the United States (see Appendix II). Census data were adjusted for response and nonresponse within each State and size group to allow for inferences back to the original population from which the sample was selected.

C. Data Collection

1. Phase I

NASS enumerators in each of the four States administered the General Catfish Management Report from January 2 to February 14, 2003. The interview took just under 1 hour to complete.

D. Data Analysis

1. Validation and estimation

Initial data entry and validation for the General Catfish Management Report were performed in the individual NASS State offices. Data were entered into a SAS data set. NAHMS national staff in Fort Collins, Colorado, performed additional validation on the entire data set after data from all States were combined.

2. Response rates

Of the 936 operations screened (NASS January 1, 2003, catfish annual survey), 36 had no catfish on January 1, 2003, and were therefore ineligible for the NAHMS Catfish 2003 study. This left a total of 900 operations to be contacted. Of these, 600 operations participated in the Catfish 2003 study, and only 152 operations (16.2 percent of the total sample) refused to participate in the study.

Response Category	Number Operations	Percent Operations
No catfish on January 1, 2003	36	3.8
Out of business[1]	89	9.5
Refusal	152	16.2
Survey complete	600	64.2
Out of scope (research farm, etc.)	14	1.5
Inaccessible	45	4.8
Total	936	100.0

[1]Operations that sold land and/or catfish and had no intention of returning to catfish business

Appendix I: Sample Profile

A. Responding Operations

1. Responding operations by pond size

Size of Foodsize Fish Pond (Acres)	Number of Responding Operations*
1 to 19	83
20 to 49	115
50 to 149	196
150 or more	175
Size not known	1
Total	570

* 30 responding producers did not raise foodsize fish

2. Responding operations by region

Region	Number of Responding Operations
East	322
West	278
Total	600

3. Responding operations by State

State	Number of Responding Operations
Alabama	172
Arkansas	123
Louisiana	46
Mississippi	259
Total	600

4. Responding operations by operation type

Operation Type	Number of Responding Operations[1]
Breed catfish	82
Operate hatchery	74
Raise fry to fingerlings	176
Growout foodsize fish	570

[1] Sum is greater than 600 because a number of operations are of multiple types.

Appendix II: U.S. Catfish Acreage Inventory and Operations

A. Regional Summary

State	Number (Acres Intended for Utilization) During January 1 to June 30, 2003 Foodsize	Fingerlings	Broodfish	2002 Total Sales (x $1,000)	January 1, 2003, Number of Operations
Alabama*	22,900	1,500	630	76,045	231
Arkansas*	28,500	4,200	650	56,380	155
California	1,810	360	90	7,875	38
Florida	590	45	15	756	34
Georgia	700	115	60	1,411	43
Illinois	65	45	10	226	12
Kentucky	460	95	15	1,180	60
Louisiana*	8,600	1,050	170	15,812	57
Mississippi*	86,000	16,800	3,000	243,226	405
Missouri	690	590	55	1,070	31
North Carolina	1,480	140	60	3,143	46
South Carolina	70	25	20	617	13
Texas	175	105	55	2,087	30
Total (4 study States*) Percent of U.S.	146,000 (96.0%)	23,550 (93.9 %)	4,450 (92.1%)	391,463 (95.5%)	848 (73.4%)
Total U.S. (13 States)	152,040	25,070	4,830	409,828	1,155

Appendix III: Study Objectives and Related Outputs

1. Examine fingerling production practices including broodstock management, hatchery management, vaccination practices, fingerling pond management, and stocking and feeding practices. Investigate foodsize fish production practices including stocking, feeding, pond management, and general management.

- Part I: Reference of Fingerling Catfish Health and Production Practices in the United States, 2003, November 2003
- **Part II: Reference of Foodsize Catfish Health and Production Practices in the United States, November 2003**

2. Describe the prevalence of disease problems in fingerling and foodsize fish, disease control and treatment practices, and risk factors associated with disease.

- Trematodes on U.S. Catfish Operations, information sheet, November 2003
- ESC and Vaccination Practices on U.S. Catfish Operations, information sheet, November 2003
- Off-flavor on U.S. Catfish Operations, information sheet, November 2003