

Acknowledgments

This is the first census of aquaculture report prepared under the direction of the U.S. Department of Agriculture (USDA), National Agricultural Statistics Service (NASS). Many people deserve recognition for their contributions to this census program.

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If you would like to learn more about the statistics available from NASS or have questions concerning this report, visit our website at www.usda.gov/nass, send e-mail to nass@nass.usda.gov, or call: 1-800-727-9540.

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INTRODUCTION

HISTORY

The 1998 Census of Aquaculture was the first national census taken for this industry. Conducted by the U.S. Department of Agriculture, National Agricultural Statistics Service (NASS), this census responded to the intense need for an accurate measurement of the aquaculture sector, which grew from \$45 million for value of products sold in 1974 to over \$978 million in the 1998. Previously, NASS tracked the catfish and trout industry through monthly catfish processing, quarterly catfish production, and annual catfish and trout surveys. Aquaculture data have also been collected during the 5-year census of agriculture since 1974. The census listed catfish, trout, and tropical fish and provided space for producers to list any other food-type fish or other aquaculture products sold from their operation.

Catfish Statistics

The first catfish processing publication dates back to February 1980. Later that same year, NASS conducted the first catfish production survey, covering 10 States. Funding problems resulted in the catfish production survey being discontinued after January 1982. The need for unbiased, reliable statistics led the Catfish Farmers of America (CFA) to enter into a cooperative agreement with NASS to fund a quarterly catfish production survey in Mississippi. The survey began in October 1984 and continued through April 1988 when funds

were appropriated for NASS to conduct the catfish survey semiannually. Subsequently, the NASS expanded program consisted of a quarterly program in Mississippi, Alabama, Arkansas, and Louisiana and an annual program in additional States. Currently, the NASS catfish production survey is conducted on a semiannual basis in the four aforementioned States and on an annual basis in nine additional States.

Trout Statistics

The NASS trout production program began in 1980, covering nine States. The survey was discontinued in 1981 but resumed in September 1988 for 15 States. Currently, the NASS annual trout program includes 21 States.

PURPOSE AND SCOPE OF THE SURVEY

The 1998 Aquaculture Census was conducted to expand the aquaculture data collected from the 1997 Census of Agriculture. The aquaculture census collected detailed information relating to on-farm aquaculture practices, size of operation based on water area, production, sales, method of production, sources of water, point of first sale outlets, cooperative agreements and contracts, and aquaculture distributed for restoration or conservation purposes. The first step in the development of the Census of Aquaculture was to learn about the industry's needs. NASS canvassed its State Statistical Offices and found that seven were already conducting or

had conducted aquaculture surveys for their States as reimbursable projects. Several organizations representing aquaculture's diversity (finfish, shellfish, crustaceans, etc.) were contacted for information, including the National Aquaculture Association, National Association of State Aquaculture Coordinators, and Catfish Farmers of America. USDA's Office of Aquaculture, which coordinates Department-wide aquaculture activities, chairs the Federal-wide Joint Subcommittee on Aquaculture (JSA), and coordinates activities of the five Regional Aquaculture Centers, also provided advice. From this effort, a draft questionnaire was developed and widely distributed for comments.

As a result of feedback and evaluation, the final questionnaire collected information about the public aquaculture sector. These noncommercial operations release or distribute their aquaculture production for restoration or conservation purposes. Examples of noncommercial operations are Federal, State or Tribal facilities (which are mostly hatcheries), academic, and private research facilities. Although information from Federal hatcheries is currently available from the U.S. Fish and Wildlife Service, their publication does not include information from State hatcheries. One of the goals of the census of aquaculture was to provide a comprehensive picture of the entire public aquaculture sector.

USES OF THE CENSUS

The census of aquaculture contains statistics about the Nation's aquaculture production and presents information on the structure of the aquaculture industry at the national, regional, and State levels. The aquaculture

census statistics may be used by Congress in developing, evaluating, and changing farm programs. Many national and State programs may use the data to plan rural development, land use management, water resource management, and aquaculture research. Private industry may also use the census statistics to provide a more effective production and distribution system for the aquaculture community.

AUTHORITY AND AREA COVERED

The census of aquaculture is covered by Public Law 105-113, the Census of Agriculture Act of 1997 (Title 7, United States Code). The census of aquaculture is a special study program from the 1997 Census of Agriculture which provides more detailed statistics on aquaculture.

GENERAL EXPLANATION

FARM DEFINITION

For the 1998 Census of Aquaculture in the United States, an aquaculture farm was defined as any commercial or noncommercial place from which \$1,000 or more of aquaculture products were sold or normally would have been sold during the census year. Commercial operations qualified with sales greater than or equal to \$1,000. Noncommercial operations were those which produced an estimated value of \$1,000 or more of aquaculture, but released or distributed their production for purposes of restoration or conservation. Examples of noncommercial operations were Federal, State or Tribal facilities (which were mostly hatcheries), academic, and private research facilities.

TABULAR PRESENTATION

Table 1 shows the number of farms and the market value of aquaculture products sold for each State, five regions, and the United States. Table 2 shows detailed U.S.-level data cross-tabulated by market value of aquaculture products sold. Tables 3 through 22 present selected data items for each State, five regions, and the United States. The regions were defined by the Joint Subcommittee on Aquaculture for the U.S. Department of Agriculture.

ABBREVIATIONS AND SYMBOLS

The following abbreviations and symbols are used throughout the tables:

S	Represents zero
(D)	Withheld to avoid disclosing data for individual farms
(NA)	Not available
(X)	Not applicable
(Z)	Less than half the unit

AQUACULTURE CENSUS DISCLOSURE RULES

In keeping with the provision of Title 7, United States Code, no data are published that would disclose the operations of an individual farm. However, the number of farms in a given size category or other classification is not considered a release of confidential information and is provided even though other information is withheld.

DEFINITIONS

The following definitions and explanations provide a more detailed description of the terms used in this publication or in the questionnaire. Items in the tables which carry the note "See text" are also explained.

Algae - Simple chlorophyll-containing organisms composed of one cell and grouped together in colonies, or as organisms with many cells, sometimes collaborating together as simple tissues. Examples include: Micro, Macro, and Nori.

Bait fish - Fish used for bait such as fathead minnows, golden shiners, and feeder goldfish. Examples of fish in the “other” baitfish category include suckers, killifish, chubs, and other types of minnows.

Cages - Normally used in larger, open bodies of water, such as lakes or rivers. The water area is the surface acreage that the cages actually occupy.

Closed Re-Circulation Tanks - An assemblage of parts and devices used for the husbandry of aquatic organisms where water is continuously cleaned and recycled.

Crustaceans - Invertebrate animals with many jointed legs and a hard external shell, such as crawfish, shrimp, and softshell crabs. The “other” category includes other crustaceans such as prawns.

Direct to consumer - Value of aquaculture products sold directly to individuals for human consumption from fee fishing operations, roadside stands, farmers’ markets, etc. Sales of aquaculture products by vertically integrated operations through their own processing and marketing operations were tabulated under “sold” and “processors.”

Fee Fishing and Recreational Establishments - Establishments involved in operations of fee-lakes, catch-out ponds, and pay-lakes. For purposes of this census, home use and farm ponds are included.

Fingerling - Young fishes, larger than a fry, but not an adult, up to 1 year old.

Flow-Through Raceways - A system where the fish are in a confined area with a

continuous flow of water passing through the confined area. Raceways can either be a natural flow system, using the natural flow of a river or stream, or a closed system where the water from the raceway flows through a series of ponds and then is pumped into a header pond that flows back into the raceway. The water area for a closed system is the surface acres of the raceway and of all associated ponds. The area for a natural flow system is the surface acres that the raceway occupies.

Food fish - Farm raised for food or for either food or sport such as carp, catfish, hybrid striped bass, perch, salmon, sturgeon, tilapia, and walleye. Examples of fish in the “other” food fish category include croakers, moi, redfish, and rockfish.

Fry - Very young post-larval fish.

Hybrid - Offspring of two plants or animals from different species or varieties.

Hybrid Striped Bass - A cross between a male white bass and a female striped bass.

Live Hauler - People who buy live fish from the farm and function as a middleman, usually between the farmer and processor.

Mollusks - Invertebrate animals with soft body coverings and shells of 1-18 parts or sections. This category includes the production of clams, mussels, and oysters. Examples of mollusks in the “other” mollusk category include abalone, snails, and quahogs.

Net Pens - Enclosures usually placed in protected bays or inlets used to produce fish.

Off farm water - Water that comes from a Federal supplier; irrigation district; mutual, private, or cooperative ditches; commercial company; or municipal or community water system.

On farm surface water - Surface supply not controlled by a water supply organization. (Examples include: streams, drainage ditches, lakes, ponds, springs, or reservoirs.)

Ornamental fish - Various fish raised for water gardens, aquariums, etc., such as angel fish, koi, ornamental goldfish, and tropical fish. Examples of fish in the “other” ornamental fish category include angelfish, guppies, and ornamental catfish.

Other animal aquaculture - The production of alligators, frogs, turtles, and egg and seed stock not listed separately.

Other outlets - Outlets other than to processors, including restaurants or other direct retailers, consumers, live haulers, fee and recreational fishing, other producers, and government agencies. Export sales are reported in this item.

Point of first sale - The first point at which fish are sold.

Ponds - The most common types of water facility for raising fish. Most ponds are man made and fish usually have access to the entire pond. Water area is the surface acres of the pond without regards to the depth of the pond.

Prepared Bottom - The bottom in tidal waters that has had oyster shell, clam shell, or other material added to improve the habitat for shellfish growth and survival.

Processors - Companies that convert live fish to a product ready to cook and distribute, such as fish fillets.

Raceway - A culture chamber, usually long and narrow, in which water enters one end and exits the other.

Recirculation - Reuse of water in an aquaculture facility (closed system) rather than releasing into nature and continually being replaced by new water (open system).

Retailers - Individuals or companies who buy live fish and resell direct to consumers.

Saltwater - Includes brackish water, tidal, sub-tidal, and open public waterways owned or leased.

Seed - Young animals, generally oysters, clams, scallops, or mussels, used for stocking.

Sport/game fish - Farm-raised fish for sport or game fishing, such as largemouth bass, bluegill, crappie, and sunfish. Examples of fish in the “other” sport/game fish category include muskie, northern pike, and small mouth bass.

Stockers - Fish that are large enough to be placed in the final grow-out pond, net pen, or tank.

Tanks - Structures usually above ground and constructed of concrete, steel, or fiberglass.

Value of Sales - Gross value received by the producer before marketing and production costs were deducted.

TARGET POPULATION AND MAIL LIST DEVELOPMENT

The target population for the Census of Aquaculture was composed of all farms that had aquaculture activity in the reference year 1998. The list of farms with aquaculture activity in 1998 was created from the 1997 Census of Agriculture and supplemented from appropriate NASS survey frames.

The list was created by including all farms that indicated a positive response to item 10, section 17 of the 1997 Census of Agriculture questionnaire; this question asked whether there were “fish and other aquaculture products” on the place in 1997. If this activity was present, the respondent provided the name, total quantity sold, and gross value of sales of the fish or products. The Census of Agriculture respondent selected from a list of pre-coded responses that included catfish, trout, hybrid striped bass, other fish, crawfish, or other aquaculture products. Specific type was requested for a response to “other fish” or “other aquaculture products.”

This list was supplemented by adding any existing aquaculture farms from the NASS list frame that did not appear on the list created from the 1997 Census of Agriculture. Also added to the list for enumeration were State and Federal fish hatcheries that distributed fish for restoration or conservation purposes.

Undercoverage existed in the population to the extent that some farms that erroneously

reported not having aquaculture activity in the 1997 Census of Agriculture also were not included in the NASS frame for the Annual Catfish and Trout Surveys. Overcoverage existed in the population because some operations were misclassified as having aquaculture activity in the 1997 Census of Agriculture; this problem was identified and corrected during enumeration.

DATA COLLECTION

The 1998 Census of Aquaculture for the United States was conducted using a combination of mail, telephone, and personal interviews. The questionnaires were mailed in mid-December 1998 to all known aquaculture producers. Two different versions of the questionnaire were used for the 1998 Census of Aquaculture, with Catfish farmers receiving the second version which asked for water area used to produce catfish and inventory of catfish. The mailings included a cover letter and a postage paid return envelope. Farm operators were requested to return their completed questionnaire within 15 days. Follow-up telephone calls and personal interviews were used to collect data from non-respondents.

EDITING DATA AND IMPUTATION FOR ITEM NONRESPONSE

All questionnaires were reviewed for legibility and data entry irregularities prior to keying. All data were reviewed for inconsistencies prior to analysis and summary. The data were passed through a computer edit to check data integrity within the questionnaire. Editing of the catfish and trout data utilized historical comparisons to

previous reported NASS survey data for water usage, inventory, production, and sales. Analysis tables were constructed to illustrate the distribution of items in the data set. The outliers in these distributions were investigated and verified or corrected. Logical comparisons given current situations and distributions were made for all operations in the aquaculture census. Every effort was made to correct all inconsistencies, errors, or omissions in reported data.

Fish were reported sold several different ways: by the fish, per pound, pounds per 1,000 fish, etc. To maximize the amount of data that could be published, some data were converted to the more common “per fish” or “per pound” units. For example, fish sold as “pounds per 1,000 fish” were converted to “per fish” sales. Most foodsize fish were reported as sold by the pound. For most species, the few reports indicating food size being sold by the fish were converted to the “per pound” basis. The reverse was true for stockers, fingerling, and fry, which were most often sold by the fish (or 1,000 fish). Any sales for these items by the pound were converted to the “per fish” basis.

Most nonresponse to particular questions on the census questionnaire that logically should have been present were resolved after re-contacting the operation. When this was not successful, the population distribution for the specific item was used to determine an imputed value. Data from the 1997 Census of Agriculture were also available.

DATA PROCESSING

Data listings were used to identify and correct keying errors, missing data, and erroneous data entries on questionnaires. Data entries of large magnitude and data item changes were again reviewed by statisticians and verified or corrected. Prior to publication, tabulated totals were reviewed to identify remaining inconsistencies.

CENSUS NONSAMPLING ERROR

Incorrect or incomplete responses to the census questionnaire or to the questions posed by an enumerator could have introduced error into the census data. To reduce reporting error, each respondent’s answers were checked for completeness and consistency by the edit and data listings.

The accuracy of the census is also affected by other nonsampling errors’ sources, including incorrect data keying, editing, and imputing for missing data.