

AQUACULTURE

Kwamena Quagrainie, author

WHAT IS IT?

Aquaculture/aquaponics

Indiana's agricultural economy includes aquaculture (fish farming), hydroponics (growing plants in water with nutrients) and aquaponics (integrated fish and hydroponics farming). These enterprises produce fish for human consumption, recreational fishing and ornamental display. There are diverse species of fish produced in Indiana, and the interest in aquaculture and aquaponics results from the availability of resources such as vacant farm buildings, large open ponds and water bodies. On the demand side, there is strong consumer preference for sustainably produced foods, local foods and fresh foods, which can lead to improvements in quality of environment and healthy local communities.

WHY ARE PEOPLE INTERESTED?

Indiana agriculture is undergoing a transition in the types of crops and livestock produced. One such animal production is aquaculture (fish farming), a specialty animal production and a small but growing industry. Aquaponics, another form of integrated farming, combines aquaculture and hydroponics in a sustainable

integrated production of specialty crops utilizing waste water from fish production, resulting in production of two crops. These production systems represent the diversity present in Indiana's agriculture economy.

Indiana has a number of aquaculture and aquaponics farms that produce food fish, sport fish, ornamental fish, crustaceans and miscellaneous fish species. Fish are grown for human consumption, recreational fishing and ornamental display. Culture methods include low-density pond production, intensive cage culture and high-tech intensive indoor re-circulating systems. Much of the emphasis in aquaculture and aquaponics is on food production, though other farms specialize in the production of sport fish such as bass, bluegill and catfish for private stocking, minnows for baitfish and ornamental fish. A number of food fish production facilities mainly producing largemouth bass, hybrid striped bass, yellow perch and tilapia, as well as crustaceans (e.g., saltwater shrimp and freshwater prawn), have been established in Indiana, increasing the production capacity of the state's agriculture economy.

CHALLENGES

The main challenge to aquaculture growth is competitiveness from imported seafood.

RELEVANCE TO ECONOMIC DEVELOPMENT / BENEFITS

Economic importance

Economic analysis of the industry in 2012 showed that it supports 280 jobs within the aquaculture industry and other supporting industries in Indiana, 169 of which are direct jobs in the aquaculture industry. The industry generates \$3,731,842 worth of labor income and \$19,484,193 of added value. The value of output generated within the aquaculture industry is \$23,599,676 and a total value of \$37,892,895 with other supporting industries. A \$1.00 sale by the aquaculture industry results in additional local output of \$0.61, and for every direct job in the aquaculture industry, there is an additional 0.66 job in the local economy. For a \$1.00 increase in added value from the aquaculture industry, there is an additional \$0.62 increase in added value in the local economy.



POLICIES AND ORDINANCES

Permitting and regulations

Indiana Department of Natural Resources (DNR)

Indiana has 38 approved fish species that can be produced, transported, imported, released and/or sold live in the state. To engage in any of these activities involving the approved species list, a person must obtain a Fish Haulers and Suppliers Permit from the DNR. To produce, import, transport and/or sell live a fish not on the approved species list, a person needs an approved Aquaculture Permit from DNR. Fish involved in aquarium or pet trade, or used solely for exhibit purposes, are exempt from both permits.

To import into Indiana a species of fish listed on the USDA-APHIS website from another Great Lakes state, a person must submit an application for an Aquaculture Pre-Entry Permit to the Indiana Board of Animal Health (BOAH). The appropriate fish health certification documents must accompany this permit application.

Indiana Board of Animal Health (BOAH)

BOAH needs to approve an Aquaculture Pre-Entry Permit before any viral hemorrhagic septicemia (VHS) disease-susceptible fish (see USDA-APHIS website) is imported from Great Lakes states or provinces. The permit application must be submitted with fish health documentation. Permits are valid for six to twelve months from date of fish testing, depending on protocol followed.

The following fish diseases are Reportable in Indiana: viral hemorrhagic septicemia (VHS), spring viremia of carp, infectious hematopoietic necrosis, epizootic hematopoietic necrosis and *Oncorhynchus masou* virus disease.

National Pollution Discharge Elimination Standard (NPDES) permit

Aquaculture facilities fall into one of three categories:

- No NPDES permit required,
- NPDES permit required with no Effluent Limitation Guidelines (ELG) or
- NPDES permit with ELG requirements (ELGs are national standards for wastewater discharges).

An NPDES Permit for Concentrated Aquatic Animal Production (CAAP) is required only if an aquaculture facility discharges water continuously for 30 days or more per year. Aquaculture facilities that fall under this definition are either flow-through, recirculating or net pen systems. Most Indiana pond, cage and recirculating aquaculture production facilities do not require permits because water is not discharged continuously for 30 days per year.

ELGs are placed on CAAP facilities that discharge continuously for more than 30 days and produce at least 100,000 pounds a year in flow-through systems and recirculating (primarily to raise trout, salmon, hybrid striped bass and tilapia). ELGs are required for facilities that produce at least 100,000 pounds a year in net pens or submerged cage systems (used primarily to raise salmon).

CONSTRUCTION IN WETLANDS/FLOODWAYS

Permits are required from the DNR, Indiana Department of Environmental Management (IDEM) and the Army Corps of Engineers. A permit is required from the DNR (Division of Water) for:

- New construction or improving existing structures in a floodway with more than one square mile of drainage area above that point, and
- Constructing a dam meeting one of the following three criteria: 20 feet or taller, 100 acre feet of water, greater than one square mile of drainage (640 acres).

An IDEM permit is required for excavating and constructing a pond in an isolated wetland.

FDA CENTER FOR FOOD SAFETY

Fish processing facilities must be registered with the U.S. Food and Drug Administration (FDA), regardless of whether processed fish products from the facility enter interstate commerce. The FDA regulates fish and seafood, canned foods and live food animals. Fish farms and fishing vessels not engaged in processing are exempt.

EXAMPLES OF PRACTICES IN INDIANA

Major fish species grown in Indiana

Largemouth Bass (*Micropterus salmoides*)

Largemouth bass are raised mainly in ponds and marketed to the live market for sport fishing as well as for food fish. Fingerlings, yearlings and adult fish are sold to the sport fishing industry for stocking into lakes for non-commercial sport fishing. Very large bass are sold as trophy fish at a premium price. Adult largemouth bass for the food market are sold live to ethnic stores and Asian communities in cities such as New York, Chicago, Philadelphia, Toronto, etc. Very few largemouth bass are sold in the food-fish industry in the form of a frozen or iced product.

Hybrid Striped Bass (HSB)

The hybrid striped bass is a cross between the anadromous striped bass *Morone saxatilis* and the freshwater white bass *M. chrysops*. The hybrids grow faster in the first two years of life, readily adapt to formulated feeds and are more resistant to diseases than the parents. HSB is raised mainly from cage and pond culture operations. Cage operations are used because it is very feasible in most farm ponds and private lakes. There is an active live market for HSB in the Asian communities in Chicago, New York City, Toronto and other north central region municipalities.



Tilapia

Tilapia is a warm-water fish and non-native to the U.S. As such, there are some state restrictions on culture systems. In Indiana, production is mainly indoors in water recirculating systems. Indoor systems are expensive to build and operate because of the high initial cost of components as well as operating costs. Several strains of the tilapia are raised in the region. This includes the Nile tilapia (*Oreochromis niloticus*), blue tilapia (*O. aureus*), Mossambique tilapia (*O. mossambicus*) and various hybrids among these. Tilapia are currently sold to the live market for food in New York, Chicago, Philadelphia, Toronto, St. Louis, Kansas City and other relatively large Midwestern cities. Asians and Hispanics are the target or primary consumer markets at this time. There is no processing as processed products from the region cannot compete with imported tilapia products.



Yellow Perch (*Perca flavescens*)

Traditionally, the entire supply of yellow perch came from capture fisheries in the Great Lakes. There has been a steady decline in supply, but the demand for yellow perch has remained high, especially in the Great Lakes region. It is estimated that about 70 percent of the yellow perch sales in the U.S. occur within 50 miles of the Great Lakes. The decline in capture fisheries has allowed aquaculture production of yellow perch to

increase. Wisconsin and Ohio are the major producers of yellow perch from aquaculture, mainly in pond culture system as well as indoor recirculating aquaculture system. Yellow perch is sold to both the sport fishing industry for stocking and to the food market. The food market does not handle live fish; instead they are processed and sold as scaled fillets to restaurants, grocers, social clubs, etc.



Salmonids (e.g., rainbow trout)

Salmonids require large amounts of high-quality water. Therefore, access to high volumes of good quality water such as springs, streams and wells usually dictates where salmonid aquaculture facilities are located. Missouri, Wisconsin and Michigan are major Midwestern states that produce trout. Idaho is the leader in food-size trout production in the U.S. Trout production utilizes indoor rearing facilities and outdoor raceways and ponds for grow out. In the Midwest, trout is sold to fee/recreational fishing operations (stocker trout) and to the food market. The food market is for processed products such as fillets and sold to restaurants, grocers, social clubs, etc.

Pacific White Shrimp (*Litopenaeus vannamei*)

The main method of rearing marine shrimp is indoors in tanks using a recirculating biofloc water treatment system. A biofloc system removes metabolic wastes using bacteria that convert ammonia to nitrate. The bacteria form aggregates (bioflocs) suspended in the water column. There is increased interest in indoor marine shrimp production in Indiana stemming from their lower capital costs, variable scale of production and relatively high market price. Shrimp is mainly sold at the farm-gate.

RESOURCES

Economic Importance of Indiana's Aquaculture Industry www.extension.purdue.edu/extmedia/EC/EC-770-W.pdf

Purdue University www.purdue.edu/fnr/extension/area-of-interest/aquaculture-aquatics/

Indiana Aquaculture Association www.indianaaquaculture.com/

Indiana Department of Natural Resources www.in.gov/dnr/fishwild/3607.htm

Indiana Board of Animal Health www.in.gov/boah/2387.htm

Indiana Soybean Alliance/Corn Aquaculture Program www.indianasoybean.com/checkoff-investments/livestock-aquaculture

REFERENCES

312 IAC 9-10-15 Fish importation permit. (1997). Indiana Department of Natural Resources. Retrieved at <https://www.in.gov/dnr/fishwild/files/FishImportationRegulations.pdf>

Species regulated by title 9 CFR Parts 83.1 through 83.7, 93.900 and 93.910 through 93.916 (the Viral Hemorrhagic Septicemia (VHS) Interim Rule). 2008. United States Department of Agriculture Animal and Plant Health Inspection Service. Retrieved at <https://www.federalregister.gov/d/E8-20852/p-61>