

A Consumer's Guide for Wisconsin Farm-Raised Fish



Developed and compiled by:

Wisconsin Aquaculture Association

**UW Stevens Point – Northern Aquaculture Demonstration
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And the

**Wisconsin Department of Agriculture, Trade and
Consumer Protection**

**Something Special
from
Wisconsin**

How Are Fish Raised in Wisconsin?

- Water for Aquaculture
- Management and Reuse of Aquaculture Waste and Effluents
- Aquaculture Fish Health
- Fish Nutrition and Feeds
- Aquaculture and the Environment

The balance between appropriate regulatory requirements and aquaculture best management practices helps the industry provide the best and safest possible aquaculture products for consumers, while protecting the State's precious resources.

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Aquaculture Best Management Practices⁽¹⁾ and Wisconsin Regulations

Wisconsin aquaculture is a diverse industry. Wisconsin farms raise over 25 different species of fish for food, stocking, bait and recreation; and in a variety of systems: ponds, flow through raceways, recirculating aquaculture systems, and aquaponics. Regardless of the system that is used, Wisconsin fish farmers use Best Management Practices (BMP's) to produce fish and must adhere to some of the most stringent fish health and environmental regulations in the country. The balance between appropriate regulatory requirements and aquaculture best management practices helps the industry provide the best and safest possible aquaculture products for consumers, while protecting the State's precious resources.

In 2005, University of Wisconsin – Sea Grant Institute published “The Best Management Practices for Aquaculture” to provide guidance to fish farmers for appropriate fish production techniques. The management guidelines in the manual help fish farmers minimize or prevent any adverse environmental impacts, maximize the health and well-being of the fish being raised and produce fish efficiently and economically.

Below is an overview of some of the key aspects of the aquaculture best management practices and a summary of selected aquaculture permits and regulations.

A. Water for Aquaculture

Aquaculture is a water dependent industry. Obviously, fish need water to survive. Poor water quality will ultimately result in poor fish production. To maintain the health of the fish produced, the fish farmer needs to keep a number of water-related factors in balance within the aquaculture system. These include water temperature, dissolved oxygen, pH, nitrogen (ammonia, nitrite, and nitrate), solids and carbon dioxide.

Sources of Water for use in Aquaculture facilities:

1. Ground or well water is generally free of impurities that can affect the aquaculture system.
2. Surface water consists of water taken from lakes, rivers, or ponds, or it can consist of rain and snow water collected for aquaculture use.
3. Municipal water can be used for a recirculation aquaculture system (RAS) that does not require a high volume of water. Municipal water generally contains residual chlorine or other additives that must be removed prior to use in an RAS system.

Water use is regulated by the Wisconsin DNR and conservation practices are encouraged to preserve this precious resource. In most aquaculture systems, water is not consumed. The water is used for the production of fish and may be reused or cleaned before returned to the environment.

Water use requirements/regulations: (See Appendix 1)⁽²⁾

B. Management and Beneficial Reuse of Aquaculture Waste and Effluents.

Discharges from aquaculture facilities must meet the standards of the Environmental Protection Agency as well as stringent state and local regulations.

The primary source of aquaculture wastes are uneaten fish food and wastes excreted by the fish. Fish farmers manage this waste by feeding only what the fish can eat and by removing solids and dissolved

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wastes. There is an economic benefit for fish farmers to manage their wastes. Uneaten fish food costs money and the aquaculture wastes will often have value as fertilizer for plant growth.

Water released from the aquaculture system can be re-used for irrigation or treated and recycled for fish culture and other purposes. For an aquatic farm to be profitable, it is essential that excellent water quality be maintained in the system. The waters leaving fish farms are often of the same or higher quality than the waters receiving them.

Water discharge requirements/regulations: (See Appendix 1)⁽²⁾

C. Aquaculture Fish Health

In developing the Wisconsin Fish Health Program, the State has taken a progressive, veterinary approach toward maintaining fish health and improving fish production efficiency.

With an emphasis on disease prevention versus drug treatment, Wisconsin fish health experts combine the disciplines of aquatic best management practices, water quality, fish nutrition, biosecurity, disease diagnostics and appropriate treatment.

The program balances education with regulatory requirements to protect the quality of aquaculture products for consumers, protect the livelihood of fish farmers and protect the health of fish and aquatic environments.

Routine testing is an important sentinel, alerting fish farmers, fish health experts and wildlife managers to potential fish health problems. Fish farmers also use fish health assessments and their animal observation skills as tools to monitor the health and well-being of their livestock. By monitoring health of their fish, the farmer can avert issues before they require drastic interventions and can provide a level of market assurance for the health of the fish.

Aquaculture Fish Health Regulatory Requirements: (See Appendix 1)⁽²⁾

In some cases, drug treatment is needed to protect the health of the fish, the farm or the environment. The approval and use of any drug or medication is regulated by the Food and Drug Administration (FDA). The FDA conducts inspections, and collects and analyzes samples of feeds and fish to help ensure that unsafe levels of any compounds used in animal production do not appear in the marketplace (NAA 2010).

D. Fish Nutrition and Feeds

Depending on their life stage, fish farmed in Wisconsin are either fed a natural or prepared diet. Young fish, especially yellow perch that are raised in outdoor ponds for the first few weeks of their lives, rely on the natural populations of zooplankton. Some game fish, such as walleye, northern pike and musky are fed live minnows. However, the majority of farmed fish are fed prepared diets. Providing the proper nutrition to fish is essential for their growth and development. The optimum diet provides the essential protein (amino acids), carbohydrates, lipids (fatty acids) and vitamins in the proper amounts and helps the fish grow, reproduce, fight infection and maintain health.

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USDA Agricultural Research Service (ARS) aquaculture scientists are working to develop alternative fish feed ingredients to improve the nutritional characteristics, palatability and sustainability of aquaculture feeds.⁽³⁾

Fish are very efficient at converting feed into muscle (meat). A Feed Conversion Ratio (FCR) is defined as the amount of food per unit gain, or the number of pounds of feed it takes to get a pound of meat. Fish are much more efficient at converting feed into muscle than other livestock (Table 1). There are a couple reasons for this efficiency including the fact that fish are cold blooded, meaning they do not need to expend energy to maintain their body temperature like warm blooded livestock. Fish do not expend energy to fight gravity, since they live in an aquatic environment. The energy that is not being used to heat themselves or keep them upright can be used instead to produce muscle.

Table 1. Common Feed Conversion Ratios (FCR) for livestock; number of pounds of feed to produce one pound of meat

Species	FCR
Cattle	6-8:1
Hogs	3:1
Chickens	2-3:1
Fish	1-2:1

Frequently Asked Questions:

Question: Is fish meal used to feed fish? How is that sustainable?

Answer: Yes, fish meal makes up a portion of the prepared diets that Wisconsin’s fish farmers feed their fish. Fishmeal is used in a variety of animal feeds including those for poultry, swine, cattle, and fish. The fish meal that is used comes from fish that are harvested from the oceans. These fish are not normally used for human consumption. The amount of fish harvested domestically is regulated by the National Oceanic and Atmospheric Administration (NOAA) and quotas are set as to how much fish can be harvested. It is important to understand that farmed fish consume far less fish than the same species of fish captured from the wild.

When looking at fish diets we need to understand the comparison of FCR and the “fish-in fish-out” ratio (FIFO) between wild and farm raised fish. In the wild, fish eating other fish rely 100% on aquatic nutrients and it is estimated that between tropic levels the FIFO ratio is 10 to 1 wet weight or 2.86 to 1 dry weight. However, fish meal/oil in farm raised fish is only about 30 % of the diet; the rest of the diet is from terrestrial source nutrients. The yield of fish meal/fish oil from wild capture fish is approximately 35% or a ratio of 2.86 to 1. The FIFO ratio for wild fish (dry weight) would be 2.86 to 1, whereas in farm raise fish we calculate percent fish meal times FIFO ration times FCR (.30 X 2.86 X 1.2) = 1.03 or rounded 1 to 1. Said another way, farm raised fish are 2.86 times more ecologically efficient than wild fish because they utilize other non aquatic nutrients in their diet.⁽⁴⁾

Understanding that aquaculture cannot continue to grow if a high reliance on ocean harvest for fish meal continues, the aquaculture industry is actively looking at ways to substitute other proteins for fishmeal. “Scientists are investigating new feed formulations and other strategies to improve feed conversion rates and reduce the amount of wastes generated. Scientists and industry across the country are actively

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working to develop a variety of sustainable feeds to ensure that the fish consume a nutritionally balanced diet to promote optimum health and growth, maintain great flavor and texture, and contain all of the important nutrients that consumers demand” (NAA 2010).

Question: Are salmon and trout fed chemicals to turn their flesh pink?

Answer: Salmon and trout species, both farmed and wild, get their pink color from carotenoids, organic pigments found in plants and animals. They are important nutrients for animal diets, including human diets, as many carotenoids are precursors to vitamin A and function as antioxidants.

There are over 600 known carotenoids, but the two that fish get their pigmentation from are astaxanthin and canthaxanthin. These nutrients are essential to the diet of salmon and trout and are needed for growth and reproduction. Salmon and trout can not produce these nutrients themselves so they get them by eating crustaceans (shrimp) that have eaten carotenoid-rich algae (Hertrampf and Piedad-Pascual 2000). We can get these same carotenoids by visiting a health food store; they are sold as dietary supplements.

These organic carotinoid pigments from algae or animals (crustaceans) are added from natural materials to the prepared diets to ensure optimum fish health and development (De Silva and Anderson 1995). Sometimes manufactured carotinoids that are chemically identical to the naturally occurring nutrients are added (Hertrampf and Piedad-Pascual 2000, Hardy and Burrows 2002).

Question: How are prepared feeds regulated?

Answer: “Aquaculture feeds are regulated under the FDA as well as respective State Departments of Agriculture and the American Association of Feed Control Officials (AAFCO). The FDA conducts inspections, and collects and analyzes samples of feeds and fish to help ensure that unsafe levels of any compounds used in animal production do not appear in the marketplace” (NAA 2010).

Aquaculture Feed Regulations: (See Appendix 1)⁽²⁾

E. Aquaculture and the Environment

Similar to other human activities, aquaculture operations can have positive, negative or no impact on wildlife. A primary goal of Aquaculture Best Management Practices is to provide guidance for fish producers to impact the environment in neutral or beneficial way.

The extent of environmental impact is dependent upon the thoughtful approach to development of new aquatic environments and the management of existing aquaculture facilities. How the aquaculture system and the addition of fish can impact wildlife needs to be considered. Food resources, nesting habitat, predation and competition can play an important role in whether an aquaculture facility may be a benefit or detriment to the environment.

For example, in Wisconsin, public water bodies are not used for new aquaculture facilities because of potential impacts on the existing wetland. However, construction of new ponds and other aquatic habitats in previously tilled upland areas can expand the areas available for organisms highly dependent on water or aquatic environments.

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Resources

Wisconsin Aquaculture Association (WAA):

<http://www.wisconsinaquaculture.com/>

University of Wisconsin- Stevens Point – Northern Aquaculture Demonstration Facility (NADF):

<http://aquaculture.uwsp.edu>

National Aquaculture Association (NAA)

<http://www.thenaa.net/>

Wisconsin Department of Agriculture, Trade and Consumer Protection (DATCP) – Aquaculture Information:

<http://www.datcp.state.wi.us/mktg/business/marketing/val-add/aqua/wynk/index.jsp>

Wisconsin Department of Natural Resources (DNR) - Aquaculture Information:

<http://dnr.wi.gov/org/caer/cea/assistance/aquaculture/>

Superscript References

⁽¹⁾UW Sea Grant Institute, Malison, Jeffrey A. and Hartleb, Christopher F. ed.: “Best Management Practices for Aquaculture in Wisconsin and the Great Lakes Region.” 2005. [Online] Available

<http://aqua.wisc.edu/publications/PDFs/AquacultureBMP.pdf>

⁽²⁾ UW Sea Grant Institute, Malison, Jeffrey A. and Hartleb, Christopher F. ed.: “Best Management Practices for Aquaculture in Wisconsin and the Great Lakes Region. Appendix II. Wisconsin’s Guidelines and Rules” 2005. [Online] Available

<http://aqua.wisc.edu/publications/PDFs/AquacultureBMP.pdf>

⁽³⁾Agricultural Research Magazine. Sharon Durham. “Finding Alternative Fish Feeds for Aquaculture.” October, 2010 Vol. 58, No.9. [Online] Available. (2010). <http://www.ars.usda.gov/is/AR/archive/oct10/>

⁽⁴⁾ Aquaculture North America, Volume 2 Issue 1 Jan/Feb 2011, Hicks, Brad, What is FIFO? Page 5.

Other References

De Silva, S.S. and T.A. Anderson. 1995. Fish nutrition in aquaculture. Chapman and Hall, London, UK.

Fishfarmingxpert provided by Norsk Fiskeoppdrett AS. Odd Grydeland. “Farmed salmon not ‘died’.” March 7, 2011. [Online] Available. (2011). http://www.fishfarmingxpert.com/index.php?page_id=37&article_id=91009

Hardy, R.W. and F.T. Burrows. 2002. Diet formulation and manufacture *in* Fish Nutrition, Third Edition, J.E. Halver and R.W. Hardy, editors. Academic Press, San Diego, CA, USA.

Hertrampf, J.W. and F. Piedad-Pascual. 2000. Handbook on ingredients for aquaculture feeds. Kluwer Academic Publishers, Dordrecht, The Netherlands.

Wisconsin DATCP Fish Health Program:

<http://www.datcp.state.wi.us/ah/agriculture/animals/aqua/health/index.jsp>

<http://vetmedce.vetmed.wisc.edu/fhm/>

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Appendix 1: Selected Aquaculture Permits and Regulations

Water use requirements/regulations:

- Permits regarding wells (NR 812)
- Permits regarding surface water withdrawal and use (NR 850, NR 852, NR 856)
- Dam Construction (Wis Stats. Ch. 31) (DNR permit)
- Pond construction (Wis Stats. Ch. 30) (DNR permit)
- Natural Water Body Permit (NR 19) (DNR permit)
- Army Corps of Engineers Permit # 404
- Water Quality Wetland Permit (NR 103) (DNR permit)

Water discharge requirements/regulations:

- Land application of aquaculture waste
- (Wisconsin Pollution Discharge Elimination System (WPDES) permit)
 - Production over 100,000 lbs Coolwater fish & 20,000 lbs cold water fish (Prior to 2004 EPA Best Management Guidelines)
- EPA Effluent Standards
 - Concentrated Aquatic Animal Production (CAAP) Guidelines:
<http://www.epa.gov/waterscience/guide/aquaculture/guidance/full-final.pdf>

Aquaculture Fish Health Regulatory Requirements:

- Fish Farm Registration (ATCP 10 Subchapter VIII) (ATCP 10.61)
- Animal Premise ID
- Wisconsin Livestock Identification Consortium:
<http://www.wiid.org/wisconsin-livestock-identification-consortium-home>
- Record Keeping (ATCP 10.61 (10))
- Health certificates (ATCP 10.65)
- Import Permits (ATCP 10.62)
- Reportable Disease (ATCP 10.66)

Aquaculture Feed Regulations:

- Feed Regulations FDA and State Agriculture Departments

Other Regulations concerning fish farming

- DNR Stocking Permits
- DNR Wild Bait Harvest Permit
- Aquatic Plant and Algae control on Fish Farms
- Aquaculture Pesticide Use

Lacey Act

- Federal Law – Lacey Act, 18 U. S. C. §§ 41-48 passed in 1900 to protect wildlife
- Applies to all “wild animals” even those bred, hatched or born in captivity
- Can be triggered by a violation of a federal law such as Endangered Species Act or species listed as Injurious Species
- Can be triggered by violation of state, federal, or foreign wildlife laws
- Penalties can be felony, 5 years in prison with fines up to \$500,000