Aquaculture in Michigan

Aquaculture is the process of raising fish, plants and other aquatic organisms in controlled conditions to produce a marketable product. The aquaculture industry includes private and state-owned fish farms that raise fish for human consumption, hatchery facilities that release fish into the wild, baitfish operations that raise minnows, and commercial growers raising fish for the aquarium trade. Michigan has great potential to use its resources to produce locally farmed fish and increase seafood sustainability.

Currently, a small aquaculture industry exists in Michigan. However, expanding Michigan's private aquaculture industry could: supply Chicago, Toronto, Detroit and other areas with fresh fish; increase jobs and revenue to many communities; and supply the recreational fishing industry with baitfish.

Benefits of Aquaculture

Since the 1980s, increasing demand for seafood worldwide has made aquaculture the fastest growing food production industry. This rapid growth has advanced research, technology and management practices, and has resulted in greater efficiencies. Cattle require about 8 pounds of feed to produce roughly 1 pound of meat for human consumption. In comparison, fish require about 2 pounds of feed to produce about 1 pound of seafood for the marketplace. In addition to the comparatively low cost to produce farm-raised fish, wastewater from aquaculture facilities is rich in nutrients and can be used to fertilize and irrigate land-based or hydroponic crops.

Aquaculture Production by Great Lakes State (2005)

State	*Sales (1000 Dollars)*	*Number of Farms*
Minnesota	$8412	77
Wisconsin	$7025	84
Ohio	$3185	55
Illinois	$3176	47
Michigan	$2398	34

Private aquaculture is a multi-million dollar industry in the Great Lakes region that brings economic resources to many communities. For example, a private facility in Okemos, Michigan has successfully sold shrimp to markets in southern Michigan for many years and has gained in popularity as Midwestern restaurants and consumers look closer to home for food sources; a Minnesota cooperative exports live tilapia to Canadian markets from Vancouver to Toronto.

Different Environments

Fish can be grown in many environments. One common method is placing fish in raceways (long, flowing channels) similar to artificial streams. Hatcheries commonly use raceways for growing fish that will be stocked for sport fishing. An advantage to growing fish in raceways, compared to growing fish in ponds, is that waste produced by the fish is flushed away by the flowing channel current. Flushing the waste helps maintain good water quality for farmed fish. At the end of the raceway, waste is collected and processed. One of Michigan's largest aquaculture facilities — Harrietta Hills Trout Farm — has raised trout in raceways using naturally flowing spring water for decades.

Some Michigan aquaculture operations employ recirculating — or closed — indoor aquaculture systems. Closed systems circulate water that is constantly filtered and reused through the fish tanks. While the cost of recirculating system can be high, they offer advantages, such as:

- Tight control of the temperature, flow and water quality to ensure optimum rearing conditions;
- A high level of biosecurity, minimizing the chance of fish escaping into the wild;
- Disease prevention; and
- Less water use than other aquaculture systems.

Safety First

Michigan's aquaculture industry, established through the state hatchery programs in the 1870s, has an excellent history of management, specifically in minimizing environmental impacts. For instance, in that time, no invasive species has been released from a Michigan aquaculture operation – which is not true for many other states. Michigan and Great Lakes fish farmers also have many accessible resources to ensure the growth of healthy fish with minimal impact. A key training resource is the Aquatic Invasive Species Hazard Analysis and Critical Control Point program, or AIS HACCP, developed by Michigan and Minnesota Sea Grant programs. This nationwide certification program addresses the control of invasive species in aquaculture facilities in order to increase security and protect surrounding ecosystems. Aquaculturists and natural resource managers develop site-specific best management practices to prevent the release of aquatic invasive species.

For more information on:

- Aquaculture in Michigan, see www.miseagrant.umich.edu/fisheries
- AIS HACCP, see www.miseagrant.umich.edu/ais/ais-haccp
- Aquatic Invasive Species, see www.miseagrant.umich.edu/ais

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RECIRCULATING AQUACULTURE SYSTEMS

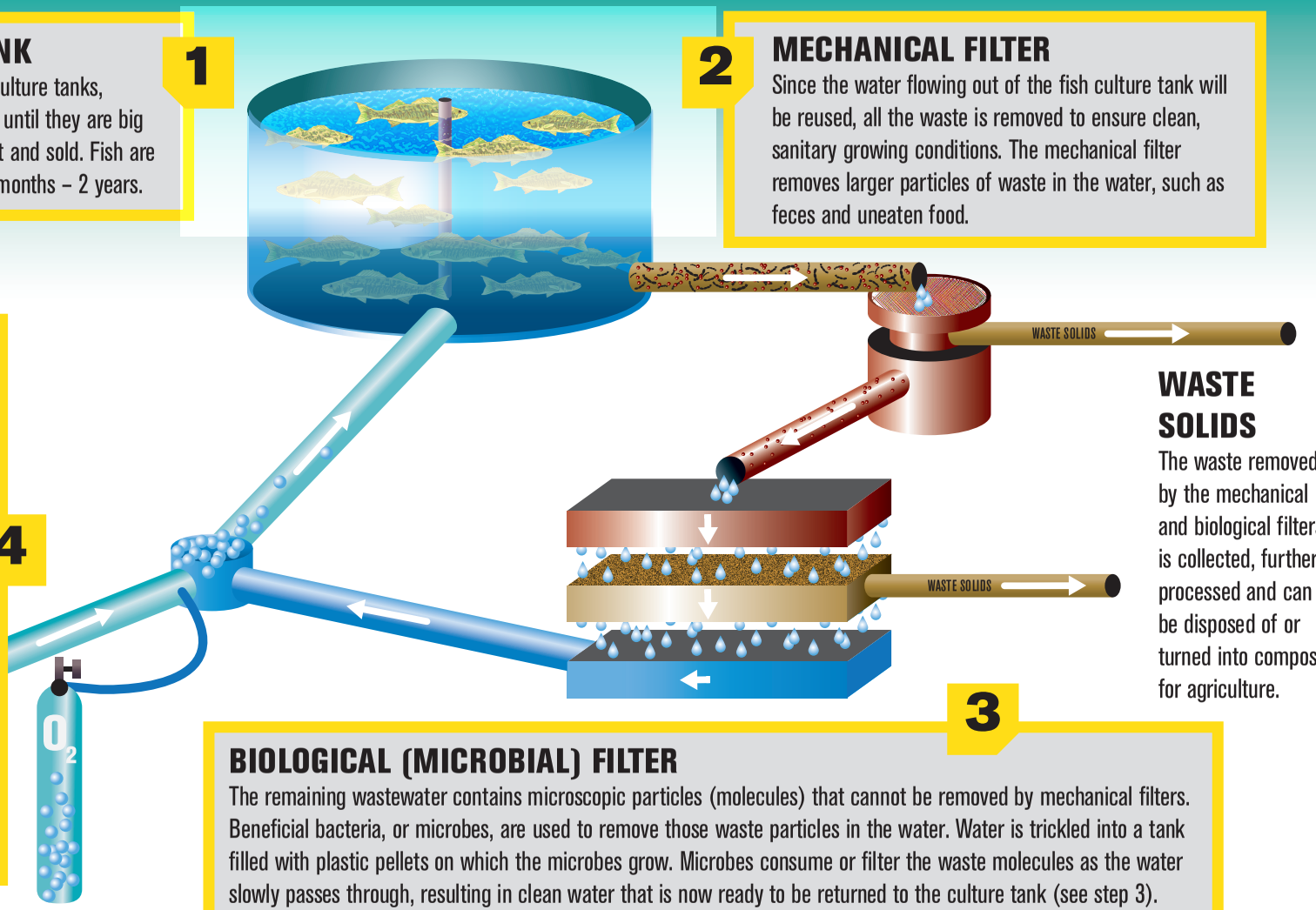
This diagram shows the typical steps needed to grow fish in an indoor recirculating aquaculture system. The primary focus of this type of system is managing the type of waste from the fish, maintaining oxygen levels and ensuring that any discharge is not damaging to the environment.

1 FISH CULTURE TANK

Juvenile fish are stocked in culture tanks, where they are fed and grow until they are big enough to be taken to market and sold. Fish are in the culture tanks from 10 months – 2 years.

2 MECHANICAL FILTER

Since the water flowing out of the fish culture tank will be reused, all the waste is removed to ensure clean, sanitary growing conditions. The mechanical filter removes larger particles of waste in the water, such as feces and uneaten food.



WASTE SOLIDS

The waste removed by the mechanical and biological filters is collected, further processed and can be disposed of or turned into compost for agriculture.

4 WATER INPUTS

To account for evaporation, water losses and waste removal, new water is added to the system at about 5-10% the total water volume.

OXYGENATION

Microbes reduce the level of oxygen in the water during the biological filtration process. Therefore, oxygen may be added to the water before it is returned to the culture tank, if the oxygen drops below levels the fish need to remain healthy.

3 BIOLOGICAL (MICROBIAL) FILTER

The remaining wastewater contains microscopic particles (molecules) that cannot be removed by mechanical filters. Beneficial bacteria, or microbes, are used to remove those waste particles in the water. Water is trickled into a tank filled with plastic pellets on which the microbes grow. Microbes consume or filter the waste molecules as the water slowly passes through, resulting in clean water that is now ready to be returned to the culture tank (see step 3).

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www.miseagrant.umich.edu/fisheries/aquaculture.html

Sea Grant Michigan

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