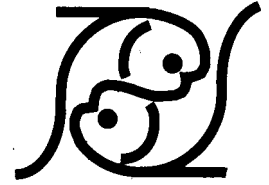

North Central Regional Aquaculture Center



In cooperation with USDA

Pond Culture of Walleye Fingerlings

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Introduction

Walleye, *Stizostedion vitreum*, has potential to be an aquaculture species in the North Central Region because:

- it is native to the region;
- it maintains optimum growth at temperatures lower than many other current aquaculture species (such as channel catfish);
- it is a highly-prized sport fish;
- its flesh is considered a delicacy; and
- the fillets are high in protein and low in fat, making walleye an attractive food selection for today's health conscious consumer.

Currently the highest return on investment for the walleye culturist is in the production of 1- to 3-inch fingerlings in culture ponds. Fingerlings can be sold for stocking of farm ponds, private lakes, and public lakes. Research has shown that walleye introductions are more successful when fingerlings 2 to 3 inches long are stocked instead of fry (newly hatched fish).

The objective of this publication is to "introduce basic concepts of walleye aquaculture, and to summarize briefly the methods most commonly used for rearing walleye fingerlings in ponds. Research is being conducted on methods to rear walleye

to food size, but there are no economically viable methods at this time

Biology

Walleye are native to most rivers and natural lakes in the North Central Region. They have been introduced (through stocking) into most publicly made lakes, and annual maintenance stocking is common

Females will produce about 30,000 eggs per pound of body weight. Spawning occurs in early spring when water temperatures are 40°–50°F. Hatching of the eggs is temperature dependent, but at 44°F it occurs in 10 days. At hatching, fry are 1/4- to 1/2-inch long. They do not begin feeding until the yolk sac is absorbed, which is 5-8 days after hatching.



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Walleye are strike feeders that rely on vision to capture their prey. Initially, very small planktonic animals (*zooplankton*) are the primary prey of the fry. Eventually larger prey such as insect larvae become important in the diet. Walleye are cannibals; they will begin eating their siblings when only 1/2 - inch long.

The optimum water temperature for growth of fingerling walleye is 69°–72° F. Depending on water temperature, fry can be expected to grow to a length of 1/2 to 2 inches in 30-55 days.

Pond management

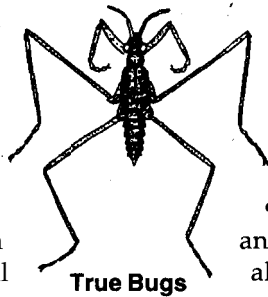
Even though walleye fingerlings have been raised in outdoor rearing ponds by state agencies for many years, there is no single culture method that has proven to be optimum. Suggested methods are general and are dependent on many variables, including pond types, water source, and weather.

To date, the most effective fingerling walleye culture is done in drainable earthen ponds. Ponds may be 1–5 acres in area, 4-10 feet in depth, and have a longitudinal slope of 1/4 to 1 foot per 100 feet of length (1/2 to 1 percent). Though harvest will be less efficient in non-drainable ponds,

they are usable as long as there are no other fish in the pond that will prey on fry or fingerlings. If such predators exist, they must be removed by chemical means (rotenone), unless the pond is shallow enough to winterkill before fry are stocked.

Pond filling

Assuming the pond to be used is drainable, it should be dry for at least 24-48 hours to make sure all gill breathing organisms (competitive fish and amphibians) are dead. Fill the pond 7-14 days prior to fry stocking (shorter time period will suffice if surface water is used) so that a good zooplankton population can be established. Without predatory insect populations also being established, some aquatic members of the *Hemiptera* (true bugs) and *Coleoptera* (beetles) orders are predacious on fish fry. Zooplankton will be the primary food source for the fry in the 'early phase of the culture period. Water for filling the culture pond may originate from a holding reservoir, a well surface runoff, or other surface water source, e.g. streams.



True Bugs

Filling procedures vary depending on the water source. Fill well-water ponds well ahead of stocking so an adequate zooplankton population can develop. Filter water from a surface water source to eliminate all fish eggs and all wild fish that may prey on walleye fry. Several types of simple filters can be used, with cloth filters being the most common.

Fertilization and zooplankton inoculation

One of the most critical factors in pond culture is the available food supply for walleye fry. Nearly all surface waters naturally contain

zooplankton, and, given enough time, less fertile waters will be colonized. Because fish usually are cultured at high densities, zooplankton densities also must be high. Fertilizers are commonly added to fish culture ponds to increase zooplankton numbers by increasing zooplankton food- organic material, bacteria, and algae.

Many different types, kinds, application rates, and application schedules for fertilizers are available. There seems to be little indication of an optimal treatment, and success can be highly variable.

Fertilizers are classified into two types:

- *inorganic fertilizers* (such as 10-35-0) are chemical compounds. The grade of a fertilizer refers to percentages by weight of nitrogen, phosphorus, and potassium. These nutrients stimulate algal growth.
- *organic fertilizers* are plant and animal materials — alfalfa, soybean meal, bone meal, and manures.

Organic fertilizers can provide food for the fish by stimulating algal growth, as do inorganic fertilizers. However, zooplankton can feed directly upon organic fertilizers as well as bacteria and protozoa, which are also food for zooplankton. Organic fertilizers have been commonly used for walleye culture throughout the North Central Region because algal growth is usually slow at low temperatures.

"Organic fertilizers may increase oxygen demands on the system, and manures may increase ammonia levels. Ponds with intense "blooms" of algae may exhibit low dissolved oxygen (DO) in the morning (less than 2 ppm) and high pH levels in

the afternoon. Depleted oxygen, high ammonia, and variable pH levels may be lethal to walleye. At pH of 8, water temperature of 68°F, and total ammonia nitrogen (TAN) of 0.5 ppm, walleye fingerling growth will be reduced.

Fingerlings will be killed at 5.0 ppm TAN. If pH levels or water temperature increase, a lower concentration of TAN will be toxic to fish. Consider such water quality parameters prior to selecting a fertilizer; measure water quality "parameters at regular intervals following fertilizer application.



Beetle

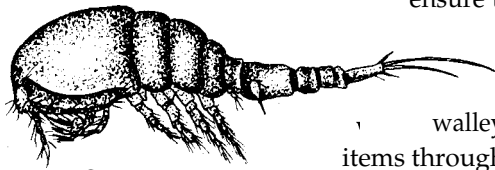
To determine fertilizer application rates and schedules, monitor zooplankton populations. Common application rates of alfalfa hay or pellets in drainable ponds in the North Central Region are 500-1500 lb. per surface acre applied in 3-5 portions over the 4-6 week culture period (150-300 lb. per week). However, a particular regime must be determined for each setting. Fertilizer applications in walleye culture ponds (in contrast to some fertilizer regimes used in Southern areas), are not determined by water temperature. If the culturist waits for the water temperature to reach 70°F, as recommended in the southern region, the walleye culture season could be over before fertilization takes place.

Zooplankton inoculation is another method whereby zooplankton populations can be managed. The purpose of inoculation is to seed the system so an adequate density of zooplankton is available to the walleye throughout the culture period. The *inoculum* (a large number of desirable zooplankters) is usually collected and concentrated from a nearby water source that is without fish but rich in zooplankton. Inoculation can be very important in systems using well water or in plastic-lined ponds, or where

zooplankton populations have crashed. In nutrient-rich waters, or where the ponds are filled from surface water sources, the value of zooplankton inoculation may be limited.

Water quality

Pond culturists must monitor the water quality in their ponds throughout the culture period. Water chemistry is complex and most variables are temperature- and pH-dependent. Monitor all major parameters, including dissolved oxygen (DO), temperature, pH, alkalinity, and ammonia. For more details see *Managing Iowa Fisheries: Water Quality*, Iowa State University Extension Publication Pm-1352a. (Printing and Publications, Iowa State University, Ames, Iowa 50011)



Copepod

Aquatic vegetation control

As in other forms of agriculture, undesirable forms of vegetation may pose a problem to successful fish culture. This is especially true in nutrient rich, fertilized waters. Types of vegetation that maybe present in ponds are algae, and submergent, emergent, and floating aquatic vascular plants. At low levels, vegetation is normally not a problem, but when abundant it can sometimes cause low dissolved oxygen at sunrise, or it can significantly interfere with harvest. The control of established aquatic vegetation may result in initial low dissolved oxygen associated with decaying vegetation, or decreased zooplankton population levels. Vegetation control may be accomplished using a pre-filling treatment of the pond bottom with recommended herbicides or by treating problem vegetation after it develops;

in either case, it is preferable to avoid excess vegetation. (For additional information refer to *Aquatic Pest Control, Category 5, A Guide for Commercial Pesticide Applicators*, Iowa State University Extension Publication CS-17. (Printing and Publications, Iowa State University, Ames, Iowa 50011)

Zooplankton and benthos monitoring

Take zooplankton and benthic (bottom material) samples weekly to ensure that there is an adequate food supply available to the walleye. Important food items throughout the pond's entire depth include zooplankton (*copepod and cladoceran* "water fleas") and *Chironomids* (midge larvae or blood worm) usually found on the pond bottom. Zooplankton can be sampled by towing a fine mesh plankton net (80µ mesh opening) a known distance through the water column. Other methods, e.g. tube samplers and pumps, may be used to collect zooplankton samples. Night sampling of zooplankton is most reliable because most zooplankton species migrate to the upper pond layers at night; but samples taken during periods of relatively low light should be adequate to assess the zooplankton population

Classify and count the zooplankton samples to determine composition and density. No minimum density required for pond culture of walleye fingerlings has been established, but a general guideline is that no less than 800 large-bodied (e.g. copepod and cladoceran) zooplankton per gallon should suffice. If zooplankton cannot be counted, hold up a clear container filled with pond water; a large number of these animals

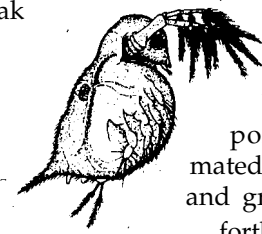
should be seen moving about with characteristic jerky movements. The naked eye should be able to see the outline of these animals.

A grab sample of the bottom (via a dredge or by hand) should yield some chironomids. There are no set guidelines for desired chironomid populations, but these benthic organisms can be a valuable food source to fingerling walleye, especially near the end of the culture period when zooplankton populations may have been depleted and fingerlings require more energy.

Fish management

A critical component of walleye pond culture is the quality of fry. Finding a reliable source of good and healthy fry is essential. Fry are usually received in a plastic bag partly filled with water and pure oxygen. Fry should be at least two days old (post hatch) before stocking, but not more than five days old.

After receiving the fry, compare pond temperatures and the temperature of the water in the bag. The fry should be temperature acclimated one-half hour for each 2°F temperature difference between bag water and pond. This can be done by placing the bag into the pond, and allowing the bag water temperature to become equal to that of the pond. Once fry are acclimated, cut open the plastic bag and gradually move it back and forth in the water until the fry are dispersed. Take care to place the fry on the leeward (up wind) side of the pond so they will not be washed ashore.



Water Flea

Optimal fry stocking densities are dependent upon productivity levels of the water, the pond configuration, soil organic content, and fertilization regimes. Conservative recommendations on stocking densities range from 20,000 to 30,000 per acre-foot (1

surface acre 1 foot deep). In extremely productive waters with experienced management, stocking rates as high as 50,000 per acre foot have been successful. High stocking densities may lead to strong competition for available food supplies resulting in high numbers of small fish. Lower stocking densities may reduce competition and maximize the size of fish produced. Production goals must be considered **prior** to stocking.

Two to three weeks after stocking the fry, collect fish to monitor progress. Small, soft mesh seines (1/16 to 1/8-inch, "ace" type) work well at this time. Measure and weigh 10 to 20 fish, and examine stomachs for prey types being consumed and evidence of cannibalism.

After 4-8 weeks of normal growing conditions, walleye fingerlings should be ready to harvest. The exact size or age at which to harvest fingerling; is often determined by food availability, fish condition, draining restrictions, and market demands. If the fish are in good condition, an adequate food source is present, and there is no significant cannibalism, they can be left in the pond until they are approximately 2 1/2 inches long. Once the fish reach 1 1/2 to 2 inches in length, culture conditions may begin to decline (e.g. decreased prey populations or increased cannibalism), and the fish should be harvested at this time. If conditions decline prior to fish reaching the desired size, try fertilization or zooplankton inoculation. If that does not work, then

begin harvest as soon as possible. In poor culture conditions, both walleye fitness and survival rates can decline rapidly.

Harvest techniques

It is crucial that harvest of fingerlings be conducted efficiently. Drainable ponds with concrete catch basins (collecting basins at drain outlets) have many advantages for harvesting fingerlings. In the catch basin, fingerlings can be dip netted out and placed into portable tanks for transportation. If the pond is not drainable, fingerlings can be captured in fish traps (fyke nets) or seined. Appropriate fyke net construction consists of 1/8 - to 3/8-inch "ace" type mesh. Seine construction for harvesting 2-inch fish consists of 1/8-inch "ace" or "king" type mesh. When fish are 2 3/4 to 3 inches long, use 1/4-inch mesh of #9 twine size. By early fall, when fish are 5 to 7 inches long, use 1/2-inch mesh and #15 to #21 twine size. Successive attempts may be needed to assure a large percentage of the fish are harvested. None of these methods will be as efficient as pond draining.

Stress at harvest must be kept to a minimum to ensure delivery of healthy fingerlings. Stress may be associated with, crowding, handling, and environmental extremes, e.g., low dissolved oxygen, high ammonia levels, and high temperatures. As the fingerlings are being harvested, the culturist must ensure that an adequate supply of well-oxygenated clean water is present

for the fish during harvesting. Do not harvest walleye when water temperature exceeds 75°F; less than 70°F is better. All of the other management measures are useless if the fish are stressed and die at harvest or later due to subsequent diseases. Do not hold walleye less than 2-inches long for more than 3 days in holding tanks or starvation may begin.

At harvest, weigh the fish and take three or four sample counts from each pond to determine total number and size of the fish harvested. Size of fingerlings is usually presented as the number of fish per pound. Though determination of harvest success is often based on percent return, fish condition and total pounds of fish produced are, also important.

Markets

The culturist has the option of either selling the fingerlings or attempting to raise them to food size. One of the best market choices is to sell fingerlings to individuals or sporting clubs for sport fish stocking purposes. Techniques and facilities to train pond-raised walleye to formulated feeds are being investigated in current research.

Find a market before it is time to harvest fish. Markets are available, but they usually must be cultured as carefully as the fish.

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