Outlook for Yellow Perch, Walleye and Sauger Culture in Kentucky

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Introduction

In North America, the economically important members of the perch family (Percidae) include the walleye (Stizostedion vitreum vitreum), sauger (Stizostedion canadense), and the yellow perch (Perca flavescens). Members of the pike family (Esocidae) are also important sport-fishes in the United States and Canada. The life history and culture techniques for esocids are described in the article "Outlook for Muskellunge, Northern Pike and Chain Pickerel Culture in Kentucky (SKY-583)." Members of the perch and pike families are often described as "coolwater" fishes. These fishes thrive at water temperatures which range between 64 to 77 degrees F (Kendall 1978). Generally, these water temperatures are considered too warm to allow the survival of most coldwater fishes (trout and salmon), and too cold to permit the optimum growth of warmwater fishes (catfish and sunfish).

Walleye, sauger and yellow perch are highly regarded as food and sport-fishes. Review of the literature suggests the walleye and walleye (female) - sauger (male) hybrid may possess the most potential for commercial aquaculture. Kentucky coolwater fish production will likely be limited by warm summer water temperatures (> 90^{o} F). Spring-fed trout culture operations may produce these fishes in water-warming ponds as a supplemental crop. Other surface and groundwater resources may be suitable for coolwater fish production.

Coolwater species consume large numbers of fish in the wild. Intentional or accidental introductions of any fish may destroy resident fish populations or interfere with current management programs. Contact the Kentucky Department of Fish and Wildlife Resources or a Kentucky State University Aquaculture Extension Specialist **before** stocking any fish into private waters.

Distribution and Life History of the Walleye

Walleye populations occur in streams, rivers and reservoirs throughout Kentucky (Burr and Warren, 1986). The walleye is confined to the freshwaters of North America (Scott and Crossman, 1973). Walleye spawn in spring when water temperatures range from 48 to 55 degrees F (Piper et al. 1989). The fish spawn on rocky substrates below impassible falls, in river tailwaters behind dams, or on lake shoals. Spawning occurs at night. The eggs of the larger females are fertilized by the smaller males.

A female walleye, 31.5 inches long, may contain 612,000 eggs. After the eggs are released, they sink into rock crevices. Walleye eggs will hatch in 1 to

3 weeks depending on water temperature (Stickney, 1993). Fry may begin feeding prior to absorption of the yolk sac. Ten to fifteen days following hatching, the walleye fry disperse into open water where they feed on invertebrates and larval fish near the surface. Invertebrates may be the most important food source for fry particularly in the spring and early summer. Cannibalism may occur among larger fry if insufficient food, such as the fry of yellow perch, is not available. Walleye appear to feed on any species of fish. The young may reach 3 to 8 inches long after the first growing season. Males generally mature after reaching a length of 12 inches, or 2 to 4 years of age. Females mature at lengths of 14 to 17 inches, or 3 to 6 years of age in the southern United States. Walleye live from 10 to 12 years and females may reach 25 lbs (Scott and Crossman, 1973). Walleye are sight predators and prefer turbid, shallow lakes where they school near the bottom. These fish have a layer of the eye (Tapetum lucidum) which gathers light and is extremely sensitive to bright light. While walleye fry are attracted to light, adult fish usually feed in dimly lit zones or at night. The fish feed actively throughout the year. Northern pike, yellow perch, sauger, smallmouth bass, and lake whitefish may prey upon young walleye and compete with them for food (Scott and Crossman, 1973).

Culture of Walleye

Walleye culturists depend on eggs taken from wild fish to stock their hatcheries.

Walleye have been reared intensively in raceways, tanks and troughs; however, the fry do not readily accept artificial feed and mortality is often high (Kendall 1978). These culture systems have not been proven to be economically feasible for rearing fry (Stickney, 1993). Currently, most walleye fry are cultured in fertilized ponds which support abundant natural food. Survival to the fingerling stage using traditional pond culture techniques is unpredictable. After the fish reach 1

Broodfish are caught in rivers with fyke trap nets, gillnets or by electrofishing at night. Mature females will have swollen abdomens and red colored vents which turn purple as the eggs mature. The broodfish are transported to a hatchery where they are anesthetized. Eggs are stripped from the females into a dry pan, by hand. Milt from male fish is added to the eggs.

The eggs and sperm are mixed and left to fertilize for 5 to 15 minutes. Walleye eggs are adhesive. This may cause the eggs to cluster and suffocate during incubation if they are not properly separated (Piper et al. 1989). Tannic acid may be used as an initial rinse for fertilized eggs. The eggs are then placed in a 400 mg/l bath solution for 2 to 3 minutes. In approximately 1 to 2 hours, the eggs will "water harden." Water hardening occurs when the egg absorbs water between the shell and the yoke. Water hardened eggs will feel firm when touched. The water must be exchanged at least once every hour before the eggs are rinsed and transferred into 1 gallon hatching jars. Water flows, adjusted between 1 to 1.5 gallons per minute, are used to create a gentle rolling movement in the hatching jars. Generally, 75% of jar volume is filled with eggs (approximately 30,000 - 35,000 eggs per liter). The eggs will hatch in about 10 days at 55 degrees F. Hatching success of 50 to 70% is common. Yolk absorption occurs in 3 or more days after hatching, depending on water temperature. Walleye fry must have access to adequate food within 3 to 5 days of hatching (Stickney, 1993).

inch long and will accept artificial food, they may be moved to a more intensive culture environment (Stickney, 1993).

Small ponds (1 to 5 surface acres) should be drained, dried and than re-filled in less than 14 days to minimize predacious aquatic insect populations which eat the fry. Where draining is not practical, pond water must be treated with rotenone to eliminate other fish. Surface water should be filtered to prevent the introduction of predators into the pond. The ponds should be fertilized after filling to promote zooplankton food for the fry. Inorganic fertilizers, high in phosphorus, or organic fertilizers such as bone meal, alfalfa, or manures are commonly used to stimulate plankton blooms. Dense plankton blooms will also help prevent the establishment of unwanted plants and algae in the pond (Harding et al. 1992).

Walleye fry are transferred to earthen ponds when they are 2 to 5 days old. The fish must be acclimated to the pond's water temperature, 30 minutes for each 2 degree F difference in water temperature (Harding et al. 1992). Dissolved oxygen levels should remain at 5 mg/l or greater, throughout the culture period. Walleye fry have been found to grow larger and faster in water with high calcium and magnesium hardness, as opposed to soft water. Typical stocking densities for walleye fry range between 20,000 and 50,000 fry per acre foot of pond volume (Piper et al. 1989).

Walleye fingerlings must be trained to accept artificial food. Diets such as the W14-16 series developed by the U.S. Fish and Wildlife Service or the Abernathy salmon diet, contain 50 to 60% protein which is composed of 60 to 80% animal protein. Low intensity lighting, providing 16 hours each day, enhances feeding and growth. Automatic feeders, set at 2 to 10 minute intervals, should offer food to walleye for a minimum of 16 hours per day. Initially, the fingerlings should be fed 10% of their body weight daily. For intensive production units, one or two water exchanges per hour at water temperatures of 68 degrees F is recommended. Upwelling current inside the tank, will be required to keep the fine food particles available to the walleye. As the fish feed more actively, offer food at 3 to 6% of their body weight daily. Cannibals should be removed. Walleye grow quickly and require frequent grading (Stickney, 1993).

Typically, 1 to 3 inch long walleye fingerlings are produced in ponds. When sufficient food is available, fingerlings may be harvested after 4 to 8 weeks. Fingerlings should be harvested when water temperatures are less than 68 degrees F (Harding et al. 1992). If larger fish are desired, minnows should be stocked into the ponds when the walleye are approximately 1.5 inches long. To produce 4 to 6 inch long walleye, small fingerlings may be stocked at 10,000 to 20,000 fish per surface acre. If 6 to 8 inch long walleye are to be grown, small fish can be stocked at approximately 5,000 to 10,000 fingerlings per acre. To produce walleye fingerlings 8 inches long or longer, fish should be stocked at less than 4,000 per acre (Piper et al. 1989).

Once harvested, walleye fingerlings may be stocked into intensive fish culture systems. However, economical methods of intensively culturing large walleye have not yet been demonstrated. Harvested fish should be placed in a 0.5% salt and bacteriostatic solution during transport (Stickney, 1993).

Walleye fingerlings could be sold to Kentucky sportsmen's clubs for stocking private lakes. Larger fish may provide some small impoundment owners an

alternative predator species. Adult walleye could support a food-fish market, provided large fish production techniques become more reliable and economical.

Distribution and Life History of the Sauger

Sauger and walleye occur in similar habitats throughout Kentucky. However, the sauger appears to be tolerant of more turbid waters than walleye (Burr and Warren, 1986). The sauger's preferred habitat seems to be large shallow lakes which have turbid waters (caused by suspended clay particles) or turbid, large, slow-moving rivers. The sauger occurs solely in the fresh waters of North America (Scott and Crossman, 1973).

Sauger spawn in the spring when water temperatures are between 39 to 43 degrees F. Spawning occurs at night on gravel shoals. Often, sauger spawn immediately after the walleye and in the same locations. In some instances, walleye and sauger hybridize. Sauger eggs are semi-buoyant and fall into substrate crevices following spawning. A female will lay 15,000 to 40,000 eggs for each pound of her body weight. The eggs will hatch in 25 to 29 days when water temperatures range between 40 and 55 degrees F. Fry feed on zooplankton and aquatic insect larvae. Sauger fry will begin consuming other fish when they reach 0.5 inches long. Juvenile sauger may reach 3 to 6 inches long after the first growing season. Female sauger may reach 19 inches long and weigh 3 lbs. Male fish mature at 2 to 3 years, while females mature at 4 to 6 years of age. Sauger generally live 5 to 6 years in the southern United States (Scott and Crossman, 1973).

Like walleye, sauger are sight predators. Adult sauger prey upon a wide variety of small fishes. Most of these species are not considered economically important. Northern pike and walleye likely compete with sauger for food. Predators and cannibalistic behavior probably account for most natural sauger mortality (Scott and Crossman, 1973).

Culture of Sauger

Literature about the culture of sauger is limited. Under intensive culture conditions, the walleye female - sauger male hybrids grew faster, were less aggressive and were less affected by handling stress than either parent species. Hybridization did not influence egg survival or the rate of hatching for either species. Hybrid fingerlings accepted artificial feed and were not as aggressive towards one another as were the purebred fishes. The hybrid fish gained weight nearly twice as fast as walleyes. There is also evidence which suggests this hybrid may reproduce. As with the walleye, potential hybrid fingerling and food-fish markets could be established. Advancements in the production technology of these hybrids will be required for profitable commercial fish production to occur in the future.

The reciprocal hybrid (sauger female x walleye male) did not display improved growth and production characteristics as compared with the parent species. Purebred sauger had more injuries than either the walleye or the hybrids which may indicate more aggressive behavior within this species. Additionally, purebred sauger grew slower than walleye or either of the hybrids (Malison et al. 1990).

Distribution and Life History of the Yellow Perch

Yellow perch occasionally appear in the Ohio River, bordering northern Kentucky, and have been stocked in some lakes in south-east Kentucky (Burr and Warren 1986). This fish is common in lakes, ponds and quiet rivers of the Midwest, Atlantic Coast, and Canada. The yellow perch is a schooling fish and is commercially caught in the Great Lakes (Scott and Crossman, 1973). Approximately 75% of these fish are consumed in the State of Wisconsin. The yellow perch is an important gamefish in much of North America (Stickney 1993) however, it is not considered desirable in the southern United States (Kendall 1978).

Yellow perch spawn in spring when water temperatures are between 44 to 54 degrees F. Spawning occurs at night or during early morning. Semi-buoyant eggs are contained in a gelatinous, folded string or tube and are most likely fertilized by several males. The egg tube is released from the female and adheres to rooted vegetation, submerged brush, sand or gravel substrate. The eggs receive no care, but apparently contain a substance which discourages predation by other fishes. The eggs hatch in approximately 8 to 10 days (Scott and Crossman, 1973).

Females grow faster and larger than males, but rarely exceed 14 inches or weigh more than 1 lb. A female fish, 10 inches long, may contain 109,000 eggs. Young perch will grow 1 to 4 inches long during their first summer, feeding on invertebrates and fish. Feeding occurs during the morning and evening hours, rarely at night. Yellow perch will feed throughout the year, even under ice. Perch will consume the eggs and young of a wide variety of fishes. They may compete for food with brook trout, black basses, crappie and bluegill (Scott and Crossman, 1973).

Yellow perch can adapt to diverse habitats and are tolerant of low dissolved oxygen. Preferred water temperatures have been experimentally determined to range between 70 and 77 degrees F. Perch have a high reproductive rate and their populations frequently become stunted (Scott and Crossman, 1973). Extensive stocking programs released millions of yellow perch in the early 1900's (Stickney 1993). Currently, few stocking programs are still in existence. Some states in the north-east and Pacific United States have expressed interest in limiting or removing yellow perch populations because they compete for food with salmonids. Often, yellow perch grow slowly and to a small size (Kendall 1978).

Culture of Yellow Perch

Information about the culture of yellow perch is limited. However, the biology of this species is similar to the walleye. Typically, yellow perch are harvested at 1/4 to 1/3 lb and are 8 to 10 inches long. Like the walleye, perch fry will not readily accept artificial feeds until they are approximately 3/4 of an inch long. Fry are reared in fertilized ponds and can be harvested by lift nets at night when attracted to light. Approximately 80% of yellow perch fingerlings cultured can be trained to accept pelleted food. The training program must include the elimination of natural foods, elevated water temperatures (68 to 75 degrees F) and frequent feeding and grading to reduce cannibalism. Fingerlings may be reared in tanks or ponds (Stickney 1993). Automatic feeders, which dispense small amounts of feed at frequent intervals, are recommended for rearing yellow perch in

tanks and raceways. "Training" yellow perch fingerlings to feed in specific pond locations is recommended, as opposed to broadcasting feed over the entire pond surface (Kendall 1978).

Yellow perch have been reared in Wisconsin ponds. Broodstock were obtained by ice fishing, and non-induced spawning took place in a metal tank. Average weight of female fish was less than 1.5 ounces, while males weighed less than 0.5 ounce. Plastic spawning mats and vertical fencing were placed on the tank bottoms as spawning substrate for the egg envelopes. Most eggs were deposited when water temperature was 50 degrees F. Eggs were placed in trout hatching troughs and in a vertical tray incubator. Water flow rates were adjusted to range between 1 and 2.5 gallons per minute. Formalin was used to control fungal growth on eggs (Kendall 1978).

Average time to hatch was 18.5 days with a water temperature of approximately 51 degrees F. After several fry hatched, the eggs were transferred to floating screens placed in a rearing pond. Floating screens were anchored in a shallow, 0.5 surface acre pond. The 0.25 inch mesh permitted the fry to pass through the screen after hatching. Fry were first spotted in the pond when lengths were greater than 0.5 inches. Five hundred lbs of hay was used to fertilize the pond to promote populations of zooplankton to feed the fry. After approximately 6 weeks, 0.38 g fingerlings were harvested from the pond. Survival was 35% from the egg stage to 0.38 g. Fingerlings were fed a commercial trout feed. Some fish were transferred to a circular tank with water temperatures held at 61 degrees F. Thirty-eight percent of these perch survived and grew to 1.36 g average over a two month period (Kendall 1978).

The economics of yellow perch culture as food-fish does not appear practical. Contributing factors would include, high production costs (fingerlings and feed), competition from commercial catch, small size (particularly males) at harvest, and low dress-out yields of approximately 42% for fillets (Stickney 1993).

REFERENCES

Burr, B. M. and M. L. Warren, Jr. 1986. A Distributional Atlas of Kentucky Fishes. Kentucky Nature Preserves Commission Scientific and Technical Series Number 4.

Harding, L. M., C. P. Clouse, R.C. Summerfelt, and J. E. Morris, 1992. Pond Culture of Walleye Fingerlings. North Central Regional Aquaculture Center, Fact Sheet Series #102.

Kendall, R. L. Editor, 1978. Selected Coolwater Fishes of North America. American Fisheries Society Special Publication No. 11.

Malison, J. A., T. B. Kayes, J. A. Held and C. H. Amundson, 1990. Comparative Survival, Growth, and Reproductive Development and Sauger and Their Hybrids Reared under Intensive Culture Conditions. Progressive Fish-Culturist 52:73-82.

Piper, R. G., I. B. McElwain, L. E. Orme, J. P. McCraren, L. G. Fowler and J. R. Leonard, 1989. Fish Hatchery Management. United States Department of the Interior Fish and Wildlife Service, Washington D.C.

Scott, W. B. and E. J. Crossman, 1973. Freshwater Fishes of Canada. Fisheries Research Board of Canada, Ottawa. Bulletin 184.

Stickney, R. R. 1993. Advances in Fisheries Science: Culture of Nonsalmonid Freshwater Fishes. Second Edition. CRC Press, INC.