Muskegon Futures:

Walleye in the Muskegon River

Muskegon Watershed Research Partnership Volume 9

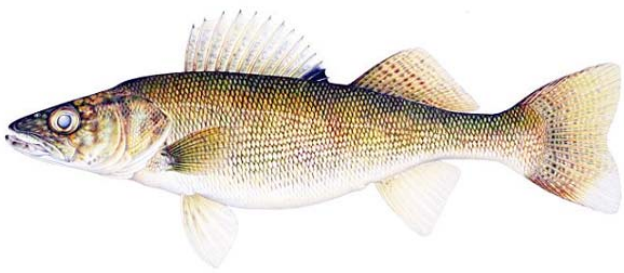
Critical Habitats:

Walleye adults reproduce on cobble/gravel river substrates within a 1-mile area below Croton Dam, and also between Thornapple boat launch and Newaygo. After a 3-4 week incubation period, larvae hatch in late April and early May, and drift down to Muskegon Lake where they rear in the lake's eastern basin. Juveniles grow rapidly in shallow areas of Muskegon Lake. Adult walleye in Muskegon River forage in pools and run habitats with slower flows. After spawning, most adult walleye disperse from the river to Muskegon Lake and Lake Michigan (FIG. 1, pg 3).

Natural Reproduction and Early Survival

The Muskegon River historically provided the only major spawning site for the walleye population in eastern Lake Michigan. It once produced enough walleye to support a commercial fishery, but the population declined soon after alewife invaded Lake Michigan and the Muskegon Lake nursery area, reaching 2000 adults by 1975. In response to the decline, walleye were stocked by Michigan DNR in Muskegon Lake beginning in 1978, and the population has responded, reaching approximately 50,000 adults in the spring spawning run.

Successful reproduction by walleye is limited in the Muskegon River. Natural reproduction currently accounts for only 10-20% of the adult population in the system. Walleye spawn in the Muskegon River in late March or early April, with an estimated spawning run of 38,000 to 50,000 fish in recent years. Most walleyes spawn within a mile of Croton Dam, but some individuals spawn farther downstream from Croton to Newaygo. We estimated egg production, and densities and survival of walleye eggs and larvae during 2003 through 2006. We found an estimated 5 billion walleye eggs are spawned each year in the river, but few survive to the larval stage. Walleye larvae hatch the first week of May, and within 1-2 days are swept downstream to Muskegon Lake, where they spend their first year of life. In contrast to a 1980s study documenting presence of walleye larvae in Muskegon River, we collected very few naturally-spawned walleye larvae using the same techniques, suggesting that factors affecting egg survival, hatch or larval survival limit walleye recruitment. Although we still don't know the reasons why walleye don't reproduce successfully in the Muskegon River watershed, our studies suggest that egg survival, hatching success and transport from the river to Muskegon Lake are higher with a higher river.



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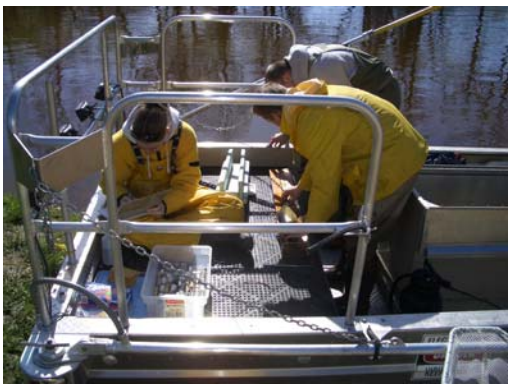
Size, Composition, Growth and Movement

In terms of growth, walleye from the Muskegon Lake, Muskegon River, or Lake Michigan have comparable sizes at age. Their growth rate is relatively rapid compared to other locations, with comparable or better growth to walleye in Lake Erie, and much better growth than walleye on average in Michigan. For example, the average 6-year-old male from the Muskegon River is 22 inches in length, the average female 25 inches, the average male from Lake Erie 20 inches, the average female from Lake Erie 23 inches, and the average size of sexes combined for Michigan is 19 inches. That is a difference of six inches in length between a female walleye from the Muskegon system at age six, compared to the average walleye at age six throughout the state of Michigan.

Walleye move freely within the Muskegon Lake and Lake Michigan system up to Croton Dam. Current and past studies indicate that distances walleye move increase with fish size and age, and also with population density; large adult fish tend to migrate further from the spawning grounds than do small adults, and more fish migrate long distances when population size is high. Adult walleye from a wide area of Lake Michigan migrate to the Muskegon River to spawn and accumulate below Croton Dam in



water temperatures of about 50° F. Fish returning from Lake Michigan have a higher proportion of older fish ages 6-8, and after spawning return quickly to Lake Michigan and are gone from the Muskegon River system by May. However, a second, younger group of fish (average age is 4.5 years) migrates from Muskegon Lake and the Muskegon River to the same reaches to spawn, and these fish spend additional time in the river. As an example, we inserted transmitters into 20 walleye from the Muskegon River system (FIG. 2). Of the 12 fish implanted in the river, all but 2 moved into Muskegon Lake sometime during the summer, usually by July. In addition, two of these fish moved out into Lake Michigan in early summer. All of the eight fish that were originally implanted in the lake remained within the lake, except during spring when they moved into Muskegon River to spawn. While locations of fish can be lost due to fish being caught, transmitters malfunctioning, or fish moving out of our range, most of the fish were monitored over more than a year's duration, and these fish were found in the river during spawning in the spring, then residing either in the river (~10%), in Muskegon Lake (~80%), or back in Lake Michigan (~10%) in summer. The fish in these studies were all fish that were in the river after the initial spawning and departure of Lake Michigan-based fishes.

FIGURE 2. Walleye (top) implanted with transmitter, and (left) sampled for biological information and diet

Diet and Food Web

During 2004 and 2005, we collected walleye between April and August from both Muskegon Lake and Muskegon River. We were unable to collect fish from Lake Michigan, due to the large size of the lake and the collecting techniques we used. It appears that walleye reside within Muskegon River as long as prey resources and temperatures are appropriate, and then gradually move down to Muskegon River when the quality of these resources decline within the river system. As summer progresses, walleye in the Muskegon River eat a variety of prey, but really focus on Chinook salmon parr and stocked rainbow trout (FIG. 3A). Rainbow trout seem to be particularly important in their diet, as these are stocked at a relatively large size and comprise a large volume of prey for the Muskegon River walleye. Trout stocking usually occurs in the spring while temperatures are still rising within the river. The combination of continued rising water temperatures and the declining abundance of trout within the river appears to cause walleye to move into Muskegon Lake in summer.

Within Muskegon Lake, walleye also consume a variety of prey, but focus heavily on alewife and gizzard shad (FIG. 3B). Alewife tend to move into the system in late May or early June and can comprise up to 75% of the prey consumed during those periods of time. Alewife are also relatively large prey, and it is common to see walleye stomachs gorged with alewives, especially during June. Later in the summer, gizzard shad replace alewife in walleye diets, and are also large prey that are consumed at a high rate, particularly during August. In addition to these prey species, walleye in Muskegon River and Muskegon Lake will consume a variety of minnow species, a few round gobies, sticklebacks and killifish, mottled sculpin, and a few invertebrates.

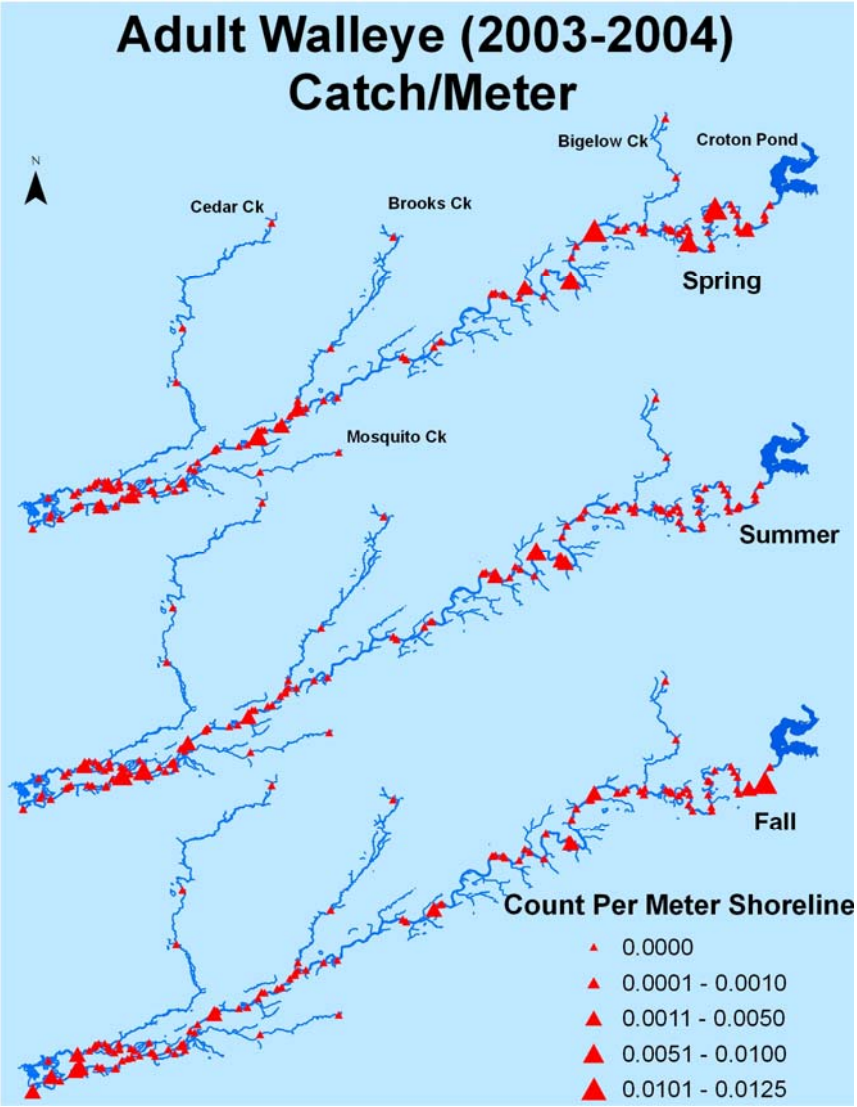


FIGURE 1. Distribution and density of adult walleye in the Muskegon River during spring (May-June), summer (July-August), and fall (September-October). Larger symbols indicate higher density.

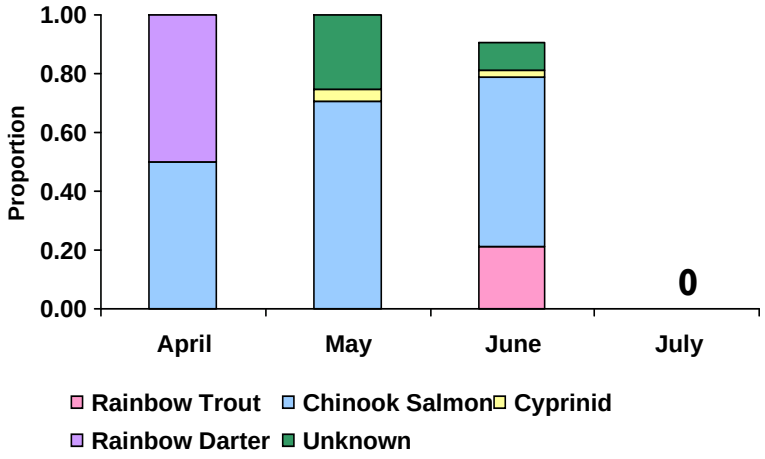


Figure 3A. Diet of walleye (total of 132 sampled) in Muskegon River during spring and summer, 2005. No walleye examined in July had food.

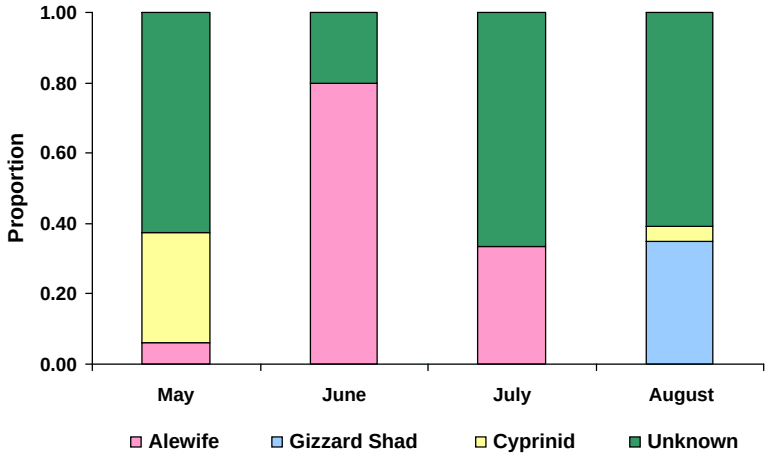


Figure 3B. Diet of walleye (total of 94 fish sampled) in Muskegon Lake during spring and summer, 2005.