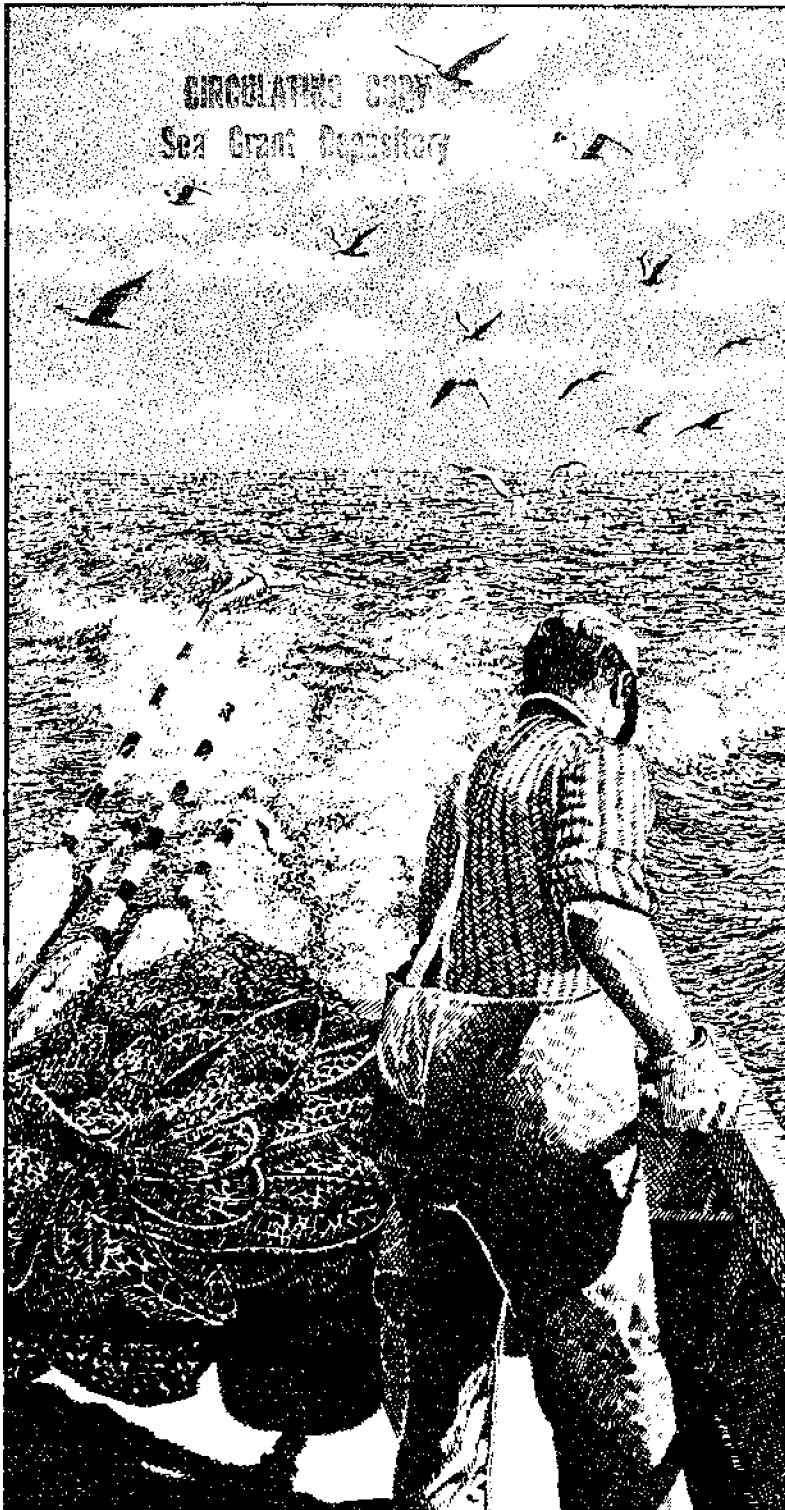


Green Bay's Yellow Perch Fishery



by Clifford Kraft

Yellow perch are a Green Bay tradition — as much a part of Green Bay as the Packers.

Perch have been a mainstay of the local commercial and sport fisheries for many years. They are the main attraction at almost every Friday night fish fry in northeastern Wisconsin. Perch are also sought by sport fishermen out on a lazy summer afternoon or ice fishing on a cold winter morning.

Such traditions started because the waters of southern Green Bay are especially well suited for these fish. But today these traditions are threatened by declining catches of the fish. As a result, the per-pound price of perch fillets in the supermarket has surpassed that of T-bone steak. Less expensive fish are replacing lake perch at the local Friday night fish fry. Sport fishermen are coming home with empty creels.

Fishermen are asking, "Will the perch come back?"

The University of Wisconsin Sea Grant Institute is one of several organizations concerned with finding the answer to this question and determining why perch populations have declined. With Sea Grant support, researchers in several scientific fields are trying to solve this and other aquatic resource problems confronting Wisconsin and the region. The responsibility for managing and regulating the state's fisheries, however, rests with the Wisconsin Department of Natural Resources (WDNR).

This pamphlet outlines what we currently know about the Green Bay perch fishery and how this knowledge is being applied to the management problem of improving perch catches for both sport and commercial fishermen.

Yellow Perch Life History

After spending the winter in deep waters, yellow perch begin to move toward shore to spawn during mid April to early May, when water temperatures reach 50°F. Perch spawning follows that of walleyes and often coincides with sucker spawning. The exact date of spawning varies from year to year and from one location to another. For example, two major spawning areas on Green Bay's west shore—the bays formed by Little Tail and Long Tail Points—warm at different rates, so peak spawning times occur several days apart at these locations. Spawning usually continues over several days at each location.

The smaller male fish precede the females to the spawning grounds, which are primarily located along the shallows and river mouths of Green Bay's west shore. Spawning has been reported to take place in other lakes at night and early morning, usually near rooted vegetation, submerged brush or sunken trees. Spawning has also been observed over bottom sand and gravel; this is probably the situation along the west shore, where much of the submerged vegetation has disappeared (see "Exotic Species" section).

The number of eggs released by the female perch increases with her size, so the older females produce

more eggs. As many as 100,000 eggs have been found in a single female yellow perch, but the average number is about 25,000.

The female yellow perch release their eggs in a distinctive gelatinous ribbon that may extend up to seven feet in length. Instead of a protective nest, this accordion-like tube enables the eggs to adhere en masse to submerged vegetation or, at times, to the bottom. The eggs have no other protection until they hatch, usually eight to 10 days later.

At birth, larval perch are only 0.2 inches in length and spend the first five days absorbing their yolk sac. After this, they begin to grow rapidly, feeding on the microscopic plants and animals, or plankton, suspended in the bay's water. For this reason, the larval fish are called planktivores. Because of their small size, larval perch are at the mercy of lake currents, and large numbers of them are eaten by other fish—even adult perch—or die from a variety of other causes.

Larval perch are attracted to light during the first few months of life—which also attracts them to where the plankton are most abundant. From May to mid July, they remain among the plankton. By their first winter, the perch will have grown as large as four inches long.

After several months, the young perch begin to avoid well-lit areas and begin their adult bottom-feeding habits. The larval perch change to new food items, like bottom-dwelling insects, molluscs, crustaceans, leeches and even small fish or crayfish. As adults, the fish become opportunistic

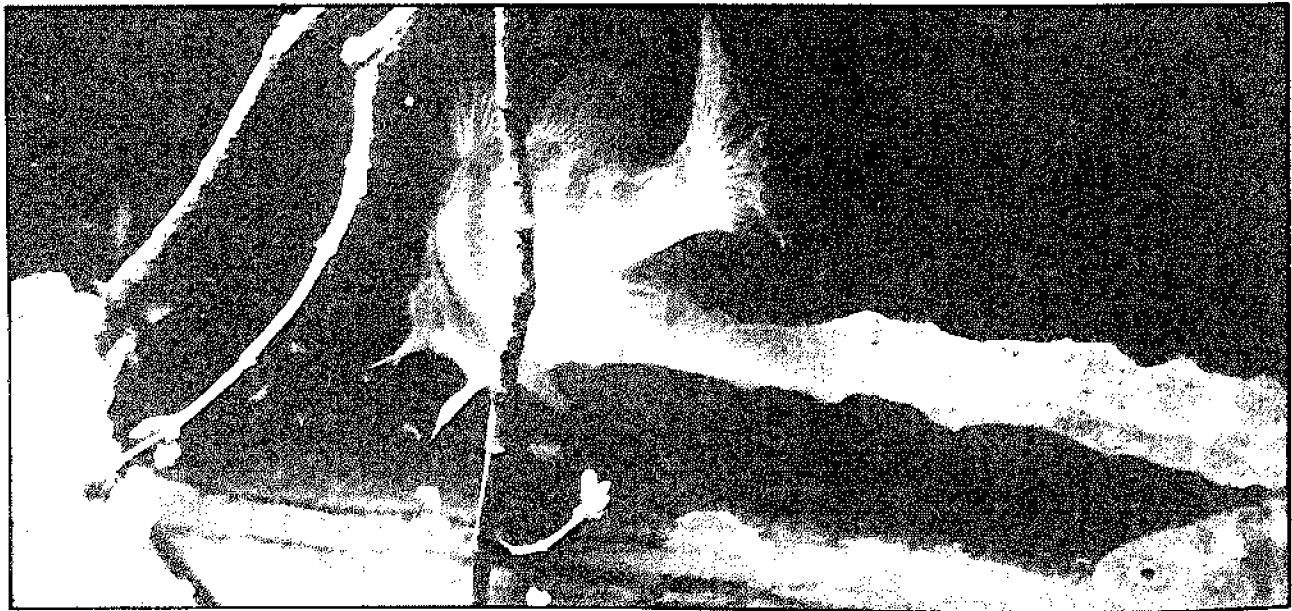
feeders; that is, they will feed on whatever prey is available in the right size within their habitat. Perch feed much more actively during the summer, when prey is abundant, than during the colder months. Studies have shown that the optimum feeding temperature for perch is 20-22°C.

Scientists have tracked and tagged yellow perch to learn more about their movements. Yellow perch congregate in schools during daylight hours, probably to reduce their susceptibility to attack through the safety of large numbers. These schools break up at night, and the fish settle on the bottom—either because they have difficulty seeing each other, or schooling is no longer needed for defense purposes. Perch are also much more active during the day than at night, and they feed largely at mid-morning and midafternoon.

Though perch move throughout the bay, WDNR tagging studies indicate that these perch do not leave Green Bay and migrate into Lake Michigan proper. In Lake Erie, daily movements from nighttime resting areas to daytime feeding areas have been observed. Further tagging studies are currently underway in Green Bay.

Adult yellow perch are eaten by a variety of predator fish. Walleyes, bass, northern pike and burbot have been observed to feed upon adult perch, but this has not been well studied in Green Bay. Burbot captured in drop nets with yellow perch often have perch in their stomachs, yet this feeding could occur while they are trapped together in the net. Further work on this subject is needed.

Bill Mancini



2

Yellow perch laying a ribbon of eggs: A new crop of fish.

Yellow perch in other areas have reportedly lived to the age of nine or 10 years old, but less than one percent of the Green Bay perch population reaches four years of age. Perch caught commercially in Green Bay have traditionally been smaller than perch caught in other areas. During the early 1950s, premium commercial perch from Lake Erie were available at sizes up to three quarters of a pound each, while Wisconsin perch were seldom even a quarter of a pound. The largest perch on record — four pounds, 3.5 ounces — was caught in New Jersey in 1865.

There has been general concern about contamination of Great Lakes fish by polychlorinated biphenyls or PCBs. PCB levels in whole Green Bay yellow perch are generally lower than two parts per million — well below 5ppm, the allowable PCB limit in food under present federal standards. Furthermore, PCBs tend to accumulate in fatty tissues, so only a small amount of the PCBs found in a perch is contained in the edible portion, which is mostly muscle tissue.

The Early Green Bay Fisheries

Commercial fishermen were among the first white settlers around Green Bay. The early fishery was geared primarily for taking whitefish, lake trout and lake herring. But as more people moved into the area, these species were overfished and began to decline. The area's booming lumber and paper industries also changed the bay environment — water pollution increased, dams blocked fish migrations and spawning grounds were covered by silt.

Though the early fishery was not managed or regularly monitored by any government agency, an increase in the bay's perch population was observed near the Oconto shoreline in one of the first Green Bay fish surveys (Smith and Snell 1891):

"While the whitefish and the pike have been disappearing, the perch have become enormously more abundant. Before 1882, only a few scattering ones were obtained, averaging about six to each lift of the pound net. Since then they have become more and more numerous each year, until in the spring of 1885, never less than 50 pounds and sometimes as much as a ton of them were taken at a lift."

The reported increase in perch numbers can be explained several



ways, but the sketchy historical records available make it impossible to determine the exact cause. Perhaps the concentrated harvests of other fish made more food available for the less-exploited perch. Or phytoplankton and other fish foods may have increased as sewage and sawmill wastes added nutrients to the already rich waters. Another explanation is that fishermen began to use nets with a smaller mesh and so caught more perch. Then again, the increase in perch may have been part of a normal population cycle.

By the mid 1880s, large numbers of yellow perch were being netted for sale. Along with walleyes and white bass, perch were harvested in shallow waters with gill nets, pound nets and drop nets (modified fyke nets). One of the most popular early fishing grounds was at the mouth of the Fox River.

Unfortunately, this boom in the yellow perch fishery was short-lived. By the late 1890s, the commercial perch harvest was already declining. Since then, catches have fluctuated widely, but have generally headed downward. The yellow perch fishery has never returned to such abundant levels as those of the 1800s.

The Perch Fishery in Recent Years

The Catch

Green Bay catch figures have been separated from other Lake Michigan records only since 1914 (see Figure 1). Though catches probably peaked during the 1890s before accurate records were kept, commercial perch harvests in southern Green Bay have ranged from a high of 2.4 million pounds in 1943 to a low of 162,000 pounds in 1966.

Southern Green Bay usually produces the largest perch harvest on Lake Michigan. The 1979 harvest of 930,000 pounds, for instance, was 83 percent of the lake's total perch catch that year — a percentage that has increased in recent years.

As shown in Figure 1, some of the most consistently high catches on Green Bay occurred between 1952 and 1964, when the average perch harvest was more than one million pounds a year. Since 1964, the commercial perch harvest has dropped to an average of less than 500,000 pounds a year. Despite wide fluctua-

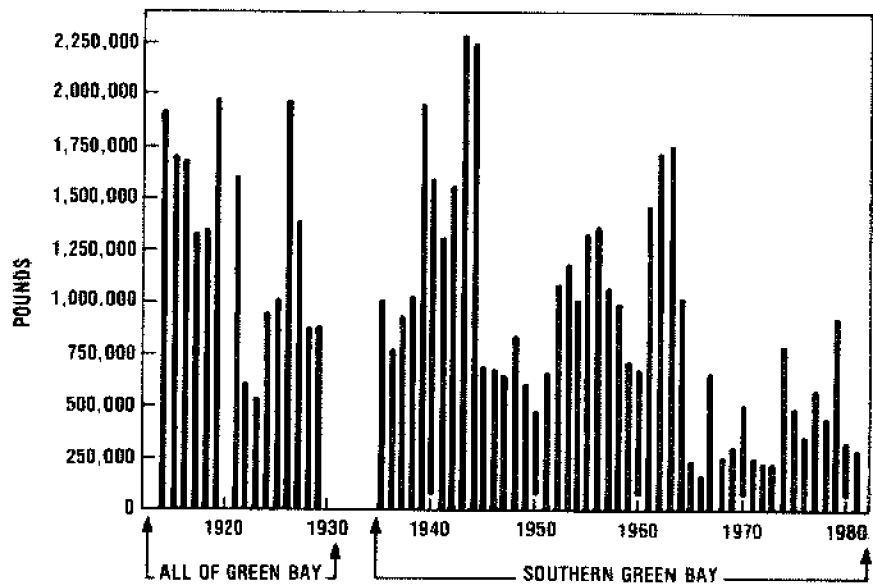


FIGURE 1: Commercial Yellow Perch Production in Green Bay.



Perch fishermen in Green Bay lift the bag of a drop net (see Fig. 3).

tions from year to year, perch harvests overall have declined during the past 100 years or so of commercial exploitation.

Historic catch figures are not always representative of fishermen's success because of changes in regulations and record-keeping. Prior to 1930, the WDNR records only show catches from all of Green Bay. After 1935, they began separate catch rec-

ords for southern Green Bay, which includes Egg Harbor and points south.

Early catch records also include records for areas now off-limits to commercial fishermen, such as the productive bays at Egg Harbor and Sturgeon Bay. In addition, some fishing gear can no longer be used. Drop nets, for instance, are now illegal in Door County.

Despite these limitations, historic catch records are among the limited data available for comparison with the present situation.

The Methods

Perch catches vary in part with the number of fishermen fishing and how much effort they put into fishing. Catches are often expressed in terms of "catch per unit effort," or CPU.

The WDNR currently limits the number of commercial fishing licenses by issuing new ones only when old licenses are retired from use. The number of licensed commercial fishermen reporting yellow perch catches from southern Green Bay was 119 in 1981. The annual fee for a commercial fishing license varies from \$60 to about \$200.

Only a small number of fishermen actively fish throughout the commercial perch season, which extends from May 20 to April 9. In 1980, the greatest catch reported for a single license was 15,012 pounds. The number of licensed fishermen reporting perch catches over 1,000 pounds was 52 in 1980, compared to 71 in 1979 and 48 in 1978.

About 50 percent of the yellow perch harvest comes from gill nets (Figure 2). This gear takes fish of a fairly uniform size range, but it can be difficult to manage in a multispecies fishery where different species are protected at different sizes. Regulations require that fishermen check gill nets every day during the summer, and every two days during winter.

The other 50 percent of the catch comes from drop nets (Figure 3), which are not as size-selective. Over

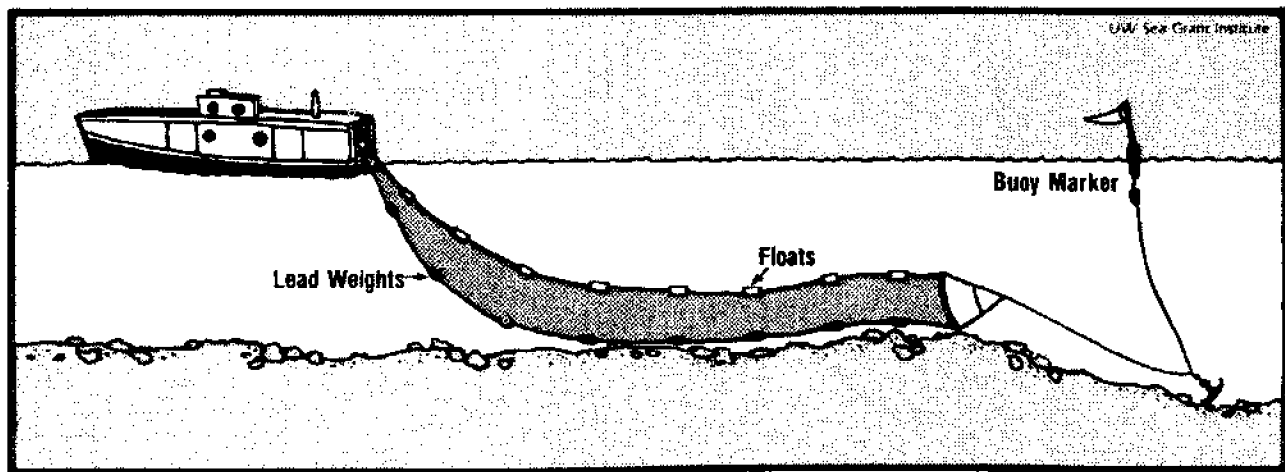


FIGURE 2: Setting the gill net. Like an anchored curtain, this net lies just off the bottom, trapping fish that swim into it by tangling them around the gills. This is a selective type of fishing gear because fisherman can control the size of fish they catch by controlling the size of mesh in the nets.

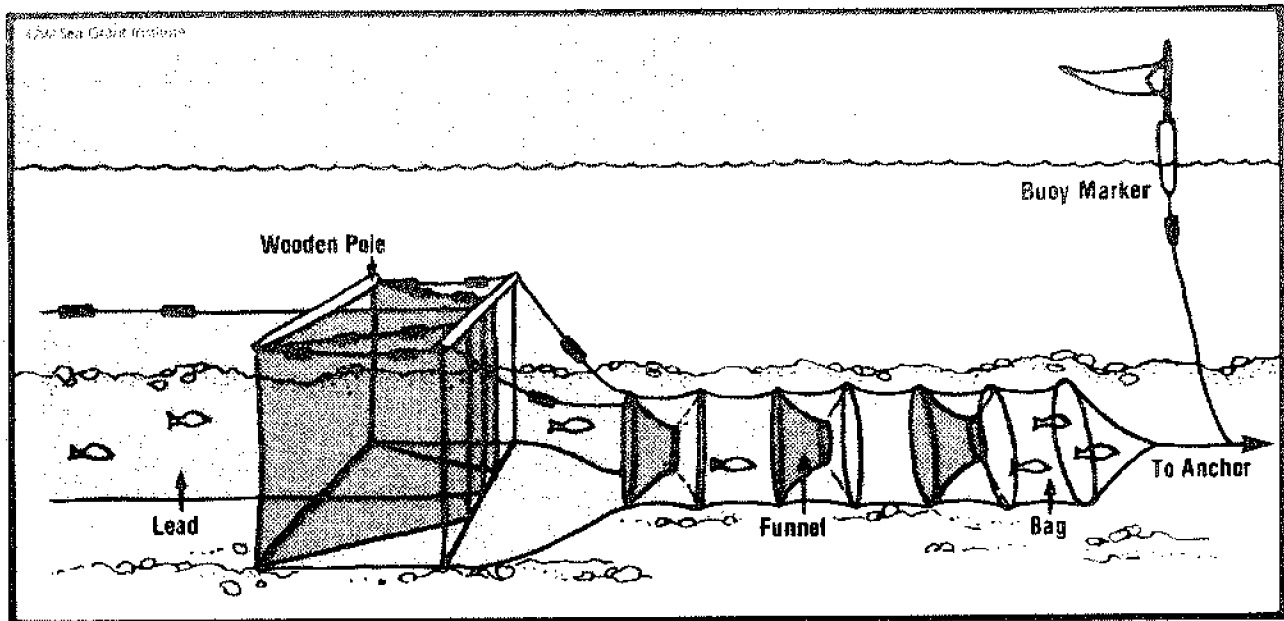


FIGURE 3: Drop net. With this net, fish swim along the lead net (left) and into the trap. In trying to escape, they go deeper and deeper into the net until they are trapped in the bag. This part of the net is then lifted and the fish are harvested or thrown back.

half of the perch caught in this gear are below the legal commercial size. Perch smaller than the 7.5-inch minimum legal size and noncommercial species are returned to the bay when the nets are checked. Regulations require that drop nets be checked once every three days.

WDNR biologists have expressed concern that many of these sublegal perch die from this handling after they are returned to the bay. Sea Grant fisheries scientists from UW-Stevens Point will begin studying this problem during the summer of 1982 and will work with commercial fishermen to increase the efficiency of their efforts.

The Market

The value of Green Bay's perch fishery varies widely from year to year, depending on the catch and the market price for yellow perch. Since Lake Erie produces almost 80 percent of the total North American commercial perch harvest, prices for Green Bay perch are largely dependent on Lake Erie production.

This puts Green Bay fishermen at the mercy of outside markets—even though they sell their catch to local wholesalers and restaurants.

This can have both positive and negative effects. In 1979, for example, local fishermen received about a dollar a pound for perch in the round despite the largest Green Bay perch harvest in 15 years because the Erie catch was down that year. The follow-

ing year's harvest was only one-third as much, but the fishermen received an average of less than 60 cents a pound because Lake Erie had an abundant harvest that year.

The sport harvest has also varied widely from year to year, depending on the abundance of yellow perch. No precise figures exist for the number of sportsmen who historically have fished yellow perch, but these numbers surely dropped during the past 20 years as catches declined in many popular areas. The WDNR estimates

that sport fishermen take 15 percent of the total catch.

Unlike the Lake Michigan salmon sport fishery, which attracts many out-of-state anglers, Green Bay perch fishing is done mostly by nearby Wisconsin residents who fish from small boats, on the ice or along the shore. The major sport harvest now occurs on the streams flowing into the bay for a two-week period after ice-out, on several offshore reefs during midsummer, and on Duck Creek and Larsen's Reef while the bay is ice-covered.

Rick Evans



Everett (left) and Eugene Marks, successful part-time perch fishermen, clean their nets after a day on the bay. Their father was also a commercial fisherman in Green Bay.

The Current Situation

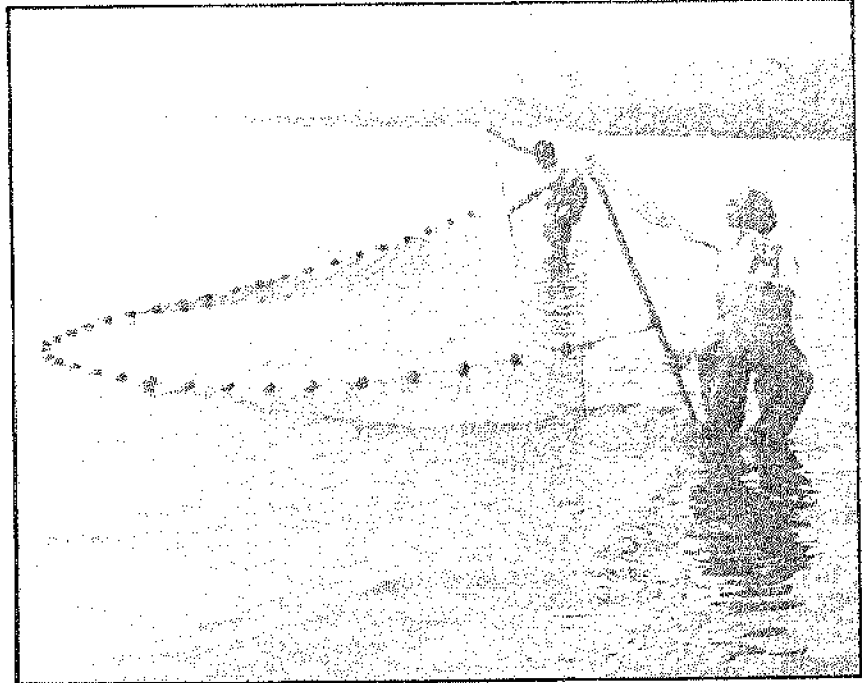
The size of the commercial catch is not always indicative of fish abundance because fishing effort — the number of nets, how often they are set, etc. — varies from year to year. Therefore, fishery scientists also look at biological features of fish populations (such as size and age structure, rate of growth and age of sexual maturity) to determine the health of a fishery.

Research undertaken during the past few years by UW Sea Grant and WDNR biologists indicates that the current yellow perch population in Green Bay is very unstable.

Studies show that perch populations are presently more uniform in size than in the 1930s. Most of the perch in Green Bay now are two to three years old or less, while perch up to nine years old were more common in the past. Almost none of the bay's perch survive that long today, so there are very few large perch to be found.

The only known cause for the present lack of older, larger perch is fishing pressure. Now that young perch dominate in Green Bay, two or three unfavorable spawning seasons can seriously reduce the entire population.

Another distinct feature of the current Green Bay perch populations is the rapid growth of individual fish. This is in contrast with observations made during the 1940s, when Green Bay and Lake Michigan perch were found to grow more slowly than perch in other large northern lakes. The explanation given at that time was that too many young fish were competing for a limited food supply.



Using a seine net, researchers capture perch fingerlings in an effort to locate perch spawning grounds in the bay.

The present rapid growth rates suggest that perch growth is no longer limited by food supply. Rather, the presence of only one or two year-classes of spawning adults indicates that catches are down because perch reproduction is constrained by the relatively small number of adults spawning to produce the next generation.

The fish's size at sexual maturity is also important. The capture of too many fish below this size may also limit a fish population's ability to reproduce. Studies during the 1940s showed that most males longer than

Bill Manc

five inches and females between seven and 7.5 inches were sexually mature.

Recent studies show perch mature at a similar size but younger age than in the 1940s. Sampling in 1980 indicated that no females were sexually mature as yearlings, but 86 percent of the two-year-old fish were mature. Many of these fish, especially females, reach the legally harvestable 7.5-inch size by the fall of their second year — which means they are available for commercial harvest before they have a chance to spawn the following spring.

A 1979 UW Sea Grant study looked at the factors that have historically coincided with variations in perch catches. The study showed that perch catches were negatively related to the catch two years previously in every year over a 28-year period. This indicates that as more adult fish are caught, fewer young fish are produced — and two years later this shows up as a decline in the catch.

The study also found that two years following a year of great alewife abundance, adult perch catches are lower. This suggests that alewives, too, can reduce the survival rate of very young perch.

The study identified no definite relationship between spring warming patterns and successful year-classes of perch, though it has been generally observed that steady spring warming trends improve the survival of larval perch.



The female perch (top) grows faster than the male (bottom). Some females in Green Bay reach the legally harvestable size of 7.5 inches before they are two years old and mature enough to spawn.

Ecosystem Changes Related to Declines in the Green Bay Perch Population

Water Pollution

Green Bay's ability to support some fish was drastically reduced early in the 20th century by increasing pollution from untreated municipal and industrial wastes. During periods of warm temperatures and low water flows in summer, excess nutrients in the water encouraged so much plant growth that when the algae began to decay, much of the oxygen was removed from the water.

Unlike carp and catfish, yellow perch cannot tolerate low oxygen levels. In the 1920s, midsummer fish kills were a common sight in the Fox River from Wrightstown to Green Bay.

According to commercial fishermen, low oxygen levels may still be causing fish kills. They contend that drifting masses of "bad water" — water in which the dissolved oxygen content is very low — have suffocated fish in their drop nets. In 1982, UW Sea Grant investigators began to look at this problem. The scientists are working to modify perch nets so that the fish can avoid suffocation, if that proves to be a problem, and so sub-legal perch can escape the nets.

Exotic Species

Ocean fish that by accident or design have been introduced into the Great Lakes have been a plague on Lake Michigan's fisheries — most notably the parasitic sea lamprey, an invader which devastated the lake trout population. The lake's yellow perch population has probably been affected by the introduction of these exotic fishes as well, but to what extent is uncertain.

One invader that has possibly affected the perch is the unpopular German carp, originally introduced with good intentions in the late 1800s as a favorite food fish from Europe. Carp feed among the bottom sediments, eating small crustaceans and bits of organic matter. Unfortunately, they also uproot aquatic vegetation upon which perch spawn. Carp are abundant among perch spawning grounds along the west shore of Green Bay, where extensive areas of underwater vegetation have disappeared. Unfortu-

nately, the commercial harvest of carp — which once kept the fish in check — has been curtailed for several years because the fish are contaminated with high levels of PCBs.

The alewife, a sardine-size ocean fish, invaded the Upper Great Lakes in the late 1940s. Because few predators remained in the lakes after the sea lamprey invasion, alewives literally exploded in number and quickly altered the type of food available for other fish. The dense schools of alewives not only compete with native fish for food, but may also feed directly upon larval fish or fish eggs of other species.

Although alewives and yellow perch do not compete year-round in Green Bay, alewives do spawn in the bay and large schools of alewives are found in the lower bay from early July to late November. Alewives have been harvested in Green Bay for fish meal and cat food since the 1960s, but such fish meal production has now been largely halted because these fish are also contaminated with PCBs. Green Bay alewife harvests have accounted for 50 to 85 percent of the total Lake Michigan catch of alewives. Even so, this harvest probably removed only a small portion of the alewives in the bay.



Cathy Coberly

Millions of pounds of alewives were once harvested and used in animal feeds, but PCB contamination has brought alewife production to a halt in recent years.

Man-Made Changes

During the mid 1970s, studies showed that thousands of young yellow perch were being destroyed by the cooling water intakes of the Pulliam power plant in Green Bay. Small fish were sucked in and crushed against the screens of the water intakes located in the mouth of the Fox River. Barrier nets placed in front of these intakes have greatly reduced the number of fish so destroyed during the past few years.

Perch have also been influenced by the filling and other alterations to 60 percent of the bay's west shore marshes. These areas may be important sources of food for young perch. Similarly, the channelizing and dredging of the rivers entering Green Bay have reduced available spawning habitats.

Management Issues

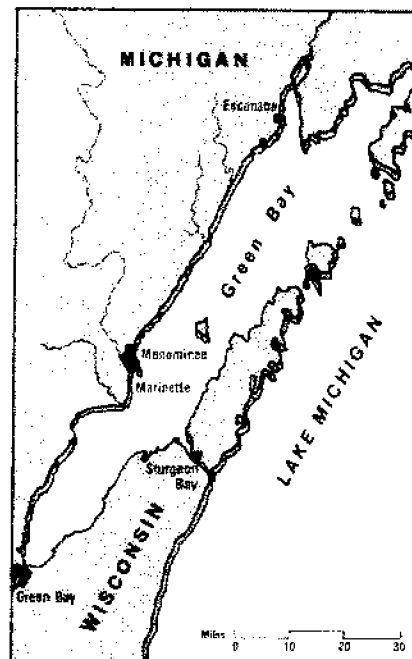
Management of the Green Bay yellow perch fishery has historically been directed at the commercial fishery. This has been a controversial subject and will probably continue to be so.

Fishery regulation usually involves one or more of the following methods. All are currently being applied, to one degree or another, on Green Bay:

1. *Closed seasons.* The commercial perch season is closed during the spawning season from late April to early May.
2. *Size limits.* The commercial size limit is 7.5 inches.
3. *Gear restrictions.* Gill nets are limited to a mesh size of 2.4 to 2.5-inch stretch measure, and their total size cannot exceed 60 meshes in depth.
4. *Closed areas.* The area south of Long Tail Point and west of the shipping channel is closed to commercial fishing year-round; the remainder of the area south from Little Tail Point to Dykesville is closed seasonally. Door County bays, including Sturgeon Bay and Egg Harbor, are closed to commercial fishing year-round, as well as all areas within a quarter of a mile of the Kewaunee and Door County shorelines.
5. *Quotas.* Sport fishermen are restricted to a limit of 50 perch from April 10 to May 19; the rest of the year there are no quotas.



A scientist collects juvenile perch from a test net in Green Bay for further study.



Over the years, the controversy over commercial perch fishing regulations for Green Bay has centered on size limits. The first perch size limit of seven inches was enacted in 1909. From that time on, the debate on whether existing size limits were adequate to protect spawning females has seldom died down. The debate over size limits has usually reappeared after a period of poor harvests.

The perch harvests from Green Bay dropped by half during the early 1930s—from a 20-year average 1,280,000 pounds to 688,000 pounds. At the same time, other perch-producing areas like Ontario and Michigan had perch size limits of 8.5 and nine inches—a fact that caused friction between commercial fishermen in Michigan and Wisconsin. After three changes in four years, an eight-inch size limit was established in 1943. This lasted until 1952, when the present 7.5-inch size limit was instituted after another period of low harvests.

In debates over the proper size limit for Green Bay perch, three biological questions come up regularly. Are the bay's perch naturally smaller than perch in other lakes? Have they matured by the time they reach the present size limit? Do the larger perch leave Green Bay and migrate into Lake Michigan proper?

The answers, as best we know them, are: Perch in Green Bay are indeed capable of reaching the same size as perch in other lakes. Most perch are mature at the existing size limit, but many have not had a chance to spawn before they are caught. And no significant migration of perch from Green Bay into Lake Michigan has ever been observed.

Our present understanding of perch biology cannot be directly translated into black-and-white answers about optimal size limits or any other management option. Every option has biological impacts on the fish as well as economic and social impacts on people.

For example: periods of low fish abundance are the most difficult times for commercial fishermen to make expensive gear changes that may be required by new regulations designed to increase the fish population because the fishermen have less income from their catches. Changes in fishing gear may also affect other important fish stocks, such as trout or walleye. Most importantly, fishing is an important commercial enterprise around Green Bay, as well as a way of life for many people.



The perch seen through the side of an aquarium tank (above) are destined for use in studies of perch aquaculture at the UW-Madison, while perch on a stringer (below) are destined for the dinner table.

Wisconsin Department of Natural Resources

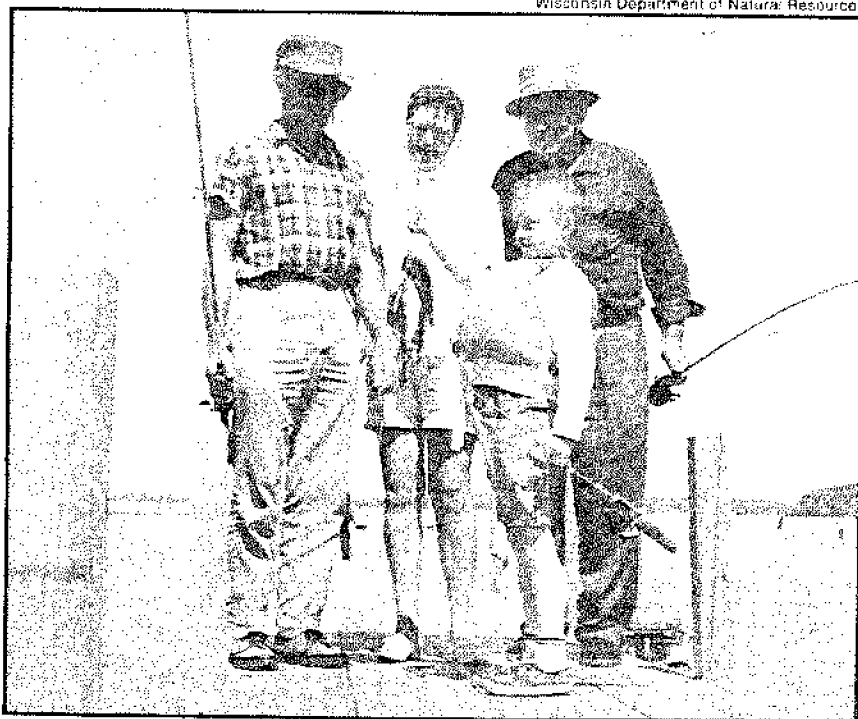
Future Prospects, Further Research

The record suggests that Green Bay should be able to sustain a fishery as productive as that of the mid 1950s to mid 1960s. But this has not been the case. Perch catches have been down for 15 years except for a few isolated seasons.

What can be done to correct the situation?

Since changes in regulations are the quickest and most effective management tool, the WDNR is considering rule changes designed to boost fish populations. Some of the options being considered are a longer closed commercial fishing season and quotas on both sport and commercial fish catches.

In addition, University of Wisconsin scientists, under Sea Grant sponsorship, will work with commercial fishermen and the WDNR to evaluate the impacts of drop nets on perch mortality. UW-Stevens Point fishery scientists Frederick Copes and Daniel Coble will be working with fishermen to develop drop net modifications to



reduce the number of undersized perch killed in the nets.

In cooperation with other groups, the UW Sea Grant Institute, as part of its major Green Bay research program, is sponsoring a number of studies directed at improving the water quality of Green Bay. The question of how areas of low oxygen move through the bay is being investigated by Sea Grant water chemist James Wiersma of UW-Green Bay and limnologist Clifford Mortimer of the UW-Milwaukee Center for Great Lakes Studies.

Sea Grant is also maintaining its longstanding role in the forefront of research on the movement of PCBs and other microcontaminants through aquatic ecosystems. The presence of these toxic substances in carp and alewife is currently limiting the harvest of these fish, the removal of which would probably benefit yellow perch.

Another area of current UW Sea Grant research is a study of the potential size range and abundance of fish in Green Bay, given the quality and amount of available food. This study will lead to better predictions of the potential fish harvest from the bay.

Finally, in a related area, Sea Grant has sparked an effort to develop techniques for raising yellow perch in Wisconsin farm ponds. Though problems of larval rearing, disease and nutrition still need to be worked out, this research may eventually lead to a new Wisconsin industry – and more perch on the table for the consumer.



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Related UW Sea Grant Publications

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**Applications of a Bioenergetics Model to
Yellow Perch (*Perca flavescens*) and
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Richard W. Soderberg and John T.
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Report WIS-SG-77-416.

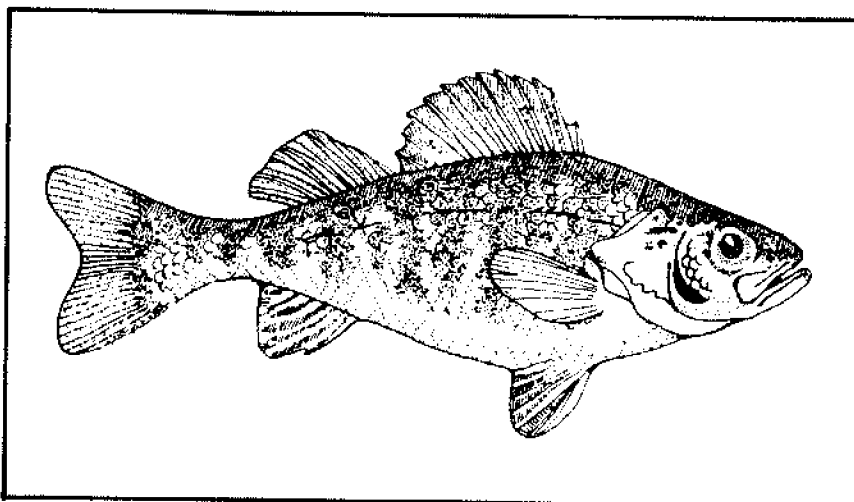
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