How're They Biting?

Research helps put together the puzzle of anglers, lakes, and fish to show why fish catches change over time.

By Mark F. Cook and Jerry A. Younk

All anglers have their favorite fishing holes. But few anglers can keep their favorites to themselves anymore. Record numbers of anglers have changed fishing on Minnesota lakes.

Fishing license sales tell the story of more anglers on the water. In 1911 Minnesota began to sell fishing licenses to nonresidents for $1. Resident fishing licenses first went on sale in 1927 and cost 50 cents each. The number of licenses sold each year has been on an upward trend ever since major world events such as the Great Depression and World War II caused dips in license sales. After the war, more cars and better roads gave anglers access to more lakes, and fishing license sales boomed.

Since the 1970s almost the entire increase in sales has been due to resident fishing license sales. Today Minnesota has about 3.5 anglers fishing its waters for every one angler in the 1920s. More than 2.3 million people (licensed anglers and children who are not required to buy licenses) fish in Minnesota each year.

How much room does that leave each angler to fish? Dividing Minnesota's 3.8 million acres of fishable waters by 2.3 million anglers leaves 1.7 acres per angler. If an angler were to cast 51 yards in every direction from a boat without moving it, that angler would fish 1.7 acres.

Lake Size and Location

How many fish can an angler expect to harvest from an acre or two of water? To answer this question, compare an acre of water to an acre of farmland. Farmland will not produce an endless supply of corn each year; nor will an acre of water produce an endless supply of fish. Both yields are measured by the acre, corn in bushels and fish in pounds.

The more fertile the land, or the lake's watershed, the larger the yield, whether corn or fish. Geographic location of a lake directly relates to watershed fertility. In Minnesota, watershed fertility increases from northeast to southwest; therefore, so do fish yields per acre. In central Minnesota a good crop of corn would yield perhaps 100 bushels per acre, while a good crop of fish would be 15 pounds per acre. Near the Iowa border, corn yields might be 150 bushels per acre, and fish yields 26 pounds per acre.

While lake fertility limits the productivity of an acre of water, the lake's size limits the total number or weight of fish produced in a lake. For example, anglers harvest more fish from Lake of the Woods than they do from Lake Phalen in St. Paul because, even though an acre of Phalen will produce more fish, Phalen is smaller. Other factors such as prey availability, water pollution, habitat modifications, and length of the growing season affect productivity too.

When discussing lake productivity, biologists often use the term carrying capacity. This is the number of animals a habitat can support on a sustained basis. For anglers, carrying capacity is important because it sets a natural biological limit on how many fish can be produced in a lake each year. Only by increasing carrying

capacity can the production of a lake be increased.

Each harvested fish creates room for a smaller fish to grow larger. This replacement by growth works well, unless anglers harvest fish faster than the fish can grow. Just like a corn crop, some time must pass between harvests.

Anglers' preferences also affect a lake's yield. As creel surveys show, few Minnesota anglers keep fish other than panfish, walleye, and northern pike. Rarely do they keep species such as burbot, bullheads, suckers, buffalo, and carp. Harvesting some of these fish would increase yields from Minnesota lakes.

Anglers Wait

Fisheries managers measure angling success by how long it takes an average angler to catch a fish. Two factors influence this: lake productivity and the number of anglers fishing. Since total fish production in a lake is in a constant range, then, as fishing pressure increases, the length of time between bites becomes longer and each angler's share becomes smaller. This happens because more anglers are sharing the same amount of fish. No wonder anglers often complain that "fishing just isn't what it was in the good ol' days."

Because lake size varies, fisheries biologists compare fishing pressure and harvest between lakes on a per-acre basis. For example, anglers spend more hours (800,000) fishing Lake of the Woods in the summer than Lake Bemidji (80,000 hours). However, on a per-acre basis, Lake Bemidji receives more fishing pressure at 12.6 hours per acre than does Lake of the Woods at 1.3 hours per acre. This means anglers are more likely to feel crowded on Lake Bemidji, and fishing pressure will potentially reduce an angler's harvest sooner.

Taking Stock

Because more anglers are harvesting more fish, the obvious solution to declining harvest rates would seem to be to stock more fish. However, an acre of water can only produce so many pounds of fish each year. Not even stocking can change this natural limit.

The DNR uses stocking as a substitute for poor natural reproduction in a lake. Once fish are stocked, it takes several years before they grow large enough to be harvested. Most will die before this occurs (see "Growth and Death," page 23). Stocking will increase fish populations where natural reproduction is not producing enough small fish. However, stocking will not help naturally reproducing populations where too many large fish are being harvested. The reason is that these lakes already have a surplus of small fish, and carrying capacity will limit the number that grow to a size anglers like to catch.

Lake size and fertility are the limitations on how fast harvested fish can be replaced. Creel surveys suggest lakes are still producing as many fish as they always have--maybe even more, since many watersheds are now more fertile than they were at historic levels. What has changed is this: Record numbers of anglers are taking more fishing trips. Unfortunately for individual anglers, this has caused the time between bites to increase.

Wall Hangers

Regardless of species sought, nearly all anglers want to catch big fish--the one destined for the wall, the lunker. Creel surveys show what sizes of fish anglers are harvesting. For most species, anglers usually release only fish that are too small to be "keepers." With more anglers harvesting "keeper" fish, the large fish in many Minnesota waters have become increasingly scarce. Former DNR fisheries researchers Donald Olson and Paul Cunningham dramatically illustrated this when they examined 60 years of fishing contest records

collected by Fuller's Tackle Shop in Park Rapids. They found that both number and size of contest entries had declined for bluegill, black crappie, northern pike, walleye, largemouth bass, smallmouth bass, muskellunge, and brook trout. They concluded that increasing fishing pressure had resulted in more fish being harvested and caused a decline in numbers of large fish.

Creel surveys have also documented a decline in fish size. Anglers harvested smaller walleyes from 1970 into the '90s than they harvested from 1940 through the '60s. However, at all times a 14-inch walleye was the most frequently harvested size. In recent times larger walleyes, especially those greater than 18 inches, have become less common in the harvest. Two major factors account for this. The first is increased fishing pressure, which has put more of a strain on walleye fisheries because anglers are harvesting many walleyes before they can grow to large sizes. The second is selective harvest, or catch-and-release.

The Future

What do more anglers mean for the future of fishing in Minnesota? While we can't predict the future, we can make some suggestions to help determine the fate of tomorrow's fisheries. Anglers can influence the future of Minnesota's fisheries as much as the DNR can. This control is practiced every time an angler decides to harvest or release a fish.

Is harvest harmful? No. Harvest should always remain a part of fishing in Minnesota. Is excessive harvest harmful? Yes. With more anglers fishing with better boats and gear, it is possible to overfish--to harvest more fish than growth can replace in a lake. Overfishing causes the average size of fish to decrease.

How much harvest is excessive? The answer is not clear-cut. Some anglers want lots of fish, some want big fish, some just want to fish.

Fisheries managers must evaluate a variety of opinions and try to be fair to all anglers. Often this is impossible, because the desires of anglers are so varied. The DNR uses a management philosophy known as "individual waters management." That means it customizes management of different lakes. In using this approach, managers are able to provide for a variety of fishing experiences. The biggest drawback to individual waters management is that it often requires more fishing regulations.

Currently, Minnesota fisheries are managed essentially with no harvest restrictions. Many of you reading this probably just thought, "What about bag limits?" Sure we have bag limits, but actually bag limits on average do little to limit harvest from Minnesota waters. Because few anglers harvest a limit of fish during a fishing trip, bag limits have little effect on total fish harvest. In most cases, the function of bag limits is to prevent some people from becoming fish hogs when the fish are really biting.

So if bag limits do not control harvest from our lakes, what does? Two things: Fish don't always bite, and more anglers are practicing catch-and-release fishing.

Catch-and-release fishing is one way anglers as a group can control their own destiny. Many anglers realize the limitations of Minnesota's fisheries and have begun to release medium and large fish in the hope of catching them again. By practicing catch-and-release, anglers can help assure that fish--even big ones--will still be biting years from now.

Growth and Death

Growth and death rates are two population characteristics that influence how many and what size fish are in a lake. Death rates for Minnesota fish are high--up to one-half of the population dies each year. Starting with

100,000 fish age 1, only 50,000 will live to age 2. Of those, 25,000 will survive to age 3, and so on. Yet each year, another 100,000 fish will enter the population. Since most fish species reproduce in large numbers, lakes have more small than large fish.

Growth rates influence how many large fish a lake has because the faster a fish grows, the more likely it will grow large before it dies.

Lakes with the greatest trophy-fish potential have low death rates (this is where catch-and-release plays a part) and fast growth rates. Even in these lakes, trophy-sized fish will always be less common than smaller fish.The odds are against a northern pike surviving to a weight of 20 pounds or a walleye to 10 pounds.

Can we reduce mortality to grow more large fish? Fishing seasons, bag limits, size limits, and gear restrictions are all designed to reduce fish mortality. The only control the angler (or the DNR, in many cases) has is reducing harvest. If fishing pressure continues to increase, voluntary release of larger fish will become even more important to maintain some large fish in the population.

Creel Surveys

Creel surveys help assess the effectiveness of fisheries management by measuring the fish catch. "Creel" is an old term describing a basket, often made of wicker, used by anglers to hold their harvest.

Creel surveys measure the amount of fishing pressure, the number of fish caught by anglers, and the size of these fish. Many anglers voluntarily practice catch-and-release and selective harvest. Muskellunge and largemouth bass anglers, for instance, release most of the fish they catch. Consequently, estimating the number of fish released by anglers is just as important as estimating the number of fish harvested.

Throughout the fishing season, creel survey clerks make random counts of anglers. They also interview anglers at various times of day to determine how well they did fishing. Standard questions are how long anglers fished, what they were fishing for, and how many fish they caught. From the survey data, fishery managers can estimate how much time was spent fishing and what fish were caught.

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