Mazina'igan Supplement

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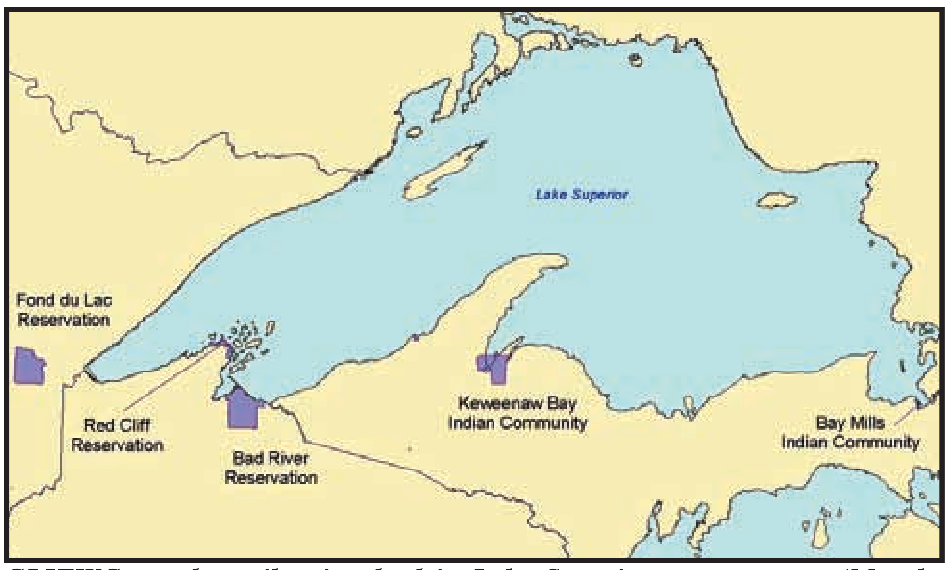
Lake Superior fishery management

Introduction

The largest collection of freshwater in the world encircled by more than 2,700 miles of shoreline, Lake Superior is a treasured resource for the hundreds of thousands who live along its coast. The health of the lake's diverse fishery is a paramount concern for tribal, municipal and national governments in both Canada and the United States.

Representing eleven member tribes in Minnesota, Wisconsin and Michigan, the Great Lakes Indian Fish & Wildlife Commission (GLIFWC) conducts ongoing assessments of fish and sea lamprey populations in cooperation with other natural resource management agencies. Grant funds supplied by the Administration for Native Americans (ANA) greatly enhance GLIFWC's ability to better understand the fishery—a resource closely tied to the physical, financial and spiritual well-being of Ojibwe people.

The following pages highlight the cultural history of Lake Superior and explain how a number of agencies and other institutions cooperate to best manage the fishery. GLIFWC gratefully acknowledges the support of ANA, a division of the U.S. Department of Health & Human Services, in funding this supplement.



GLIFWC member tribes involved in Lake Superior management. (Map by Esteban Chiriboga)

The Ojibwe & Gichigami

According to the teachings of the Ojibwe people, also known as the Chippewa or Anishinaabe, it was the sacred Megis Shell that first guided the people to the rich regions of the Great Lakes. The Megis Shell was last seen near Lake Superior's Madeline Island, which was one of the settling points for tribal people migrating from the eastern shores of the continent.

The Ojibwe were semi-nomadic people living in small bands. They followed seasonal paths to traditional hunting, fishing and gathering grounds where they harvested deer, game, fish, maple sugar, berries, and wild rice. Lake Superior, or Gichigami (big water), and the surrounding land were bountiful sources of food. Lake Superior's waters yielded namecush (lake trout), adikameg (whitefish), and namé (sturgeon). It is no wonder that several bands established villages on the present-day shorelines of Michigan, Wisconsin, Minnesota, and Canada. Gichigami was a bountiful source of food.

Tribal fishermen harvested fish using large birchbark canoes and gill nets constructed from twisted and knotted strands of willow bark. They also speared through the ice and fished with hand-carved decoys. As Europeans pushed into the Great Lakes region, the Ojibwe people used fish to trade with French and English outposts. Fish soon became one of the mainstays in the diets of the early fur traders. In the late 1800's and early 1900's Lake Superior's fishery faced a growing number of non-Indian commercial fishermen who used new technology to efficiently take fish from Lake Superior in large numbers.

As a result of the increased fishing pressure and the introduction of many exotic aquatic species, native fish populations were drastically reduced. Particularly devastating to the Lake Superior fishery was the arrival of the parasitic sea lamprey in the early 1950s. The impact of the sea lamprey, which entered the lake via the Welland Canal, coupled with an intensive commercial fishery reduced Lake Superior's commercial lake trout harvest from 3.1 million pounds in 1951 to only 380,000 pounds in 1960. The harvest of another vital species—whitefish—dropped 17 percent a year from 1955 to 1960.

Tribal fishermen who fished both commercially and for subsistence suffered both from the decreased populations of fish and the regulations imposed by the states that sought to regulate tribal harvest despite treaty agreements. The abundance to which the Megis led the Anishinaabe people had vanished, but the people did not, and their love for Gichigami remained strong. The people endured and joined with others to restore the sacred bounty of Lake Superior's revered fishery.

Sunset over Gichigami. (Staff photo)

A team effort: Co-management on Gichigami

Like all fishing activity today, the treaty commercial fishery is regulated and limited in scope. Tribes work with state, federal, and Canadian governments in co-managing the lake, recognizing that cooperation between all who value and rely on it's resources will protect it most fully.

Regulation is critical for effective resource management. Establishing seasons, closed areas, harvest limits and enforcing tribal laws are part of tribal self-regulation of the Great Lakes fishery.

Conservation enforcement is provided through the Great Lakes Indian Fish and Wildlife Commission's Enforcement Division and tribal enforcement officers. Fully-certified conservation officers routinely monitor treaty commercial fishing activity both on and off the water. Violators are tried in tribal courts which strictly enforce the regulations and ordinances established by the respective tribal councils. Tribal judges are granted the authority to adjudicate violations of natural resource codes by tribal members, including those codes which regulate off-reservation hunting and fishing activities.

In Wisconsin the Bad River and Red Cliff Bands enter into ten-year agreements with the State of Wisconsin. The agreements define the treaty commercial fishery, including quotas, seasons and fishing areas. Fishermen from the Bay Mills Indian Community also fish under an agreement with the state of Michigan. The Keweenaw Bay Indian Community exercises its fishing rights within the guidelines of its own fishery management plan.

Tribes use information gathered through biological assessments and monitoring of the treaty commercial fishery to determine quotas and other regulations pertaining to the Lake Superior treaty fishery. Biologists from the tribes and from GLIFWC have been actively involved in annual assessments and monitoring the treaty commercial fishery, as well as conservation activities for years. Population information is gathered through spring, fall and summer assessments. Approximately four to six thousand fish are measured each year for assessment purposes.

Biological and statistical information is collected from assessment netting, monitoring commercial fishermen and catch reports filed by tribal fishermen. Whitefish, lake trout and other species are sampled at selected sites to record size, growth, mortality, and abundance.

Information on the effects of the parasitic sea lamprey is also gathered during these assessments. This data is essential in determining the Total Allowable Catch (TAC), a figure which provides the basis for tribal and non-Indian lake trout harvest quotas in waters of Lake Superior.

Implementation of Lake Superior treaty fishing

Treaty harvest in Lake Superior is regulated by the tribes, and tribal fishermen adhere to restricted quotas in order to provide opportunity for non-Indian fishing as well.

The Great Lakes Indian Fish and Wildlife Commission, an inter-tribal natural resource management organization representing eleven Ojibwe bands, assists its members in the regulation of the treaty commercial fishery in Lake Superior. GLIFWC member bands who fish commercially in Lake Superior include the Red Cliff Band of Lake Superior Chippewa and the Bad River Band of the Lake Superior Tribe of Chippewa Indians in Wisconsin and the Keweenaw Bay Indian Community and the Bay Mills Indian Community in Michigan.

Large and small boats which operate during the open water season are licensed through the respective tribes and must adhere to tribally adopted codes regulating the fishery. During winter months, when sheltered bays turn solid with ice, snowmobiles instead of boats transport fishermen out to the stakes which mark their nets, and the catch is pulled through holes chopped in the ice.

Fishing is conducted primarily with gill nets from both the large tugs and small boats. Some fishermen also harvest fish with trap nets. While the majority of the fishery is comprised of small boats, the majority of the harvest is taken by large boats.

Whitefish, lake trout, siscowet (or fat trout), herring, and salmon make up over 95% of the tribal commercial harvest. Whitefish is the predominant species sought by tribal fishermen. The life of the commercial fisherman remains rugged and challenging. For many it is a life passed down from generation to generation. It is a way of life, lived close to nature and requiring intimate knowledge of the big water, Gichigami, and its fishery.

The Great Lakes Indian Fish & Wildlife Commission's research and enforcement vessel Mizhakwad leaves port from upper Michigan's Keweenaw waterway for a day of near shore fish assessments in Keweenaw Bay. (Photo by Nate Bigboy)

Mike Plucinski, GLIFWC's Great Lakes fishery technician, inserts a tag into a lake trout during an October fall assessment survey on Lake Superior. (Photo by Charlie Otto Rasmussen)

Fishing vessel JJC, operated by Joe Newago returns to port after a morning on Lake Superior near the Keweenaw Peninsula's 5 Mile Point. (Photo by Bill Mattes)

Treaties, courts establish Ojibwe role in fishery

Fish and fishing have long been a part of Anishinaabe culture. Traditionally, camps were set up in the summer next to lakes and major rivers so that fish, a major food source, could be caught, eaten, and dried for later use. Most of the major Anishinaabe communities seen today were originally established next to lakes or rivers to be near food supplies that included fish. As the Europeans came into the area, fish were traded with explorers, trappers and settlers.

With fishing an important part of Ojibwe life, it is no wonder that during the negotiations of several nineteenth century treaties the Ojibwe wanted to guarantee the ability to fish for themselves and future generations. The Anishinaabe leaders made sure the protection of tribal fishing was guaranteed in the treaties.

From 1836 to 1854, four land cession treaties were signed between the United States Government and the Ojibwe tribes living in a vast area around Lake Superior that later became the states of Michigan, Wisconsin, and Minnesota. In return for their land, the Ojibwe reserved the right to hunt, fish, and gather throughout the ceded territories, including Lake Superior. As long as resources were plentiful, this reservation of rights seems to have been of little concern. But as fish and wildlife populations began to decline due to increasing exploitation and habitat destruction, the states began to develop regulatory programs and to enforce their laws against the Ojibwe. Nevertheless, survival and tradition led tribal members to continue to hunt, gather, and fish either on reservation lands or off the reservation where they were subject to arrest by state wardens. And so only a few decades after the last treaty was signed, the Ojibwe began to be denied their treaty-reserved rights.

Starting in the 1970's and continuing through today, tribal members and tribal governments began challenging the authority of the states to apply their resource regulations against tribal members hunting on ceded lands and fishing in ceded waters, both inland and in Lake Superior. In a series of federal and state court decisions, the treaty-reserved rights of the Ojibwe were reaffirmed (e.g. in Michigan the 1971 *Jondreau* decision; in Wisconsin the 1972 *Gurnoe* and the 1983 *Voigt* decisions; and recently during the 1990's in Minnesota, the *Mille Lacs* and *Fond du Lac* decisions). In some instances, after the existence of the rights was reaffirmed, further litigation followed to establish the scope of state regulation, the adequacy of tribal regulations, and how the resources should be allocated. In other cases, further litigation did not follow, and the parties chose to negotiate regulations and allocation issues on a periodic basis. Also, in some cases management authority was an issue. Different types of written agreements, approved by the courts, were used to set up institutional arrangements to coordinate management. Thus, in the Ojibwe ceded territories, coordinated or cooperative management arrangements are normally founded in court decisions reaffirming treaty-reserved rights, but each arrangement differs in various ways. In all cases, the Ojibwe, as governments and as nations, believe that harvest rights carry with them the responsibility to protect and manage resources.

Rich in natural resources like timber and minerals, Ojibwe or Chippewa lands attracted the attention of the United States government in the early 1800s. By 1854, the Ojibwe had negotiated four land cession treaties with the United States.

Development of tribal management capabilities and infrastructure

Soon after each court decision was made reaffirming the rights, the tribes began to work on the implementation of the rights. The tribes signatory to the 1842 Treaty looked to the northwestern United States and saw that those tribes had formed an inter-tribal commission. The Ojibwe recognized that a braided rope is stronger than the individual strands of fiber and formed their own commission, called the Great Lakes Indian Fish and Wildlife Commission.

The Ojibwe leaders also recognized that they needed their own scientists because those were the people that non-Indians and the courts relied on for answers to biological questions. However, in forming their commission, the leaders stated that traditional Anishinaabe culture and values were to be infused in all aspects of it's work. In the 1992 GLIFWC Strategic Plan, they explained that "The 'Anishinaabe Way' underlies the unique approach to resource management which is brought by tribal people into the critical, modern day decisions, regarding natural resources. Traditional thought directs management to be holistic and integrated, respectful of all creation. An understanding of the universal order and recognition of man's dependence on all other life forms, rather than his dominance, assures holistic management. Traditional thought also demands long-term vision, protecting the well-being, not just of the next generation or two, but of the 'Seventh Generation,' thus extending responsibility for the impact of management decisions far into the future."

So the Ojibwe hired their own fisheries and wildlife biologists, in part, to review data gathered and analysis done by state biologists and to compile accurate, resource inventories. Their scientists were expected to help develop regulations that would allow tribal members to harvest off-reservation resources in ways that protected the resources, that were culturally appropriate, and that might include methods not allowed by the state. The commissioners also recognized that wardens were needed to enforce laws and that wardens should be placed on each reservation. Finally, tribal court systems were supported with funding for operations and training.

Protecting the Resources

With the right to harvest comes the responsibility to protect. Fisheries management is a fundamental part of protecting the resources. Those involved in fish management include:

Tribes—Tribal leaders understand that unless the fisheries resources are properly managed the resource can decline and even disappear. Tribal traditions are strong in only taking what you need, and ensuring those things you use are available for future generations. Tribes are very active in fisheries resource management and enhancement programs. Most tribes have natural resource departments, conservation enforcement departments, and fish hatcheries. They work with state departments of natural resources, U.S. Fish and Wildlife Service and international organizations to protect the fishery resources of the Great Lakes.

Great Lakes Indian Fish and Wildlife Commission (GLIFWC)—Eleven tribes in Michigan, Wisconsin and Minnesota form the Great Lakes Indian Fish and Wildlife Commission. The Board of the Commissioners consists of tribal chairmen, or a designated representative from each member tribe, and directs the Commission in the protection of resources within the 1836, 1837 and 1842 Treaty ceded areas. The Lake Superior Committee makes policy recommendations to the board and advises the Great Lakes Section's work priorities.

Chippewa Ottawa Resource Authority (CORA)—Another intertribal agency similar to GLIFWC, the Chippewa Ottawa Resource Authority consists of five bands from upper and lower Michigan. CORA assists its member tribes in implementing 1836 Treaty rights.

State Departments of Natural Resources (DNR)—The Wisconsin, Minnesota and Michigan DNRs are involved in fisheries management. They work with the tribes in establishing overall fishing quotas, do assessment work and share data with tribes regarding state assessments and sport harvesting. Tribes in turn share their own data with the states.

Great Lakes Fisheries Commission (GLFC)—Organized in 1955, this international organization began as an effort to control sea lamprey in the Great Lakes and restore Great Lakes fishing. Originally consisting of states in the U.S. and provinces in Canada surrounding the Great Lakes, today, tribes and GLIFWC are both involved in committees of the Great Lakes Fisheries Commission.

Universities and Colleges—Universities and colleges around the Great Lakes are involved in research and development of the lakes and their fish. GLIFWC and tribal natural resource agencies partner with universities and colleges to garner grant monies to fund projects which further the understanding of Great Lakes fish and fisheries. Universities and colleges include: Michigan Technological University, Michigan State University, University of Michigan, Purdue University, Northland College, University of Minnesota–Duluth, and the University of Wisconsin–Stevens Point.

Modeling: Key to manag

Fish harvest management—where the fish hits the road

Fish harvest, or those fish people remove from the water, is one element in the life of a fish that scientists can manage or control. Other elements such as food, predators and natural diseases, are less controllable or not controllable at all through human intervention.

Most fish harvest is governed by a harvest policy that determines the acceptable fish harvest—the number of fish which can be kept by fishers—for each fish population. Harvest policy is generally set once, while acceptable fish harvest is determined once every one to five years. Most know "acceptable fish harvest" as bag limits, quotas or Total Allowable Catch (TAC).

Many harvest policies are based on the idea that there is a "maximum sustainable yield;" others are based on rebuilding depleted populations, and yet others upon minimizing or eliminating harvest—such as in the by-catch of non-target species. Maximum sustainable yield—the most common basis for harvest policy—sets the number of fish kept by fishers at the highest level possible without causing a continuous, or irreversible, decline in the number of fish over time.

As with most anything in life, there is uncertainty. Uncertainties in fisheries management include such aspects as natural variation in the survival of young fish due to weather, having only partial control of harvest, and only partially observing the fish during assessment work. Harvest policies can choose to ignore uncertainty or account for uncertainty.

There are varied approaches to setting harvest policies, harvest and dealing with the uncertainty that is inevitably present. A good approach to dealing with uncertainty is to develop tools that allow you to simulate the effects of "critical" uncertainties and forecast the range of possible outcomes under a given harvest policy.

In Lake Superior, data from annual assessments, monitoring and special projects are used to judge the health of Lake Superior fish and to decide upon quotas and other regulations pertaining to the treaty fishery. These data are essential in determining the TAC, a figure that provides the basis for tribal and non-Indian lake trout harvest in waters of Lake Superior.

Stock assessment models and their associated TAC have been a primary tool used to evaluate the rehabilitation and continuing restoration of lake trout stocks in Lake Superior. Stock assessment models gauge the status of lake trout in portions of Lake Superior by estimating the number of fish in an area of the lake, and then tracking how many die each year due to natural causes, fishing and sea lamprey attacks.

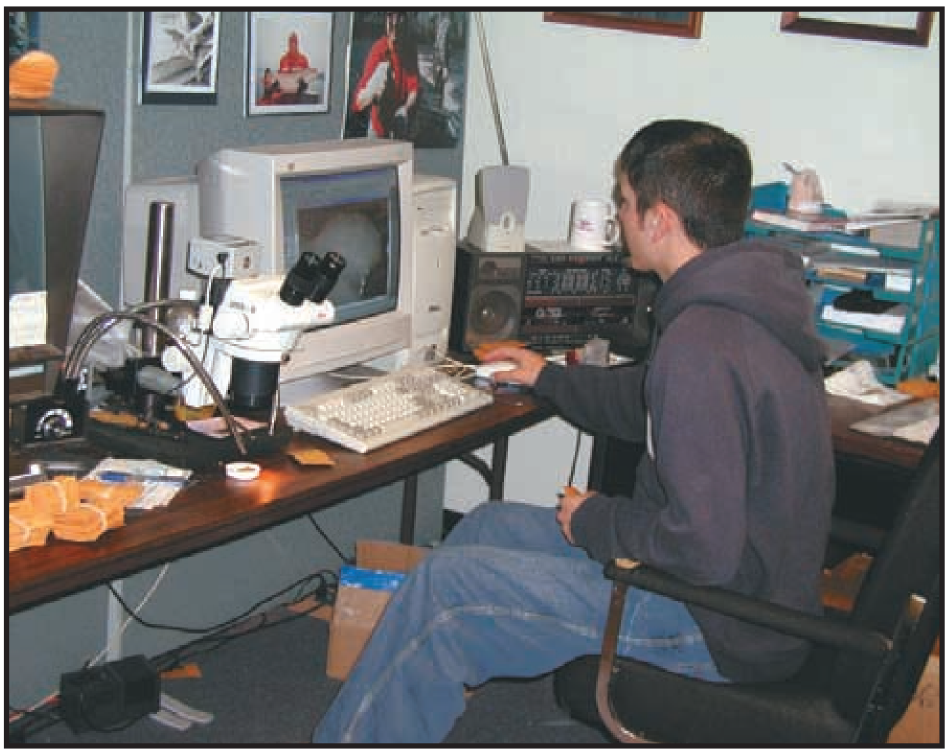
It is important to note that stock assessment is distinct from setting harvest levels. Stock assessment is the use of statistics and mathematic calculations to predict how many fish are in an area of the lake and to estimate key "parameters" of the lake trout population, such as mortality and recruitment.

The stock assessment model predicts the number of fish (stock size) over the same time period as which data have already been gathered from the fishery. Once a stock is assessed to estimate stock size, the decisions about how to set harvest figures still remain. Projections of stock size are used to determine harvest (i.e., a TAC) by forecasting future stock size based on what is known from the past—through the stock assessment model.

History of model development on Lake Superior

From 1984 to 2002, a cohort model, which estimated and projected lake trout abundance, age composition, mortality and harvest, was developed and used to assess lake trout stocks around the Apostle Islands by the Wisconsin State/Tribal Technical Committee. In following years, the Wisconsin model was updated and similar models were developed jointly by GLIFWC, Red Cliff, Keweenaw Bay, and the U.S. Fish and Wildlife Service for Michigan waters of Lake Superior within the 1842 Treaty ceded area.

However, in calculating lake trout abundance the cohort model used only a portion of the available scientific information. For example, commercial harvest and effort, spring and fall lake trout assessment, stocking, and lamprey information were used. However, summer assessments, sport harvest and effort, and catch-at-age from commercial and sport fisheries, were unused.



Nate Bigboy, ANA fisheries technician, ages an otolith (ear bone). GLIFWC Lake Superior fisheries specialists use a number of technological tools to analyze scale and ear bone samples. (Photo by Jim St. Arnold)

Currently on Lake Superior, statistical catch-at-age models are used to estimate fish abundance. This approach to describing fish abundance represents a state-of-the-art application of statistical catch-age analysis using software that is widely used by fisheries scientists inside and outside the Great Lakes basin and is a substantial step forward in fisheries stock assessment for Lake Superior.

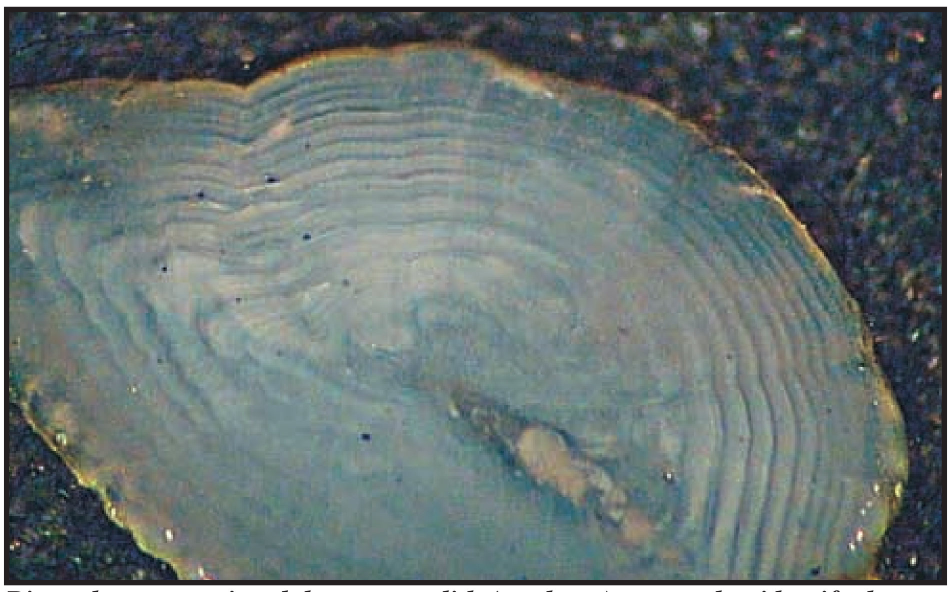
Statistical catch-at-age

Statistical catch-at-age (or SCAA) is an approach used to estimate fish abundance at each age for each year. Assumptions made in connecting estimated parameters (i.e. age 1 abundance) and stock status (i.e. number of fishable stock) with observed data is formally defined and is therefore repeatable and easily updated as new information is collected on the fish stock.

As Dr. James Bence, a prominent scientist on Great Lakes fisheries says, "a catch-age model is fit to available data. These models consist of two components. The first is a sub-model describing the population dynamics of the stock. The second is a sub-model that predicts observed data, given the estimated population each year. The agreement between the model predictions and observed data is measured by statistical likelihood. Both the population and observation sub-models include adjustable parameters. Any given set of these parameters corresponds to a specific sequence of stock abundances, mortality rates, and predicted data. The set of such parameters and associated stock dynamics and mortality rates that maximizes the likelihood estimates is taken as the best estimate."

Based upon the Baronov catch equation, the SCAA fish model is a mathematical process using data and knowledge to predict the number of harvestable fish and maintain a sustainable fishery.

The model itself includes ***data, parameters, likelihood, and sub-models of population and observation*** (see figure #1). The information that goes into the fish model is always changing as new information is gathered.



Rings that appear in a lake trout otolith (ear bone) are used to identify the age of the fish.

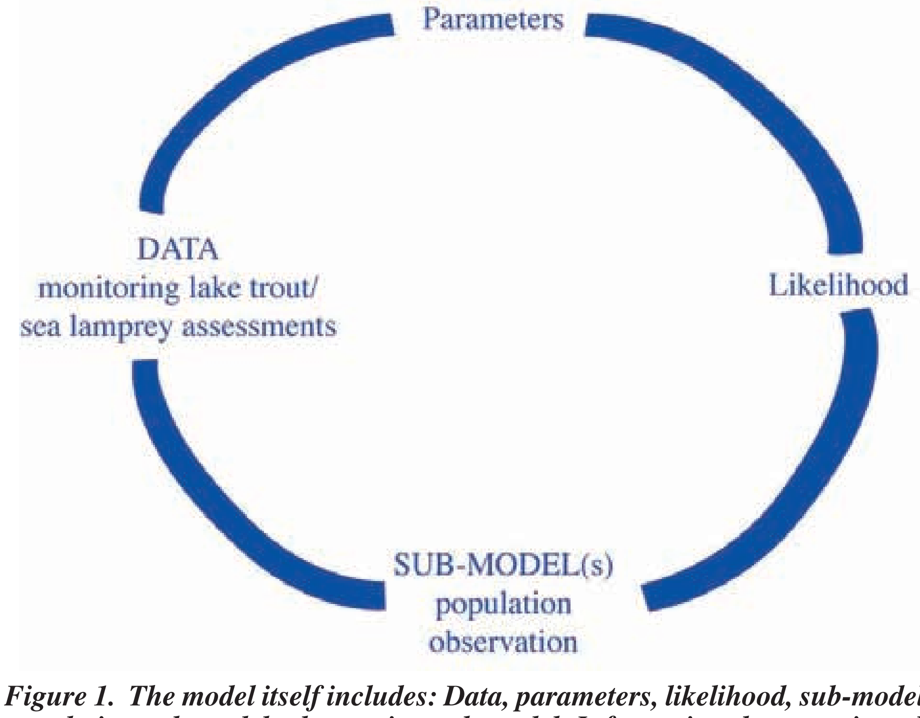


Figure 1. The model itself includes: Data, parameters, likelihood, sub-models, population sub-model, observation sub-model. Information that goes into the fish model is always changing as new information is gathered.

ging fisheries resources

Data

Data is based upon the information gathered from spring, summer and fall fish assessments.

Nets are set at specific places each year in Lake Superior. Information from caught fish includes number of fish caught, size, age, stomach composition, and lamprey wounding. A sub-sample of fish have a scale or otolith (inner ear) removed for aging, and stomach contents removed for analysis. All fish are measured and are inspected for lamprey wounds. In addition, information is collected from tribal commercial fishermen and state fishermen.

The more information gathered, the better the model. Data is collected from various sources including:

Spring assessments

- Catch Per Unit Effort (CPUE)—Number of fish per 1000 feet of net
- Age composition—Number of fish at each age
- Growth—Size of fish at each age over a given time
- Sea lamprey wounding—Number of wounds per 100 fish

Summer fish assessments

- CPUE—Pre-recruit assessment—Pre-recruit are fish 6 years and younger
- Age structure—Pre-recruit assessment
- Growth—Pre-recruit assessment
- Maturity Schedule—Pre-recruit assessment

State commercial fishery information

- By catch—Fishermen's catch report
- Discards—Fishermen's catch report
- Harvest—Fishermen's catch report
- Effort—Fishermen's catch report

Tribal commercial fishery information

Tribal commercial fishermen are required to file catch reports that provide information for the lake trout models and include:

- Harvest—Fishermen's catch report
- Effort—Fishermen's catch report
- Harvest composition—Fishermen's catch report
- Age composition—GLIFWC staff monitoring of commercial harvest

States also provide information on the sport fishery

This information is gathered from creel surveys and charter boat reports and include:

- Harvest—Creel census of anglers and charter boat reports
- Effort—Creel census of anglers and charter boat reports
- Harvest Composition—Creel census of anglers and charter boat reports
- Age Composition—Creel census of anglers and charter boat reports

During fall fish assessments information is gathered regarding

- Number of eggs/female—Fall lake trout assessment from field surveys
- CPUE of spawning size fish

Research information

Research information is also gathered from specific studies and scientific literature and includes:

- Natural mortality bounds
- Average temperature at which lake trout live

Tribal commercial fishing tug operators assist biologists in assessing Gichigami fish populations. Above is Neil Malmgren, Keweenaw Bay commercial fisherman. (Photo by Sue Erickson)

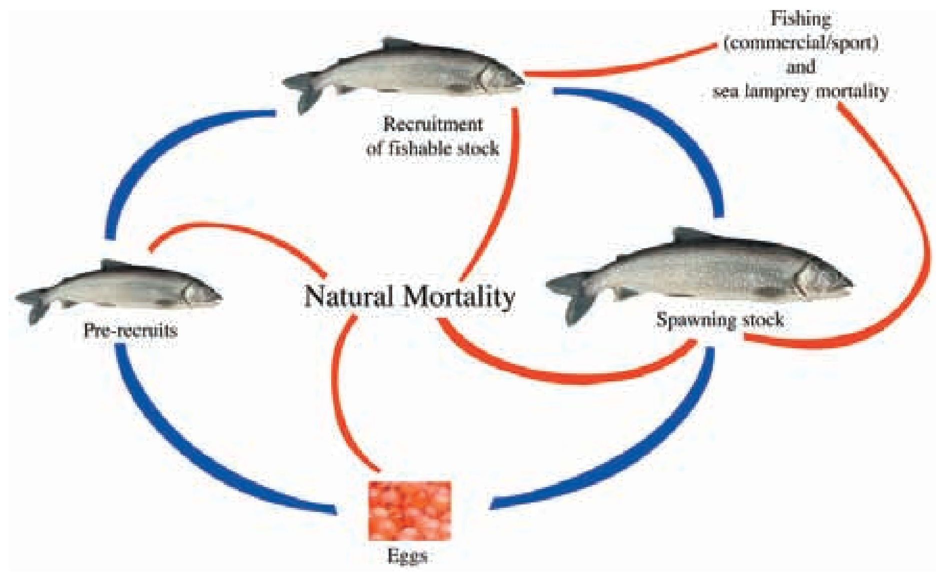


Figure 2. The life-cycle of lake trout.

Parameter

The values or numbers estimated from best guess or prior studies. For example: number of age one fish, number of females, number of eggs each female lays, number of harvestable fish would be based upon best guess or past studies.

Likelihood

The values for parameters that are most likely—based upon the observed data. For example: What catch is likely given the total annual mortality, fishing pressure, and age composition of harvest.

Population Sub-Model

A "paper fish" used to project population estimates forward in annual time steps that benefit the observed data.

In the sub-model, (see figure 2), estimates are made regarding the number of pre-recruits needed to reach a harvestable number of recruits or fishable stock. In turn, estimates are made regarding the number of recruits needed to reach a viable number of spawning fish. Of these, estimates are made about the numbers of spawners that will lay eggs, and how many of the eggs will hatch and survive to the pre-recruit stage.

For each, natural mortality is taken into account when estimating numbers. This includes disease and natural predation. When estimating numbers and potential numbers for recruits and spawning fish, fishing, both commercial and sport, and sea lamprey mortality are taken into account.

Observation Sub-Model

Observations of "real fish" used to adjust predictions and include fishery catch, age composition and catch-per-effort.

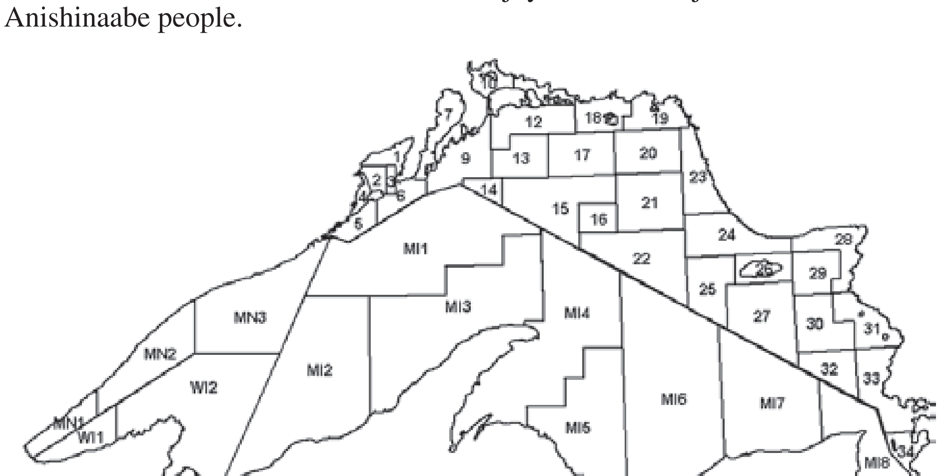
In the observation sub-model, information is gathered from spring, summer and fall fish assessments and monitoring of commercial and sport fisheries, including size, stomach contents, and age. The observation sub-model includes field and in-house work.

Continuing Process

Fish modeling is a continuing process. Data are input each year for each lake trout management area in Lake Superior, and models are run every one to five years. This is necessary because the mortality rate, growth rate, and fishing pressure is different for each management unit because lake trout tend to stay within an 80-mile radius of their spawning grounds.

Fish modeling by the tribes gives them a stronger voice in fish management within Lake Superior. Fish modeling on a tribal level allows the tribes to actively participate in the establishment of tribal fishing quotas and the continued exercise of a treaty protected fishery under tribal regulation.

Tribal regulation and fisheries management ensures the protection of the fisheries resource for everyone, economic benefit to tribes through the tribal commercial fisheries, and the continued enjoyment of a major food source of the Anishinaabe people.



There are 47 lake trout management units in Lake Superior, 13 in U.S. waters and 34 in Canadian waters.

Year-round data collection yields comprehensive look at Gichigami

In cooperation with tribal, state, federal, and Canadian partners, GLIFWC tracks key indicators of the health of the Gichigami fishery throughout the year. By pooling the resources of numerous agencies, fishery managers have a better understanding of Great Lakes dynamics than ever before.

Harvest monitoring

Fish harvested by tribal commercial fishermen are monitored each year throughout the fishing season, which runs for approximately eleven months, from late November to mid-October. Lake trout, whitefish and other species netted are measured for length and weight. In addition, scales or otoliths (ear bones) are removed for determining the age of each fish. Fish are also examined for sea lamprey wounds. Data collected during harvest monitoring are the backbone of computer models that have been developed to assess the health of Lake Superior fish populations.

Bill Mattes, GLIFWC Great Lakes section leader and Mike Plucinski, GLIFWC Great Lakes fishery technician, collect biological information from commercial fisherman Joe Newago's catch. (Photo by Charlie Otto Rasmussen)

Sea lamprey control

In the Great Lakes Basin sea lamprey control and assessment work is led by the Great Lakes Fishery Commission (GLFC), which was established in 1955 by the Canadian/U.S. Convention on Great Lakes Fisheries. It is their mission to provide an integrated sea lamprey management program that is ecologically and economically sound and socially acceptable. The U.S. Fish and Wildlife Service (USFWS) serves as an agent of the GLFC, and both work in cooperation with various federal, provincial, state, and tribal agencies in estimating sea lamprey numbers.

In Lake Superior GLFC assists fish managers in establishing targets for sea lamprey populations which are designed to suppress the lamprey population to a level that causes only insignificant mortality on adult lake trout. One target looks to reduce the spawning lamprey abundance to an average of 39,000 spawners annually, while another aims at reducing wounding rates on lake trout to five wounds per 100 fish.

GLIFWC initiated adult sea lamprey assessment work in 1986. This work is done in cooperation with the USFWS Sea Lamprey Control Program in Marquette, Michigan. The data collected by GLIFWC crews are used to estimate the number of adult spawning lamprey in rivers sampled to track changes in lamprey biology over time. A portion of the lamprey captured each day are given a mark which is unique by week, with the remainder of the lamprey and recaptured lamprey being destroyed and transferred to a landfill. As lamprey are recaptured, a ratio of marked

GLIFWC staff pull a sea lamprey cage trap from the Bad River Falls. (Photo by Charlie Otto Rasmussen)

Dawn Dupras, Michigan DNR technician and Bill Mattes, GLIFWC Great Lakes section leader, aboard the fishing vessel Three Sons operated by Gilmore Peterson. Biological information is gathered on lake trout during spring large mesh gill net assessments in Lake Superior's management unit MI-3. (Photo by Charlie Otto Rasmussen)

to unmarked animals is tracked and fed into a statistical formula to generate an estimate of the overall numbers of lamprey in the river. Estimates of the spawning lamprey populations from various rivers of different sizes and flows are then fed into a larger statistical model which generates estimates of abundance for all of Lake Superior.

Lake trout assessments

Three seasonal assessments are carried out annually to collect data on lake trout populations throughout Lake Superior during the spring, summer and fall.

Spring

Since 1959, standardized lake trout assessments have been done annually in U.S. waters of Lake Superior. Since 2000 GLIFWC has been cooperating with tribal commercial fishermen and the Michigan DNR to carry out these assessments along the northwest side of the Keweenaw Peninsula. These assessments monitor long-term trends in lake trout biology and relative abundance. Information on growth, age and lamprey-inflicted mortality are all collected during these surveys. Originally, these assessments were conducted in the spring of each year by licensed commercial fishermen under the auspices of the U.S. Bureau of Commercial Fisheries, a predecessor to today's U.S. Fish and Wildlife Service. As the number of commercial fisheries on Lake Superior declined, the assessments became routinely conducted by state fishery agencies using the same style of gill nets and methods as first implemented in 1959.

The fisheries assessments began at different points in time in each of the three U.S. political jurisdictions: first in Michigan and Wisconsin waters in 1959, then in Minnesota in 1963. In 1984, the Red Cliff Fisheries Department began conducting spring assessments in western-Michigan waters, and in 1991 the Keweenaw Bay Indian Community's Biological Resources Division began spring assessments within Keweenaw Bay. In Ontario waters, spring assessments began in 1997 in eastern waters and have been expanded to include more units.

A fisheries technician prepares to remove a lake trout captured in graded mesh gill net set during summer assessments near Eagle Harbor, Michigan. (Photo by Mike Plucinski)

Lake Superior assessments

Historically, assessments conducted by commercial fishermen targeted lake trout with standard gill nets, moving nets around to either follow or optimize catches of lake trout. As the state natural resource agencies became more involved in the actual setting and lifting of the assessment gill nets, the lifts became treated as standard index sites in the same general areas as when the commercial fisheries conducted the surveys. Currently, in each jurisdiction a specific number of lifts are made in each lake trout management unit at a specific number of pre-defined sites.

Nate Bigboy, ANA fisheries technician, prepares to release a lake trout captured during the fall lake trout spawning assessment survey at Union Bay on Lake Superior near Silver City, Michigan. (Photo by Ed Leoso)

The general protocol for the assessment as directed by the Lake Superior Technical Committee is to set multi-filament nylon gill nets, six feet high with a 4.5 inch stretched mesh, during the open water season from April through early June. The nets are set across contour, or down the bank, in 30 to 250 feet of water, at fixed locations around Lake Superior.

Individual agencies determine the appropriate number of nights between lifts and length of net to set as long as the catch-per-unit effort (CPUE) is reported in number of lean lake trout caught per 1,000 feet per night. Biological information is taken from each captured lake trout, which includes: length, weight, sex, maturity, sea lamprey marking, stomach samples, and aging structures. Incidental catch and biological information from species other than lean lake trout are also recorded.

Summer

Many of the agencies on Lake Superior conduct graded mesh gill net surveys during the summer to assess abundance of juvenile lake trout. These same surveys also capture many lake herring, chubs and siscowet. The catches of juvenile lake trout are useful for evaluating reproductive success of lake trout.

As with harvest monitoring and spring assessments, captured lake trout, whitefish and other species are measured for length and weight and scales or otoliths are removed for determining the fish's age. Fish are also examined for sea lamprey wounds.

Fall

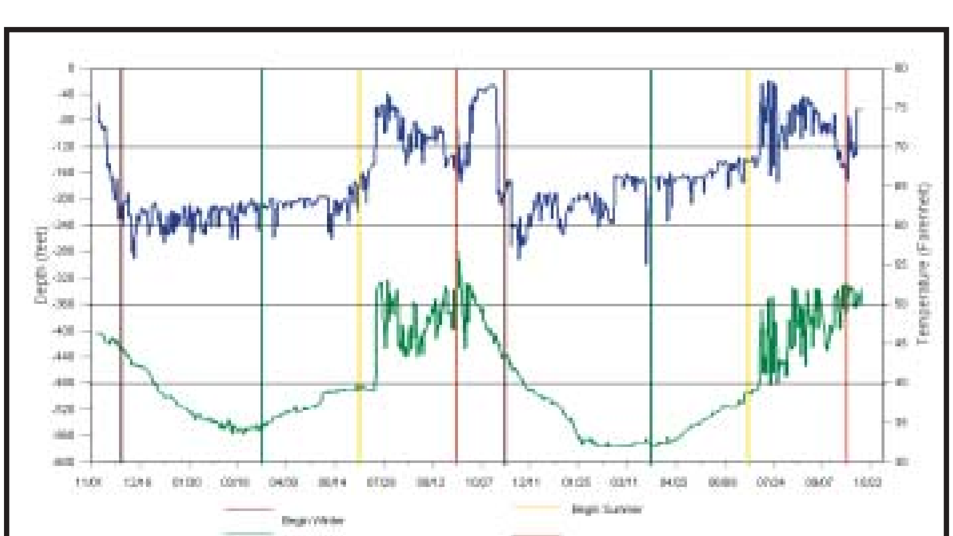
In the fall of the year—from early October to late November—assessments of spawning stocks of lake trout and whitefish are conducted by setting gill nets at predetermined locations in shallow water, less than 50 feet. These annual assessments provide a data base used by biologists to make management recommendations on the fishery. The information allows fisheries biologists to track trends in numbers of spawning fish by stock over time and to identify discreet spawning stocks. Biological information such as growth, mortality and movement between stocks is also obtained and gives insight into how fishing affects various stocks of fish.

Other projects on Gichigami

Lake trout depth/temperature study

In addition to the annual monitoring and assessment work, special funds are utilized to perform specific projects which are designed to answer questions scientists have about Lake Superior and its fish. A recent study funded by the Great Lakes Fish and Wildlife Restoration Act collected information on the depth and temperatures used by lake trout in Lake Superior through the use of archival tags. Fourteen of 124 lake trout implanted with depth and temperature archival tags were recaptured. Each archival tag holds up to 37,000 records of depth and temperature recordings which are taken every 15 seconds and then averaged over a period of time dependent upon how long the tag is "at large"—that is how long the tag is in the belly of a Lake Superior lake trout.

The first fish captured after being at large 40 days had depth and temperature recordings average over every four minutes, while the last fish captured after being at large 719 days had depth and temperature recordings averaged every 60 minutes. For these 14 lake trout, the number of days between date of release and recapture ranged from 40 to 706 days and averaged 372 days; temperature recordings ranged from 31.6℉ to 63.0℉ and averaged 40.4℉, while depth recordings ranged from the water's surface to 548 feet and averaged 93 feet.



Information on depth and temperatures was collected by the use of archival tags. Each archival tag holds up to 37,000 records of depth and temperature recordings which are taken every 15 seconds and then averaged over a period of time, dependent upon how long the tag is in the belly of a Lake Superior lake trout. Depth is indicated by the blue line and temperature is indicated by the green line.

Ed Leoso, Bad River fisheries technician closes up a lake trout with sutures after implanting an archival tag into the fish. (Photo by Bill Mattes)

Spawning reef mapping

In collaboration with the National Water Research Institute (NWRI) of Environment Canada, GLIFWC received funding from the Great Lakes National Program Office to use an acoustic seabed classification system (RoxAnn™) to conduct preliminary mapping of the extent of the Buffalo Reef spawning area located east of the Keweenaw Peninsula. This mapping will determine the boundaries of the suitable spawning habitat on the reef. Underwater video will be taken in areas known to contain stamp sands and in areas of native sand in order to determine whether the sands can be distinguished visually. Samples of the sands will be collected for grain-size analysis.

This information, along with GLIFWC's fall lake trout spawning assessment data gathered over the past 15 years, will be put into a database, and GIS maps will be created that combine substrate information with fish distribution. This will help managers assess where fish are spawning in relation to substrate type.

Consider Gichigami fish for a healthy heart

Lake trout, whitefish high in omega 3

Eating regular meals of some Lake Superior fish appears to lower the risk of developing coronary heart disease (CHD), according to two major health organizations. The U.S. Food and Drug Administration and the American Heart Association have announced that certain omega 3 polyunsaturated fatty acids that naturally occur in flesh of fish can help stave off blood clots that cause heart attacks.

"The evidence suggests that foods rich in omega 3 fatty acids can reduce the risk of CHD," said Great Lakes Indian Fish & Wildlife Commission Environmental Biologist Adam DeWeese, "But people should bear in mind that fish also contain certain chemical contaminants like mercury and PCBs."

According to University of Minnesota researcher Paul Addis in a published report, the main benefit of omega 3 is a reduction of blood platelet activity, slowing down the build-up of fibrous plaque on the walls of blood vessels. Heart attacks can occur when blood clots formed by blood platelets become clogged in an artery. Contrary to some public perceptions, Addis also reports that omega 3 acids do not significantly reduce blood cholesterol.

On Lake Superior, siscowet, or fat trout, contain the highest amount of the beneficial fatty acids, followed by herring, whitefish and lake trout (see Omega 3 fatty acid content chart).

"Siscowet tend to be higher in PCBs and dioxins than other Lake Superior fish, so it is wise to eat less of it and incorporate more species like whitefish and rainbow trout which are excellent sources of omega 3," DeWeese said.

Lake Superior whitefish, in particular, is a good choice to serve regularly at the dinner table, Deweese said. Markedly low in mercury, high in omega 3s, and very tasty baked, grilled or smoked, whitefish is readily available throughout the region. Restaurants, grocers and local fish shops commonly offer whitefish from Gichigami.

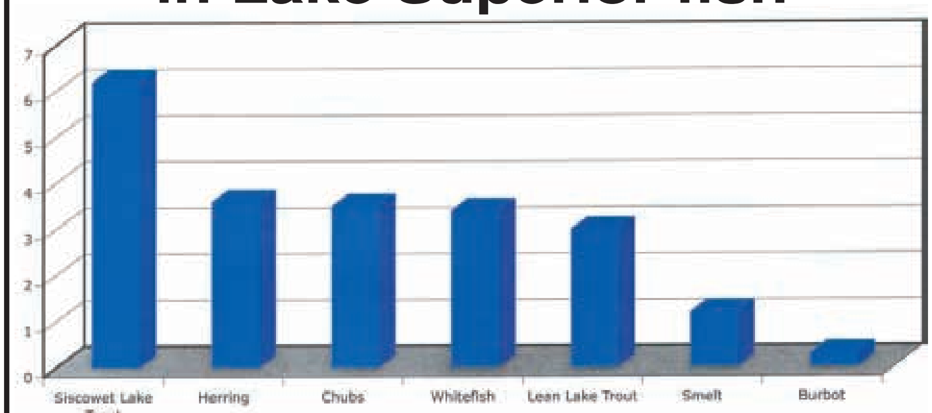
Also readily available to consumers in the Lake Superior region, lean lake trout fillets contain the benefits of omega 3 acids, but with fewer contaminants than siscowet trout.

Under Wisconsin guidelines, women who might become pregnant and children should closely monitor their intake of fish and eat no more than one eight-ounce meal of whitefish per week.

"To get the potential health benefits of omega 3 and reduce the risks of the harmful effects of chemical contaminants, it is wise to follow state fish consumption advisories when selecting species of Great Lakes fish to eat and follow GLIFWC advice for inland lakes," DeWeese said. Although GLIFWC has not issued guidelines for eating Lake Superior fish, it produces color-coded walleye consumption maps for inland lakes in the 1837 and 1842 ceded terrriory where tribal members routinely harvest fish. Wisconsin, Michigan and Minnesota all publish guidelines for eating Lake Superior fish.

Levels of toxins found in Lake Superior fish are not known to cause immediate sickness in adults. While chemicals collect in the human body over time, it may take years of routinely eating contaminated fish to build up amounts that are a health concern. A developing fetus, however, may be put at risk for neurological problems if the mother ingests too much fish contaminated with mercury in a short window of time.

Omega 3 fatty acid content in Lake Superior fish



Eating regular meals of some Lake Superior fish appears to lower the risk of developing coronary heart disease. Certain omega 3 polyunsaturated fatty acids that naturally occur in fish can help stave off blood clots that cause heart attacks. Lake Superior, siscowet, or fat trout, contain the highest amount of the beneficial fatty acids, followed by herring, whitefish and lake trout. (Figures from Dr. Paul Addis, University of Minnesota researcher.)

Fish consumption guidelines on the web

Michigan Advisory

http://www.michigan.gov/documents/FishAdvisory03_67354_7.pdf

Wisconsin Advisory

http://www.dnr.state.wi.us/org/water/fhp/fish/pages/consumption/choosewisely05.pdf

Minnesota Advisory

http://www.health.state.mn.us/divs/eh/fish/eating/lakesuperior.html

GLIFWC Advisory

http://www.glifwc.org/bio/mercury.htm

John Netto from the U.S. Fish and Wildlife Service assists Tom Doolittle of the Bad River Natural Resources Department in setting up a statistical catch-at-age model during an ANA-GLIFWC sponsored workshop. (Photo by Bill Mattes)

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