

Spring 1990

By

Michael D. Staggs
Fisheries Management
Madison

Robert C. Moody
Fisheries Management
Woodruff

Michael J. Hansen
Fisheries Management
Madison

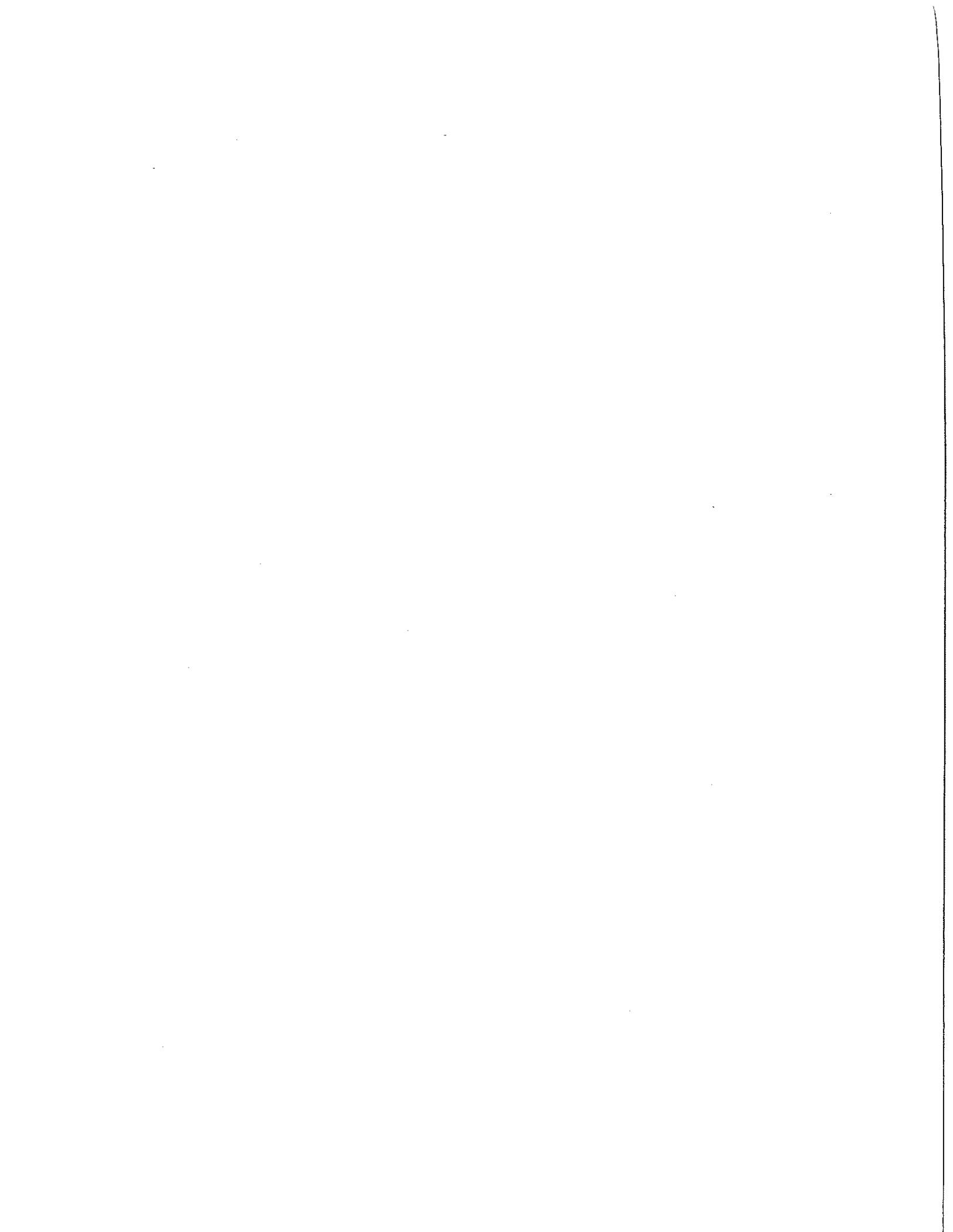
Michael H. Hoff
Fisheries Research
Woodruff

Edited by
Kendra Nelson

Bureau of Fisheries Management
Department of Natural Resources
Madison, Wisconsin 53707

SPEARING AND SPORT ANGLING FOR WALLEYE IN WISCONSIN'S CEDED TERRITORY

INTRODUCTION	3
FEDERAL TREATIES AND FEDERAL COURT DECISIONS	4
A Brief History of the Federal Treaties	4
Recent Federal Court Decisions Concerning Chippewa Treaty Rights	4
LOCATION AND DESCRIPTION OF THE CEDED TERRITORY	8
CURRENT STATUS OF CEDED TERRITORY FISHERIES	8
Walleye Angling and Its Effects on Walleye Populations	8
A Comparison of Spearing and Angling	16
CURRENT SPEARING AND ANGLING MANAGEMENT	22
Walleye Population Management Objectives	22
Harvest Regulations	23
Evolution of the Chippewa Quota System	24
Procedures Used to Calculate Safe Harvest Levels	25
Accommodating the Chippewa Harvest	27
MONITORING CEDED TERRITORY FISHERIES	29
Monitoring Fish Populations	30
Monitoring Harvest Levels	30
Costs and Benefits of WDNR Monitoring Activities	31
SUMMARY	32
LITERATURE CITED	34



INTRODUCTION

Federal courts have recently ruled that the Chippewa may spear and net on northern Wisconsin waters outside reservations -- in the region commonly referred to as the ceded territory. The Chippewa have speared and netted on reservation waters historically, and they have harvested off-reservation waters using methods available to all citizens. However, federal courts have now ruled that the Chippewa may also use efficient methods, such as spearing and netting, on all ceded territory waters -- and may even sell their catch commercially.

Unfortunately, the implementation of these rights -- especially the right to spear spawning walleye and muskellunge, has caused substantial controversy among Wisconsinites. Some support the federal court decisions, which affirm Chippewa rights guaranteed under past federal treaties, and some also support subsequent WDNR actions to implement federal court decisions. Others strongly oppose Chippewa harvest methods and seasons, which are generally illegal for non-Chippewa, and often blame the Wisconsin Department of Natural Resources for "allowing" the Chippewa to exercise treaty rights.

Many are concerned that Chippewa harvesting may damage the fishery resource or may interfere with non-Chippewa fishing. Many northern Wisconsin business owners are concerned that Chippewa harvesting or actions to implement Chippewa harvesting may hurt tourism, which is vital to the local economy. Many Chippewa, confronted by angry protesters while harvesting, do not believe that the Wisconsin Department of Natural Resources or other state officials have made adequate efforts to protect treaty rights.

Much of the controversy seems due to a poor understanding of the issues. Harvest management is extremely complex, and simple press releases or fact sheets cannot adequately describe the steps taken to manage the newly developed treaty fisheries. This publication reviews legal background and biological issues related to the most controversial harvest method -- the spearing of spawning walleye -- in order to initiate better understanding of the fishery resource and of the diverse peoples who must share that resource.

FEDERAL TREATIES AND FEDERAL COURT DECISIONS

A Brief History of the Federal Treaties

The federal treaties apply to most of Wisconsin's northern third. The Chippewa sold, or ceded, this land to the federal government, along with portions of Minnesota and Michigan's upper peninsula, in 1837 and 1842 federal treaties. In exchange, the Chippewa received money and goods -- and reserved the right to live, hunt, fish, and gather natural resources in the ceded territory. The federal treaties affirmed the Chippewa as a sovereign nation.

Under the treaties, the President could terminate the Chippewa's ceded territory harvesting and occupancy rights, and President Zachary Taylor did so in 1850. However, federal efforts to remove the Chippewa were unsuccessful -- and an 1854 treaty established permanent reservations within the ceded territory. In the late-1800s, the state of Wisconsin, assuming that either the Presidential order or the establishment of reservations eliminated off-reservation harvesting rights, began to regulate off-reservation harvesting under rules that applied to all users. Recently, however, federal court decisions have affirmed Chippewa off-reservation hunting, fishing, and gathering rights.

Recent Federal Court Decisions Concerning Chippewa Treaty Rights

In 1974, the Chippewa sued the state of Wisconsin to prove that Chippewa off-reservation hunting, fishing, and gathering rights still existed. A series of federal court trials -- the Voigt litigation -- clarified the details of Chippewa off-reservation harvesting in Wisconsin.

Initially, Federal District Judge Doyle agreed with the state of Wisconsin that Chippewa off-reservation harvesting rights had been terminated, but in 1983 the 7th Circuit Federal Court of Appeals in Chicago reversed Doyle's decision and affirmed the off-reservation rights. At that time, the federal courts ordered the state of Wisconsin and the Chippewa to negotiate interim agreements that would allow the Chippewa to fish while further litigation was underway. The first Chippewa spearing occurred in spring 1985.

Legally, ceded territory hunting, fishing, and gathering rights are referred to as usufructuary -- rights to use property belonging to somebody else. Other usufructuary rights include mineral rights or utility easements; the Wisconsin Department of Natural Resources often leases rights for public fishing access from private property owners. In all usufructuary cases, the user does not own the property but may use certain resources thereon.

Federal District Judge James Doyle. Subsequent litigation -- ordered by the Federal Court of Appeals -- determined what off-reservation harvesting would be allowed and to what extent. In February 1987, Federal District Judge Doyle ruled on the following:

Q: What natural resources may the Chippewa harvest -- and using what methods?

A: The reserved property rights include harvesting any fish, wildlife, and plant species now in Wisconsin -- using any method available when the federal treaties were signed, plus any subsequent improvements.

Q: How much may the Chippewa harvest?

A: The Chippewa may harvest enough natural resources to achieve a "modest standard of living" for themselves. However, the Chippewa hold these harvest rights "in common" with other users.

Q: May the Chippewa sell their harvest?

A: Yes -- the Chippewa may sell or trade any of their harvest to both Indians and non-Indians -- and they may use modern distribution methods.

Q: May the Chippewa exercise treaty rights on private property in the ceded territory?

A: Not at this time -- however, if the Chippewa can demonstrate to the federal court that they require the natural resources on private property to achieve a "modest standard of living," then arrangements may be made to allow Chippewa harvesting on private property.

Q: May the state of Wisconsin regulate off-reservation harvesting?

A: Yes -- state regulation may be imposed on Chippewa harvesting if the restrictions are reasonable and necessary in order to conserve natural resources or protect public safety.

Federal District Judge Barbara Crabb. Subsequent litigation clarified the Doyle decision. In June 1988, Federal District Judge Crabb ruled on the following:

Q: What constitutes a "modest standard of living?"

A: A "modest standard of living" translates as an annual family income of \$20,036.

Q: How much natural resource harvesting would support a "modest standard of living" for the Chippewa?

A: If the Chippewa harvested and sold all the natural resources (all the fish, game, and plants -- including the timber) in the ceded territory, they would not make enough money to support a "modest standard of living."

Q: How do Chippewa harvest rights compare to the harvest rights of other Wisconsinites?

A: Chippewa off-reservation harvest rights to natural resources are paramount. The Chippewa may take "what they need" before others may harvest. However, Chippewa harvest rights are held "in common" with other Wisconsinites and are "not exclusive."

Q: What share of the fishery resource belongs to other Wisconsinites?

A: No specific amounts were reserved for either group, primarily because the Chippewa took only small numbers of fish. ("Allocation" was considered in a subsequent decision.)

Further litigation addressed how off-reservation harvesting would be regulated -- and whether the state of Wisconsin or the Chippewa would be responsible for regulation. In March 1989, Federal District Judge Crabb ruled on the following:

Q: Will off-reservation harvesting be regulated by the state of Wisconsin or the Chippewa?

A: The Chippewa may regulate their own off-reservation harvesting. The state of Wisconsin may impose its regulations if Chippewa regulations risk public safety, threaten natural resource conservation, or do not meet federal court mandates. The Chippewa have enacted regulations that meet federal criteria.

Q: What determines if Chippewa regulations are adequate?

A: Many regulation issues were settled through negotiation, but some required litigation. Based on trial testimony from WDNR and Chippewa biologists, several conditions must be met:

- * Spearing and netting quotas must be set for all ceded territory lakes. These "safe harvest level" quotas must be based on scientific estimates of the fish populations and must ensure that spearing and netting harvests will not exceed maximum allowable catch rates more than 1 time in 40. Less efficient harvest methods -- such as ice-spearing, hook-and-line angling, setlines and bankpoles -- are regulated with bag limits, gear restrictions, and closed seasons.

- * The Chippewa may take all the fish within spearing/netting "safe harvest level" quotas until a permanent ruling on allocation is made.

- * Gillnets may not be used on lakes <1000 acres. Other high efficiency methods may be used on any lakes.

- * "Safe harvest level" quotas must be set for walleye and muskellunge.

- * A lake may be intensively harvested with efficient methods for no more than 2 consecutive years. During closed years, biologists should conduct population surveys.

- * WDNR biologists must be allowed to directly monitor all Chippewa harvesting and must be given all off-reservation biological and harvest information.

- * The Wisconsin Department of Natural Resources must be notified by 15 March each year of intended off-reservation harvest levels and dates.

Q: Who is responsible for managing the ceded territory natural resources, including the fisheries resource?

A: The state of Wisconsin retained the "responsibility and authority" for managing ceded territory fisheries. Chippewa biologists may conduct management activities-- such as stocking or surveys -- with approval from the Wisconsin Department of Natural Resources.

On May 9, 1990, Federal District Judge Crabb ruled that: "all of the harvestable natural resources in the ceded territory are DECLARED to be apportioned equally between the plaintiffs [the state of Wisconsin] and the non-Indians, with such apportionment applying to each species and to each harvesting unit..." Further litigation could take 5-10 years. Unresolved issues include financial damages claimed by the Chippewa for the years they did not exercise their off-reservation rights. Also, certain decisions will be appealed.

LOCATION AND DESCRIPTION OF THE CEDED TERRITORY

The ceded territory includes all or parts of 30 northern Wisconsin counties. Its original boundaries include rivers, portages, and trading posts. However, many rivers now have different names, and exact portage and trading post locations are long forgotten. Therefore, ceded territory boundaries have been updated to follow current landmarks that approximate the original boundaries (Fig. 1). The Wisconsin Department of Natural Resources has county maps showing the exact boundaries.

Of Wisconsin's 14,563 lakes -- 77% are in the ceded territory. Ceded territory lakes total 53% of Wisconsin's lake surface area, excluding Great Lakes surface area. Chippewa reservations contain 1.9% of the lakes, 5.1% of the lake surface area.

Most walleye and muskellunge in Wisconsin are in ceded territory lakes -- 1.6-million adult walleye in 856 lakes and 89,000 adult muskellunge in 664 lakes. The juvenile populations, though not estimated, equal or exceed the adult populations.

CURRENT STATUS OF CEDED TERRITORY FISHERIES

Walleye Angling and Its Effects on Walleye Populations

Those who fish always insist that "it isn't what it used to be." Most believe that increased fishing pressure, advanced fishing "science," improved gear, and degraded habitat have caused dramatic gamefish population declines. Chippewa biologists claim that the ceded territory fishery is "depleted" and insist that "the real problem is a poorly managed recreational fishery" (Busiahn et al. 1989). However, walleye-angling trends and walleye population surveys in the ceded territory contradict the "accepted beliefs."

Two major innovations brought Wisconsin into the modern fisheries management era. In 1947, licenses became mandatory for fishing in Wisconsin, documenting annual numbers of fishery resource users. Also in the late 1940s, the Northern Highlands Fishery Research Area in Vilas County began to study angling effects on fish populations -- requiring anglers on the research area's five lakes to check in and register any catch. The largest lake, and the only one containing walleye, is 293-acre Escanaba Lake.

Long-term monitoring of the northern Wisconsin walleye fishery was largely limited to Escanaba Lake, where complete creel censuses have been conducted annually since 1946. WDNR biologists assume that Escanaba Lake trends are regionally typical and, therefore, use Escanaba Lake studies to help develop northern Wisconsin angling regulations. Furthermore, WDNR biologists think that Escanaba Lake data yields a conservative policy in response to angling effects because Escanaba Lake has no bag, season, or size limits for walleye.

Modern anglers are generally considered better informed and equipped than their predecessors. Current opportunities to learn and improve angling skills include fishing clinics, trade shows, and commercial media. Electronic fish locators, trolling motors, and improved boats, reels, rods, lines, and terminal tackle may substantially improve angling efficiency. Modern anglers are presumably more productive, covering more water in less time.

For anglers in the ceded territory, however, modern angling has not dramatically increased angling harvest rates for walleye. On Escanaba Lake, where walleye had become a popular gamefish by 1949, angling catch rate increases from 1949-87 were statistically insignificant (Fig. 2). On waters with bag, season, or size limits, angling effects would be even less than on Escanaba Lake. Indeed, from 1980-87, harvest rates averaged 0.167 fish/hour on Escanaba Lake compared to 0.104 fish/hour on all ceded territory lakes (Staggs 1990).

Angler numbers have increased -- about 40% in 40 years -- from 1-million anglers in the late-1940s to 1.4-million by the late-1980s (Fig. 3). However, there is no direct evidence that angling effort on northern Wisconsin lakes has greatly increased. In fact, on Escanaba Lake angling effort decreased from 25,000 hours/year in the 1950s to 15,000 hours/year recently, which is currently typical of other northern Wisconsin lakes.

Figure 2. Trends in the Escanaba Lake, Vilas County, walleye sport fishery, 1949-87.

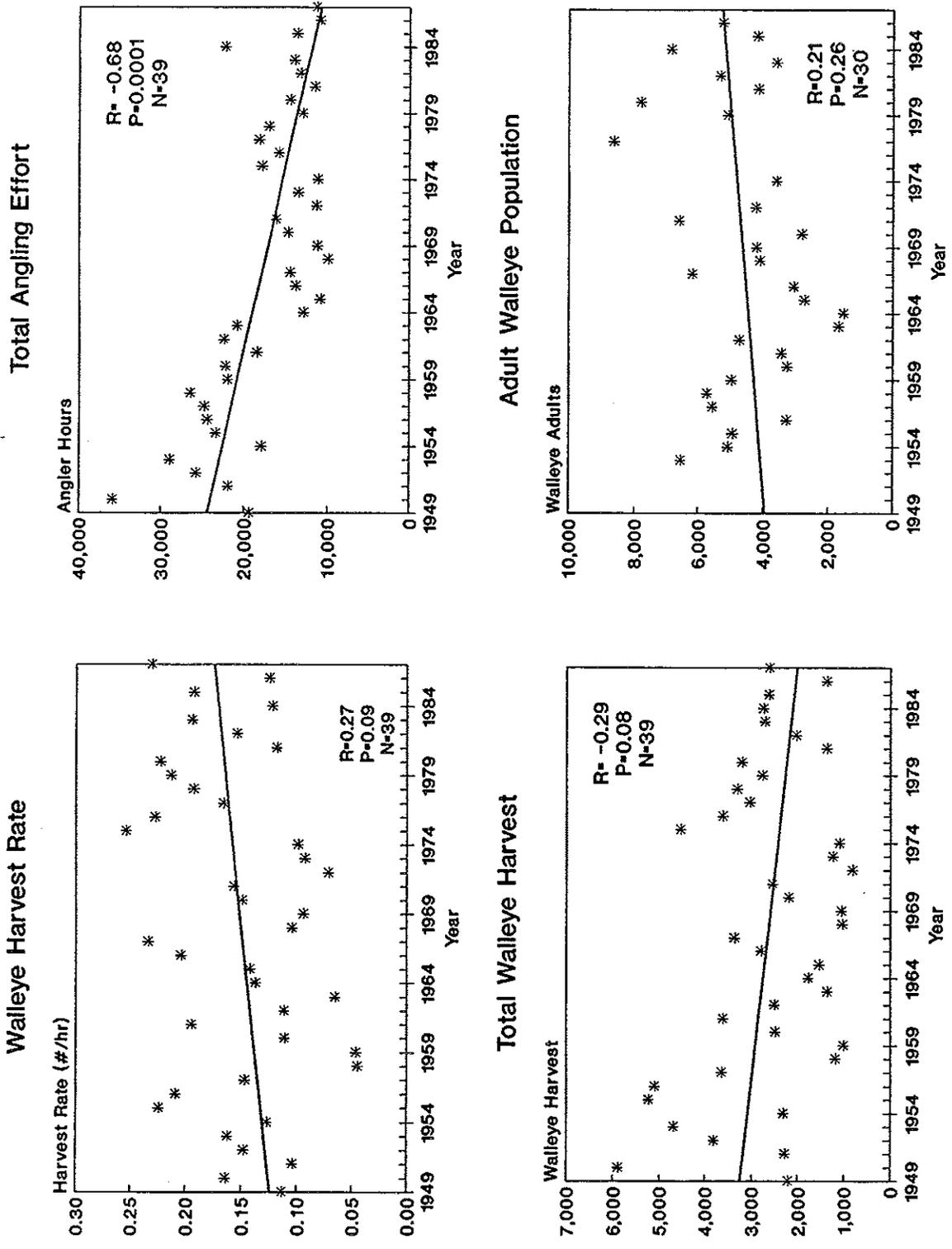
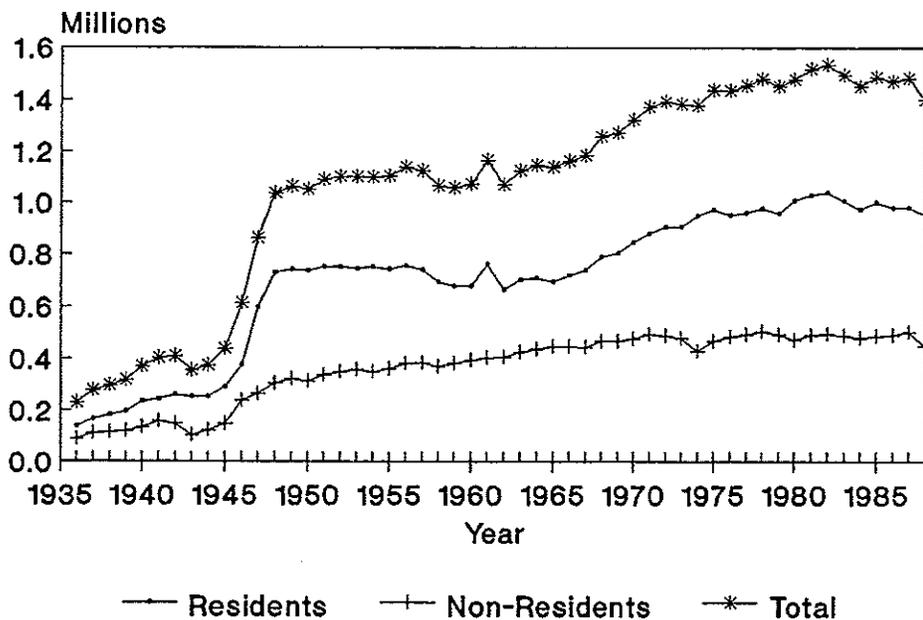


Figure 3. Total sales of fishing licenses to residents and non-residents in Wisconsin, 1936-88.



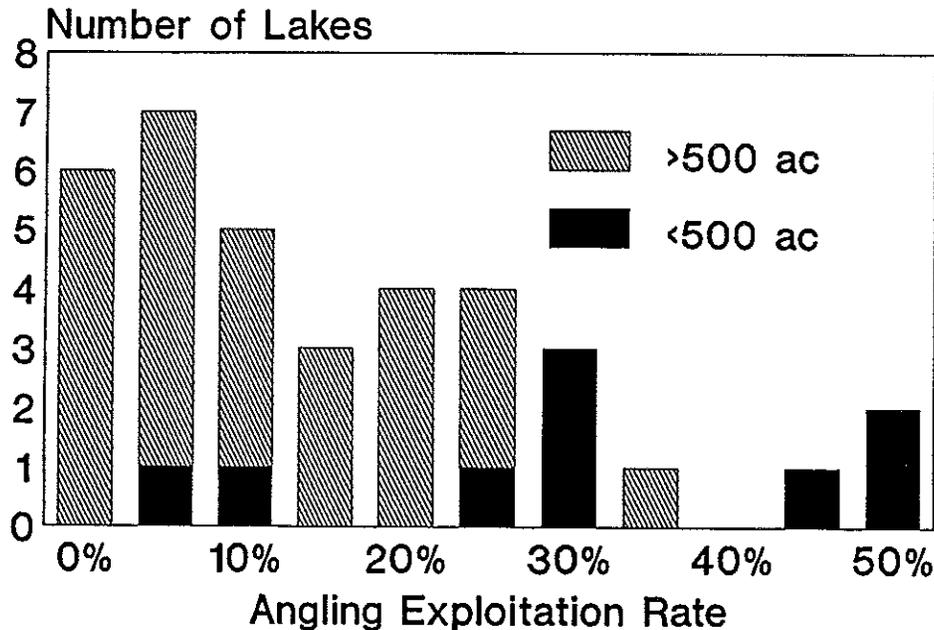
In the 1980s, angling effort totaled 33-million hours/year on ceded territory lakes, with half of those hours on walleye lakes (Staggs 1990). Angling effort averaged 80 hours/acre/year on lakes <500 acres and 45 hours/acre/year on lakes \geq 500 acres. Angling effort on Escanaba Lake averaged 60 hours/acre/year from 1949-87. Better boats, motors, vehicles, and roads make modern anglers more mobile and may mean shorter fishing trips; other recreational activities may also challenge fishing time; or modern anglers may be happy with fewer fish -- perhaps future research will reveal why modern anglers fish less.

On Escanaba Lake, decreased angling effort has offset increased angler numbers and harvest rates, so that the walleye harvest has also decreased. The annual Escanaba Lake harvest averaged 3,000 walleye (11/acre) in the early 1950s, but now averages 2,200 walleye (7.5/acre). On ceded territory walleye lakes, the total annual angling harvest averaged 670,000 walleye (1.9/acre) in the 1980s (Staggs 1990).

Overall, the naturally reproducing walleye population in Escanaba Lake has remained stable for 40 years. Current adult walleye populations in ceded territory lakes -- which average 5.4/acre on lakes with naturally reproducing populations and 2.4/acre on stocked lakes -- also seem stable, although little data is available for comparison with the 1940s-50s on lakes other than Escanaba Lake.

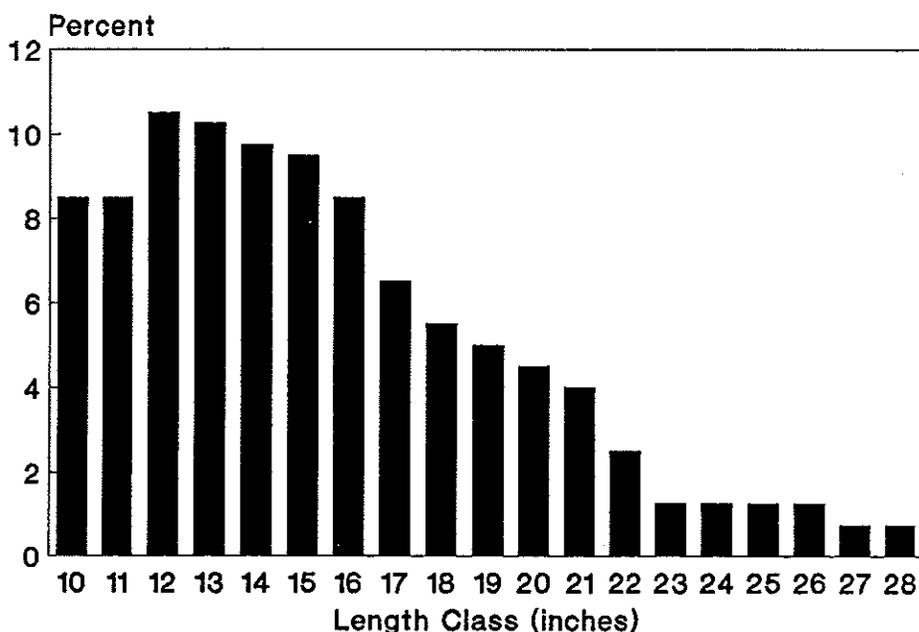
The Wisconsin Department of Natural Resources measured angling exploitation rates for adult walleye on 35 ceded territory lakes from 1980-88. The rates averaged 18.2%, ranging from 2-58% (Fig. 4). If rates were similar in earlier years, angling would not likely have reduced walleye populations. WDNR biologists consider 20-25% average angling exploitation rates "healthy" for most walleye populations -- although lakes with excellent reproduction and productivity, such as Escanaba Lake, can sustain exploitation rates up to 35%.

Figure 4. Distribution of all measured adult walleye angling exploitation rates in Wisconsin's ceded territory, 1980-88. Shown separately for lakes >500 acres and lakes <500 acres.



In lakes harvested only through angling, overexploited fish populations often show high mortality rates; few older, larger fish; and increasing growth rates. A composite adult walleye size distribution from 80 northern Wisconsin lakes does show exploitation -- but a large proportion of the adult walleye sampled were >15 inches, which would not occur at excessive exploitation rates (Fig. 5).

Figure 5. Composite length distribution of adult walleye from 80 northern Wisconsin lakes.



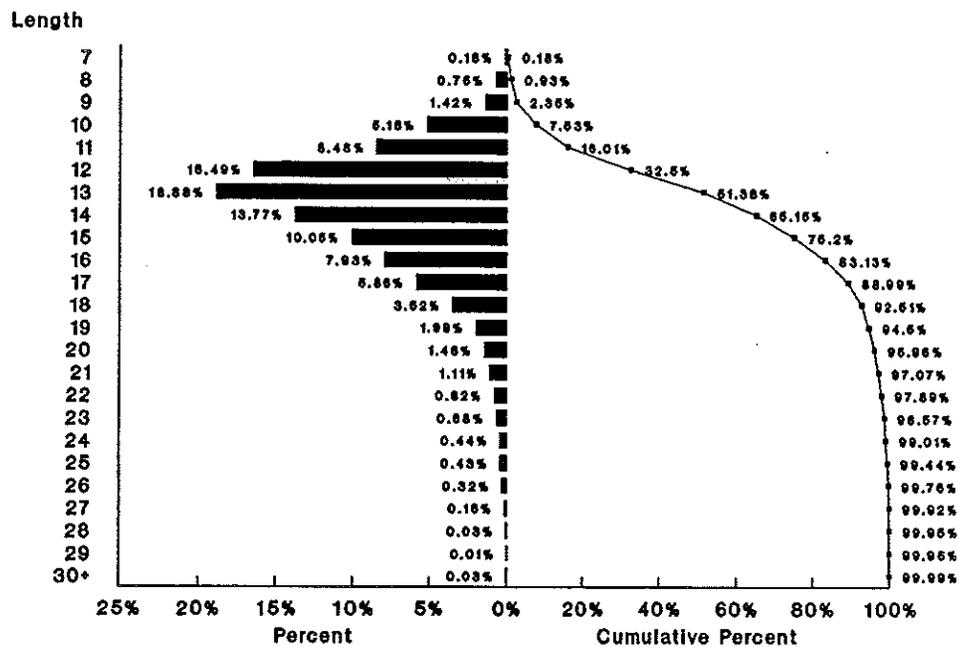
Walleye are currently found in more ceded territory lakes than at the turn of the century, when they were primarily found in large rivers and the lakes connected to those rivers. In the last 100 years, walleye were stocked in many additional waters (Becker 1983). They are now found in 856 ceded territory lakes that range in size from 22-15,300 acres.

Although angling in the ceded territory during the last 40 years has not resulted in walleye population declines, WDNR biologists are concerned about the quality of fishing in northern Wisconsin. The average size of angler-harvested walleye from Escanaba Lake, which remained constant for 30 years, began to decline in the 1980s (Table 1). In the ceded territory, about 2/3 of the angler-harvested walleye are <15 inches while only 1/20 are \geq 20 inches (Fig. 6).

Table 1. Average length (inches) and weight (pounds) of walleye caught by anglers in Escanaba Lake, Vilas County.

<u>Years</u>	<u>Length</u>	<u>Weight</u>
1950-59	12.64	0.79
1960-69	12.93	0.79
1970-79	13.25	0.79
1980-87	12.98	0.72

Figure 6. Length distribution of angler-harvested walleye in the ceded territory, 1980-87.



Also, WDNR biologists are concerned about walleye populations in smaller lakes. Escanaba Lake exploitation rates averaged 28% over 40 years, but in 4 of the last 7 years have exceeded the 35% desired maximum. The average angling exploitation rate in the ceded territory is near the 18% biological optimum. However, smaller lakes tend to have higher angling exploitation rates -- averaging 34.9% on surveyed lakes <500 acres compared to 13.3% on surveyed lakes \geq 500 acres. A statewide 15-inch minimum size limit for walleye was implemented in 1990, in part to address these concerns.

Summary: There is no evidence that angling in northern Wisconsin since the late 1940s caused general walleye population declines. The effects of angling before then are, and will likely remain, unknown. In the last 40 years, angler numbers have increased about 40%, while angling harvest rates and walleye populations have been stable. The 1980s walleye fishery shows poor harvest size distribution, and currently the angling exploitation rates are high in smaller lakes.

A Comparison of Spearing: and Angling

Since Chippewa off-reservation fishing resumed in 1985, the major harvest has been through walleye spearing during spring spawning, when walleye concentrate near shore. Spearers also incidently harvest many other species including muskellunge, northern pike, and largemouth and smallmouth bass.

Chippewa spearing increased from 1985-88, but decreased in 1989 following the Crabb decision (Table 2). Although more lakes were speared in 1989 than in any other year, spearer numbers and total harvest declined from the previous two years. Citizen protests at many boat landings and harsh weather that caused a late and very short spawning season probably affected the 1989 walleye harvest.

Table 2. Off-reservation spring spearing activity on ceded territory lakes during 1985-1989. Data compiled from various GLIFWC reports (Kmiecik 1987; Kmiecik and Shively 1988, 1989 and 1990). spearing also occurred on one river in 1988 and on two lakes during the fall of 1989.

<u>Year</u>	<u>Individual Spearers</u>	<u>Lakes Speared</u>	<u>Muskellunge Harvested</u>	<u>Walleye Harvested</u>
1985	NA	17	86	2,761
1986	194	32	55	6,940
1987	419	70	196	21,321
1988	426	93	158	25,969
1989	271	102	118	16,054

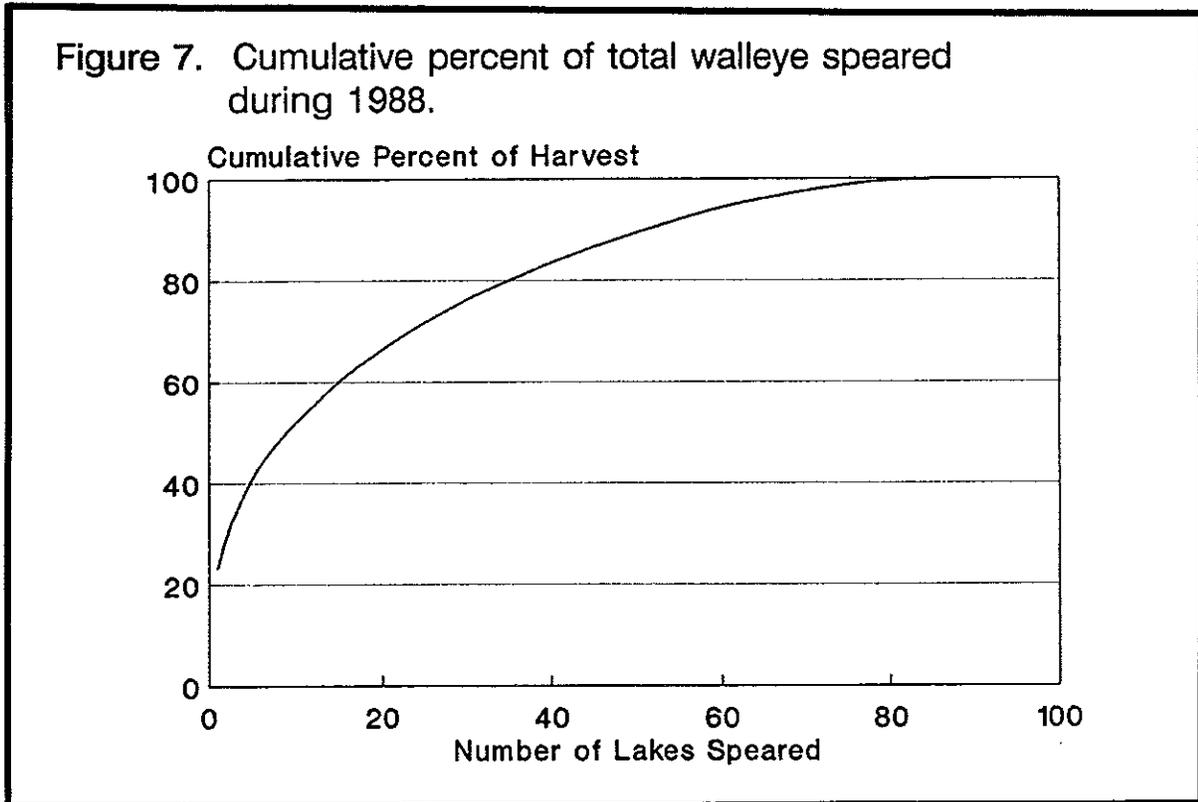
Although spearing accounts for only 4% of the ceded territory walleye harvest, spearing accounts for 15-22% of the harvest on lakes where spearing occurs. In 1986-88, creel surveys on 22 lakes where some fish were speared and 19 lakes where ≥ 20 fish were speared showed that spearing accounted for 15.4% of the harvest, 22.5% after excluding lakes with minimal spearing harvest (Table 3). On two lakes, Sand Lake in Burnett County and Minocqua Lake in Oneida County, spearing harvest during the 2-week spring period was comparable to or greater than angling harvest during the 10-month angling season.

Table 3. Total number of walleye harvested by spearers and sport anglers in all ceded territory lakes selected for creel surveys during 1986-88 (=no ice-fishing creel run, open water estimate multiplied by 1.129 as standard correction; <ns>=not speared).

Year	County	Lake Name	Spearing	Angling
1986	Burnett	Yellow Lake	15	2,204
	Lincoln	Nokomis/Rice Chain	<ns>	5,641
	Oneida	Squirrel Lake	753	4,289
	Vilas	Erickson Lake	<ns>	726*
		Little John Lake	<ns>	647
		Star Lake	792	1,097*
1987	Burnett	Big McKenzie Lake	<ns>	1,433
	Oneida	Kawaguesaga Lake	303	983
		Minocqua Lake	807	946
		Squirrel Lake	687	4,070*
		Tomahawk Lake	802	1,958
	Polk	Balsam	475	3,081
	Sawyer	Round Lake	961	2,366
	Vilas	Erickson Lake	<ns>	460*
		Little Arbor Vitae	81	1,441*
		Little John Lake	<ns>	265
		Star Lake	166	971*
1988	Bayfield	Lake Owen	349	1,078
	Burnett	Sand Lake	256	104
	Douglas	Whitefish Lake	17	424
	Oneida	Clear Lake	164	1,377
		Two Sisters Lake	177	476
		Willow Flowage	17	15,628
	Polk	Balsam Lake	269	2,250
	Price	Pike Lake	236	390
		Round Lake	289	427
	Sawyer	Lac Courte Oreilles	187	837
	Vilas	Trout Lake	1,065	2,172
<u>Sum of:</u>				
All Speared Lakes (n=22)			8,868	48,569
			(15.4%)	(84.6%)
Lakes with >17 Speared (n=19)			8,819	30,313
			(22.5%)	(77.5%)

Whereas the angling fishery affects most ceded territory walleye lakes, the treaty fishery concentrates on only a few. From 1986-88, the Turtle-Flambeau Flowage in Iron County provided about 1/4 of the total Chippewa walleye harvest (14,357 of 54,230 walleye). In 1987, Balsam Lake in Polk County provided about 1/2 of the total Chippewa largemouth bass harvest. In 1988, spearing occurred on 92 of the 856 ceded territory walleye lakes, but 80% of the harvest came from only 35 lakes (Fig. 7).

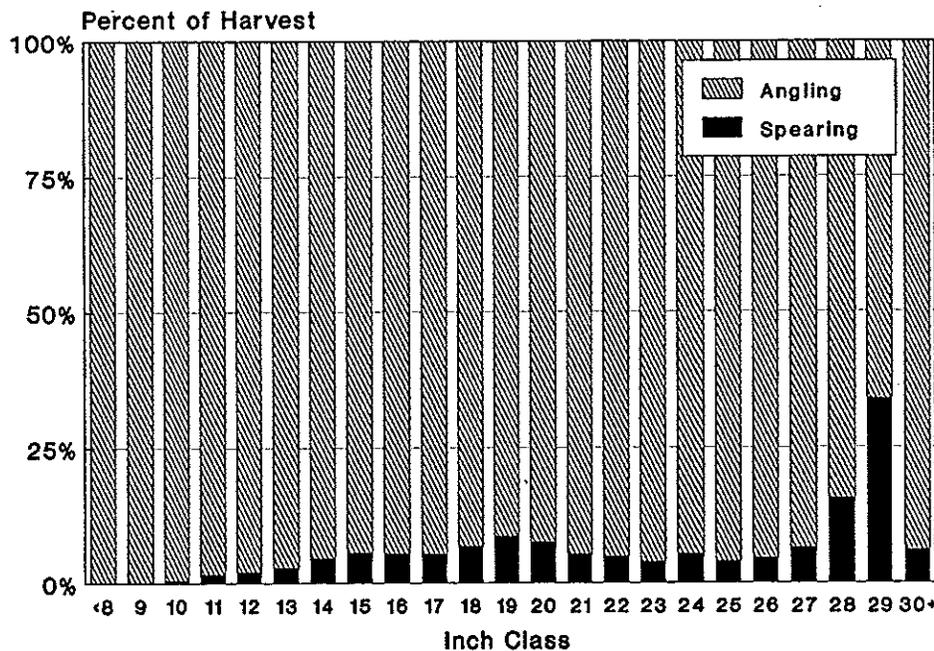
Figure 7. Cumulative percent of total walleye speared during 1988.



Spearers almost exclusively harvest mature walleye; anglers harvest mature and juvenile walleye. Angler-harvested walleye from ceded territory lakes average 14 inches; speared walleye, about 16 inches (Kmiecik and Shively 1990). Spearing harvests contain about twice the percentage of 16- to 21-inch walleye as do angling harvests.

Spearers harvested 126 walleye ≥ 20 inches from Trout Lake in 1988 during a 12-day season, while anglers fishing the entire open-water season harvested only 120 walleye ≥ 20 inches. Altogether in 1988, spearers harvested 16% of the trophy walleye (> 29 inches) taken in the entire ceded territory -- even though the Chippewa speared in $< 1/8$ of the ceded territory walleye lakes and harvested under a reduced bag limit for ≥ 20 -inch walleye (Fig. 8).

Figure 8. Relative walleye harvest by angling (861 lakes) and spearing (92 lakes) in the ceded territory, 1988.



Because the Chippewa spear spawning walleye, a concern was that too many mature females would be harvested before laying eggs. However, a comparison of spearing harvest length frequencies and WDNR fykenet surveys showed that older males are most vulnerable to Chippewa harvest (Fig. 9). Females do not remain in shallow spawning areas as long as males and are protected from selective spearing harvest. In 1985-89, the spearing harvest was 84.0% male, 9.2% female, and 7.1% unknown (Kniecik and Shively 1990).

Spearing is an efficient harvest method. An average spearer harvests a walleye every 5 minutes, but an average angler specifically fishing for walleye harvests a walleye every 9.65 hours (Fig. 10). In 1988, anglers fished an estimated 32.9 million hours on ceded territory lakes; spearers, only 2,241 hours.

Spearers are also more likely to harvest walleye when populations are low. Analysis of 1986-88 data showed a negative relationship between spearing harvest rate and adult walleye population density (Fig. 11). In contrast, walleye angling is self-regulating. Escanaba Lake showed a positive relationship between angling catch rate and population density (Fig. 12).

Figure 9. Relative selectivity (proportion in harvest - proportion in population) of spearing for male and female walleye, 1986-88.

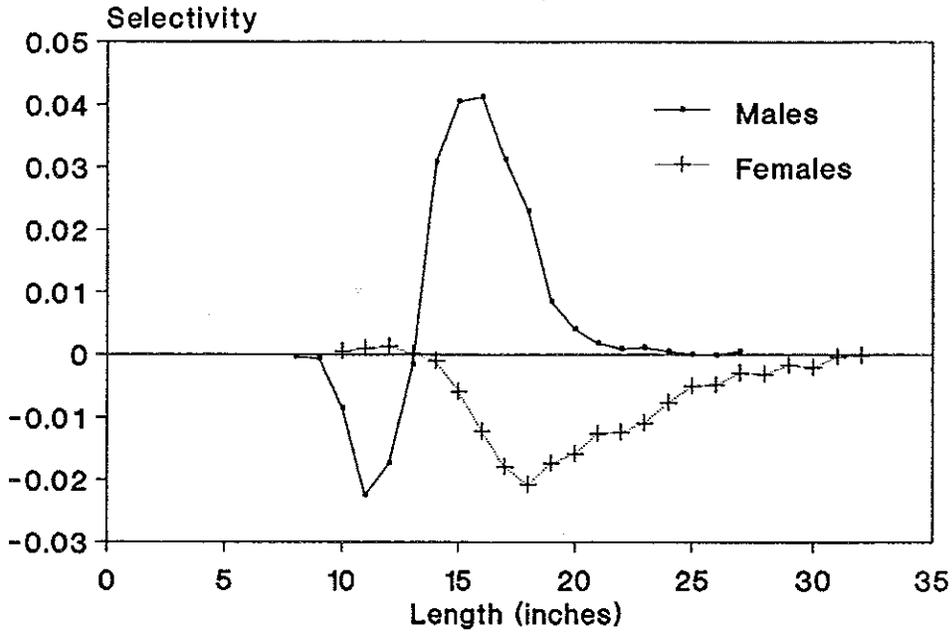


Figure 10. Hours needed to harvest 1 walleye, 1986-88.

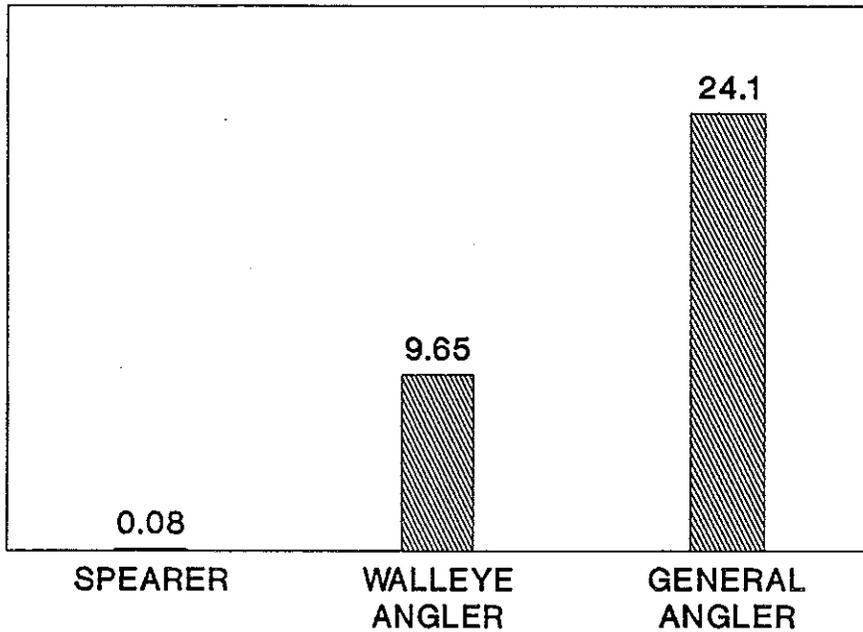


Figure 11. Comparison of spearing harvest rate with adult walleye population density in lakes with mark-recapture population estimates, 1986-88.

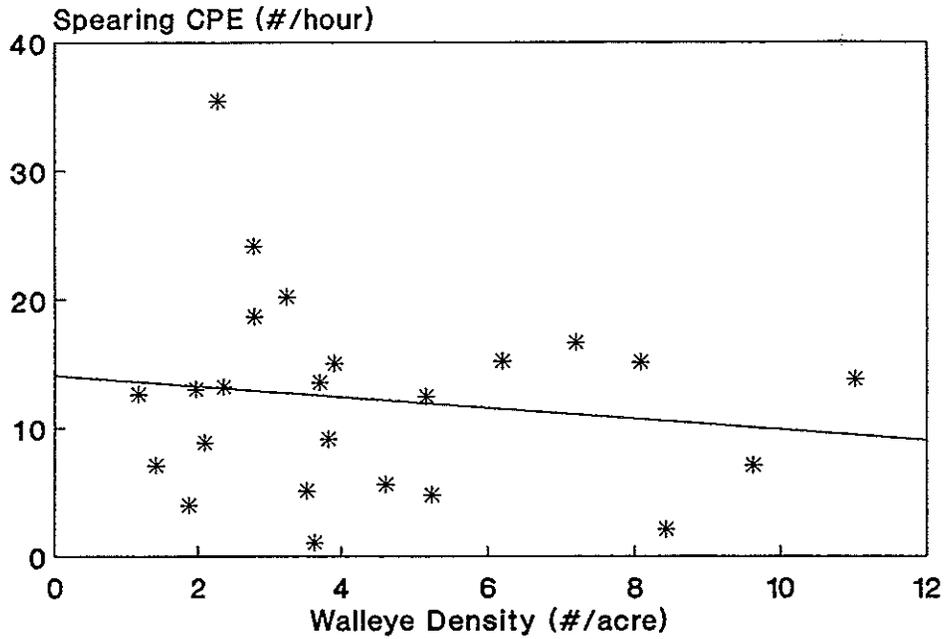
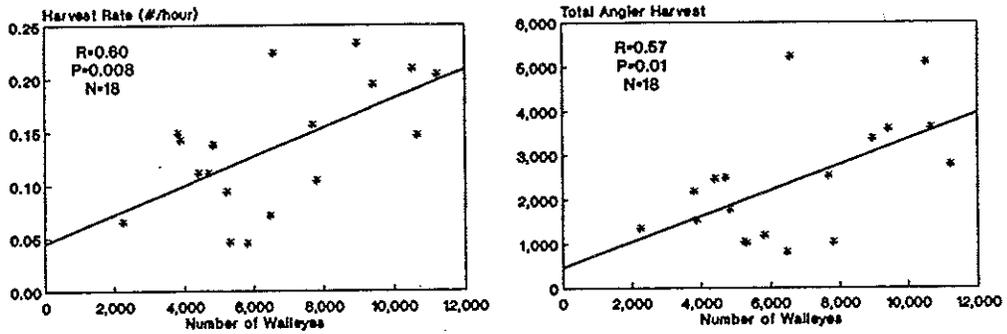


Figure 12. Comparison of angler harvest rate and total harvest with the walleye population size in Escanaba Lake, Vilas County.



Summary: Spearing and angling are very different harvest methods. Angling is relatively inefficient but enjoyed by many citizens on most Wisconsin waters; spearing is highly efficient and practiced by 200-400 Chippewa on selected Wisconsin waters. Anglers tend to harvest small walleye of both sexes, while spearers harvest spawning walleye, primarily males. Angling harvest tends to be limited by walleye population densities, whereas spearing harvest tends to be limited by quotas. Developing a practical system to manage and regulate these two very different fisheries has been a formidable task.

CURRENT SPEARING AND ANGLING MANAGEMENT

Walleye Population Management Objectives

WDNR and Chippewa biologists have developed the following objectives to manage exploited walleye populations in the ceded territory:

OBJECTIVE 1 -- naturally reproducing walleye populations at abundance levels commensurate with available habitat -- Maintain or achieve minimum population densities of 3 spawners/acre with ≥ 3 strong reproducing year classes (5 female year classes per sample or 3 year classes with each contributing $\geq 15\%$ per 100 females). Populations falling below these levels typically require management actions such as harvest restrictions or stocking.

OBJECTIVE 2 -- walleye populations that optimize fishing opportunities -- Increase abundance in lakes with poor reproduction, overharvest, or high natural mortality. Increase growth rates in overharvested or overpopulated lakes.

OBJECTIVE 3 -- walleye populations that, through predation, optimize abundance and/or growth rates of other species.

OBJECTIVE 4 -- stability of desired populations.

Meeting these objectives will require lake-specific data to analyze population variables and to develop lake-specific plans.

In ceded territory walleye lakes, recruitment -- the supply of young fish to adult year classes -- comes primarily from natural reproduction. Some of the lakes, with habitat more suitable for other species, have no walleye reproduction. Stocking occurs in about 30% of ceded territory walleye lakes.

Water fertility, temperature, other species present, and abundance determine fish growth rates. Higher abundance often slows growth, but harvest and natural mortality limit abundance. Natural mortality includes predation, starvation, and disease. Harvest includes angling, spearing, and netting. Harvest and natural mortality are sometimes inversely related. When harvest is high, natural mortality is often low.

Harvest Regulations

Spearing and angling are regulated differently. Spearing harvest quotas are determined through methods that the Wisconsin Department of Natural Resources and the Chippewa agree on -- and that are approved by the federal court. By 15 March each year the Chippewa must notify the Wisconsin Department of Natural Resources of how many fish the Chippewa will harvest from each ceded territory lake during the upcoming season. The Wisconsin Department of Natural Resources then has time to adjust angling regulations to accommodate the Chippewa harvest.

Under walleye harvest quotas, the Chippewa issue a daily permit to each spearer. The number of permits issued is limited by the remaining Chippewa quota. Individual harvests are regulated through variable bag limits (stated on permits) and maximum size limits (only 1 fish 20-24 inches and 1 fish of any size). Chippewa biologists must count and measure each spearer's harvest immediately after the spearer quits harvesting to ensure that harvest quotas are not exceeded.

In some respects, state-licensed walleye anglers are more strictly regulated than Chippewa walleye spearers. Anglers must purchase fishing licenses, may not spear or net, and may not fish during spawning seasons on most waters. Anglers are also limited by comparatively small daily bag and possession limits (which reduce the total number of fish an angler may keep and preserve over time), the number of lines allowed, and size limits on most waters.

In other respects, state-licensed walleye anglers are less strictly regulated than Chippewa walleye spearers. Anglers do not have report any catch on-site immediately after fishing, nor do anglers have to register any walleye harvested. The number of anglers on each lake is restricted only by access or space available, and angling is not limited under annual quotas -- although the same biological limits used to derive quotas are used to assess angling effects on the fishery.

Evolution of the Tribal Quota System

The state of Wisconsin and the Chippewa agreed before trial that spearing and netting must be regulated directly under quotas, but hook-and-line angling, ice-spearing, setlines, and bankpoles can be regulated indirectly under bag, season, gear, and size limits. Both also agreed that the total allowable catch (TAC) should be $\leq 35\%$ of the adult population. Based on the agreements, the federal court approved a harvest quota management system for Chippewa spearing and netting -- with Chippewa hook-and-line angling, ice-spearing, setlines, and bankpoles to be managed under indirect regulations.

The state of Wisconsin and the Chippewa could not agree on a system for setting quotas -- so the federal court developed a compromise.

The state of Wisconsin proposed setting quotas only on lakes with recent mark-recapture population estimates. The quotas would be set at 20% of TAC to accommodate a mixed use (Chippewa and others) fishery. However, if such quotas were insufficient to meet Chippewa needs, the state of Wisconsin proposed to set quotas on other lakes based on the best available minimum population estimates. Although the latter quotas would not be the full number available if better population estimates were available. WDNR biologists thought these proposed guidelines ensured against systematic overharvest.

The Chippewa proposed setting quotas for all lakes based on any available population estimates, regardless of accuracy. The quotas would range from $<20-100\%$ of TAC, depending on the accuracy of the available population estimate. The Chippewa made no provision for a mixed use (Chippewa and others) fishery. Chippewa biologists thought these proposed guidelines ensured against systematic overharvest.

WDNR biologists proved at trial that the Chippewa harvest plan would allow unacceptable levels of systematic overharvest on some lakes. The Chippewa successfully argued that because Chippewa rights are paramount, the state of Wisconsin harvest plan would unnecessarily limit Chippewa harvest opportunities in order to provide a mixed use fishery. Based on testimony from both sides, the federal court compromise harvest plan requires setting quotas for all ceded territory waters, but at levels that limit Chippewa overharvest to 1 out of 40 waters. Quotas that met these requirements were termed "safe harvest levels."

Procedures Used to Calculate Safe Harvest Levels

"Safe harvest level" and TAC (total allowable catch) are usually not the same, and to understand how Chippewa quotas are set, it is important to clearly understand how TAC and "safe harvest level" differ. TAC is the theoretical maximum number of walleye that can be harvested annually from a lake. Using TAC to set a quota would assume that biologists know exactly how many walleye are in the lake.

The "safe harvest level" is a quota that, if harvested, has a known probability of exceeding TAC. The "safe harvest level" is always \leq TAC, with the magnitude of difference positively related to the accuracy of available population estimates and negatively related to the desired probability of exceeding TAC. The federal court has mandated the probability of exceeding TAC at no more than 1 time in 40 (2.5%).

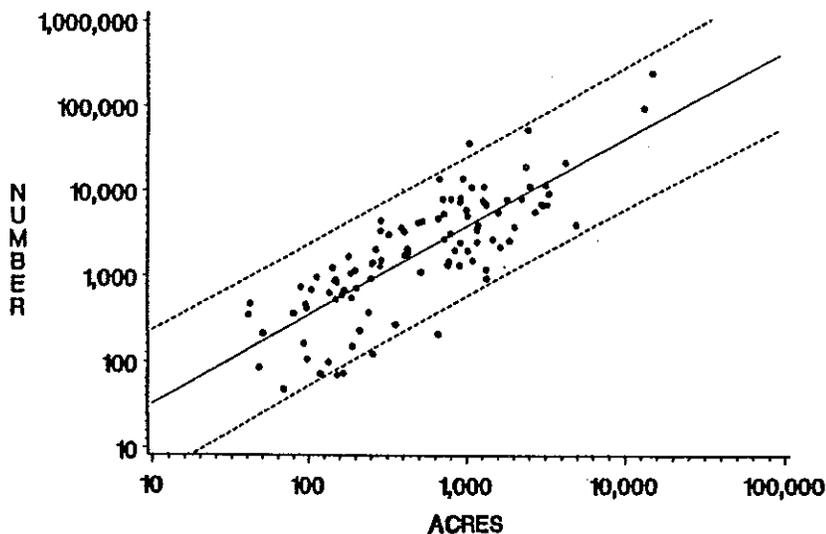
To determine "safe harvest level" -- first calculate TAC, multiplying the walleye population by the maximum sustainable exploitation rate. WDNR and Chippewa biologists have agreed, pending a more thorough study, that a reasonable maximum sustainable exploitation rate for many ceded territory walleye populations is 35% of the spawning stock each year. Exact walleye population size cannot be determined, but several methods are used to estimate the population size.

The most accurate determination of walleye population comes from mark-recapture estimates immediately before harvest. During initial sampling, numerous fish in a population are captured, marked, and released. After several days, the population is resampled and the ratio of marked to unmarked fish in this sampling indicates the population size. Unfortunately, mark-recapture estimates are expensive (\$15,000-\$20,000) and, therefore, can not be done on all 815 lakes for which "safe harvest level" quotas must be set.

The next best determination of walleye population is to use previous mark-recapture estimates. This is less accurate because walleye populations often change dramatically year-to-year. Currently, mark-recapture estimates are used for 2 years.

Most lakes have no recent mark-recapture estimates. For these, walleye populations are estimated from a statistical relationship (a regression model) between population size and lake area (Fig. 13, Hansen 1990). The regression model was developed for two groups of lakes -- stocked and naturally reproducing -- with recent mark-recapture surveys. The model enables quick, but not necessarily accurate, population estimates for any lake. Specifically, walleye populations in 1,000-acre lakes can vary from 500-12,000, with a mean of 3,200.

Figure 13. Relationship of adult walleye population size to lake area, with a 95% confidence interval.



If TACs calculated from population estimates were used directly as quotas, many populations would be routinely overharvested. Using the 1,000-acre lake regression model, TAC would be the mean estimate of 3,200 multiplied by 35% -- or 1,120 walleye. Thus, TAC would exceed the number of fish present in some lakes. The "safe harvest level" is TAC discounted by a "safety factor" that allows for the inaccuracies of population estimates and for desired probabilities of exceeding TAC. The "safety factor" for mark-recapture estimates made immediately before harvest -- based on statistical variables and specific samplings -- has averaged 75%, ranging up to 92%. The "safety factors" for one- and two-year-old mark-recapture estimates -- based on Escanaba Lake walleye population changes over 30 years and on numerous short-term changes in other northern Wisconsin lakes -- are 35% and 30%, respectively. The "safety factors" for the regression model -- based on the lower 95% confidence interval -- vary with lake size but average 28% on stocked lakes and 30% on naturally reproducing lakes.

Chippewa biologists have criticized "safe harvest levels" (Kmiecik and Shively 1990, Busiahn et al. 1989). However, under current "safe harvest level" quotas, the Chippewa may harvest over 100,000 fish -- which is 3-5 times the number of fish ever taken by Chippewa harvesters. In addition, "safe harvest levels" provide a quantifiable level of protection against exceeding TAC, ensuring that Chippewa harvesting can not be blamed for any overharvest that occurs.

The federal court also empowered the Chippewa and the state of Wisconsin to update "safety factors" and population estimate procedures as needed. Trial testimony from WDNR biologists indicated that less protective "safety factors" may be needed if future recruitment levels can be quantified during population estimation.

Summary: The "safe harvest levels" used to set spearing and netting quotas are calculated by multiplying the estimated population by the maximum sustainable exploitation rate (currently 35%) to get TAC (total allowable catch). TAC is then multiplied by a "safety factor" that accounts for population estimate inaccuracies and the desired probability of exceeding TAC (currently 1 time in 40, or 2.5%). In 1989, "safety factors" ranged from 28-92%.

Accommodating the Chippewa Harvest

Interim agreements for 1985-88, limited Chippewa harvest to a low percentage of TAC. WDNR biologists assumed that because quotas appeared low, changes in the angling fishery were unnecessary. Unfortunately, monitoring in 1988 proved the assumption wrong, and emergency angling regulations had to be enacted on two lakes -- Trout Lake in Vilas County and Balsam Lake in Polk County.

Part of the problem was that the quotas had been set directly from TAC without accounting for population estimate inaccuracies -- "safety factors" were incorporated to solve this problem. However, on some lakes, angling exploitation was already near maximum sustainable levels. On Balsam Lake, for example, angling exploitation in 1987 was 38.9% and exceeded 25% by August 1988 (King 1989). The average exploitation rate on lakes <500 acres is nearly 35%. On these lakes, even a small Chippewa harvest would require angling harvest reductions -- or overall harvest would routinely exceed TAC.

To keep overall harvest within TAC, WDNR biologists developed a bag limit reduction regulation (Table 4). This regulation -- approved by the Natural Resources Board and State Legislature -- requires the Wisconsin Department of Natural Resources to reduce daily bag limits from 5 walleye/lake to 4, 3, 2, 1, or 0, depending on what percentage of "safe harvest level" the Chippewa declare before the season that they will harvest. The result should be combined Chippewa and angling exploitation rates about equal to earlier angling-only exploitation rates.

Table 4. Required bag limit reductions for various levels of tribal harvest declarations.

<u>Percent of Safe Harvest Declared by Tribes</u>			
Required Bag Limit	Current Pop. Est.	1-2 Year Old Pop. Est.	Regression Pop. Est.
4	1 - 7	1 - 14	1 - 20
3	8 - 18	15 - 39	21 - 54
2	19 - 36	40 - 76	55 - 84
1	37 - 68	77 - 94	85 - 94
0	69 or more	95 or more	95 or more

The bag limit reduction regulation is based on a 1980-87 study of nearly 29,000 anglers who were interviewed after fishing trips on ceded territory lakes (Staggs 1990). Most fishing trips (93%) yielded no walleye, and only 50% of anglers who caught walleye caught more than one (Fig 14). Nonetheless, the few anglers who caught several walleye accounted for a large enough portion of the harvest to make bag limit reductions feasible (Fig. 15).

Figure 14. Percent of ceded territory anglers who caught 0-5 walleye during 1980-87 (based on interviews with 28,901 anglers).

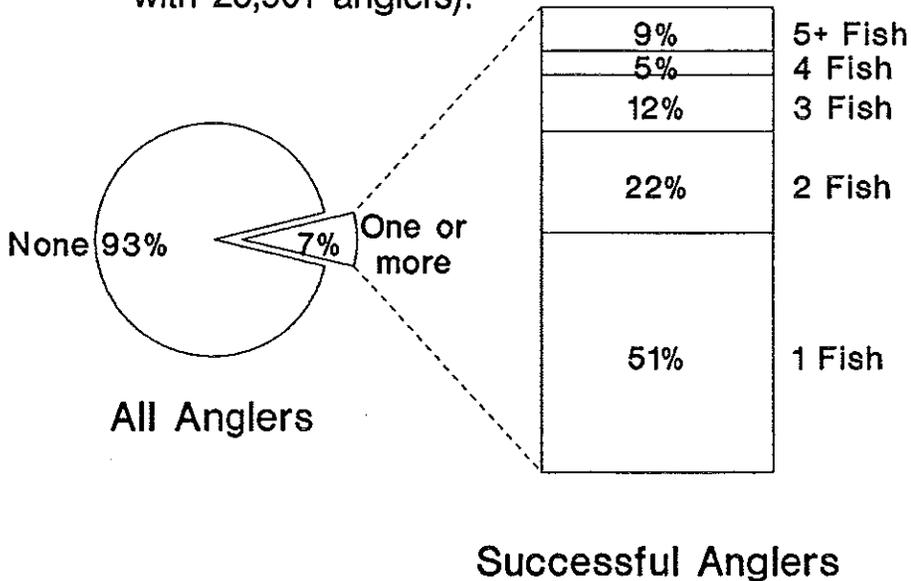
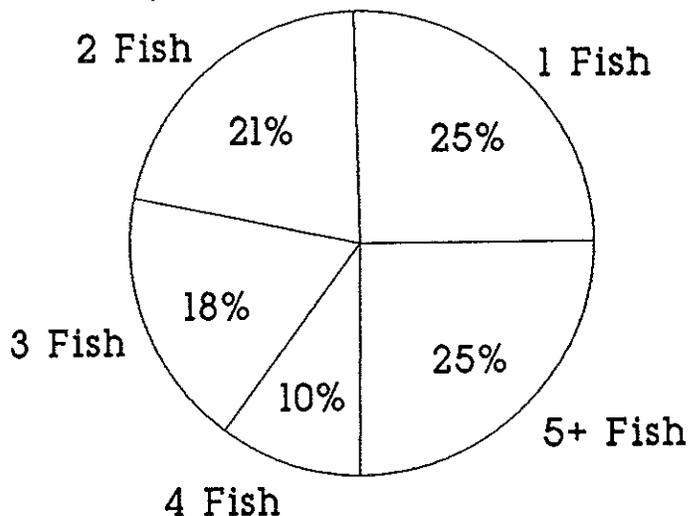


Figure 15. Percent of ceded territory angler-harvested walleye caught by anglers with bags of 1-5 fish (based on interviews with 28,901 anglers).



Alternatives to bag limit reductions were considered. However, closed seasons would unfairly affect some anglers but not others (summer tourists vs. local ice-anglers, for example). A short-term minimum size limit would concentrate the harvest on larger walleye, without being in effect long enough for smaller ones to mature. Areawide regulations (a 3 bag limit across the ceded territory, for example) would be insufficient on some lakes and unnecessary on others. Daily bag limit reductions avoid most of these problems, affecting only those few anglers who catch large numbers of fish. Nonetheless, this regulation has proven unpopular, largely due to many anglers' perceived loss of fishing opportunities.

In 1989, bag limit reductions were based on Chippewa intentions to harvest 254 lakes. During the spring spearing season, the Chippewa harvested only 102 lakes. However, Chippewa harvesting may continue with summer gillnetting and fall spearing, so reduced bag limits remained in force on the other 152 lakes. Eventually, the Chippewa relinquished their quotas on several lakes, but many bag limit reductions proved unnecessary.

MONITORING CEDED TERRITORY FISHERIES

The Chippewa treaty fishery adds a new source of fishing mortality with efficiencies and selectivities different from traditional hook-and-line angling. Protecting and apportioning the fishery resource now demands more accurate knowledge of fish populations and harvests.

Monitoring Fish Populations

The only way to monitor a fish population is through surveys on-the-water. In an angling-only fishery, biologists monitor a fish population's health through data such as length frequency or mortality rate, which is relatively inexpensive to collect. In the mixed fishery, more expensive mark-recapture population estimates are needed to set quotas.

In 1990, the Wisconsin Department of Natural Resources will estimate walleye populations on 23 speared and 10 unspeared lakes. This represents a target sampling percentage of 20% of the 125 lakes that have historically been speared. The lakes to be sampled were randomly selected, so survey results can be statistically expanded to unsampled lakes. During the next 5 years, all 125 lakes will be sampled in a random order. This sampling schedule ensures that each speared lake will be surveyed at least once during a walleye generation. (Walleye typically live 3-8 years.) Any drastic fishery changes should thus be detected in time to avoid irreversible overharvest.

Monitoring Harvest Levels

Before trial, WDNR and Chippewa biologists agreed that certain types of harvest monitoring were needed on ceded territory fisheries. Quota fisheries, such as Chippewa spearing and netting fisheries, required daily on-site catch monitoring -- whereas a less efficient fishery, such as the angling fishery, required annual statistical surveys or registration (Biological Issues Group 1988).

On-site clerks monitor Chippewa spearing and netting harvests, counting all fish and measuring a statistically valid sample. This intensive monitoring is possible only because Chippewa harvest is landed at previously declared lakes and landings during a relatively short time.

Angling harvest in the ceded territory has traditionally been monitored either directly through creel surveys and registration, or indirectly through sampling exploited fish populations. Currently, anglers must tag and register any sturgeon harvested. During WDNR creel surveys on selected lakes, a creel clerk monitors a lake throughout the angling season. The clerk counts anglers at predetermined, random times and interviews them about catch, harvest, and length of fishing trip in order to estimate annual angling effort and harvest. If creel surveys are conducted with population estimates, angling exploitation rates can be estimated.

As fish populations decline, angler catch rates decline and some dissatisfied anglers quit fishing or move to other lakes. This self-regulation effect makes it unlikely that anglers will remove a large portion of a fish population in a short time, and adverse angling effects usually occur slowly over many years. Therefore, most WDNR biologists prefer to monitor the health of angling fisheries rather than angling harvest levels. A chronically overharvested fish population shows signs of stress such as increased total mortality rate, increased growth rate, lower average age, absence of larger fish, reduced age at maturity, unstable recruitment, and declining abundance.

Occasional creel surveys and population monitoring, however, are inadequate to manage a mixed fishery. Unlike angling, spearing is not self-regulating. A few spearers can remove a large proportion of a fish population in a short time regardless of abundance.

Beginning in 1990, the Wisconsin Department of Natural Resources will conduct creel surveys on 20% of mixed fishery lakes -- the same lakes that are randomly selected for population estimates. Annual average harvest levels and exploitation rates will be statistically expanded to all mixed fishery lakes. During a 5-year cycle, WDNR creel surveys will measure angling on all mixed fishery lakes. WDNR creel surveys will also measure angling on 10 unspeared ceded territory lakes -- a lower sampling intensity adequate for angling fisheries.

Costs and Benefits of WDNR Monitoring Activities

In 1990, WDNR's Bureau of Fisheries Management will spend \$846,000 on fishery surveys and harvest monitoring -- this does not include law enforcement expenses. About half the cost will be for permanent fisheries personnel salaries (28,168 hours or 13.5 worker-years) and the other half will be for expenses such as equipment purchases, maintenance, travel, and salaries for temporary help. The State Legislature has provided \$330,000 from General Purpose Revenues, but the remaining amount must come from fisheries program funds (license fees and Dingell-Johnson Sport Fishing Restoration federal aid).

Although the expense of monitoring and protecting the ceded territory fishery is high - - nearly \$1-million -- the value of that resource to the state's economy is much higher. In 1985, anglers spent an estimated \$240-million on fishing-related activities in the ceded territory. Total input to the local economy is enhanced beyond that figure by the multiplier effect, making fishing a critical economic factor in northern Wisconsin.

SUMMARY

1. In 1837 and 1842 federal treaties, the Lake Superior Chippewa ceded large areas of northern Wisconsin to the United States but retained the right to harvest using traditional methods on the ceded territory.
2. Recent federal court judgements affirmed that Chippewa usufructory rights were not affected by an 1850 Presidential removal order or by an 1854 federal treaty that established permanent reservations.
3. Federal court rulings allow the Chippewa to use efficient harvest methods (spearing and netting) to take 100% of the "safe harvest level," to sell their harvest commercially, to regulate their own harvesting, and to have paramount harvest rights -- but the responsibility for managing the fishery resource remains with the state of Wisconsin.
4. The ceded territory covers 30 northern Wisconsin counties, including 77% of Wisconsin lakes that total 53% of Wisconsin inland lake area and contain about 1.6 million adult walleye and 89,000 adult muskellunge.
5. The number of licensed anglers in Wisconsin has increased from 1.0-million in 1948 to 1.4-million today. These anglers harvest 670,000 adult and juvenile walleyes (1.92/acre) annually during 32.9-million fishing hours (16.2-million on walleye lakes).
6. Despite perceived fishing technology advances, the walleye-angling harvest rates and the total harvest have not shown significant increases.
7. Northern Wisconsin walleye populations have generally not declined in the last 40 years. Population size distributions and angler exploitation rates even today are well within acceptable bounds. Furthermore, stocking has produced many new populations.
8. Exploitation rates average 18.3% on sampled ceded territory walleye lakes, but 35% on those lakes <500 acres. Biologists think that 35% is the maximum sustainable exploitation rate, but a range of 20-25% is optimum.
9. Angler-harvested walleye averaged 14 inches -- 65% were <15 inches, 5% were \geq 20 inches. Spearer-harvested walleye averaged 16 inches.
10. The number of spearer-harvested walleye has varied from 2,914 in 1985 to 26,477 in 1988. The largest number of Chippewa spearkers was 426 in 1988.

11. In 1986-88, spearers harvested 1 walleye every 5 minutes on average. In 1980-87, anglers specifically fishing for walleye harvested 1 walleye every 9.65 hours on average.
12. Angling catch rates are proportional to walleye population densities. Spearing rates are not related to walleye population densities.
13. Chippewa spearing accounts for only 4% of the walleye harvested in the ceded territory, but 15-22% of the walleye harvested on lakes where spearing occurs.
14. The primary management objective for ceded territory walleye is to protect and enhance naturally reproducing populations. Stocking is ineffective in most ceded territory walleye lakes.
15. TAC (total allowable catch) is the total number of fish that could be harvested from a lake if the number of fish in the lake could be accurately counted. To date, TAC has been based on a 35% maximum sustainable exploitation rate.
16. The "safe harvest level" is a quota that, if harvested, will exceed TAC with a known probability (currently 1 in 40 or 2.5%). It is usually <TAC.
17. "Safe harvest level" regulation has met Chippewa harvest needs with a low probability of overharvest.
18. Chippewa harvesting has been accommodated on ceded territory lakes through lake-by-lake daily angling bag limit reductions proportional to Chippewa harvest declarations.
19. Spearing and angling are managed differently. Spearing is limited through "safe harvest level" quotas. Angling is regulated through gear, season, bag, and size restrictions. The effects of both fisheries are measured against TAC.
20. Chippewa biologists determine if Chippewa spearers are harvesting within quotas through daily on-site monitoring. This rigorous monitoring is mandated because spearing is a highly efficient harvest method.
21. WDNR biologists determine if anglers are harvesting within TAC through creel surveys on selected waters and widespread walleye population monitoring on other waters. Less rigorous monitoring is sufficient because angling is comparatively inefficient.
22. In 1990, WDNR biologists will begin long-term, intensive monitoring of all mixed fishery lakes, estimating populations and conducting creel surveys every 5 years.
23. The cost of WDNR fisheries surveys and harvest monitoring in 1990-94 will average \$846,000/year to protect a resource that generates \$340-million/year in revenue from sport angling.

LITERATURE CITED

- Becker, G.C. 1983. Fishes of Wisconsin. University of Wisconsin Press, Madison, WI. 1,052 pp.
- Biological Issues Group. 1988. Report on Biological Issues. mimeo report prepared by state-tribal biological issues group, presented as evidence in trial LCO et al. vs. state of Wisconsin in U.S. District Court for the Western District of Wisconsin, Madison, WI. August 1988.
- Busiahn, T., N. Kmiecik, J. Thannum, and J. Zorn. 1989. 1989 Chippewa spearing season - separating myth from fact. Great Lake Indian Fish and Wildlife Commission, P.O. Box 9, Odanah, WI. 20 pp.
- Hansen, M.J. 1989. A walleye population model for setting harvest quotas. Wisconsin Department of Natural Resources Fish Management Report No. 143. 12 pp.
- Hansen, M.J., M.D. Staggs, and M.H. Hoff. (in review). Derivation of safe harvest quotas from past estimates of adult walleye abundance. submitted to North American Journal of Fisheries Management 1990.
- King, R.M. 1989. Assessment of the Native American treaty spear fishery in northwestern Wisconsin. Dingell-Johnson Federal Aid to Fish Restoration Progress Report July 1987 - March 1989. Wisconsin Department of Natural Resources, Cumberland, WI. 250 pp.
- Kmiecik, N. 1987. Results of spearing during spring 1986: data summaries. Great Lakes Indian Fish and Wildlife Commission Administrative Report 87-3. 30 pp.
- Kmiecik, J. and J.D. Shively. 1988. Spear fishery of the Lake Superior tribes of Chippewa Indians Spring 1987. Great Lakes Indian Fish and Wildlife Commission Administrative Report 88-2. 48 pp.
- Kmiecik, J. and J.D. Shively. 1989. Spear fishery of the Lake Superior tribes of Chippewa Indians, spring 1988. Great Lakes Indian Fish and Wildlife Commission Administrative Report 89-2. 43 pp.
- Kmiecik, J. and J.D. Shively. 1990. Open water spearing and netting in northern Wisconsin by Chippewa Indians during 1989. Great Lakes Indian Fish and Wildlife Commission Administrative Report 90-1. 40 pp.
- Staggs, M.D. 1990. Walleye angling in the ceded territory, Wisconsin 1980-1987. Wisconsin Department of Natural Resources Fish Management Report No. 144. 35 pp.

Department of Natural Resources
FM/4
Box 7921
Madison, WI 53707

Do Not Forward
Address Correction Requested
Return Postage Guaranteed

U.S. POSTAGE
PAID
MADISON, WI
PERMIT 906

B
L
K.
R
T.

