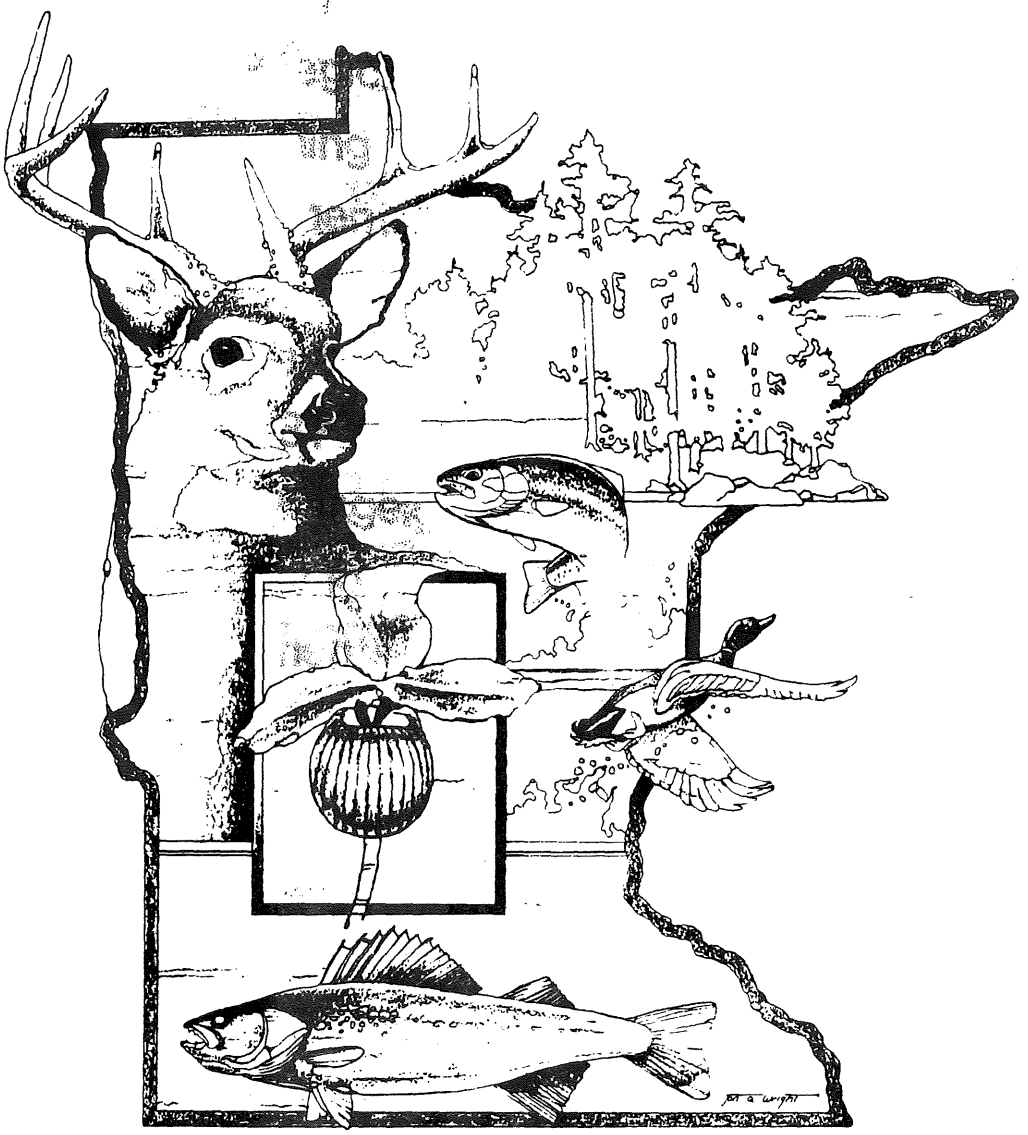
VOL. 1

PLANNING FOR MINNESOTA FISH, WILDLIFE, AND NATIVE PLANT RESOURCES

1987
Strategic
Planning
Document

Draft
1987
Long Range
Planning
Documents



Department of Natural Resources
Division of Fish and Wildlife
Box 20, 500 Lafayette Road
St. Paul, Minnesota 55146

FORWARD

Minnesota is generously endowed with fish, wildlife and native plant resources, all contributing to the unique quality of life we enjoy. There are some one-half million hunters, two million anglers and four million people who relate to these resources. The Governor's Task Force on Hunting and Fishing in Minnesota placed the annual economic value of hunting and fishing at one billion dollars! The task force estimated that it would require an expenditure of an additional 60 million dollars annually to properly manage these resources. The value of the resource to society is immeasurable.

The land and water base on which these resources depend is decreasing in quantity and quality. Demands for the production of food and fiber, and for living space, are eroding at the resources available to support viable populations of fish, wildlife and native plants. Environmental contaminants, increasing advances in harvest technology, changing societal values and needs; and reduced buying power of the dollar are some of the challenges faced by resource managers. These factors makes planning for proper resource stewardship mandatory.

Long range planning for resource management is an organized means to meet our resource stewardship challenges and attempts to balance the biological, social and political pressures that are exerted on the resource. Each Long Range Plan describes the current status of the resource, and establishes measurable objectives against which progress can be measured. The foreseeable problems are identified and strategies are provided for their solution.

The Long Range Plans were written by committees of experts, and designed to address the resource issues for the next six years. They were reviewed within the Department of Natural Resources, but will receive final approval only after a period of review and comment and revision. Once approved, they become the basis for our resource management programs.

The planning process is by no means an attempt to tie our hands in resource management. The plans will be revised to meet changing demands and use new knowledge in the management or our living natural resources.

Funding for the Fish and Wildlife Comprehensive Planning Project has been provided by:

Legislative Commission on Minnesota Resources (LCMR);

Federal Aid for the Restoration of Sport Fisheries and Wildlife, Project FW-10-P, and;

Division of Fish and Wildlife, Minnesota Department of Natural Resources.

8/17/87

STATE OF
MINNESOTA
DEPARTMENT OF NATURAL RESOURCES

BOX , 500 LAFAYETTE ROAD • ST. PAUL, MINNESOTA • 55155-40_____

DNR INFORMATION
(612) 296-6157

October 30, 1987

To Interested Parties:

It is with great pleasure that I send to you a draft copy of the Long Range Plans for fisheries management for the State of Minnesota. This is a part of the Fish and Wildlife planning effort of the Minnesota Department of Natural Resources and is jointly funded by the Legislative Commission on Minnesota's Resources (LCMR), the Minnesota Division of Fish and Wildlife and Federal Aid for the Restoration of Fish and Wildlife. At this time the plans are available for all fish species in Minnesota, and were written by the state's experts in fish resources. Similar plans for wildlife and native plants have been written, and are in the process of review and approval. They will be available in early 1988. The plans for wildlife, native plants and habitats, and other portions of the planning manual, will be sent to you when available.

The Long Range Plans in this packet focus on statewide and regional objectives, problems and strategies for fisheries management over the next 6 year period. They provide a benchmark for our fisheries managers, anglers, and environmental interests in obtaining common goals.

The plans in this volume, and subsequent plans you will be receiving, are open for review and comment for the next few months. The plans are being distributed to our own resource professionals, other agencies with an interest in fish, wildlife and native plants, to universities, public libraries, sportsmen groups, environmental groups, and the news media. Plans for individual species, or groups of species, are available from the Fish and Wildlife Planning Team at 500 Lafayette Road, St. Paul MN 55155-4025.

The plans will provide the basis for much dialogue between the Division, other agencies with interests in fish, wildlife and native plant management, and the public, over the next few months. The input will be assessed and pertinent recommendations incorporated into a final version of the Long Range Plans.

I am certain that your agency will have comments regarding our proposed management of these resources, and invite your comments. They can be made on the comment form, included at the end of each plan, or in a letter addressed to the Fish and Wildlife Planning Team.

Yours truly,

Larry Shannon

Larry Shannon, Director
Division of Fish and Wildlife

LS:PK:bac
Cover Letter 3/C3P

STATE OF
MINNESOTA
DEPARTMENT OF NATURAL RESOURCES

BOX , 500 LAFAYETTE ROAD • ST. PAUL, MINNESOTA • 55155-40 25

DNR INFORMATION
(612) 296-6157

October 29, 1987

TO: Everyone with an interest in the future of Minnesota's fisheries resource.

FROM: Planning Team, Minnesota Division of Fish and Wildlife

WHAT: Long Range Plans for Fisheries Management.

WHY: Improving the long range planning for fisheries management.

WHEN: Review period ends February 1, 1988.

HOW: Use the forms provided at the end of each plan, or a letter addressed to: FISH PLAN
Minnesota Department of Natural Resources
500 Lafayette Road
St. Paul, MN 55155-4025

(use this address to get additional plans, or information regarding the planning process).

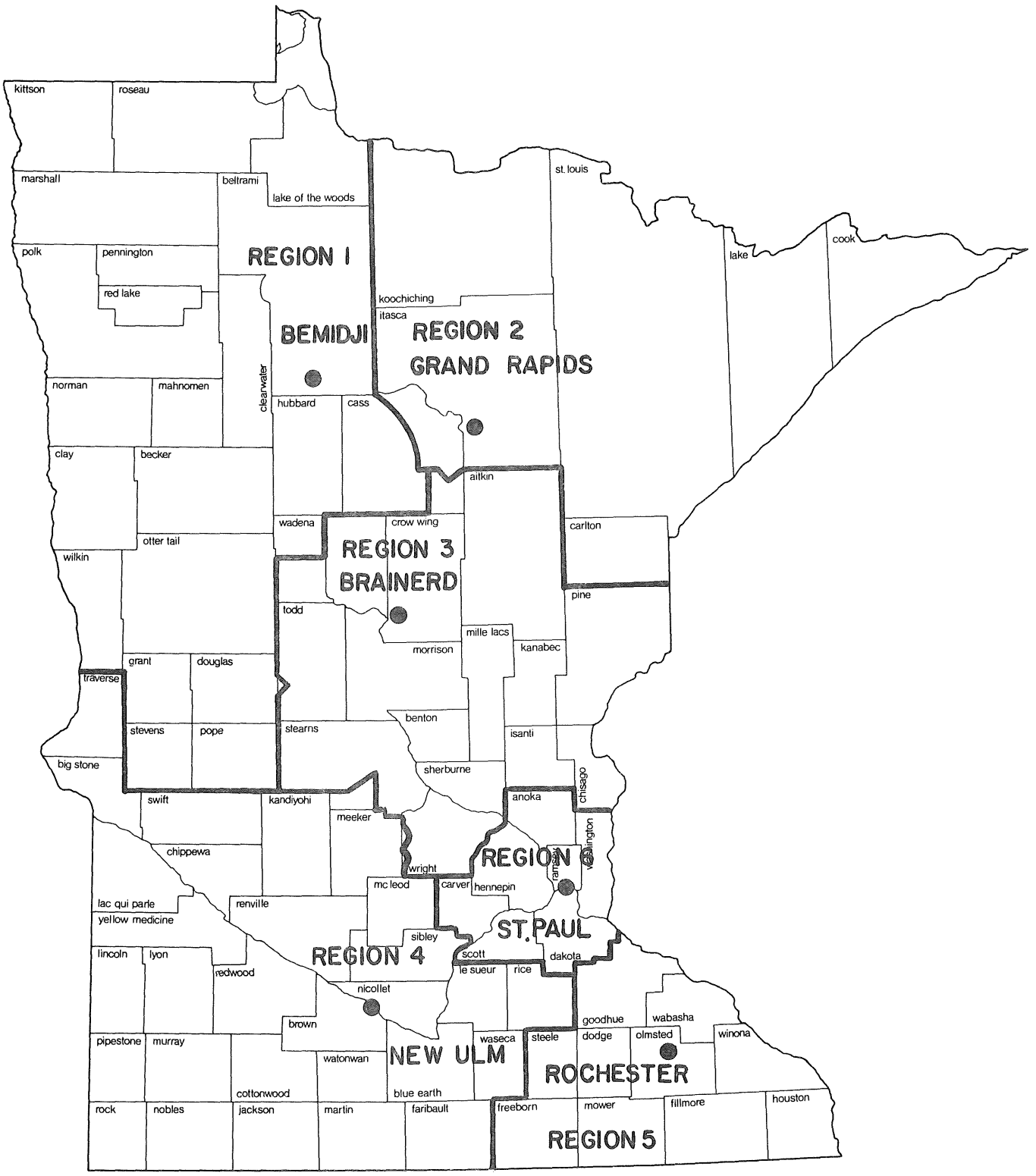
This package contains the proposed Minnesota Department of Natural Resources (DNR) Long Range Plans for fisheries management. The plans are preliminary at this time, and we are inviting comments from everyone with an interest in management of the fisheries resource. There is a form at the back of each plan to facilitate your response, or you can send a letter to the address given above.

The plans provide a brief narrative describing the resource, followed by a section outlining the goals, objectives, problems and strategies that we expect to face in the next 6 years of managing the species, or groups of species. The goals and objectives provide the direction for management to take. The problems are obstacles foreseen in attaining the objectives, and the strategies are suggested ways in which the problems may be overcome. The plans were written by committees of fish management experts and reviewed by Department personnel. It is the wish of the DNR to have all interested persons make suggestions to be considered before the plans are put into operation. In reviewing, remember that the plans were written to address problems on a regional or statewide basis, and not to address the problems of an individual lake or river. Local problems are addressed in plans available from the Area Fisheries Supervisor for a specific area in question.

Long range plans for wildlife management will be published in early 1988.

We invite your continuing participation in the planning process!

Contents



Regions and Regional Offices for the Section of Fisheries, Division of Fish and Wildlife, Minnesota Department of Natural Resources.

7/87

1. Walleye & Sauger

Walleye (Stizostedion vitreum vitreum) is Minnesota's official state fish, whose delectable flesh and desirability as a trophy combine to make it the state's most sought after fish species.

The sauger (S. canadense), a small walleye look-alike that is sometimes known as sand pike, is mentioned where applicable in the following text.

Resource Management

During the 1950s and 1960s, resident angling license sales approached 1 million, and angling became the foremost statewide recreational activity. The average angler was not very mobile and for the most part fished locally.

Most of the Department of Natural Resources (DNR) Section of Fisheries working time was committed to walleye rearing and stocking. Little effort was spent on studying the biology, ecology, or angler harvest of the walleye. Habitat protection and water quality were only occasionally considered as issues. The major walleye regulations were creel limits and season restrictions.

Management changed when the Dingell-Johnson Restoration Project was incorporated into fish management activities in 1951, and major programs for lake and stream surveys were initiated.

Fisheries management during the past 25 years has escalated to meet angler demands. Fishing magazines, angler groups, tournaments, and television have changed the concept of sport fishing. More anglers want to catch more and especially larger walleyes.

An historical review of creel surveys indicates that the number of anglers and time spent fishing has increased 3 to 4 times. Summer fishing pressure has increased by more than 440 percent on Lake Winnibigoshish from 1939 to the mid-1950s and over 60 percent from the 1950s to the 1970s. This is an increase of 771 percent from 1939 to the 1970s.

On some of the larger walleye lakes, such as Mille Lacs and Winnibigoshish, anglers are dissatisfied with the size of the fish caught. Lake Winnibigoshish creel surveys have documented that the walleye yields have increased, while the age and size of fish caught has declined over the past 40 years. The smaller fish size continues to cause dissatisfaction among state anglers.

Many anglers believe that stocking walleye in a lake is important to improve angling. Because fry stocked in the spring and fingerlings in the fall take 3 to 4 years to become 1-pound fish, stocking of fish is not an overnight cure to poor fishing. It is only a partial answer to remedy walleye catch rates. Other factors such as high forage abundance, lake clarity, fish distribution and/or the angler's ability all affect walleye fishing success.

Regulations such as possession limits and season restrictions are still the primary management tools, but special regulations are gaining importance. Maximum size limits for walleye are currently being evaluated on some lakes.

Resource Analyses

Walleye inhabit more than 1,700 lakes with nearly 2 million acres of water, and more than 100 warm-water streams

encompassing nearly 3,000 miles. Sauger are present in Lake of the Woods, Rainy Lake, Lake Kabetogama, and in the St. Croix, Minnesota, and Mississippi River drainages below the Coon Rapids Dam.

Creel surveys were conducted during the 1970s and 1980s to gather harvest and pressure data on 10 lakes larger than 15,000 acres. These lakes comprise more than 800,000 acres of natural walleye water and are fished at the rate of 4.9 million hours annually during the open water season (6.1 hours/acre). The overall walleye catch rate for these lakes is 0.22 walleye per hour, or 1 walleye for every 4.5 hours fished.

On 11 lakes of 1,000 to 15,000 acres the fishing pressure was estimated at 800,000 hours annually, averaging 14.4 hours/acre. The overall catch rate was 1 walleye per 8.5 hours of fishing. Forty years of creel surveys reveal an average annual lake harvest of 3.5 million walleye weighing 4.0 million pounds.

Opportunities for stream and river angling exist on more than 3,000 miles of water for walleye and 675 miles for both walleye and sauger. Documentation on the number of walleye and sauger anglers, number of hours spent fishing, and harvest on the streams and rivers needs improvement.

A heavy burden is being placed upon the walleye resource, but many of the problems cannot be attributed solely to fishing pressure. Long-term pollution from heavy metals and PCBs have resulted in fish consumption advisories. Non-point agricultural run-off has been another major factor in the deterioration of water quality. Intensive lakeshore development has degraded lakes by increasing siltation, accelerating eutrophication, and removing valuable fish habitat. In some areas, walleye spawning habitat has been lost because of poor shoreline management.

Resource Value

Walleye fishing contributes more than $500 million annually to the state's economy. No other state in the nation offers a comparable walleye fishery.

Long Range Planning for Walleye and Sauger

PRODUCT: Provide suitable walleye and sauger populations for the state's resource shareholders.

GOAL: Manage the fishery for optimum yield to provide the walleye and sauger angler with an opportunity to experience quality fishing while protecting the resource for future generations.

OBJECTIVE 1. To maintain and enhance current walleye and sauger fishing, harvest, and populations in lakes comprising nearly 2 million acres of water, and over 3,000 miles of major streams (Table 1-1).

Table 1-1. Distribution of Walleye and Sauger Habitat by DNR Fisheries Region

	FISHERIES REGION						
	1	2	3	4	5	6	Total
LAKES							
Number	475	670	375	175	2	56	1,753
Acres (thousands)	282	339	188	140	25	26	1,000
Small Lakes *							
Large Lakes **	561	248	132	--	--	14	980
Total Acres (thousands)	843	587	320	140	25	40	1,955
Percent	43	30	16	7	1	2	99
STREAMS							
Number	21	51	31	16	4	4	127
(miles)	630	1,250	790	311	168	112	3,261
Percent	19	38	24	10	5	3	99

* Lakes under 15,000 acres
** Lakes over 15,000 acres

OBJECTIVE 2. To provide 13 million angler days of walleye and sauger angling opportunities through 1992 (Table 1-2).

Table 1-2. Distribution of Fishing Pressure by Fisheries Region

	FISHERIES REGION						
	1	2	3	4	5	6	Total
ANGLER DAYS (million)	4.4	2.9	2.4	1.0	1.1	1.3	13.1
Percent	34	22	18	8	8	10	100
ANGLER HOURS/ ACRE	5.2	4.9	7.5	7.1	44.0	32.5	6.7

OBJECTIVE 3. To maintain current estimated annual walleye and sauger angling harvest of 4 million pounds (Table 1-3).

Table 1-3. Distribution of Walleye and Sauger Harvest by Fisheries Region

	FISHERIES REGION						
	1	2	3	4	5	6	Total
POUNDS (Thousands)	1,686	880	639	420	51	81	4,051
Percent	42	29	16	10	1	2	100
POUNDS/ACRE	2.0	1.5	2.0	3.0	2.0	2.0	---

PROBLEM 1. Walleye and sauger habitat protection, maintenance, and improvement are inadequate in lakes and streams.

STRATEGY A. Identify, monitor, and protect physical and chemical habitat for walleye and sauger.

STRATEGY B. Cooperate with other agencies in establishing and administering flow regimes and water levels on rivers, lakes, and reservoirs to enhance the walleye and sauger life cycle.

STRATEGY C. Provide information on and protect vital walleye and sauger habitat requirements when participating in aquatic permit and environmental review.

STRATEGY D. Cooperate with Minnesota's Pollution Control Agency (PCA) and Public Health Department by supplying walleye and sauger samples for detecting freshwater contamination and identify sources.

STRATEGY E. Work with appropriate agencies regarding lake and riparian zoning to protect fish habitat.

STRATEGY F. Encourage adequate funding to improve lake and rivers habitat.

PROBLEM 2. Data on the economic value of the walleye and sauger sportfishery and cost benefit of the management programs is insufficient.

STRATEGY A. Develop and implement methodology to monitor the economic value of the walleye and sauger fishery.

STRATEGY B. Develop cost-benefit analysis of walleye and sauger management programs to evaluate their effectiveness.

PROBLEM 3. Biological data and knowledge of the population dynamics, stock structure, and the annual harvest of walleye and sauger are needed to carry out management programs.

STRATEGY A. Continue walleye and sauger population assessment for management evaluation.

STRATEGY B. Investigate community dynamics in natural and manipulated walleye-sauger ecosystems.

STRATEGY C. Develop methodology to determine walleye and sauger potential yield for each of the 9 lake ecological classifications and river systems.

STRATEGY D. Develop population models and programs to analyze walleye and sauger recruitment by geographic areas of the state.

STRATEGY E. Explore alternative methods and programs for enhancing walleye and sauger population structures.

PROBLEM 4. Heavy fishing pressure on some walleye and sauger lakes has reduced fishing quality and angler satisfaction.

STRATEGY A. Emphasize existing quality walleye and sauger angling opportunities statewide to distribute fishing pressure.

STRATEGY B. Encourage access opportunities to additional walleye and sauger lakes and rivers where inadequate.

STRATEGY C. Initiate voluntary catch-and-release programs to educate walleye anglers on the value, techniques, and proper size of fish to release.

STRATEGY D. Initiate modifications of walleye angling regulations, such as night fishing bans, slot limits, and limited entry for altering harvest and pressure to produce quality opportunities.

STRATEGY E. Quantify walleye angler satisfaction by developing and implementing angler surveys.

PROBLEM 5. Information is needed on the impact of walleye stocking on walleye populations and aquatic communities.

STRATEGY A. Implement studies to measure the effectiveness of walleye stocking.

STRATEGY B. Implement studies on the effects of walleye stocking on aquatic communities.

STRATEGY C. Implement studies on the genetic structure of natural walleye populations.

STRATEGY D. Improve the effectiveness of the walleye production and distribution program, including hatchery controls to match the environment.

STRATEGY E. Establish guidelines for walleye stocking rates based on ecological habitat classification.

PROBLEM 6. Sharing of border water with 4 states and 2 provinces requires cooperation in walleye and sauger management.

STRATEGY A. Cooperate with other agencies responsible for fish management on border waters.

STRATEGY B. Cooperate with state, provincial, federal and international agencies to establish water levels on border waters to minimize effect on the walleye and sauger life cycle.

PROBLEM 7. Communication with the public concerning walleye and sauger management is inadequate.

STRATEGY A. Develop information and education programs to inform the public on fish research and management activities.

STRATEGY B. Inform the public, resort industry, legislature, and other stakeholders on fisheries programs and statistics.

STRATEGY C. Encourage fisheries personnel to understand more about their clientele's needs so they can relay more relevant information regarding walleye management.

STRATEGY D. Educate the public concerning recreational opportunities and fishing quality that is being lost as a result of deteriorating water quality and fish habitat.

STRATEGY E. Cooperate with various volunteer groups to foster sound walleye and sauger management programs.

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
500 Lafayette Road
St. Paul MN 55155-4025

FISH, WILDLIFE & NATIVE PLANT RESOURCES
LONG RANGE PLAN

The Division of Fish and Wildlife is inviting comments from individuals and organizations on the Long Range Plans for the management of fish, wildlife and native plant resources. Use this form, or write us a letter, telling us how we can improve the plan (or plans) you have reviewed.

Plan Name:_____

Comments:_____

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Your name:_____

Address:_____

_____

_____

Are these the official comments of this organization?__Yes __No

Organization:_____

Thank you for your comments.
To mail: fold & seal with tape, or place in envelope.

2. Lake Trout

The lake trout (Salvelinus namaycush) has qualities and characteristics that make it unique among Minnesota fish resources. This species offers trophy fishing in many cold, deep, and relatively infertile waters of Minnesota.

Lake trout provide multiple benefits: They are sought as a trophy, as fine table fare, and as a fine sportfish that can provide a lot of action during all seasons.

Lake trout are sensitive to habitat degradation and need special management consideration, such as protection from overharvest, because they are slow to mature and reproduce. In addition, their habitat requirements are narrow, limiting their distribution and making them susceptible to habitat degradation.

Lake trout attain the largest size of all native North American trout. The Minnesota state record lake trout weighed 43.5 pounds and was caught in Lake Superior. Some lake trout weighing more than 30 pounds are caught occasionally in inland Minnesota lake trout waters.

Lake trout are found in Minnesota's portion of Lake Superior (1,416,000 acres) and at least 112 inland lakes. Ninety-eight of these lakes (62,300 acres) lie entirely within Minnesota's borders and 80 are within the Boundary Waters Canoe Area Wilderness (BWCAW). The other 14 lakes (56,950 acres) are the shared fisheries management responsibility of Minnesota and Ontario.

Resource Management

Within the United States the greatest responsibility for perpetuating and managing the inland lake trout resource lies in Minnesota, New York, and Maine. Minnesota ranks second in numbers of lake trout lakes and fourth in total acreage of lake trout water. The management of inland lake trout populations is primarily through stocking, regulations, population manipulation, and habitat protection.

The state hatchery system is a vital component of Minnesota's lake trout management program. Improved incubation and culturing equipment and techniques have helped fish culturists reduce the incidence of disease, increase survival rates, raise significantly larger fish, raise wild and native strains of lake trout, and retain wild and native brood stocks for future production.

Presently, Minnesota has 35 known native lake trout lakes, referred to as Heritage Lakes, that deserve special management consideration. Lake trout have been stocked in many lakes outside of their original range with varying degrees of success. Seventy-two lakes have been stocked with lake trout within the past 10 years. There are 26 lakes managed for lake trout along with other species such as rainbow trout and walleye. Smallmouth bass and walleyes introduced into many inland lake trout lakes in northeastern Minnesota appear to have caused lake trout populations in some of these lakes to suffer from interspecific competition. Efforts to reduce the abundance of coregonids, such as cisco and whitefish, have produced inconclusive results.

A statewide inventory of lakes suitable for lake trout management was made in 1967. Since that time 3 lakes in Cook County--Birch, Mayhew, and Moss--were chemically rehabilitated and stocked with lake trout. Nine lakes

ceased being managed as lake trout lakes and 28 lakes were identified as having potential for lake trout management.

The highly successful and prized catches of lake trout in Lake Superior came to an abrupt halt with the invasion and subsequent buildup of the sea lamprey population in the early 1950s. The lake trout population, already stressed by exploitation, was decimated.

A rehabilitation program for lake trout in Lake Superior, under the auspices of the Great Lakes Fishery Commission, was started in 1962. It is subscribed to by all state and provincial jurisdictions on Lake Superior, and is organized to reestablish self-sustaining lake trout populations. Intensive lamprey control conducted by the U.S. Fish and Wildlife Service has controlled the predatory lamprey since the 1960s at less than 10 percent of its peak population and enabled small- to middle-sized lake trout to survive. Lamprey are still a major mortality factor of large mature lake trout.

Lake trout populations in Lake Superior have increased in response to a combination of regulations, stocking, and lamprey control. Population levels may be leveling off in response to stabilized stocking levels and increased sport harvest.

More than 90 percent of lake trout caught over 17 inches in length are of hatchery origin. Evidence of increasing natural reproduction has been noted recently, presumably because of increasing numbers of fish living long enough to spawn. Juvenile native lake trout abundance has increased and now composes 18 percent of fish less than 17 inches sampled.

Lake trout populations isolated in various northeastern Minnesota lakes and Lake Superior may have developed differing characteristics favoring survival under a variety of conditions. Evaluations are being conducted in 4 northeastern Minnesota lakes and Lake Superior to determine

what size and strain of stocked lake trout maximizes survival, growth and reproduction. These evaluations will help determine the most cost-effective strains and sizes of lake trout to stock. We should then be able to tailor lake trout stocking plans to individual lake trout lakes.

Commercial Fishery

Commercial fishing for lake trout is closed in Minnesota waters of Lake Superior except for assessment purposes. A charter boat sportfishing industry is developing. State charter boat captain licenses were first required in 1985 and 32 were issued that year.

Harvest of lake trout by Indians occurs in Lake Superior adjacent to the Grand Portage Indian Reservation, but the annual take is not documented. Litigation on Indian fishing rights under the treaty of 1854 is presently underway.

Resource Analyses

Minnesota lake trout populations are concentrated in 3 northeastern counties and Lake Superior. Excluding Lake Superior, the 112 lakes managed wholly or in part for lake trout represent 2.5 percent of Minnesota's 4,445 managed fish lakes. An additional 70 lakes have been identified as having lake trout management potential.

Supply

The annual supply of lake trout available for stocking from the state hatchery system is 100,000 fingerlings and 380,000 yearlings. An additional 200,000 to 300,000 yearlings have been available from the federal hatchery system in support of the lake trout rehabilitation program in Lake Superior. Natural reproduction is an additional source of fish, but its magnitude and potential is not fully documented.

Supply increases could conceivably come from 1) new or expanded hatchery facilities, 2) more efficient stocking strategies resulting from ongoing size and strain evaluations, and 3) increased natural reproduction. Decreases could result from 1) loss of facilities, 2) allocation changes in the distribution of federally raised fish, 3) loss of natural reproduction due to reduced number of adults or habitat degradation, or 4) increased harvest.

Demand

Lake Superior fishing pressure has increased from an average of 22,000 angler hours per year from 1970-1972, to 344,000 per year during the summers of 1983 and 1984. The lake trout catch on Lake Superior has increased from an average of 427 fish per year in 1970-72, to an average of 25,600 fish per year during 1983 and 1984. Most anglers (80 percent) fishing Lake Superior are from Duluth or other North Shore communities.

Demand is not adequately documented on the inland lake trout resource. Limited data from the Grand Marais area indicated stable pressure on lakes within the BWCAW during the winter (1 angler hour per acre). Pressure on lakes outside the BWCAW has increased from 4.2 angler hours per acre in the 1960s and 1970s to 7.9 anglers hours per acre in the 1980s. Current data on the summer inland lake trout fishery is not available.

Resource Value

Benefits derived from Minnesota's inland lake trout program cannot be quantified due to lack of comprehensive use surveys. On Lake Superior, an average of 344,000 angler-hours (94,516 trips) per year were expended during the summer months in 1983 and 1984. Given that lake trout have composed 70 to 80 percent of the catch, the fishing was

primarily generated by lake trout. Benefits in income derived can be estimated based on a nationwide average of $34 generated per trip. The Lake Superior sportfishery generates almost $2,500,000 of which 70 to 80 percent could be attributed to lake trout.

Long Range Planning for Lake Trout

PRODUCT: Populations of lake trout for their use, appreciation, and ecological values.

GOAL: Protect and enhance statewide lake trout populations to meet the demand for fishing by present and future generations.

OBJECTIVE 1. Maintain the genetic integrity of the phenotypes of discrete native lake trout populations.

PROBLEM 1. There is a lack of knowledge concerning taxonomy and population genetics of existing native lake trout populations.

STRATEGY A. Examine lake trout populations electrophoretically to determine taxonomic status.

STRATEGY B. Protect genetic integrity of lake trout in 35 Heritage Lakes and develop public support for native lake trout populations in Heritage Lakes.

STRATEGY C. Enforce special lake trout fishing regulations on Heritage Lakes as necessary to protect the native lake trout populations.

STRATEGY D. Review lake survey and other historical information regarding lake trout populations in Heritage Lakes.

STRATEGY E. Stock only lake trout of the same genotype found in Heritage Lakes.

STRATEGY F. Ensure genetic integrity of lake trout in some Heritage Lakes by not stocking any lake trout into self-sustaining populations.

PROBLEM 2. Lake trout populations are potentially threatened with environmental degradation.

STRATEGY A. Identify and monitor potential environmental problems relating to lake trout.

STRATEGY B. Eliminate adverse environmental conditions relating to lake trout.

PROBLEM 3. There is a lack of access to assess lake trout populations within the Boundary Waters Canoe Area Wilderness (BWCAW).

STRATEGY A. Develop cooperative agreement with the U.S. Forest Service (USFS) to provide access for assessment of lake trout populations.

OBJECTIVE 2. Attain lake trout management capability to meet fishing demand by 1992.

PROBLEM 1. There is a lack of knowledge concerning lake trout populations.

STRATEGY A. Review new techniques for lake trout resource assessment.

STRATEGY B. Develop population models for lake trout.

STRATEGY C. Assess environmental conditions of lake trout habitat according to lake management

plans.

PROBLEM 2. There is not enough knowledge concerning fishing opportunities for lake trout populations.

STRATEGY A. Attempt to quantify present angler demand of the lake trout resource as well as estimate and monitor future trends.

STRATEGY B. Evaluate impact of current uses of lake trout populations.

STRATEGY C. Conduct population assessments on existing and potential lake trout lakes according to lake management plans.

OBJECTIVE 3. To maintain the existing lake trout populations until new objectives are identified.

PROBLEM 1. The supply of appropriate lake trout for the lake trout management program is not consistent.

STRATEGY A. Develop or acquire additional lake trout hatchery facilities.

STRATEGY B. Reduce dependence on federally supplied lake trout.

STRATEGY C. Manage for self-sustaining populations of lake trout where appropriate.

STRATEGY D. Identify and protect suitable strains for lake trout brood stock purposes.

STRATEGY E. Develop additional brood stock lakes

for lake trout by stocking desired strains in other lakes.

STRATEGY F. Stock lake trout of appropriate size and densities to ensure optimum return to anglers.

PROBLEM 2. Treaties may allow harvest of lake trout in Lake Superior by Indian bands.

STRATEGY A. Evaluate the potential impact of existing Indian treaties, regulations, and harvest on lake trout populations in Lake Superior and other areas.

PROBLEM 3. Sea lamprey continue to pose a problem to lake trout survival in Lake Superior.

STRATEGY A. Maintain lamprey control and lake trout assessment efforts.

STRATEGY B. Coordinate lake trout rehabilitations and lamprey control with Great Lakes Fisheries Commission.

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Are these the official comments of this organization?__Yes __No

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Thank you for your comments.
To mail: fold & seal with tape, or place in envelope.

3. Stream Trout

There are 3 species of stream trout, 1 trout hybrid, and numerous strains of trout managed in Minnesota: rainbow trout (Salmo gairdneri), brown trout (S. trutta), brook trout (Salvelinus fontinalis) and splake (Salvelinus namaycush X Salvelinus fontinalis). Brook trout are native, rainbow and brown trout were introduced in the late 1800s, and splake, in 1962.

Resource Management

The first tool in stream trout management was stocking, which dates back to the late 1800s in Minnesota. Later management emphasized inventory, protection, and enhancement of trout habitat. As a result, the management of "wild trout," which complete their entire life cycle within the natural environment, has increased in importance.

Stream trout have stringent environmental requirements. As indicators of cold, highly oxygenated, pollution-free water, stream trout reflect quality habitat and have a high management priority.

Stream trout are found in 623 designated trout streams totalling 2,600 miles, 164 designated stream trout lakes (approximately 7,000 acres) and Lake Superior (1.4 million acres).

Minnesota's portion of Lake Superior has 154 miles of coastline with 179 tributary streams. Anadromous rainbow

(steelhead), brook (coasters), chinook salmon, coho salmon, Atlantic salmon, and brown trout inhabit Lake Superior and tributaries.

Habitat improvement, stocking, and regulations are the tools most often used in stream trout management. Habitat programs have improved more than 325 miles of trout streams in the last 40 years. Stream trout are managed in 173 lakes which have been reclaimed and stocked.

The Minnesota Legislature established a trout stamp in 1981 to fund stream trout habitat improvement. The Legislature expanded the trout stamp in 1984 to include designated stream trout lakes and Lake Superior and expanded use of the fund to include stocking. Trout stamp sales have increased from 42,412 in 1982 to 65,000 in 1986. Resource 2000 appropriations (Trout Stream Easements and Access) and a fishing license surcharge in 1985 have provided additional funding sources for stream trout management.

Resource Distribution

Region 1 (Northwest)

Region 1 has 130.7 miles of trout streams, which is relatively few. However, included among them is the well-known Straight River in the Park Rapids area. Fishing pressure is light (100 hours/mile of stream) on 67 percent of the streams and moderate (100-500 hours/mile of stream) on 26 percent of the streams. Seven percent of the streams receive heavy fishing pressure (500 hours/mile of stream).

Seventy percent of the streams contain brook trout; 37 percent, brown trout; and 1 stream, rainbow trout. The majority of trout water (62 percent) contains a mixture of wild and stocked fish.

Region 2 (Northeast)

Region 2 has the most trout streams. Its 1,582 miles

of fishable streams contain all of the state's anadromous trout fisheries. Sixty-four percent of the stream miles are classified as wild trout water. Only 1 percent of the stream miles have solely stocked fish.

The supply exceeds demand for stream trout in this region, with the exception of streams containing anadromous trout populations. The reasons for this are: 1) the region has a large lake resource, and 2) many streams contain populations of small brook trout that are lightly fished.

Fishing pressure for the spring anadromous fishery on 37 North Shore streams is increasing. Fishing hours totaled 60,015 in 1982, an increase of 380 percent since the 1960s. The Knife River accounted for more than 30 percent of the total estimated hours. Harvest rates by stream ranged from 0.02 to 1.67 fish per hour. Rainbow trout were the most commonly taken migratory fish with total harvest estimates of 3,021 and 2,561 in 1981 and 1982, respectively.

Region 3 (Central)

Region 3 has 211.9 miles of trout streams containing brook trout, brown trout, and rainbow trout. Fishing pressure is either unknown, nonexistent, or light on 89 percent of the streams. Only 5 percent of the stream miles rely solely upon stocked trout. The remainder consisted of wild (57 percent) or wild and stocked (38 percent) fish.

Region 4 (Southwest)

Region 4 relies totally on stocked brown trout for its 10 trout streams. The region contains 34 stream miles and 3 lake acres. Fishing pressure is unknown on 7 streams, light on 2 streams, and moderate on 1 stream. Eight of 10 streams have been surveyed and assessed since 1970.

Region 5 (Southeast)

The 591 miles of trout streams and 1.3 acres of stream

trout lakes are an important fishery in Region 5. Brown trout are the major species present, although many streams contain brook trout and a few contain stocked rainbow trout. Trout standing crops are 100 lbs. per acre on high quality streams and can be over 300 lbs. per acre on excellent streams. Thirty-four percent of the stream miles have wild trout, 48 percent have a mixture of wild and stocked trout, and 18 percent rely solely on stocked trout. Most streams (91 percent) have survey/assessment information from the 1980s. Fishing pressure is characterized as heavy on 23 percent, moderate on 28 percent, and light on 43 percent of the streams (4 percent unknown).

Streams tributary to the Whitewater River have been historically popular for trout fishing. Fishing pressure from 1972 to 1977 ranged from 727 to 2,112 hours per mile. Fishing pressure on Whitewater streams from 1981 through 1985 ranged from 656 to 1,938 hours per mile. Harvest rates ranged from 0.15 to 0.46 fish per hour.

Fishing pressure on Hay Creek in Goodhue County increased from 560 hours per mile in 1975 to 1,122 hours per mile in 1983. Harvest also increased from 113 fish per mile in 1975 to 215 fish per mile in 1983.

Region 6 (Metro)

Region 6 has 11 trout streams, of which 8 are small wild brook trout streams, that total 13.5 miles. One is a stocked brown trout stream and another has low populations of brook and brown trout. One stream has naturally reproducing populations of brown, brook, and rainbow trout. Eighty-five percent of the stream miles contain wild trout, while 15 percent of the stream miles contain only stocked trout. Fishing pressure is light on 9 streams, moderate on 1 stream, and nonexistent on 1 stream.

Lake Management

The 164 lakes managed for stream trout are stocked annually with approximately 93,000 brook trout, 21,000 brown trout, 400,000 rainbow trout, and 148,000 splake.

Annual fishing pressure on managed stream trout lakes varies from light --10 to 12 man hours per acre on some remote Boundary Water Canoe Area Wilderness (BWCAW) lakes-- to heavy (635 man-hours per acre on Courthouse Lake, Carver County, an intensively managed lake in a heavily populated area). The heaviest use is often on those lakes that are isolated from other stream trout lakes or near large population centers.

When lakes are managed for stream trout, fishing pressure is often intense, especially during the first 2 weeks of the spring and winter seasons. The yield of stream trout from these lakes can be much higher than the naturally occurring species.

The stream trout harvest in lakes varies from less than 1 fish per 100 hours of fishing to more than 1 fish per 3 hours. Major factors influencing catch rates are fish abundance, fishing pressure, and lake size. The highest stream trout catch rate is on readily accessible lakes of low productivity managed for brook trout, while the lowest catch rate is on highly productive lakes managed for brown trout.

Resource Analyses

Angler use of stream trout resources is increasing. Demand is highest for trout in streams in the southeast portion of the state and anadromous fish in the Lake Superior watershed.

Most areas of the state have a limited number of trout streams and lakes. However, potential for increased supply does exist if area streams are enhanced by habitat improvement.

In recent years there has been an increase in the supply and demand of stream trout lakes. Demand for stream trout lakes has been created by increasing the supply through reclaiming non-productive lakes and stocking them with stream trout. The stocking of abandoned mine pits has been especially popular, and once the public is exposed to this fishing, the demand for additional opportunities increases.

Resource Value

Stream trout fishing composes approximately 5 percent of the total angling public (based on trout stamp sales). Stream trout anglers in 1980, through licenses, food, lodging and equipment purchases, spent approximately 18 million dollars.

Stream trout have stringent environmental requirements. As indicators of cold, highly oxygenated, pollution-free water, stream trout benefit not only the angler, but every Minnesota citizen. As such, they have always had a high management priority.

Long Range Planning for Stream Trout

PRODUCT: Opportunity for use and appreciation of the stream trout resource.

GOAL: Maintain and enhance opportunity for public use and appreciation of the stream trout resource.

OBJECTIVE 1. Attain catch rate of 0.25 fish (10 inches or larger) per hour for brown and rainbow trout; 0.50 fish per hour for brook trout; and maintain catch rates of 0.10 fish per hour for Lake Superior stream trout.

PROBLEM 1. Heavy fishing pressure can reduce stream trout catch rates below acceptable levels.

STRATEGY A. Redirect stream trout anglers to lightly fished waters.

STRATEGY B. Increase stream trout fishable areas by obtaining additional stream access.

STRATEGY C. Increase stream stocking rates of stream trout in heavily fished streams.

STRATEGY D. Change species of stream trout being managed to attain higher catch rates.

STRATEGY E. Adapt special regulations to fully utilize the stream trout populations.

STRATEGY F. Reduce fishing pressure for stream trout by restricting use (such as limiting access parking, bait, and gear restrictions).

PROBLEM 2. Poor growth of some trout strains results in low numbers of acceptable size stream trout.

STRATEGY A. Investigate methods such as manipulating diet and temperature to improve growth in slow growing stream trout.

STRATEGY B. Determine genetic strains of stream trout most suited to Minnesota environment.

STRATEGY C. Alter regulations on individual waters when applicable to manage for specific stream trout strains.

PROBLEM 3. Hatchery production of stream trout is inadequate to meet the objectives.

STRATEGY A. Produce an additional 32,000 rainbow trout yearlings and 75,000 brook trout fingerlings, and 50,000 splake for stocking in stream trout lakes; 1 million steelhead fry, 30,000 rainbow trout yearlings, 200,000 brown trout fry and 200,000 brook trout fingerlings for North Shore streams annually.

STRATEGY B. Implement proposed plans for upgrading stream trout hatcheries.

STRATEGY C. Modernize stream trout hatchery facilities beyond currently planned projects.

STRATEGY D. Purchase or develop additional stream trout hatchery facilities as required for increased production.

PROBLEM 4. Hatchery production of proper strain and size of fish for inland and Lake Superior stocking is insufficient to meet demand.

STRATEGY A. Rear anadromous stream trout for Lake Superior stocking only at French River.

STRATEGY B. Acquire eggs of wild trout from other states.

STRATEGY C. Increase number of anadromous broodstock available to the French River Hatchery.

STRATEGY D. Encourage production of migratory strains of rainbow such as Kamloops for stocking in Lake Superior.

PROBLEM 5. Inadequate public knowledge regarding angling opportunity limits stream trout use.

STRATEGY A. Direct anglers to lightly fished stream trout waters.

STRATEGY B. Develop and distribute brochures promoting stream trout management and fishing opportunities in Minnesota.

OBJECTIVE 2. Maintain the fishing opportunity on the lakes presently managed for stream trout.

PROBLEM 1. Stream trout populations and water quality capable of supporting stream trout are not sufficiently maintained.

STRATEGY A. Cooperate in keeping designated stream trout water free from point and nonpoint pollution discharges by reporting any problems to regulatory agencies.

STRATEGY B. Cooperate with the Pollution Control Agency and Minnesota Department of Agriculture to educate land users adjacent to stream trout water on the best land use practices to control runoff.

STRATEGY C. Obtain and evaluate stream trout of proper size and strain for stocking.

STRATEGY D. Keep undesirable fish species from becoming established in waters managed for stream trout.

STRATEGY E. Chemically rehabilitate stream trout waters only when necessary.

STRATEGY F. Obtain proper public access to stream trout waters by purchasing and developing when needed.

OBJECTIVE 3. Provide additional opportunities for stream trout fishing by identifying and stocking an additional 50 lakes and mine pits by 1992.

PROBLEM 1. Lakes and mine pits environmentally suitable for stream trout need to be identified and described.

STRATEGY A. Take inventory of watersheds for stream trout habitat resources.

STRATEGY B. Survey stream trout lake resources for summer temperatures.

STRATEGY C. Test strains of stream trout that reportedly have high upper lethal temperature limits.

STRATEGY D. Monitor water quality in stream trout waters in low alkalinity regions.

STRATEGY E. Monitor water quality in low stream trout winterkill situations.

STRATEGY F. Acquire and develop new stream trout lakes and ensure adequate public access.

OBJECTIVE 4. Provide quality cold water aquatic communities by maintaining 325 miles of improved stream trout streams and improve the habitat in an annual average of 30 miles of trout streams per year.

PROBLEM 1. Poor habitat quality results from improper land and water use on watersheds containing stream trout resources.

STRATEGY A. Promote development and enforcement of existing local zoning ordinances to protect watersheds and stream trout habitat.

STRATEGY B. Maintain existing statutes that protect watersheds containing stream trout resources.

STRATEGY C. Seek legislation to limit environmental degradation of watersheds and stream

trout resources.

STRATEGY D. Educate watershed landowners on effect of improper land use on stream trout resources.

STRATEGY E. Improve interagency cooperation on regulating water appropriation and discharge permits for stream trout waters.

PROBLEM 2. Some stream trout habitat improvement techniques have not been fully tested and evaluated for their effectiveness.

STRATEGY A. Design research to measure the effectiveness of stream trout habitat improvement techniques.

STRATEGY B. Test and evaluate hypolimnetic aeration and mid-water discharge systems to enhance stream trout habitat.

PROBLEM 3. High beaver populations may result in destruction of stream trout habitat.

STRATEGY A. Investigate and employ effective means of beaver control on stream trout waters.

STRATEGY B. Educate the public on negative effects of beaver on trout streams.

STRATEGY C. Encourage contracting for beaver removal and provide information on beaver concentrations to trappers.

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
500 Lafayette Road
St. Paul MN 55155-4025

FISH, WILDLIFE & NATIVE PLANT RESOURCES LONG RANGE PLAN

The Division of Fish and Wildlife is inviting comments from individuals and organizations on the Long Range Plans for the management of fish, wildlife and native plant resources. Use this form, or write us a letter, telling us how we can improve the plan (or plans) you have reviewed.

Plan Name: _____

Comments: _____

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Your name: _____

Address: _____

_____

_____

Are these the official comments of this organization? __Yes __No

Organization: _____

Thank you for your comments.
To mail: fold & seal with tape, or place in envelope.

4. Salmon

Salmon include all species of the genus Oncorhynchus and the Atlantic salmon (Salmo salar). They are anadromous fish that mature in the ocean and spawn in fresh-water streams, but they can also mature in fresh-water lakes. Salmon require cold water and high oxygen levels and have been stocked primarily in Lake Superior where the habitat is suitable. Plants of coho salmon in inland waters have not satisfied program goals and were discontinued. The Minnesota Department of Natural Resources (MDNR) has an active management program in Lake Superior for Atlantic and chinook salmon that contributed $1.4 million into the regional economy in 1984.

Resource Management

In Lake Superior, salmon must share habitat with lake trout and rainbow trout--the current high-priority species. The quantity and availability of forage resources are not well understood, so management objectives for these predators must be conservative. Stocking must be thoroughly assessed to determine the impact on other fish species in Lake Superior.

Lake Superior's size makes it difficult to determine the supply of salmon for angler harvest. Currently, state hatcheries can provide 300,000 to 400,000 fish annually. Statistics such as spawning returns and angler catch are indirect indicators of supply and have been highly variable

for all salmon species. It is unclear whether the variation is due to differences in survival or movements of the stocked fish.

Lake Superior's salmon are sought by both lake and stream anglers. Angler demand for the aggregate fishery is increasing at about 12 percent per year (Figure 4-1). Stream fishing effort for salmon (fall fishing) has not been determined, but observations indicate that potential effort is similar to spring rainbow trout fishing (55,000 hours in 1984).

Chinook Salmon

Chinook salmon were introduced into Minnesota and Michigan waters of Lake Superior as early as 1874 and more recently by the Michigan DNR in 1967. Minnesota introduced spring strain chinook in 1974 and converted to fall strain in 1979.

Minnesota has taken eggs from wild chinook salmon since 1980 at the French River Coldwater Hatchery and became fully self-sufficient in 1984. The chinook is managed as a "put, grow, and take" fishery that provides species diversity for trolling and shore fishing and offers an opportunity for stream fishing in the fall.

Chinook salmon provide an opportunity for anglers to pursue trophy-sized fish with excellent food quality. At the same time, this fishery provides an important boost to the regional economy.

Resource Analyses

Hatcheries produce approximately 300,000 smolts per year, but the quantity of adults available to anglers is unknown. Chinook salmon provide about 6 percent of the salmonid sport harvest on Lake Superior (Figure 4-1), stream fishing in the fall is attributable almost entirely to chinooks.

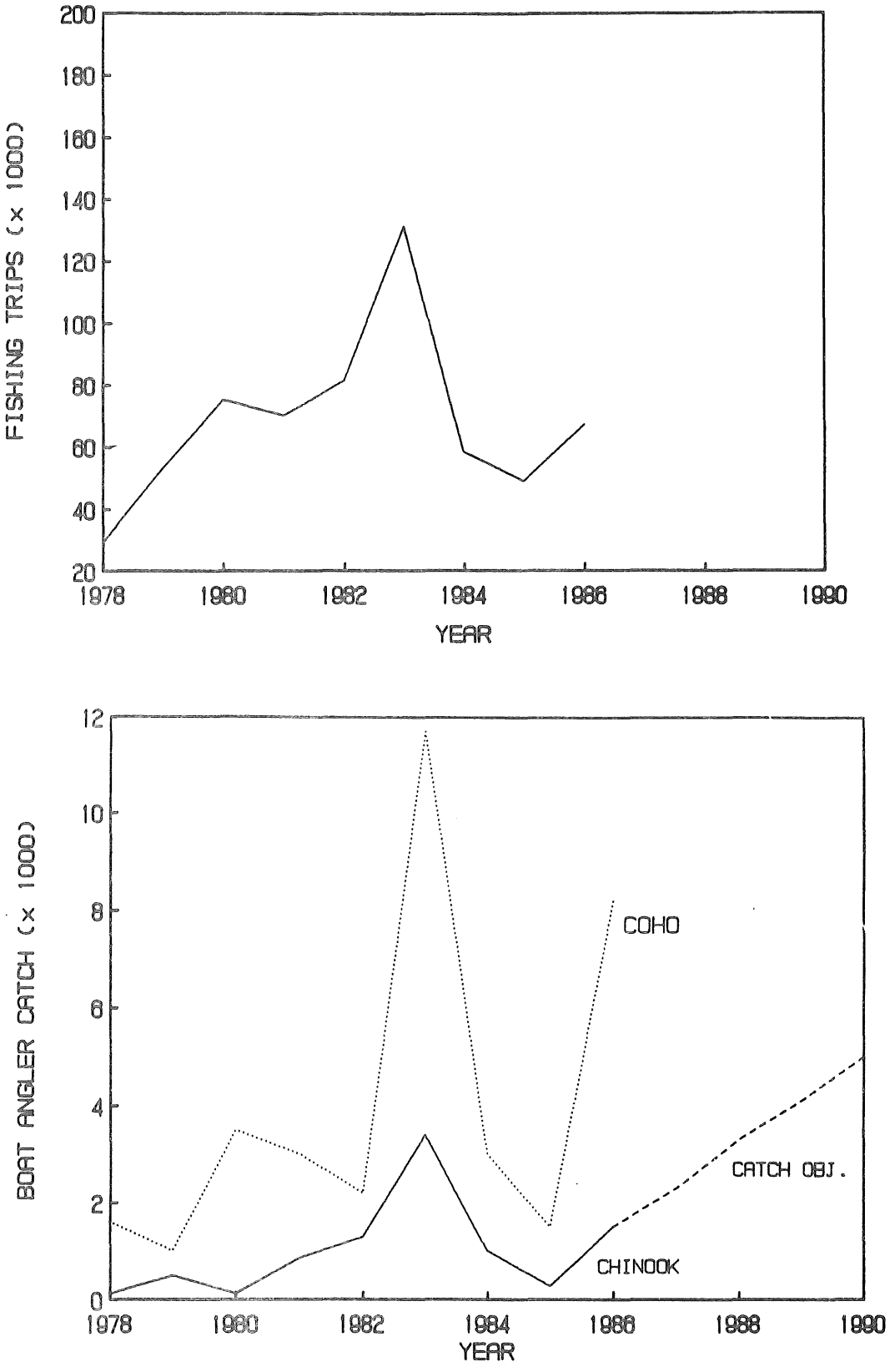

Figure 4-1. Fishing effort and catch of chinook and coho salmon in Lake Superior

Atlantic Salmon

The Atlantic salmon is Minnesota's newest salmonid species. A small number were stocked into Erskine Lake (Itasca County) in 1979 and a minor sportfishery developed in the early 1980s. Since 1980, all of Atlantic salmon releases have been in the French River, a Lake Superior tributary. The fish traps at French River have taken 70 to 235 adult fish annually since 1981.

Creel data from 1982 to 1985 indicate that fewer than 140 fish have been harvested per year. Better returns are expected as the program increases stocking densities.

Atlantic salmon are world-renowned for their sport qualities and are perceived as a limited resource even in their native range. Many Minnesota anglers have expressed a strong interest in the fish.

Resource Analyses

The Atlantic salmon program has been limited by difficulties encountered in hatchery rearing. Limited natural reproduction creates a strong demand for hatchery production. Public demand has increased even with the current limited availability and demand can be expected to increase with supply.

Other Salmon Species

Coho salmon were stocked experimentally in 2 inland lakes in 1968 and in Lake Superior from 1969 to 1972. Coho were caught by inland anglers for only a short time after the fish were stocked so stocking was discontinued. In Lake Superior, slow growth rate, small size of creeled fish, low return of Minnesota stocked fish to the anglers, and timing of the spawning migration did not meet the program goals, so stocking of coho was discontinued in favor of chinook salmon.

Pink salmon were accidentally introduced into Canadian waters of Lake Superior in 1956. It is the only salmon species that is naturally reproducing in Minnesota waters of Lake Superior and it has never been actively managed.

Resource Analyses

Coho are second only to lake trout in frequency of catch in Lake Superior. Natural reproduction and stocking by other states should continue to provide satisfactory angling, allowing management effort to be spent on other species.

The pink salmon has few characteristics that are consistent with the program goals. Minnesota Sea Grant studies concluded that because of their small size at maturity and low relative abundance, it is unlikely that pink salmon will ever be an important sport or commercial fish.

No other salmon species are present in Minnesota or are likely to be introduced. Other salmon species feed primarily on plankton, which reduces angling vulnerability and limits growth potential.

Resource Value

The average economic value of the Lake Superior fishery from 1979 to 1986 totaled 1.9 million dollars. Coho and chinook salmon represented an average of 22 percent of the angler catch during the same interval. Addition of the growing fall stream fishery for chinook salmon suggests that these species represent a significant economic resource for the state.

The coho salmon fishery provides a reasonable opportunity to catch a large number of fish that are second to none in table quality, while the size and power of the chinook salmon add tackle testing excitement to the Lake Superior fishing trip.

Long Range Planning for Salmon

PRODUCTS: Salmon populations and the opportunity to use and appreciate.

GOAL: Provide additional opportunities to use and appreciate Minnesota's salmon fishery.

OBJECTIVE 1: Provide an annual harvest of 7,500 chinook and 1,000 Atlantic salmon from Lake Superior and its tributaries and to provide Atlantic salmon for inland waters on an experimental basis.

PROBLEM 1. Salmon are difficult to catch at times and, as a result, are underutilized.

STRATEGY A. Inform the public of seasonal migration patterns of salmon in Lake Superior and successful techniques for boat and shore angling.

STRATEGY B. Stock streams with salmon close to populations so that maximum utilization of the fishery will occur.

STRATEGY C. Inform the public of methods for making river-caught salmon more palatable.

STRATEGY D. Inform the public of methods for taking salmon in the rivers without snagging.

PROBLEM 2. Current returns of salmon in Lake Superior meet program objectives; however, higher densities are necessary to satisfy angler demands.

STRATEGY A. Seek improvements in hatchery and stocking technology so that spawning return of 2-2.5 percent of stocked fish is attained.

STRATEGY B. Increase annual stocking to 400,000 chinook smolts and 100,000 Atlantic smolts.

STRATEGY C. Stock chinook in the Lester River and Atlantic salmon in the Split Rock River, adding salmon to 2 streams near population centers.

STRATEGY D. Assess angler use with creel census to determine harvest.

STRATEGY E. Stock rivers with pre-smolts in late evening or in turbid water to ensure that fish are properly imprinted and predation is reduced.

STRATEGY F. Stock adequate numbers of salmon fingerlings in the French River to meet the hatchery needs for management programs.

PROBLEM 3. Hatchery production of Atlantic salmon is limited because of their requirements for lower rearing densities and their sensitivity to hatchery conditions.

STRATEGY A. Improve hatchery rearing facilities for Atlantic salmon.

STRATEGY B. Contract with private hatcheries for hatching and rearing of salmon if demonstrated to be cost effective.

STRATEGY C. Fish population densities should always be optimum as determined by models

developed for the specific hatchery.

STRATEGY D. Keep wild brood stock of salmon in water cooler than 48° F to inhibit disease.

STRATEGY E. Immunize salmon against lethal pathogens before stocking.

STRATEGY F. Continue using natural selection to develop a stock of salmon best suited to Lake Superior.

STRATEGY G. Raise Atlantic salmon only in hatcheries capable of attaining rearing temperatures above 49°F for the first 3 months to optimize growth.

PROBLEM 4. High quality Atlantic salmon fishing opportunities will be limited.

STRATEGY A. Develop inland lake fishing for Atlantic salmon when sufficent hatchery production has been developed.

STRATEGY B. Adopt stream specific regulations such as "fly fishing only" to enhance the quality of the fishing experience for Atlantic salmon.

PROBLEM 5. Public opportunities for boating and shorefishing access are inadequate, particulary to Lake Superior.

STRATEGY A. Introduce and support proposals for new access development, particularly to Lake Superior.

STRATEGY B. Inform the public of access opportunities through brochures and other Lake Superior related informational materials.

OBJECTIVE 2. Coho and pink salmon are maintaining sufficent numbers by natural reproduction. Promote increased utilization of coho and pink salmon to provide a diversity of fishing on Lake Superior.

PROBLEM 1. Coho and pink salmon are only available to the angler during a limited period.

STRATEGY A. Inform anglers when and where coho and pink salmon are available and how these species can be caught.

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
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FISH, WILDLIFE & NATIVE PLANT RESOURCES
LONG RANGE PLAN

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Plan Name:_____

Comments:_____

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Your name:_____

Address:_____

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Are these the official comments of this organization?__Yes __No

Organization:_____

Thank you for your comments.
To mail: fold & seal with tape, or place in envelope.

5. Northern Pike

The northern pike (Esox lucius) is the most adaptable game fish species in Minnesota. It inhabits all types of Minnesota lakes, spawning in shallow weedy bays or in adjacent marshes. A favorite among anglers, it is an important part of Minnesota's summer and winter fisheries.

Resource Management

The fisheries research unit has gathered much information on northerns. Fishery biologists have researched the potential uses of fingerlings and yearlings, summarized the procedures for propagation and stocking, and provided information about harvests. Together with lake surveys, this information has led to the current management strategies for northern pike.

Northern pike propagation started in the 1930s in Minnesota when it was found that natural production could be augmented by regulating water levels in natural spawning areas. Breeding areas need sufficient water levels for migration and spawning of adults, incubation and growth of larvae, and emigration of fingerlings. There are some occasions when either the adults or the fingerlings become stranded by a sudden lowering of the water level. By blocking the outlet of such an area with sandbags or a board weir (dam), the water shortage problem could be overcome in all but the driest of seasons.

Management for these spawning areas in the 1930s and 1940s was done in cooperation with local angler groups and private landowners. Propagation efforts increased in the 1950s when acquisition and development costs were included in the federal Dingell-Johnson (D-J) program. Under the D-J program, the first land was purchased in 1953. The first construction of a D-J dike, outlet structure, and pumping facility followed in 1964. Maintenance, management, and repair were included in the D-J program in 1983.

Another early management technique, pioneered in the late 1950s, was winter rescue of northern pike. Fall and winter trapping of northern pike from shallow lakes and sloughs in danger of winterkill became an extensive fish management practice. These fish are often taken in great numbers and stocked into lakes with low pike populations. Survival of winter rescue fish is usually much greater than that of small fingerlings from spawning areas.

Northern pike can be taken by angling from mid-May through February 15th and by darkhouse spearing from December 1st through February 15th. The daily and possession limit is 3 pike of any size per day. The conservative possession limit reflects an attempt to protect northern pike, which are vulnerable to angling. Regulations on border waters differ slightly and are generally more liberal.

Special regulations encourage the harvest of northern pike on some lakes. Six northerns are allowed in possession and only 3 may be more than 24 inches.

The northern pike is the major gamefish taken in Minnesota by winter spearing. Approximately 15 percent of the annual harvest is taken by spearers. Some critics claim that spearers take a disproportionate number of larger fish. Creel census data through 1981 supports this claim. Since 1961, 33 lakes have been designated for muskellunge management and closed to darkhouse spearing.

Harvest of trophy northerns by angling appears to have peaked in the late 1940s and has been declining ever since. This may be attributed to increased fishing pressure, better angler access, angler sophistication, and lake eutrophication.

Creel censuses show the annual harvest of northern pike from Minnesota waters ranges from 0.3 to 15 pounds per acre. The average annual harvest is 3.2 million fish, weighing 8.4 million pounds. Recent angler satisfaction studies indicate they are generally satisfied to catch northerns 22 inches or longer.

It appears that overproduction of northern pike from spawning areas and the stocking of winter rescue fish in some lakes has reduced forage populations, primarily yellow perch, with resulting stunted panfish populations and declining walleye populations. This idea contradicts the former management belief that northern pike control panfish populations. Other effects of overabundant northern pike populations may be extensive predation on walleye populations and stunting of the northern pike themselves. Some management techniques include selective stocking, removal of adult fish, blocking of spawning runs, and removal by trapnet just after the ice melts in spring.

The ability of the northern to survive and prosper under many conditions makes it difficult to control once it has become established in a fish community. Strategies for managing adequate northern pike populations were first formally proposed in the Minnesota Department of Natural Resources (MDNR) lake management planning guide.

Resource Analyses

The MDNR manages approximately 4,000 lakes and 15,000 miles of fishable streams for northern pike. In general, northern pike populations are high because of successful management and favorable water levels during the spawning

season.

Region 1 (Northwest)

There are 1,900 lakes managed for northern pike. Median gillnet indices are 5.4 northerns weighing 11.1 pounds per lift. Trends indicate increased numbers and decreasing size of fish. Most spawning areas are not operated but some stocking is done in winterkill situations. Some winter rescue operations are conducted, but most fish are transferred to other regions. Removal of over-abundant northern pike is difficult because of virtually unlimited spawning areas in this region's lakes.

Region 2 (Northeast)

Approximately 1500 lakes are managed for northern pike. Median gillnet indices are 3.6 northerns weighing 6.5 pounds per lift. The lakes in this region support a smaller biomass because of lake water chemistry.

Region 3 (Central)

There are 460 lakes managed for northern pike. Median gillnet indices are 5.7 northerns weighing 10.0 pounds per lift. Very little stocking is done and some removal of adult fish from spawning areas is being attempted. Most spawning areas remain in readiness in case northern pike populations decline. Winter rescue operations are being run as a source of fish for other regions. Trends in this regions are the same as those for Regions 1 and 2.

Region 4 (Southwest)

There are 170 lakes managed for northern pike. Median gillnet indices are 4.4 northerns weighing 8.2 pounds per lift. Lakes in this region of the state tend to be highly eutrophic and contain high populations of forage fish.

Many natural spawning areas are purchased and protected from intensified farming and lakeshore development.

Region 5 (Southeast)

Four lakes are managed for northern pike. Median gillnet indices are 3.0 northerns weighing 7.6 pounds per lift. Populations of forage and nongame fish species are high. Northern pike are a very desirable species in this region because they not only help control other species but are desired by anglers.

Region 6 (Metro)

Approximately 268 lakes are managed for northern pike. Median gillnet indices are 3.0 northerns weighing 8.33 pounds per lift. Lakes in this region have very high fishing pressure and low availability of spawning habitat. Stocking of winter rescue northern pike has a high priority.

Rearing Pond and Rescue Operations

Approximately 200 managed spawning areas representing 3,000 acres are available for northern pike fingerling production. Because of the pike's high abundance, not all of the ponds have been utilized in recent years. Annual production has ranged from 0.7 to 5.7 million fingerlings. The 1984 production was 3.1 million fingerlings.

Operating and maintenance costs of northern pike spawning areas was $37,000 in 1984. Most likely, the number of spawning areas under fisheries control and the opportunities for winter rescue operations will make additional spawning areas unnecessary. The exception to this would be a few natural areas endangered by development.

Winter harvest operations are carried on primarily in the northern half of the state. Region 1 produces most of the rescued pike. Production from winter rescue operations peaked in 1972, when 366,692 fish were rescued for stocking.

Since then, the need for these fish has declined to 90,000 in 1984. The cost of the winter rescue program was $32,600 in 1984. Currently, there are approximately 150 sites available for rescue or removal if lake management requires additional stocking.

Resource Value

The northern pike represents a substantial portion of Minnesota's fishery resource. Approximately 10 percent of all anglers specifically seek northern pike and a larger percentage seek northern pike in combination with other species. Those anglers spent 8.4 million days fishing in 1980. The economic value of their fishing trips was over $200 million.

Long Range Planning for Northern Pike

PRODUCT: Northern pike populations for use, appreciation and ecological values.

GOAL: To maintain current fishable populations and improve quality of angling opportunities for northern pike.

OBJECTIVE 1. Maintain the present statewide northern pike population of 9.6 million fish, 18 inches or longer.

PROBLEM 1. Knowledge of northern pike populations needs to be updated continuously.

STRATEGY A. Conduct population assessments of northern pike on representative lakes and rivers.

STRATEGY B. Determine population parameters and develop models to assist in northern pike management.

PROBLEM 2. Natural reproduction of northern pike is inadequate in some southern Minnesota waters to meet the demand.

STRATEGY A. Determine recruitment of northern pike into the populations on specific waters.

STRATEGY B. Stock northern pike as required to meet lake management plans' population objectives.

STRATEGY C. Develop northern pike spawning areas identified in lake management plans.

STRATEGY D. Protect northern pike critical habitat through regulation, enforcement, and pollution abatement.

PROBLEM 3. Northern pike may be too abundant in some northern Minnesota waters, resulting in poor growth rates, fish size unacceptable to the angler, and a disruption to the aquatic community.

STRATEGY A. Remove northern pike from lakes where they are overabundant.

STRATEGY B. Establish temporary barriers at natural northern pike spawning areas to prevent use by spawning fish.

STRATEGY C. Operate improved northern spawning areas only as needed to meet management objective.

STRATEGY D. Encourage development of forage fish species where they have been depleted by excessive northern pike predation.

STRATEGY E. Liberalize the fishing regulations for northern pike on specific lakes where excess numbers diminish the quality of the northern fishery.

OBJECTIVE 2. Provide 8.4 million angler days with a harvest of 3.8 million northern pike annually.

PROBLEM 1. The size of northern pike is unsatisfactory to some anglers in some waters.

STRATEGY A. Apply special regulations, such as bag limits and restricting spearing, to manage for trophy northern pike in selected waters of the state.

STRATEGY B. Adapt fishing regulations to utilize the northern pike resource according to the capabilities of individual lakes.

PROBLEM 2. Some northern pike management strategies are not always understood by the public.

STRATEGY A. Determine characteristics of northern pike anglers and their expectations.

STRATEGY B. Develop effective programs to inform and educate anglers about northern pike opportunities and population management.

STRATEGY C. Develop and utilize northern pike demonstration areas (lakes) to explain management programs.

PROBLEM 3. Public access is insufficient to some northern pike waters to meet angling objectives.

STRATEGY A. Identify northern pike waters in need of public access development.

STRATEGY B. Promote additional finances for access development and maintenance to northern pike waters.

OBJECTIVE 3. Provide the necessary information for management of northern pike through a system of identifying

research needs and conducting the research necessary to meet these needs.

PROBLEM 1. New research is necessary to solve problems facing the northern pike resource.

STRATEGY A. Review northern pike literature and make results known to fisheries staff for evaluation and inclusion in northern pike management program.

STRATEGY B. Identify areas in which more research on northern pike is necessary.

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6. Muskellunge

The muskellunge (Esox masquinongy) in Minnesota is unique in having a significant number of reproducing populations. These naturally reproducing populations are found primarily in the Mississippi River and Hudson Bay watersheds.

Naturally occurring populations are present in 29 Minnesota lakes with a combined area of more than 219,000 acres, and in 4 river systems. Approximately 75 percent of this acreage is represented by Leech and Winnibigoshish lakes, which have a combined size of 165,000 acres.

The species has been propagated and introduced into many other lakes in Minnesota, resulting in fishable populations of muskellunge in an additional 50 lakes totaling 98,000 acres. Recent introductions could expand this by 3 lakes and 184,000 acres.

Hybrid muskellunge (muskellunge x northern pike) occur naturally, although infrequently, in some lakes and are considered as muskellunge. The fish management program has expanded to include the propagation and introduction of hybrids in specific urban situations with plants into approximately 25 lakes in the Minneapolis/St. Paul metropolitan area and the St. Louis River estuary near Duluth.

Records indicate that commercial exploitation of muskellunge has never been permitted in Minnesota. The sportfishing harvest has been regulated through season

length, harvest methods, bag and minimum size limits.

Some universal factors contributing to a marked decline in muskellunge abundance in North America during the past century are overharvest, declining water quality, loss of habitat (especially spawning habitat) and interaction with northern pike. Competition from northern pike is often implied in cases of declining muskellunge abundance, but direct cause and effect relationships have not been documented.

These factors are considerations in Minnesota, but the state has experienced lesser environmental degradations than many parts of the country. Minnesota is fortunate that many natural reproducing populations remain, and that the Mississippi strain of muskellunge successfully co-exists with populations of northern pike.

Resource Management

In the first part of this century, native muskellunge populations were extirpated, or declined dramatically, in the Park Rapids area, the lower Mississippi River, the St. Louis River estuary of Lake Superior and possibly Mille Lacs Lake.

Propagation of muskellunge, and an expanded management program in Minnesota, began in the 1930s in response to a dramatic decline in abundance of the species in lakes of the Park Rapids region. Early culture efforts were directed at that geographic area. Limited and uncertain sources of eggs from the Park Rapids region prompted a search for other sources of eggs.

Genetic Strains

Shoepac Lake located on the Kabetogama peninsula near International Falls was a source of muskellunge eggs for about 15 years. Because of its remoteness, eggs from Shoepac Lake had to be flown out for hatching and rearing at

Park Rapids.

Mantrap Lake near Park Rapids, which had a remnant natural population, received annual stockings of muskellunge from Shoepac Lake. The population increased sufficiently to allow egg collection for propagation. Shoepac Lake was then discontinued as an egg source. Progeny resulting from eggs collected from Mantrap Lake were introduced into many other lakes in Minnesota, and additional egg sources were established.

In 1979, radio transmitters were implanted into adult muskellunge captured by angling in Leech Lake. Those fish were monitored for a period of 18 months, which included the 1980 spawning season. Six specific muskellunge spawning locations were documented, and preferred spawning habitat was determined for Leech Lake. This permitted the capture of spawning fish and collection of eggs from that source beginning in 1981.

After more than 2 decades of propagation using Shoepac and Mantrap Lake stocks of muskellunge, it became apparent that fish grown from those stocks were small. Data from the sport harvest, and from Minnesota Department of Natural Resources (MDNR) net catches, indicated that most fish in those populations were less than 36 inches total length. A summary of 1,826 muskellunge catches from Minnesota waters by members of Muskies, Inc. for 1970 to 1980, indicated that 85 percent of that catch came from lakes with natural populations, and 15 percent from the introduced populations. The lakes with natural populations produced over 97 percent of the fish greater than 40 inches and all of the fish 50 inches and larger.

The accumulation of evidence on growth differences led to a genetic analysis of the strains of muskellunge available for stocking. The analysis revealed that at least 2 genetic strains of muskellunge occur in Minnesota--the Mississippi strain and Shoepac strain.

Fish from Mantrap Lake, near Park Rapids, which received annual stockings of Shoepac muskellunge for an extended period of time, were genetically different from true Shoepac stocks. The introduced Shoepac fish apparently crossed with a remnant population of native fish in that lake.

These findings led to a decision to utilize the Mississippi strain in our management program. Seven lakes were selected and stocked in 1982 with Mississippi strain fish. Those lakes will eventually serve as brood stock sources of eggs after the fish mature. In the interim, eggs will continue to be taken from Leech Lake fish.

A Wisconsin "type" muskellunge has been reared and stocked by Minnesota in the past several years. This resulted from egg collections from a Minneapolis-St. Paul area lake originally stocked with fish that were purchased from a private hatchery in Wisconsin by Muskies, Inc. under MDNR permit. The fish are from captive brood fish of uncertain ancestry and origin. Minnesota's production of these fish has been used to replace the Shoepac strain in our stocking program until an adequate supply of Mississippi strain eggs becomes available.

Resource Analyses

Muskellunge production for stocking in this state has been designed to maintain introduced populations and, to a lesser extent, supplement natural populations. Native populations of muskellunge are primarily found in large walleye lakes, hardwater walleye lakes, and large rivers in association with walleye, largemouth bass, smallmouth bass, northern pike, and panfish. In nearly every instance those natural populations are associated with populations of soft-rayed forage which attain large size, primarily cisco, whitefish and suckers.

Fishable populations of muskellunge are present in 79 lakes with a combined area of over 317,000 acres, and in 3 large river systems in Minnesota (Table 6-1).

Table 6-1. Distributions of Muskellunge Resource by Fisheries Region

	Native		Introduced		
Region	Lakes	Acres	Lakes	Acres	Streams
1	24	160,168	19	39,954	
2	5	59,014	12	17,855	3*
3	0	--	8	9,307	1*
4	0	--	1	820	
5	0	--	--	--	--
6	0	--	10	31,087	
TOTALS	29	219,182	50	98,023	3

* Mississippi River listed for Regions 2 and 3.

Resource Value

The number of anglers using this resource, fishing pressure specifically directed at muskellunge, and the statewide harvest are unknown. Nor do we have any information on the size and age-sex structure of that harvest, or population trends in the state's important muskellunge waters.

Long Range Planning for Muskellunge

PRODUCT: To produce muskellunge as a trophy fish, to protect its genetic integrity and provide opportunities for use and appreciation.

GOAL: Manage natural and introduced populations of muskellunge for maximum trophy fish opportunities while maintaining the genetic integrity of native muskellunge populations.

OBJECTIVE 1. Maintain trophy muskellunge fishing opportunities in the environmentally suited 79 lakes and 300 miles of rivers.

PROBLEM 1. Information on muskellunge populations is needed to adequately manage for trophy fish.

STRATEGY A. Develop and implement better muskellunge population sampling techniques and methods.

STRATEGY B. Design and implement a muskellunge creel reporting system for muskellunge fishing.

STRATEGY C. Obtain and evaluate muskellunge life history data.

STRATEGY D. Investigate population genetics of muskellunge in Minnesota.

PROBLEM 2. Critical habitat for muskellunge is poorly understood, particularly that required for reproduction.

STRATEGY A. Design and implement investigations to identify and catalogue muskellunge spawning and nursery habitats.

PROBLEM 3. Angling harvest of muskellunge may increase beyond what the existing populations can support.

STRATEGY A. Develop regulations for muskellunge that promote trophy opportunities.

STRATEGY B. Use native strains for stocking and evaluate muskellunge stocking programs.

STRATEGY C. Review dark house spearing and winter angling activities as they may affect muskellunge populations.

STRATEGY D. Promote a catch and release ethic among muskellunge anglers.

STRATEGY E. Redistribute fishing pressure to take advantage of underfished muskellunge populations.

PROBLEM 4. Interaction with northern pike may be a limiting factor to muskellunge populations.

STRATEGY A. Conduct investigations to evaluate interspecific competition between northern pike and muskellunge.

STRATEGY B. Consider strategies to optimize muskellunge populations in waters designated for muskellunge management.

PROBLEM 5. Stocking of muskellunge is not always effective.

STRATEGY A. Develop and adhere to muskellunge stocking guidelines.

STRATEGY B. Use only large-sized strains of muskellunge in the stocking programs.

STRATEGY C. Public education of muskellunge is essential to establishing new populations.

STRATEGY D. Develop rearing techniques and adequate hatchery production facilities for muskellunge.

PROBLEM 6. Socio-economic benefits of muskellunge trophy angling are unknown.

STRATEGY A. Investigate socio-economic benefits of muskellunge trophy angling.

PROBLEM 7. Providing muskellunge trophy angling opportunities may conflict with other recreational uses.

STRATEGY A. Identify potential and actual conflicts in uses of waters designated for muskellunge management.

STRATEGY B. Involve public in muskellunge manage efforts.

STRATEGY C. Develop lake management plans for waters designated for muskellunge management.

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7. Largemouth Bass

Despite the great popularity of the largemouth bass (Microplerus salmoides) in most of the United States, it has never received great emphasis in the history of Minnesota fish management.

Resource Management

Much previous stocking was done indiscriminately with little thought given to actual need or native species composition. Current largemouth bass stocking is more selective. In most cases it is done to establish or replace fish lost in winterkill or reclaimed lakes. Numbers of largemouth bass stocked usually range from 50 to 100 fingerlings/acre, or 1 pair of adults/10 acres to 10 adults/acre.

Past management techniques made it difficult to evaluate largemouth bass population status or stocking survival. The existing information has been collected primarily from lake surveys and assessment netting. Since largemouth bass are poorly represented in standard survey nets, their presence in the nets can only be considered indicative of their presence, and not population status. Night electrofishing has been conducted in recent years to provide more reliable information.

Frequency of evaluation for most waters statewide has ranged from 3 to 20 years. Most of the available quantitative data on population size and dynamics has been collected from 2 intensive mark-recapture studies conducted

in the 1950s and the 1970s. Another study on largemouth bass in Lake Minnetonka provided useful data on age, growth, mortality, and population estimates. It also found a relationship between bass tournament results and spring electrofishing operations. In general, these special projects (plus creel census and the monitoring of professional bass tournaments in recent years) provide a better picture of the status of largemouth bass populations than our present lake survey methods.

Regulations concerning largemouth bass have remained relatively unchanged over the years. The only changes that have occurred were made between 1949 and 1962 when the opening date for bass angling was changed several times. In recent years the bass season has opened 2 weeks after the walleye season, generally the last weekend in May. Until the 1970s the most popular regulation pertaining to bass was the posting of spawning areas to prohibit angling along particular sections of shoreline. Size limits as a management tool are just now beginning to be examined in Minnesota. A study to evaluate the slot limit (restricting harvest to a particular range of total length) is now in progress.

Resource Analyses

Largemouth bass are widely distributed throughout Minnesota and are found in most of the state's fishing waters. The extent of the bass populations in most of these waters is virtually unknown because of the difficulties in determining actual abundance by our standard methods of evaluation. Special research methods have provided standing crop estimates for a few of Minnesota's principal bass waters. These estimates range from 6.3 to 14.4 pounds/acre.

It is widely recognized that angler interest in Minnesota's largemouth bass is increasing, although bass

anglers remain a definite minority. Creel census data from northwestern and central Minnesota indicate that the proportion of anglers seeking largemouth bass now varies from less than 5 percent to 25 percent for most areas. A mean total length of approximately 12.5 inches seems to be a typical acceptable size to most anglers, and a typical harvest figure is about 3.2 pounds/acre.

Angling for largemouth bass is promoted in some parts of the state by various resort and angler groups, especially in northwest Minnesota. Within the last 10 years professional tournament fishing for largemouth bass has become a popular activity on some of Minnesota's largest and best-known bass lakes. These tournaments are highly desirable for economic reasons and consequently are heavily promoted. Controversy exists over possible detrimental effects caused by these tournaments, although most of these tournaments are catch and release.

Growth of largemouth bass is quite variable, depending on such factors as population size, competition, and amount of available food supply. As with the walleye and northern pike, the availability of yellow perch as a prey species can be quite important to the largemouth bass. The largemouth bass has many complex relationships with other predator and prey species.

The health and well-being of Minnesota's largemouth bass populations could easily be compromised as demand for outdoor living and recreation continues to rise. As the number of lakeshore homes and cabins increases, more shoreline will be altered and more potential bass spawning and living habitat will be eliminated. Also, poor land use practices in heavily agricultural southwestern Minnesota contribute to degraded water quality and rapid eutrophication of fairly limited lake and river habitats. This nutrient loading aggravates the winterkill problem, and, along with the degradation caused by excessive nongame

fish, could further accelerate elimination of largemouth bass habitat.

Resource Value

An estimated 5-25% of all anglers seek largemouth bass, suggesting that bass angling contributes between $26 million and $130 million annually to Minnesota's economy statewide. A current Fisheries Research project, D.J. Study No. 307, seeks to gather more specific socio-economic data on all species of interest to the angler. This will enable us to more accurately estimate actual expenditure for largemouth bass on local and regional levels.

Long Range Planning for Largemouth Bass

PRODUCTS: Provide for populations of largemouth bass and the opportunities for use and appreciation.

GOAL: Enhance largemouth bass populations and provide opportunities for their use and appreciation

OBJECTIVE 1. Maintain largemouth bass populations in 1,199 lakes and 500 river miles considered suitable largemouth bass habitat (Table 7-1).

Table 7-1. Lakes with Largemouth Bass by Fisheries Region

	FISHERIES REGION						
	1	2	3	4	5	6	TOTAL
No. lakes	432	280	343	48	3	93	1199
Acres (Thousands)	280	76	141	30	1	45	573
Percent	49	13	25	5	-	8	100

PROBLEM 1. Sampling methods for largemouth bass need to be improved and applied to determine population status of this species.

STRATEGY A. Develop new or alternative sampling methods to assess largemouth bass populations.

STRATEGY B. Develop the standards for population assessment with alternative sampling gear.

STRATEGY C. Increase the creel census efforts for determining the harvest of largemouth bass.

PROBLEM 2. Angling can affect the quality of largemouth bass fishing.

STRATEGY A. Promote and educate anglers in the advantages of a catch and release program for largemouth bass.

STRATEGY B. Establish special regulations such as size limits, slot limits, and bag and season restrictions as needed to protect the largemouth bass resource and provide fishing opportunity.

STRATEGY C. Provide access to underutilized largemouth bass waters.

STRATEGY D. Encourage Minnesotans to organize catch and release largemouth bass fishing tournaments, rather than regular tournaments, to reduce overharvest.

PROBLEM 3. Community relationships of largemouth bass need to be better understood to assure proper management of the species.

STRATEGY A. Research is required into the ecology of largemouth bass.

PROBLEM 4. Habitat loss limits largemouth bass populations in some areas.

STRATEGY A. Promote use of safe lake aeration methods where needed to promote largemouth bass populations.

STRATEGY B. Encourage increased commercial harvesting in some waters to remove nongame fish and improve conditions for largemouth bass.

STRATEGY C. Promote more efficient land use practices to prevent nutrient sediment and pesticide loading to lakes and rivers, which has reduced largemouth bass habitat quality.

STRATEGY D. Encourage upgrading of sewage treatment facilities to safeguard and enhance largemouth bass habitat.

STRATEGY E. Consider restricting MDNR Aquatic Nuisance Control and Division of Waters permits for removal of bullrushes and other macrophytes in largemouth bass spawning and nursery areas.

STRATEGY F. Develop and enforce effective shoreland zoning regulations.

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8. Smallmouth Bass

Even though widely considered to be one of the premier gamefish in the country, the smallmouth bass (Microplerus dolomieui) has always been a species of minor importance in Minnesota's fish management program. Only 3 of the 6 regions in the state have past records of smallmouth bass production and none are currently in effect.

Resource Management

Little specific evaluation of smallmouth bass population status or stocking survival has been conducted statewide. Efforts to evaluate status and survival have mostly been incidental to survey and assessment efforts for other species, which are usually conducted every 3 to 10 years.

Since smallmouth bass are not considered vulnerable to passive lake survey gillnets and trapnets, their presence in net catches is only indicative of their presence and says little about their actual numbers. Electrofishing is considered to be more reliable for sampling smallmouth bass and has been used statewide for a number of years. However, the only catch per unit of effort (CPUE) data available are from southeastern Minnesota (Region 5), where electrofishing in 22 streams and rivers produces CPUEs of 0-52.1 smallmouth bass per hour.

Few changes in smallmouth bass regulations have occurred over the years. Season lengths and bag limits have

remained fairly constant. The only major changes have been in the date of the season opener, which was adjusted several times during 1949 to 1962, generally to an earlier date each time. Regulations are uniform statewide except for northeastern Minnesota, where bass open along with walleyes, 2 weeks earlier than the bass opening in the rest of the state.

Resource Analyses

A considerable amount of Minnesota water is potentially suitable for smallmouth bass management. Most of these 1.5 million lake acres are found in the northern half of Minnesota and most of the 800+ river miles are in the southeastern part of the state. However, population or standing crop estimates are unavailable for any of the lakes or rivers, so the total dimension of the resource is virtually unknown.

The smallmouth bass appears to be a species of specialized appeal, according to the limited creel census data available. Census data in Region 2 indicate that 5 to 10 percent of anglers were seeking smallmouth bass and that low catch rates (0.02 - 0.035 fish/hour) may be fairly typical. Lake Vermilion (St. Louis County) is an exception, because smallmouth bass were 8.9 percent of the total harvest. Region 5 creel census data reveal mostly light to moderate fishing pressure, although pressure was extremely heavy on 1 river at 1,135 hours/acre. In Region 3 it is estimated that there may be good smallmouth bass fisheries in the Mississippi and at least 5 other rivers, with demand possibly increasing.

Active promotion of smallmouth bass angling has occurred primarily in northeast Minnesota. Here smallmouth bass fishing has been encouraged to reduce pressure on the walleye.

bass fishing has been encouraged to reduce pressure on the walleye.

In general, water quality does not seem to be limiting the propagation and survival of smallmouth bass except in southern Minnesota. Natural reproduction varies greatly there because of heavy flooding in June or July that can eliminate newly hatched fry. Some watersheds in the southeast, such as the Root River system, are plagued by poor water quality caused by inadequately treated sewage discharge.

Very little information is available on community relationships, population dynamics, or growth of smallmouth bass in Minnesota. The only growth data, from southeastern Minnesota, indicate that growth there is quite slow. Perhaps this slow growth is caused by stocking rivers with what is assumed to be a lake strain of smallmouth bass.

Resource Value

The smallmouth bass is found and fished primarily in southerastern and northeastern Minnesota. In Lake Vermilion (St. Louis County) it is sought by 5 to 10% of the anglers, and its well-known sporting qualities make it of interest in many other lakes in northeastern Minnesota. Concern also exists because the smallmouth bass range is expanding and is believed to be a serious competitor with lake trout and walleye in northern waters.

Ten to 15% of the streams in southeastern Minnesota contain fishable populations of smallmouth bass. Many of these populations are considered as fragile due to their vulnerability to habitat degradation and overharvest.

Long Range Planning for Smallmouth Bass

PRODUCT: Smallmouth bass populations with opportunities for use and appreciation.

GOAL: Enhance smallmouth bass population size and numbers to provide opportunities for use and appreciation.

OBJECTIVE 1: Maintain and improve smallmouth bass populations in 235 lakes and 800 river miles of suitable habitat.

Table 8-1. Lakes with Smallmouth Bass by Fisheries Region.

	Fisheries Region						
	1	2	3	4	5	6	TOTAL
No. lakes	22	183	20	6	1	3	235
Acres (thousands)	25	239	15	13	-	3	295
Percent	8	81	5	5	-	1	100

PROBLEM 1. Standard lake survey methods are inadequate to assess the smallmouth bass population status accurately.

STRATEGY A. Develop alternative sampling methods such as electrofishing to determine the population status of smallmouth bass.

STRATEGY B. Develop standards for smallmouth bass population assessment utilizing alternative sampling techniques.

STRATEGY C. Increase creel census efforts on smallmouth bass waters to assess fishing pressure and harvest.

PROBLEM 2. Ecology of smallmouth bass is poorly understood.

STRATEGY A. Research life history and community relationships of smallmouth bass.

PROBLEM 3. Habitat degradation limits smallmouth bass populations in southern Minnesota.

STRATEGY A. Promote land use practices that will reduce soil erosion and water pollution that adversely affect smallmouth bass populations.

STRATEGY B. Encourage upgrading sewage treatment facilities to safeguard and enhance smallmouth bass habitat.

STRATEGY C. Encourage reduction in airborne contaminants that adversely affect water quality and smallmouth bass habitat.

STRATEGY D. Acquire critical areas and conduct habitat improvement to create new habitat for smallmouth bass.

OBJECTIVE 2. Increase the proportion of Minnesota anglers seeking smallmouth bass from approximately 5 percent in 1985 to 15 percent in 1992.

PROBLEM 1. Anglers are unaware of the opportunities for smallmouth bass fishing.

STRATEGY A. Promote smallmouth bass angling qualities and the distribution of fishing opportunities.

STRATEGY B. Acquire access by easements on streams and rivers having a demonstrated potential for smallmouth bass angling.

OBJECTIVE 3. Develop quality angling opportunities for smallmouth bass greater than 12 inches total length in selected rivers and lakes in Minnesota.

PROBLEM 1. Smallmouth bass grow slowly at the northern edge of their geographical distribution in Minnesota.

STRATEGY A. Promote catch and release angling of smallmouth bass to recycle fish.

STRATEGY B. Consider the use of trophy regulations such as length limits, reduced creel limits, or slot limits for smallmouth bass to increase the number of fish in the larger size classes.

STRATEGY C. Investigate genetics of smallmouth bass in lake/river strains and shallow lake/deep lake strains of west central MN.

STRATEGY D. Investigate smallmouth bass community interactions.

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9. Panfish

Panfish are gamefish that include yellow perch (Perca flavescens), white bass (Morone chrysops) bluegills (Lepomis macrochirus), pumpkinseed (L. gibbosus), rock bass (Ambloplites rupestris), black crappie (Pomoxis nigromaculatus), and white crappie (P. annularis) in Minnesota.

Resource Management

White Bass

White bass are confined primarily to the southern third of the state where they inhabit the larger rivers and lakes or reservoirs on river systems. This species is found in 1.5 percent of Minnesota lakes. White bass are actively sought by a number of anglers. The species is able to maintain itself without additional management efforts.

Yellow Perch

Yellow perch are widely distributed in Minnesota, occurring in 82 percent of the state's lakes and larger rivers. The species is valuable in large walleye lakes, where it is the principal forage fish for walleye and northern pike and is incidental in the angler harvest. In smaller lakes, yellow perch seldom grow to a size acceptable to anglers, but are important forage for predators. Angler harvest of yellow perch from some large walleye lakes has

increased dramatically, becoming a significant component of the total yield. In Lake Winnibigoshish, in 1977 and 1978, yellow perch were 46 percent (by weight) of a total harvest (all species combined) of 11.5 pounds per acre.

Experimental management of yellow perch has been conducted in Minnesota by reintroducing it to waters where populations were depleted and avoiding the stocking of predators. Large stockings of predators are undertaken when there are dense populations of small yellow perch. There is a daily angler limit of 100 on yellow perch to prevent commercialization.

Bluegills

Bluegills are the "bread and butter" panfish, occurring in 65 percent of the lakes in the state and in backwater areas of the Mississippi River. They are abundant and easy to catch. The supply of quality-sized bluegills (greater than 7 inches in length), however, does not meet the demands of the anglers. Test nettings show the size of bluegills has decreased in many Minnesota lakes.

Past bluegill management efforts included stocking of winterkill lakes and lakes where little reproduction occurs. Stocking of predator fish, primarily northern pike, has had little success in controlling bluegill populations and appears to promote stunting. Though costly, partial treatment of lakes with antimcycin-A has been successful in improving bluegill growth rates and average size. The key to good bluegill management appears to be the elimination or reduction of year classes. There are some indications that over-harvest of quality fish as well as habitat degradation may contribute to smaller fish.

Crappies

Black and white crappies are important panfish for many anglers. Black crappie is the most widespread, occurring in

64 percent of the state's lakes. White crappies occur in 7 percent of the lakes in the state and tend to reach their greatest densities in turbid lakes of southern Minnesota. Crappie abundance tends to be cyclic in many lakes. The majority of crappies are harvested during the winter and early spring.

In the past, areas where crappies congregate in the spring were posted to restrict fishing. This practice has been discontinued in most areas to allow a greater crappie harvest with no apparent harm to the fishery.

Rock Bass

Rock bass is a species that some anglers find undesirable even though they are fun to catch. They occur in 37 percent of Minnesota lakes. The rock bass is most abundant in hard-water walleye lakes and large walleye-centrarchid lakes. They could withstand increased fishing pressure.

Resource Analyses

Significant populations of panfish are found in 1,586,500 acres of lakes and 14,000 miles of streams and rivers in Minnesota. All of these populations are essentially self-sustaining. Not enough information is available to determine a total population of panfish. It is generally accepted that in most waters there are not enough quality-sized panfish to meet angler demands because of habitat loss and fishing pressure.

Harvest

An estimated 1,350,000 unlicensed and licensed anglers (65 percent of all anglers) fished approximately 16,470,000 days for panfish during 1985. These anglers harvested an estimated 64,100,000 panfish weighing 21,367,000 pounds from Minnesota waters.

Distribution

The panfish resource and harvest distribution is based on the number of acres of panfish water in each region. More information on populations and angler use are needed to reflect a more accurate distribution of the resource and angler demand.

The distribution of panfish angling and harvest are the same, when considered as a percent of the total resource. Regional distribution is as follows:

Fisheries Region	% of Resource and Harvest
1	49
2	24
3	13
4	8
5	2
6	4

Resource Value

Panfish angling has increased substantially in popularity since the 1950s. A DNR survey conducted during the 1950s found that 38 percent of Minnesota licensed anglers caught panfish. The 1980 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation stated that 65 percent of Minnesota licensed anglers fished for panfish. According to the 1980 survey, more licensed anglers spent more days fishing for panfish than for any other fish or group of fish species.

Long Range Planning for Panfish

PRODUCT: Panfish populations for their use, appreciation, and ecological values.

GOAL: To enhance panfish populations for quality fishing opportunities, forage for other gamefish, and maximum angler benefit.

OBJECTIVE 1. Annually provide 22 million days of panfish angling for 1.5 million anglers with a harvest of 73.8 million panfish (Table 9-1).

Table 9-1. Panfish Angler Days and Harvest by Fisheries Region

	OBJECTIVES BY REGION						
	1	2	3	4	5	6	TOTAL
ANGLER DAYS (000,000s)	10.3	5.0	3.7	1.7	0.4	0.9	22.0
FISH HARVEST (000,000s)	36.1	17.7	9.6	5.9	1.5	3.0	73.8

PROBLEM 1. The average size of panfish is often unacceptable to anglers.

STRATEGY A. Determine the causes of unacceptable average size of panfish in various lakes.

STRATEGY B. Conduct research to find possible

remedies to unacceptable sizes of panfish.

STRATEGY C. Use experimental regulations in selected waters to determine the impact on panfish populations.

STRATEGY D. Determine the impact of walleye stocking on panfish communities in centrarchid lakes.

PROBLEM 2. Inadequate information exists concerning present panfish populations, harvest, demand, and economic impact.

STRATEGY A. Conduct surveys to acquire information on panfish populations, harvest, demand, and economic impact.

PROBLEM 3. Many panfish lakes lack public access.

STRATEGY A. Identify lakes with good fishing opportunities for panfish but lacking access.

STRATEGY B. Work with state public access programs and local units of government to acquire adequate public access sites to lakes with good panfish populations.

STRATEGY C. Increase panfish fishing opportunities, particularly in urban areas, through the management of marginal lakes.

OBJECTIVE 2. Increase the number of quality-sized panfish available to anglers by 10 percent in selected waters.

PROBLEM 1. Habitat loss and degradation affect important panfish habitat components.

STRATEGY A. Educate the public concerning the importance of the various habitat components that contribute to a healthy panfish fishery.

STRATEGY B. Identify within individual lakes the important habitat components for panfish such as spawning areas and nursery areas.

STRATEGY C. Improve panfish habitat components where needed.

STRATEGY D. Continue cooperation with the DNR Division of Waters, local units of government, and the Pollution Control Agency (PCA) in protecting water quality for panfish populations.

STRATEGY E. Employ lake rehabilitation measures to increase quality of panfish populations.

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10. Bullheads

Fishing for bullheads in Minnesota has varied appeal throughout different regions of the state. The 3 species found in Minnesota are the brown bullhead (Ictalurus nebulosus), black bullhead (I. melas), and yellow bullhead (I. natalis). Each species has specific habitat requirements. Bullheads are found in nearly all ecological lake types and streams, but are notably abundant in prairie and bass-panfish lakes. Bullheads spawn in May and June. They are omnivorous, feeding on aquatic invertebrates and vegetation.

Resource Management

Management of bullheads as a sport species has focused on bag limits to prevent unlicensed commercialization, intensive removal to improve overall size of the bullheads remaining in the lake, and stocking catchable-size fish in ponds to provide urban fishing opportunities. Recreational use surveys document the significance of local bullhead fisheries and the need to develop protected instream flows. In some cases commercial harvest restrictions have been imposed on 1 or more species of bullheads. Indirect management for bullheads has resulted from aeration of lakes and inadvertent introductions into chemically reclaimed waters.

Resource Analyses

Bullheads are present in nearly all lakes of the state except Region 2 (Northeast), where they are present in approximately 25 percent of the northeastern lakes. Black bullheads are found statewide, but are particularly abundant in southern waters and periodic winterkill lakes. Yellow bullheads are generally present in the southern two-thirds of Minnesota and prefer the clear, relatively deep bass-panfish lakes. Yellow bullheads frequently attain a larger size than black or brown bullheads and are preferred by bullhead enthusiasts. Brown bullheads are typically found in the central and northern parts of the state. Opportunities for bullhead fishing, at present, greatly exceed statewide demand.

The demand for bullhead fishing is increasing in southern Minnesota. This is most evident at tailwater fisheries along warm-water streams. Where lakes are naturally eutrophic, or have become culturally eutrophic, acceptance of bullhead fishing increases because of population declines of the more desirable gamefish species. A large percentage of these bullhead anglers are from out-of-state. In the remainder of the state, demand is very low, and anglers either accept incidental harvest or consider bullheads to be a nuisance to sportfishing.

Resource Value

Bullheads provide an opportunity for fishing trips with high catch rates and liberal bag limits. Stocked urban ponds provide easy angling opportunities for children, senior citizens, handicapped and other mobility-restricted persons.

Long Range Planning for Bullheads

PRODUCT: Populations of bullheads for their use and appreciation.

PROGRAM GOAL: Enhance fishing quality while controlling the present distribution of bullheads in the state of Minnesota.

OBJECTIVE 1. Increase the average size bullhead harvested from 8 to 9 inches by 1992 in selected lakes.

PROBLEM 1. The relationship between sampling catches and fishing quality is not fully understood.

STRATEGY A. Develop appropriate indices relating sample catches to fishing quality for bullheads.

PROBLEM 2. There is a lack of feasible techniques to increase size of bullheads.

STRATEGY A. Conduct research into techniques for increasing the size of bullheads in the sport catch.

STRATEGY B. Encourage research on selective fish toxicants to controlling bullhead populations.

PROBLEM 3. Some commercial fishing activities are not compatible with sportfishing for bullheads.

STRATEGY A. Develop selective commercial fishing gear for harvesting black bullheads.

STRATEGY B. Require commercial fishermen to return yellow and brown bullheads to the waters from which they were caught.

PROBLEM 4. Degradation of water quality by point and non-point sources of pollution adversely affects bullhead populations.

STRATEGY A. Eliminate point source pollution that affects water quality and bullhead populations.

STRATEGY B. Reduce nonpoint source pollution that affects water quality and bullhead populations by improving watershed management.

OBJECTIVE 2. Improve the image of the bullhead as a sport and table fish.

PROBLEM 1. The bullhead suffers poor public acceptance as a sportfish and table delicacy.

STRATEGY A. Inform public on efficient fishing techniques for bullheads.

STRATEGY B. Inform public on the proper care and preparation of bullheads for the table.

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11. Catfish

Two species of catfish in Minnesota are pursued as sport fish: the flathead catfish (Pylodictus olivaris) and channel catfish (Ictalurus punctatus). Flathead catfish are found in the large, sluggish rivers and lakes of southern Minnesota. The channel catfish is a component of warm water stream communities, except for Mississippi drainage upstream of St. Anthony Falls.

Flathead Catfish

The flathead catfish is one of Minnesota's lesser known sportfish. It often attains a weight of 40 pounds or more. A few as heavy as 70 pounds have been taken in Minnesota. Flathead catfish are found in the large rivers south of Granite Falls on the Minnesota River, Taylors Falls on the St. Croix River, and the Coon Rapids Dam on the Mississippi River. Spawning occurs in June and July, usually near a log, stump, or undercut bank in quiet water. It is a voracious piscivore, but will also eat invertebrates and carrion.

Resource Management

Management of flathead catfish has focused on bag limits and habitat protection. Anglers frequently overlook the flathead resource in favor of fishing for other more abundant species found in nearby lakes and streams. Little information exists concerning the harvest and population

dynamics in Minnesota waters.

Recent research has documented the effect of stocked flathead catfish on the community structure of centrachid lakes of southern Minnesota. Preliminary results suggest significant reduction in carp and bullhead populations, but techniques for stocking are not available to managers.

Resource Analyses

Flathead catfish are found in 505 miles of large rivers and some lakes in the southern half of Minnesota. They tend to be less abundant than sympatric channel catfish and are considered a "bonus" in the angler's catch because of the generally larger size. They are found in southwest (Minnesota River), southeast (Mississippi River) and east central (St. Croix River) Minnesota.

The demand for flathead catfish is minimal. The fish is typically underutilized within its preferred habitat. Localized interest exists in Regions 4, 5 and 6 where catfish derbies attract enthusiasts from Minnesota and other states. Use of flathead catfish populations is low and angler interest recently stable.

Channel Catfish

Channel catfish are probably the most underrated sport fish present in Minnesota waters. They are found as a component of warm-water stream communities. The channel catfish prefers swift, clean waters but will tolerate some habitat degradation and cultural eutrophication. This species spawns in June and July, usually near a log, stump, heavy rip-rap or undercut bank. It subsists on invertebrates and small fishes.

Resource Management

Past management of stream populations has focused primarily on bag limits and habitat protection. Recent

management efforts have included creel surveys to estimate recreational use of channel catfish, introductions into reaches of suitable habitat where extirpated or not previously found, development of protected stream flows, and electrophoretic analysis to determine stock origin.

During the past 20 years, stocking of channel catfish in lakes has enhanced existing fish communities, provided trophy-sized fish to anglers and created a short-term fisheries following reclamation. Prairie and bass/panfish lakes have received nearly all of these stocked fish. Although fishing for catfish on some lakes is good, efforts to sample stocked fish have been largely unsuccessful. To support the stocking program, channel catfish have been reared to yearling size on artificial diets at two hatchery facilities.

Resource Analyses

Channel catfish are found in 42 lakes totaling 45,525 acres and 35 streams encompassing 2,432 miles and 26,531 acres, most of which are found in southern Minnesota, in regions 4 and 5. Statewide, lake populations are sustained primarily with stocking. Naturally sustained populations are found in streams of all 6 regions. Five percent of the stream habitats have been stocked to introduce or reintroduce populations. Some streams with naturally sustained populations are stocked to supplement natural reproduction.

Culture efforts to produce channel catfish for stocking were initiated in 1979. Production has steadily increased at 2 hatchery facilities averaging 30,000 yearling fish annually. Present annual requests for fish are 60,000 fingerlings and 60,000 yearlings.

Harvest information on channel catfish is minimal. Angler harvest can be greater than 20 pounds per stream acre. Catfish are the principal species sought in some

southern Minnesota streams, but the general public is unaware that catfish are present in many northern streams and rivers. Demand for stream fishing is gradually increasing on southern warm-water streams and large rivers. Interest is stable in other areas.

Very little information is available on channel catfish in lakes because of few reliable methods to sample lake catfish populations. Fishing interest for lake catfish, however, is generally increasing. The catfish fishery is considered to be underutilized.

Resource Value

Flathead catfish offer anglers the opportunity to catch trophy-sized fishes the magnitude of other large gamefish. Channel catfish offer an inexpensive, quality angling experience along Minnesota's warm-water streams. Within stocked lakes, trophy-sized fish over 20 pounds are occasionally taken.

Long Range Planning for Catfish

PRODUCT: Channel and flathead catfish populations for sport and commercial utilization and appreciation.

GOAL: Maintain the channel and flathead catfish populations and improve the trophy sport fishing opportunities.

OBJECTIVE 1. Maintain the existing population status of catfish in 42 lakes and 3,000 miles of stream.

PROBLEM 1. Environmental quality may limit catfish populations.

STRATEGY A. Establish environmental quality standards for catfish.

STRATEGY B. Monitor catfish habitat quality to identify problems.

STRATEGY C. Take action to correct situations leading to the environmental degradation of catfish habitat.

PROBLEM 2. Information on the population status of catfish is inadequate.

STRATEGY A. Develop better techniques to assess the population status of catfish.

STRATEGY B. Apply known techniques to monitoring catfish populations, harvest, and recreation.

PROBLEM 3. Commercial fishing may limit catfish populations.

STRATEGY A. Monitor commercial and sport harvests of catfish to identify potential areas of conflict.

STRATEGY B. Develop guidelines for commercial and sport harvest of catfish.

STRATEGY C. Inform the catfishing interests of the findings in Strategy A and seek their input for solutions.

PROBLEM 4. Catfish require specific overwintering sites in streams that need to be identified and managed.

STRATEGY A. Identify catfish wintering areas.

STRATEGY B. Maintain a periodic survey of catfish wintering areas to ensure their continued existence.

STRATEGY C. Inform other agencies with management responsibilities influencing the wintering areas for catfish of their importance and proper management.

PROBLEM 5. Maintenance of catfish stream habitat is dependent upon adequate instream flow regimes.

STRATEGY A. Determine the proper instream flow regimes for identified catfish habitat.

STRATEGY B. Cooperate with agencies responsible for maintaining adequate instream flow regimes for catfish.

PROBLEM 6. Channel catfish populations may have to be maintained or expanded using hatchery reared fish.

STRATEGY A. Determine population status of channel catfish to identify those areas in which stocking is necessary to maintain populations, and the number of fish needed to stock these areas adequately.

STRATEGY B. Determine areas of suitable channel catfish habitat without catfish populations and the number of fish required to establish populations.

STRATEGY C. Procure channel catfish for stocking.

STRATEGY D. Use appropriate genetic stock of catfish for introductions and remedial stocking.

PROBLEM 7. Angler access to warmwater streams may have to be expanded.

STRATEGY A. Investigate the need for increased angler access to warmwater streams.

STRATEGY B. If necessary, acquire additional warmwater stream access.

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12. Whitefish & Cisco

North American explorers made reference to whitefish (Coregonus clupeoformis) abundance in the Great Lakes and its high food value more than 300 years ago. Excellent whitefish fishing influenced establishment of a mission at Saulte St. Marie on Lake Superior and was a factor used to induce settlement of the Great Lakes area.

Resource Management

The importance of whitefish was recognized early in Minnesota. During the 1870s whitefish were one of the first fishes to be artifically propagated and stocked into state waters. The program continued for more than 80 years, which ultimately resulted in lake whitefish and cisco (C. artedii) becoming established in many inland lakes. Demand for intensive gamefish management caused suspension of the whitefish propagation program during the mid-1950s.

The whitefish group includes a number of species found in Minnesota. Management emphasizes lake whitefish and cisco (which includes tullibee, cisco, and lake herring). Because of their similar appearance, spawning characteristics, and habitat preferences, separation of management by species is impractical statewide, but necessary on a regional or local level. Many lakes are host to both lake whitefish and cisco. When the 2 species coexist, cisco maintain numerical superiority. Cisco

prevail in the south central part of the state and lake whitefish are more common in the extreme northeastern part of the state. Research on this interrelationship is being conducted by fisheries scientists from the University of Minnesota.

Herring have been stocked in Lake Superior to reestablish the population. Experimental stocking of dwarf cisco into stream trout lakes has been undertaken to monitor differences in growth rates and to test their value as a buffer species for predator birds. Recently the Leech Lake Indian Reservation initiated a program to propagate and stock lake whitefish into waters within the Leech Lake Reservation.

Whitefish and cisco are closely related to trout and have similar environmental requirements. They cannot tolerate warm water for extended periods and escape to the deeper, oxygenated water where they are able to subsist on pelagic crustaceans and bottom organisms. It is not unusual to find them at water depths exceeding 50 feet during the summer months, although they commonly rise to the surface to feed on insects.

Whitefish and cisco are susceptible to periodic summer die-offs, which are preceded by hot, calm weather conditions. Stratification of water temperature coupled with oxygen depletion at the thermocline, forces the fish to surface water which is above their critical temperature. Thousands succumbed in many lakes of Minnesota and Canada in 1983. Mortality estimates of 35 to 50 pounds per surface acre were recorded in some Minnesota lakes in this die-off.

Whitefish and cisco are fall spawners. They begin to move toward shorelines in mid to late October when the water temperature falls below 50° Fahrenheit. Spawning occurs on reefs or shoals when the water temperature drops below 40° Fahrenheit. Movement of the fish into the shallows in large

concentrations presents the best opportunity for capture by sport netting, angling, and dark house spearing.

Except during spawning, the migration instinct seems poorly developed, although movement of lake whitefish and cisco into rivers during the spring and fall is common at several locations such as Cut Foot Sioux, Mississippi, Turtle, Ottertail, and other rivers. They have voracious appetites for fish eggs during these migrations.

Resource Analyses

The original range of lake whitefish and cisco in Minnesota is unknown. Lake whitefish, with few exceptions, are confined to the deeper lakes that are typically classified as walleye or trout water. Their present range begins at Whitefish Lake at Brainerd, then north and east to Lake of the Woods and Lake Superior. Cisco are abundant in many lakes beginning in Kandiyohi County, then north and east to Lake of the Woods and Lake Superior. Lake herring, native to Lake Superior, are also found in inland lakes along the Canadian border.

Dwarf cisco are found in some state waters. There is considerable speculation on whether this is a distinct species, or C. artedii. Dwarf specimens taken from Ten Mile Lake in Cass County, where they attain a maximum length of 6 inches, were experimentally stocked into other waters. They immediately exhibited normal growth of cisco in their new environment. Dwarf cisco were not considered as a separate species in this plan.

Summer sportfishing for cisco is done in the Alexandria area in deep (60+ feet) water. Winter angling is also done in deeper waters. Angling also occurs for cisco and whitefish in northern lakes during the summer when they feed on the surface.

Sportfishing of whitefish and cisco is limited, partly because the fish are available in shallow water for only a

short time in late fall and early winter. To compensate for the difficulty of catching them in deep water, licensed resident gill netting has been allowed in specified lakes during the fall spawning run. Initial netting regulations began in 1940 when separate whitefish or herring licenses were offered at $1 per net. The fee remained unchanged for the next 38 years.

Annual license sales began at about 1,500, increased to 4,000 by 1950, then remained relatively stable, except for a short-term peak during 1974 to 1976, until recently. A fee increase to $4 for 2 nets in 1978 had little impact on total license sales. The license fee was again increased in 1983, and a 1 net limit imposed. Season lengths were reduced on some lakes while others with light use were closed to netting.

Traditional netting may be losing interest. License sales declined to a 40-year low of 2,398 in 1985. Whitefish netting license revenue is an insignificant part of total fishing license sales. Receipts averaged $5,000 per year from 1940 to 1977 and $18,000 since 1978.

Minnesota lacks information for lake whitefish and cisco management. There have been virtually no studies to document their relationship with other species and whether high populations are beneficial or detrimental. Sport-fishing potential is limited and whitefish management is secondary to gamefish.

Monitoring of whitefish and cisco populations is incidental to assessment of gamefish. In some cases summer assessment netting has completely missed capturing these species even though known populations exist. Specific whitefish and cisco assessment work has usually been confined to monitoring the timing of spawning runs to aid in setting opening dates for sport netting. In both cases, assessment of whitefish and cisco populations has fallen short of the long-term studies needed to determine what role

these species serve in the lake community. Recognition of the potential of these species for sport angling should be acknowledged.

Resource Value

Sport whitefish and cisco netting harvest estimates are not available, but the resource, especially cisco, exceeds the present demand. Recruitment has been maintained entirely by natural reproduction. There has been no indication of declines in inland lakes where habitat is favorable, except in a few isolated lakes with intensive harvests. Sport angling for cisco is popular in local areas. It involves only a small fraction of the total number of licensed anglers. Lake whitefish angling is rare. A few individuals enjoy angling when whitefish are rising to insects or when they are on the shoals. Darkhouse spearing for lake whitefish is gaining popularity as a challenging sport. However, the fish are difficult to decoy into range and spear because of their tendency to be constantly moving in the water.

The comparative sport value of the 2 species probably favors cisco because of its larger range, higher abundance, and relative ease to catch on hook and line. However, where selection is possible, lake whitefish become the overwhelming favorite because they are larger and have excellent eating quality.

Large lake whitefish appear to be less susceptible to the csytiform stage of a tapeworm (Triaenophorus crassi). Although harmless to humans, it forms unsightly yellowish cysts, making the fish undesirable for human consumption. High incidence of this tapeworm cyst in some lakes on cisco and smaller lake whitefish has discouraged their use as food.

Long Range Planning for Whitefish and Cisco

PRODUCT: Whitefish and cisco populations as components of the fish community.

GOAL: To provide a whitefish and cisco harvest where compatible with gamefish management.

OBJECTIVE 1. Maintain current population and distribution of whitefish and cisco in Minnesota.

PROBLEM 1. Information on life history, community relationships, and population status of whitefish and cisco in lakes is insufficient.

STRATEGY A. Assess populations of whitefish and cisco in lakes with known populations of these fish.

STRATEGY B. Investigate the life history and community relationships of whitefish and cisco and incorporate findings into management activities.

OBJECTIVE 2. Provide annual harvest opportunities for whitefish and cisco where compatible with gamefish management.

PROBLEM 1. Demand for whitefish and cisco netting licenses is decreasing.

STRATEGY A. Inform public regarding the fishing opportunities for whitefish and cisco.

PROBLEM 2. Excessive resources are required to manage harvest of whitefish and cisco to minimize incidental catches of gamefish.

STRATEGY A. Reduce the whitefish and cisco seasons to minimize the catch of gamefish.

STRATEGY B. Enforce whitefish and cisco regulations to correct incidental catching of gamefish.

OBJECTIVE 3. Develop commercial harvest goals for whitefish and cisco.

PROBLEM 1. Economics of commercial harvest of whitefish and cisco are marginal.

STRATEGY A. Encourage the commercial fishing industry to develop markets for whitefish and cisco products.

STRATEGY B. Encourage the fishing industry to work with other government agencies in developing a market for their whitefish and cisco products.

PROBLEM 2. Commercial harvest of whitefish and cisco may be incompatible with lake management.

STRATEGY A. Allow commercial fishing for whitefish and cisco only in those waters where it is not in conflict with the sportfishery or lake management plans.

PROBLEM 3. Tapeworm cyst makes whitefish and cisco unmarketable.

STRATEGY A. Monitor the occurrence of tapeworm cysts on whitefish and cisco.

STRATEGY B. Inform the fishing public regarding the tapeworm cysts on whitefish and cisco.

STRATEGY C. Close the netting season on lakes where high incidence of tapeworm cysts occurs on whitefish and cisco.

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13. Nongame Fish

For definition purposes, fish species that are manipulated or regulated to establish, maintain, or improve a viable recreational fishery are considered game fish and all other species, nongame. Using these criteria, 111 of the 153 fish species inhabiting Minnesota waters are classified as nongame (Table 13-1).

Nongame fish are in virtually every lake, river, and stream in the state. While none are classified as endangered or threatened, 11 nongame fish are of special concern. The special concern species have unique or highly specific habitat requirements and deserve comprehensive monitoring. Some nongame species exist in restricted habitat on the fringes of their geographical ranges.

Table 13-1. Phylogenetic Listing of Minnesota Nongame Fish Species and Statutory Designation as Roughfish (RF), Minnows (MN), Commercial Species (CM) and/or Species of Special Concern (SC).

FAMILY	RF	MN	CM	SC
Petromyzontidae/lampreys				
1. Chestnut lamprey (Ichthyomyzon casteneus)				
2. Silver lamprey (Ichthyomyzon unicuspis)				X
3. American brook lamprey (Lampetra appendix)				
4. Sea lamprey (Petromyzon marinus)				
Lepisosteidae/gars				
1. Longnose gar (Lepisosteus osseus)	X		X	
2. Shortnose gar Lepisosteus platostomus)	X		X	

Table 13-1. (Continued)

FAMILY	RF	MN	CM	SC
Amidae/bowfin				
1. Bowfin (Amia calva)	X		X	
Anguillidae/freshwater eels				
1. American eel (Anguilla rostrata)				
Clupeidae/herring				
1. Alewife (Alosa pseudoharengus)	X		X	
2. Gizzard shad (Dorosoma cepedianum)	X		X	
Hiodontidae/mooneye				
1. Goldeye (Hiodon alosoides)	X	X	X	
2. Mooneye (Hiodon tergisus)		X		
Salmonidae/trout				
1. Cisco (Coregonus artedii)	X	X	X	
2. Lake whitefish (Coregonus clupeaformis)		X	X	
3. Bloater (Coregonus hoyi)				
4. Kiyi (Coregonus kiyi)				
5. Blackfin cisco (Coregonus nigripinnis)				
6. Shortnose cisco (Coregonus reignhardi)				
7. Shortjaw cisco (Coregonus zenithicus)				
8. Pygmy whitefish (Prosopium coulteri)				
9. Round whitefish (Prosopium cylindraceum)				
Umbridae/mudminnows				
1. Central mudminnow (Umbra limi)		X		
Cyprinidae/carps and minnows				
1. Central stoneroller (Campostoma anomalum)		X		
2. Largescale stoneroller (Campostoma oligolepis)		X		
3. Reside dace (Clinostomus elongatus)		X		
4. Lake chub (Couesius plumbeus)		X		
5. Ozark minnow (Dionda nubila)		X		
6. Brassy minnow (Hybognathus hankinsoni)		X		
7. Silver minnow (Hybognathus nuchalis)		X		
8. Speckled chub (Hybopsis aestivalis)		X		
9. Silver chub (Hybopsis storeriana)		X		
10. Gravel chub (Hybopsis x-punctata)		X		X
11. Hornyhead chub (Nocomis bigattus)		X		
12. Golden shiner (Notemigonus crysoleucas)		X		
13. Pallid shiner (Notropis amnis)		X		X
14. Pugnose shiner (Notropis anogenus)		X		
15. Emerald shiner (Notropis atherinoides)		X		
16. River shiner (Notropis blennius)	X			
17. Common shiner (Notropis cornutus)		X		
18. Bigmouth shiner (Notropis dorsalis)		X		
19. Pugnose minnow (Notropis emiliae)		X		X
20. Blackchin shiner (Notropis heterodon)		X		

Table 13-1. (Continued)

FAMILY	RF	MN	CM	SC
21. Blacknose shiner (Notropis heterolepis)		X		
22. Spottail shiner (Notropis hudsonius)		X		
23. Red shiner (Notropis lutrensis)		X		
24. Rosyface shiner (Notropis rubellus)		X		
25. Spotfin shiner (Notropis spilopterus)		X		
26. Sand shiner (Notropis stramineus)		X		
27. Weed shiner (Notropis texanus)		X		
28. Topeka shiner (Notropis topeka)		X		X
29. Redfin shiner (Notropis umbratilis)		X		
30. Mimic shiner (Notropis volucellus)		X		
31. Suckermouth minnow (Phenacobius mirabilis)		X		
32. Northern redbelly dace (Phoxinus eos)		X		
33. Southern redbelly dace (Phoxinus erythrogaster)		X		
34. Finescale dace (Phoxinus neogaeus)		X		
35. Bluntnose dace (Phoxinus notatus)		X		
36. Fathead minnow (Pimephales promelas)		X		
37. Bullhead minnow (Pimephasles vigilax)		X		
38. Blacknose dace (Rhinichthys atratulus)		X		
39. Longnose dace (Rhinichthys cataractae)		X		
40. Creek chub (Semotilus atromaculatus)		X		
41. Pearl dace (Semotilus margarita)		X		
42. Flathead chub (Platygobio gracilis)		X		
Catastomidae/suckers				
1. River carpsucker (Carpiodes carpio)		X		
2. Quillback (Carpiodes cyprinus)		X		
3. Highfin carpsucker (carpiodes velifer)		X		
4. Longnose sucker (Catostomus catostomus)		X	X	
5. White sucker (Castostomus commersoni)		X	X	
6. Blue sucker (Cycleptus elongatus)		X	X	X
7. Northern hog sucker (Hypentelium nigricans)		X	X	
8. Smallmouth buffalo (Ictiobus bubalus)	X	X	X	
9. Bigmouth buffalo (Ictiobus cyprinellus)	X	X	X	
10. Spotted sucker (Minytrema melanops)		X	X	
11. Silver redhorse (Moxostoma anisurum)	X	X	X	
12. River redhorse (Moxostoma carinatum)	X	X	X	
13. Black redhorse (Moxostoma duguesnei)	X	X	X	X
14. Golden redhorse (Moxostoma erythrurum)	X	X	X	
15. Shorthead redhorse (Moxostoma macrolepidotum)	X	X	X	
16. Greater redhorse (Moxostoma valenciennesi)	X	X	X	
Ictaluridae/catfishes				
1. Slender madtom (Noturus exilis)				X
2. Stonecat (Noturus flavus)				
3. Tadpole madtom (Noturus gyrinus)				
Aphredoderidae/pirate perches				
1. Pirate perch (Aphreduderus sayanus)				

Table 13-1. (Continued)

FAMILY	RF	MN	CM	SC
Percopsidae/trout-perches				
1. Trout perch (Percopsis omiscomaycus)				
Gadidae/codfishes				
1. Burbot (Lota lota)	X		X	
Cyprinodontidae/killifish				
1. Banded killifish (Fundulus grandis)				
2. Plains topminnow (Fundulus sciadicus)				X
Atherinidae/silversides				
1. Brook silverside (Labidesthes sicculus)				
Gasterosteidae/sticklebacks				
1. Brook stickleback (Culaea inconstans)				
2. Ninespine stickleback (Pungitius pungitius)				
Percidae/perches				
1. Crystal darter (Ammocrypta asprella)				X
2. Western sand darter (Ammocrypta clara)				
3. Mud darter (Etheostoma asprigene)				
4. Rainbow darter (Etheostoma caeruleum)				
5. Bluntnose darter (Etheostoma chlorosomum)				X
6. Iowa darter (Etheostoma exile)				
7. Fantail darter (Etheostoma flabellare)				
8. Least darter (Etheostoma microperca)				
9. Johnny darter (Etheostoma nigrum)				
10. Banded darter (Etheostoma zonale)				
11. Log perch (Percina caprodes)				
12. Gilt darter (Percina evides)				
13. Blackside darter (Percina maculata)				
14. Slenderhead darter (Percina phoxocephala)				
15. River darter (Percina shumardi)				
Sciaenidae/drums				
1. Freshwater drum (Aplodinotus grunniens)	X		X	
Cottidae/sculpins				
1. Mottled sculpin (Cottus bairdi)				
2. Slimy sculpin (Cottus cognatus)				
3. Spoonhead sculpin (Cottus ricei)				
4. Deepwater sculpin (Myoxocephalus thompsoni)				

Resource Management

Broad statutory regulations presently govern the harvest of 68 nongame fish as roughfish, minnows, and/or commercial species (Table 13-1). Thirty-six species are presently unregulated. The inclusion of all member species of a family under general regulations has resulted in minimal quantitative or qualitative evaluation of species having consumptive values and essentially no assessment of remaining family members. Coincidentally, there has been no management impetus to monitor unregulated nongame species having primarily nonconsumptive values.

Resource Analyses

Existing abundance and distribution data of most Minnesota nongame fish species is incomplete, though there are presently no indications that supply is limited. While the numerous lake and stream survey reports provide a large potential data base, historical evaluations of nongame species are inadequate and individuals were frequently identified only by family. Some multidisciplinary investigations of nongame fish have recently expanded the data base, the most notable being the initiation of work on an atlas of Minnesota fish in cooperation with the University of Minnesota.

Though initial funding for this project was sporadic and work was delayed in 1978, a financial base for completion of the atlas was again established in 1983 through the Section of Fisheries and the Section of Wildlife Nongame Program. The completion of this study will provide a good data base for abundance and distribution of nongame species. Other pertinent studies funded through the Nongame Wildlife Program include a survey of the St. Croix River tributaries for the southern brook lamprey and detailed life history studies of Minnesota darters.

Limited information is available on the supply of

nongame species providing consumptive values as bait or harvestable commercial species. An initial step in establishing a more comprehensive data base is to determine the abundance, distribution, and composition of nongame fish within each MDNR Section of Fisheries administrative area and to then formulate ways in which the various segments of this resource may best be managed. Scheduled lake and stream surveys and population assessments conducted by the MDNR could provide nongame information with minimal additional effort. Another means for expanding the data base is through the design and implementation of life history and community dynamics studies.

The forseable demand for bait and commercial species will continue to be met. Public demand for nonconsumptive use will likely develop, but the magnitude is unknown.

Environmental changes can be monitored through qualitative and quantitative fluctuations of nongame species. This information will allow simulation modelling on a community basis to benefit management of both game and nongame species. The specific habitat requirements of some species allow managers to measure the effects of habitat improvement projects, determine habitat degradation or improvement, and locate possible problem sources.

Resource Value

While nongame species have rarely been actively managed in Minnesota, their importance in community dynamics has long been recognized. Predator-prey relationships, energy flows, and species composition are all closely related to the abundance and distribution of nongame species. Public interest has, traditionally, focused on the management of gamefish species for recreational harvest. The emphasis on game fish management coupled with budgetary and personnel limitations has generally precluded detailed field evaluations of nongame fish species.

Public awareness of nongame species and a general concern for environmental quality and preservation has gradually expanded. Knowledge of the distribution and abundance of nongame species is needed to gauge changes in environmental quality and community dynamics.

Long Range Planning for Nongame Fish

PRODUCT: Nongame fish species as essential components of aquatic ecosystems.

GOAL: To determine the abundance, distribution and habitat requirements of nongame fish species in Minnesota.

OBJECTIVE 1. Provide a catalog of nongame fish species in Minnesota by July 1, 1990.

PROBLEM 1. The designation of many fish species is not clear.

STRATEGY A. Classify nongame fish species in Minnesota by their consumptive and nonconsumptive values.

OBJECTIVE 2. Establish a multi-disciplinary nongame fish working group by July 1, 1988 to coordinate data compilation, establish priorities, and study design and implementation.

PROBLEM 1. Data on the general abundance and distribution of nongame fish species is insufficient.

STRATEGY A. Train field personnel in nongame fish sampling techniques and species identification.

STRATEGY B. Incorporate more precise information on nongame fish species into the lake and stream survey format.

STRATEGY C. Develop a better understanding of nongame fish in the gamefish food chain.

STRATEGY D. Associate nongame fish species with specific habitat types to facilitate monitoring of environmental changes.

STRATEGY E. Establish a representative collection of nongame fish at each Area Fisheries Headquarters.

STRATEGY F. Continue to promote cooperative interdisciplinary studies of aquatic ecosystems and nongame fish.

STRATEGY G. Establish a format for an accessible nongame fish computer data base.

STRATEGY H. Research other possible and acceptable uses of nongame fish and inform clientele.

PROBLEM 2. Data on community interactions and the life histories of many nongame fish species is insufficient.

STRATEGY A. Promote and design nongame fish life history and community dynamic studies.

STRATEGY B. Locate base populations of nongame fish species on which to conduct long-term studies.

STRATEGY C. Focus initial efforts on nongame fish species of special concern and those having limited distribution.

PROBLEM 3. Grouping nongame fish species within the same family under blanket regulations does not

allow for individual species management.

STRATEGY A. Provide information on the need for individual nongame fish abundance, distribution, and life history data.

PROBLEM 4. Projects altering or affecting nongame fish habitat may be based on data for game species.

STRATEGY A. Insure that the impact on all fish species is evaluated before habitat is altered.

STRATEGY B. Provide information and stimulate interest on the importance of nongame fish to both the public and managers.

PROBLEM 5. Some management activities intended to increase gamefish numbers have adverse effects on nongame fish populations.

STRATEGY A. Ensure that the impact of fisheries management activities on nongame fish are evaluated before activities are undertaken.

OBJECTIVE 3. Establish guidelines for the accumulation and assimilation of abundance, distribution, and habitat requirement data for all nongame fish species by July 1, 1990.

PROBLEM 1. Guidelines for monitoring nongame fish species have not been established.

STRATEGY A. Establish guidelines for monitoring nongame fish species.

STRATEGY B. Intensify monitoring of nongame fish listed as species of special concern.

OBJECTIVE 4. Establish a field accessible data base for nongame fish species on a watershed basis by July 1, 1991.

PROBLEM 1. No data management framework exists for nongame fish resources.

STRATEGY A. Establish a nongame fish data management system compatible with existing files.

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
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Plan Name:_____

Comments:_____

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Your name:_____

Address:_____

_____

_____

Are these the official comments of this organization?__Yes __No

Organization:_____

Thank you for your comments.
To mail: fold & seal with tape, or place in envelope.

14. Commercial Fish

In the mid-1800s some Minnesota communities were sustained mainly by the harvest of fish taken from nearby waters. Railroads opened new markets and by the turn of the century, nearly all fish harvested were taken by commercial fishermen.

The marketplace dictated which species were harvested and the species of preference were whitefish, lake trout, herring, chubs and sturgeon. Major markets for Minnesota's fish were Minneapolis, Chicago, and New York.

Commercial fishing activity peaked in the mid-1930s. Fishermen numbers were high and major markets were moving large quantities of the product to eager consumers. Statewide road systems enabled the fishermen to get his product to the marketplace much quicker. As access to lakes improved, commercial and sportfishing expanded into more lakes.

The labor movement allowed more free time for the working class and many used this time for angling. As sportfishing increased and commercial fishing continued, conflicts developed between these user groups.

Commercial fish production reached its highest level in the 1950s and 1960s. There was a parallel increase in sport angler numbers, mobility, and harvest efficiency. The resulting fish population exploitation required fish managers to reexamine the effect both user groups had on

specific fish populations. Species eligible for commercial harvest shifted from the gamefish species, which were desired by sport fishermen, to the nongame species. Commercial production increased but overall value did not.

In the 1970s a combination of fish contamination, political pressure, and reduction in traditional markets resulted in a production decline in the commercial fishing industry. Less than one-half the number of persons commercially fishing in the 1930s and 1940s remained. Fishing income became supplemental to income derived from other occupations like farming or construction. Few commercial fishermen now earn their entire annual income from their fish harvest.

Modern commercial fishing equipment (boats, motors, ice augers, nylon webbing, sonar, winter clothing, etc.) enables fewer fishermen to spend less time producing enough fish to satisfy current markets. Three thousand participants are currently involved in the industry.

The 1980s indicate a leveling of commercial fishermen numbers and production volume. Future expansion of commercial fish harvest is dependent on local, national, and international markets (consistent with supply) (Table 14-1).

Resource Management

The commercial fishing industry of Minnesota encompasses 11 distinct fisheries; live bait, inland, Lake Superior, private fish hatchery, interstate, international, turtles, frogs, mussels and clams, inland Mississippi River and Minnesota-Mississippi River set line. Contact with each fishery is maintained through licensing, annual business meetings, fishermen reports, and personal communication.

Production reports are required from each fisherman before annual relicensing. Data from these reports are analyzed and submitted to resource managers for consideration when regulation or management decisions are formulated.

Table 14-1. Commercial Fish Production in Minnesota

Species	Current Production (pounds)	Expanded * Production
Carp	3,200,000	5,000,000
Buffalofish	1,200,000	1,500,000
Sucker	200,000	400,000
Sheepshead	100,000	500,000
Eelpout	100,000	1,000,000
Cisco	3,000,000	3,500,000
Bullhead	1,000,000	1,500,000
Smelt	500,000	1,000,000
Whitefish	150,000	200,000
Turtles	75,000	100,000
Minnows	3,000,000	3,500,000
Other **	100,000	1,000,000
TOTAL	12,625,000	19,200,000

* Estimated production expansion of currently marketable species and size classes by increasing commercial fishing gear usage

** Species of current low priority are included in "other" (redhorse, dogfish, garfish, goldeyes, frogs, mussels, etc.)

Resource Analyses

Fish species taken for commercial purposes, as identified by Minnesota statute, are carp, buffalofish, suckers, redhorse, sheepshead, dogfish, eelpout, cisco, garfish, goldeyes, bullheads, smelt, and whitefish. Statute definition of minnows includes all members of the minnow family (Cyprinid), except carp and goldfish, mudminnows and all members of the sucker family (Catostomidae) not over 12 inches in length. It also includes bullheads, ciscos, herring, whitefish, goldeyes and mooneyes not over 7 inches in length. For purposes of any law regulating harvest, sale, or transportation, a leech is considered a minnow.

Current levels of commercial effort and production (Table 14-1) are adequate to satisfy demand. If demand is increased by expanding markets, production could increase substantially without additional participants.

Resource Value

Minnesota commercial harvests total 10,000,000 pounds of whole fish annually, of which 50 percent is marketed for human consumption. The value of the commercial harvest, including minnows, is estimated to be nearly $30 million (Table 14-2). Three thousand participants are directly involved in the industry.

Table 14-2. Commercial Fisheries, 1983

Fishery *	Participants (Incl. Helpers)	Production (Pounds)	Estimated Value
Minnow	2,645	3,954,969	$23,187,962
Inland	218	6,698,348	1,020,713
Lake Superior	69	484,089	172,656
Private Hatchery	90	863,748	2,243,368
Interstate **	172	753,937	71,234
International ***	41	1,063,389	371,090
Turtles	52	40,335	16,134
TOTAL	3,287	13,858,542	$27,983,157

* Fisheries with current minimal production are not listed.

** Production affected by pollution - contaminants monitored.

*** Legislative action in 1985 has nearly eliminated commercial production.

Long Range Planning for Commercial Fish

PRODUCT: Fish products for commercial purposes.

GOAL: To provide a commercial harvest of nongame fish species at an optimum level compatible with the aquatic ecosystem.

OBJECTIVE 1. Identify and quantify commercial fish populations in the state by 1992 with funding support from the industry.

PROBLEM 1. Information on commercial fish populations that may be commercially exploited is inadequate.

STRATEGY A. Assess all fish populations of present species to determine commercial fishing opportunities.

STRATEGY B. Incorporate assessment of turtles, clams, crayfish, frogs, and leech populations into lake and stream surveys.

STRATEGY C. Develop commercial fishing effort data for all commercial fish species.

PROBLEM 2. Information on the effect of commercial fishing on fish populations and the ecosystem is inadequate.

STRATEGY A. Identify commercial fish species population response to commercial and sport fishing.

STRATEGY B. Identify the ecosystem response to commercial removal of fish.

STRATEGY C. Identify incidental catch rates and mortalities of nontarget species in commercial fishing operations.

STRATEGY D. Develop sustainable removal rates for commercial fish species for individual water bodies.

PROBLEM 3. Markets are a limiting factor in commercial fish production.

STRATEGY A. Provide data for commercial fishermen in their market development efforts.

STRATEGY B. Encourage the efforts of private enterprise in commercial fish processing facility development.

STRATEGY C. Provide commercial fish harvest statistics as requested by entrepreneurs.

STRATEGY D. Encourage the development of promotional material and programs for utilizing commercial fish species.

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Comments:_____

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Your name:_____

Address:_____

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Are these the official comments of this organization?__Yes __No

Organization:_____

Thank you for your comments.
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15. Other Fish

Lake and shovelnose sturgeon, paddlefish, burbot, and bowfin have value, although providing limited angling opportunities. Each species is important in its own right, with sturgeon, paddlefish, and bowfin a link to the past. Their continued existence is dependent on our ability to maintain and enhance their aquatic environment.

Each species' population status, ecological niche, distribution, and habitat requirements must be defined before they can be effectively managed. Population levels will likely be a result of our effectiveness in habitat protection and harvest management.

Sturgeon

Sturgeon are large primitive fish that are extremely slow growing and late maturing. The lake sturgeon (Acipenser fulvescens) is Minnesota's largest fish, having been known to reach 8 feet in length and weigh 300 pounds, while the shovelnose sturgeon (Scaphirhynchus platorynchus) is smaller, seldom over 2 feet or weighing more than 6 pounds.

During the past 100 years, lake sturgeon populations have been drastically reduced. Overfishing, poor water quality, and dam construction have been largely responsible for their decline.

Resource Management

The lake sturgeon is currently classified, federally, as rare and by the Minnesota Department of Natural Resources (MDNR) as a "species of special concern". Lake sturgeon were once abundant throughout the Hudson Bay, St. Lawrence River, and Mississippi River drainages downstream of St. Anthony Falls. Only remnant populations exist over much of their former range.

The shovelnose sturgeon occurs mainly in the Mississippi downstream of St. Anthony Falls and Missouri River drainages.

A large population of lake sturgeon once inhabited the St. Louis River. They were eliminated by poor water quality and a reduction of spawning habitat. The MDNR introduced 5,000 fingerling lake sturgeon into the St. Louis River in an attempt to reestablish this diminished fishery. Twenty to 25 years will elapse before these fish will be large enough to enter the fishery.

The commercial harvest of lake sturgeon in Minnesota peaked during the late 1800s. In 1893 the Minnesota portion of Lake of the Woods provided a yield of 1,300,000 pounds. Ten years later the catch dropped to 45,000 pounds, and shortly thereafter commercial fishing for lake sturgeon was banned in American waters. A limited commercial fishery still exists in Canadian waters of Lake of the Woods. Various sportfishing seasons exist for lake sturgeon in many of the Great Lakes states.

Minnesota's sportfishing regulations concerning both species of sturgeon have varied widely since 1922. Harvest was first regulated by weight, with no evidence of possession limits. Minnesota closed lake sturgeon fishing in 1930. The season was reopened on border waters in 1947 with minimum size limits of 30 inches, increased to 45 inches and a possession limit of 1 fish. Angling is currently allowed only in border waters with Ontario,

Wisconsin, South Dakota and North Dakota. Inland fishing is limited to tributaries of the St. Croix River.

The sportfishing season for shovelnose sturgeon is limited to the Mississippi and St. Croix rivers bordering Wisconsin with a possession limit of 10 and no minimum size limit. Limited commercial fishing for shovelnose sturgeon occurs on the Mississippi River.

Resource Analyses

Population and harvest information for both species of sturgeon is incomplete. Information concerning location of these species in Minnesota waters is available only from incidental catches during surveys and limited information from the sportfishery. Few Minnesota anglers fish for lake sturgeon. There is no information available concerning the sportfishing harvest of the shovelnose sturgeon in Minnesota. Shovelnose sturgeon are taken incidental to fishing for other species. Both shovelnose and lake sturgeon are legally taken only by hook and line from border waters and St. Croix River tributaries.

The lake sturgeon fishery in Minnesota is very localized and census information is needed to evaluate current sturgeon fishing regulations. In an effort to regulate the sturgeon harvest in Wisconsin, the Wisconsin DNR requires a "sturgeon tag," to be obtained by the angler before the season starts, and registration of all creeled lake sturgeon.

Paddlefish

Two species of paddlefish occur worldwide. The paddlefish (Polyodon spathula) is found only in North America, while a second species (Psephurus gladius) is endemic to China. Paddlefish are primitive, late maturing, and very slow growing fish. The strange rostrum or snout, which functions as a sensory organ for feeding, is almost

one-third of the fish's total length. Paddlefish may reach 6 feet in length and weigh over 100 pounds. The paddlefish is almost exclusively a plankton feeder, but will occasionally prey on small fish. They live mainly in large rivers and connecting lakes of the Mississippi River drainage. They were once common in Lake Pepin and St. Croix Lake.

The decline in Minnesota paddlefish populations can be blamed on decreasing water quality, dam construction, and overharvest.

Paddlefish spawn in the spring in clean, fast moving water with a gravel substrate. Adult paddlefish do not spawn every year.

Resource Management

During the late 1800s and early 1900s a substantial commercial fishery for paddlefish developed in the lower Mississippi drainage, including lakes Pepin and St. Croix. The sport and commercial seasons for paddlefish have been closed since 1930.

Missouri and South Dakota have a sportfishery for paddlefish. The fish are harvested by snagging. Missouri has an active culture program that stocks paddlefish in designated waters. The most recent threat has been the sale of paddlefish eggs as caviar, for which an illegal market exists.

Resource Analyses

Population data on paddlefish in Minnesota is incomplete, but paddlefish populations in Minnesota are considered low. Traditional fish population surveys do not obtain meaningful information for this species. Commercial fishermen on the Mississippi River catch paddlefish during the summer months. A coordinated effort to gather data from commercial fishery operations may be useful in establishing a data base.

Burbot

The burbot (Lota lota), also known as the eelpout or lawyer, is the only North American member of the codfish family to inhabit freshwater. Adult burbot inhabit deep cool water areas during summer months, and are often found in habitat types associated with lake trout or walleye.

Burbot spawn in shallow water over sand and gravel in late winter. During the spawning period, the adult population concentrates in the favorable spawning areas, making them vulnerable to localized fishing. Burbot are widely distributed in Minnesota. Netting information from the statewide lake survey program indicate that burbot are present in at least 133 lakes, which comprise 2,731,700 acres. The Minnesota portion of Lake Superior accounts for more than half of this total. Burbot are present in all walleye lakes larger than 15,000 acres.

Resource Management

Burbot have been managed as a nongame fish for many years. They feed on fish, fish eggs, and invertebrates. A winter food habits study on Mille Lacs Lake burbot conducted in the 1940s and 1950s documented fish in a majority of the stomach samples. Yellow perch was the single most common identifiable species and in other studies crayfish were important food. Another study documented burbot predation on newly stocked lake trout in Lake Superior, but the degree of interspecific competition between game species and burbot is poorly understood.

Resource Analyses

Burbot have been harvested commercially for many years. The greatest demand for burbot occurred in the late 1950s and early 1960s when the fish were used for animal food. Their flesh lacks the enzyme thyaminase and so they possess large livers which are high in vitamins A and D.

Commercial marketability of burbot is hampered by several factors. The flesh yield of this species is about 40 percent of total body weight, compared to 50 percent or more for other commercially marketed species. Also, burbot flesh has a poor shelf life. When refrigerated, the flesh takes on an unappetizing brownish color after 3 or 4 days. When frozen, an enzyme is released that toughens the meat. However, freshly cooked or canned burbot are excellent.

Presently the supply of burbot exceeds the demand. It has been reported that a large burbot population probably exists in western Lake Superior. Burbot commercial harvest in Minnesota peaked in 1961, when 1,314,500 pounds were harvested. Two-thirds of this was taken from Lake of the Woods.

By 1970, the total commercial harvest dropped below 300,000 pounds. From 1980 through 1983, the commercial burbot harvest remained under 200,000 pounds annually. Statewide sport harvest of burbot is unknown, but is expected to be quite low.

Resource Value

Burbot are generally taken incidentally by walleye and trout anglers during ice fishing. Burbot is gaining acceptance as a quality food fish in some parts of the state.

The International Eelpout Festival, a 3 day burbot winter fishing contest and community event, has been held annually at Walker, Minnesota on Leech Lake since 1980. It has attracted annual crowds of up to 10,000 people of which more than 2,000 were contestants. The festival has provided a great boost to the economy of the Walker area, bringing an estimated $300,000 into the community.

Bowfin

Bowfin (Amia calva) are survivors of an ancient family of fish characterized by a cartilage and bone skeleton. Because the bowfin is an ancestor to most freshwater fishes living today, it provides an opportunity to study the behavioral and physiological links between primitive and modern fishes. Like the gars, bowfin possess cycloid scales and a vascularized air bladder functioning as a lung to aid gill respiration. Bowfin are often seen coming to the surface to expel air, then submerging with a fresh supply--an adaptation allowing survival in waters with low oxygen concentrations.

Spawning takes place during May and June when water temperatures reach approximately 60° Fahrenheit. Spawning activity occurs in and around the roots of emergent plants in habitat similar to that of spawning largemouth bass.

The bowfin is a voracious and opportunistic feeder. Stomach analysis has indicated worms, insects, and fish are principal food items. Since bowfin occupy the same habitat as largemouth bass (and to a lesser extent northern pike), the species may compete with these gamefish for existing forage.

Resource Management

Active management of bowfin in Minnesota has not had priority because of its unfavorable ranking by the public as a food or sport fish, even though it is one of the most exciting fish to catch by angling. Statutory definition of bowfin as a roughfish has resulted in its removal from state waters in commercial harvest.

Bowfin are extensively distributed in Minnesota. A review of statewide lake survey data indicates that 656 lakes have bowfin. The species is common in centrarchid and centrarchid-walleye ecological lake types in southern and central Minnesota. Aitkin, Cass, Crow Wing, and Itasca

counties have the highest relative abundance within this range. Anglers' concerns that bowfin populations have increased is not substantiated in a preliminary review of assessment data.

The assumption has been made that bowfin removal is desirable and a lower population level could improve game fish populations. The ability of bowfin to help solve the problem of stunted sunfish or perch populations has not been adequately assessed. An evaluation of the effects of bowfin stocking on a stunted bluegill population was initiated in 1984 on a southeastern lake and will continue through 1987.

Angling opportunities for bowfin greatly exceeds demand over their entire range. If demand increases due to improved angler acceptance, it is likely that catch and release fishing will be practiced. A high level of fishing pressure could thus be sustained. The sporting attributes of bowfin far outweigh its food value.

Long Range Planning for Sturgeon, Paddlefish, Burbot, and Bowfin

PRODUCT: Populations of lake sturgeon, shovelnose sturgeon, paddlefish, burbot, and bowfin.

GOAL: To maintain viable populations in suitable habitat for lake sturgeon, shovelnose sturgeon, paddlefish, burbot, and bowfin.

OBJECTIVE 1. Determine statewide distribution and abundance of sturgeon and paddlefish by 1992.

PROBLEM 1. Data regarding the distribution and abundance of sturgeons and paddlefish is inadequate.

STRATEGY A. Initiate studies to collect basic population data where known concentrations of sturgeons and paddlefish exist.

STRATEGY B. Initiate studies to provide general biological and ecological information regarding the sturgeon and paddlefish resources.

STRATEGY C. Use commercial fishermen's data in surveys of paddlefish and sturgeon distribution and abundance.

OBJECTIVE 2. Maintain existing natural lake sturgeon populations through 1992.

PROBLEM 1. Present regulations may not be adequate to protect lake sturgeon populations.

STRATEGY A. Evaluate current fishing regulations

for lake sturgeon.

STRATEGY B. Season dates for lake sturgeon should be reviewed and changed, if necessary, to offer protection during the spawning season.

PROBLEM 2. A significant number of juvenile lake sturgeon may be caught by anglers who misidentify them as shovelnose sturgeon.

STRATEGY A. Provide sturgeon anglers with fish identification guides.

STRATEGY B. Provide for additional enforcement in problem areas.

OBJECTIVE 3. Provide necessary habitat for natural reproduction of sturgeons and paddlefish.

PROBLEM 1. Existing sturgeon and paddlefish habitat may be inadequate to maintain populations.

STRATEGY A. Encourage continued restoration of waterways so that optimum conditions for spawning sturgeons and paddlefish are maintained.

STRATEGY B. Maintain adequate water levels during spawning and hatching periods for sturgeons and paddlefish.

STRATEGY C. Plan habitat improvement in areas suitable for spawning sturgeon where such habitat is lacking.

STRATEGY D. Improve existing spawning habitat for paddlefish by cleaning silt and debris from gravel bars and using other accepted stream improvement techniques.

OBJECTIVE 4. Improve ecological and general knowledge of bowfin, burbot, lake sturgeon, and shovelnose sturgeon over the next 6 years.

PROBLEM 1. The role of burbot and bowfin in fish communities is not well understood.

STRATEGY A. Review literature on ecology of burbot and bowfin.

STRATEGY B. Develop investigations on interspecific competition between burbot, bowfin, and gamefish to understand populations and harvest levels.

STRATEGY C. Evaluate the potential of bowfin as a biological control of stunted panfish populations.

PROBLEM 2. Harvest data for burbot, bowfin, sturgeons, and paddlefish is incomplete.

STRATEGY A. Include burbot, bowfin, sturgeons and paddlefish assessment in standard creel surveys conducted on waters where significant populations occur.

STRATEGY B. Design and conduct specific creel surveys as required to obtain harvest data for burbot, bowfin, sturgeon, and paddlefish.

OBJECTIVE 5. Reestablish lake sturgeon and paddlefish in designated waters within their native range through 1992.

PROBLEM 1. Lake sturgeon populations are at a low level.

STRATEGY A. Continue stocking advanced lake sturgeon fingerlings in the St. Louis River at the rate of 5,000 to 10,000 annually for the next 8 to 10 years.

STRATEGY B. Increase public awareness of sturgeon and paddlefish through intensified information and education programs.

OBJECTIVE 6. Promote proper utilization of burbot and bowfin taken by sport anglers through annual programs.

PROBLEM 1. Public acceptance of burbot and bowfin as desirable food and sport fish has not been realized.

STRATEGY A. Work with agencies such as the University of Minnesota Sea Grant Program to make information on uses for burbot and bowfin available to user groups.

STRATEGY B. Produce departmental educational information on burbot and bowfin, including tips on fishing, cleaning, and recipes and their value as a sportfish.

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
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FISH, WILDLIFE & NATIVE PLANT RESOURCES
LONG RANGE PLAN

The Division of Fish and Wildlife is inviting comments from individuals and organizations on the Long Range Plans for the management of fish, wildlife and native plant resources. Use this form, or write us a letter, telling us how we can improve the plan (or plans) you have reviewed.

Plan Name:_____

Comments:_____

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Your name:_____

Address:_____

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Are these the official comments of this organization?__Yes __No

Organization:_____

Thank you for your comments.
To mail: fold & seal with tape, or place in envelope.