Wisconsin’s Great Lakes Fish Management Program 1980-1985

By Terrence R. Dehring and Charles C. Krueger

Administrative Report No. 16

Bureau of Fish Management
Department of Natural Resources
Box 7921
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INTRODUCTION

The State of Wisconsin borders the Great Lakes of Superior and Michigan. On Lake Superior, Wisconsin has 325 miles of shoreline and 1,712,000 acres of cold, clear water. Wisconsin’s shoreline along Lake Michigan is 495 miles long and adjoins 4,727,700 acres of water (including Green Bay). Wisconsin is second only to Michigan in the amount of Great Lakes shoreline and water resources included in its boundaries.

The Great Lakes contain not only an immense water resource, but a fishery resource to match. The fish resource is utilized by sport and commercial fishermen alike. More than 240,000 anglers enjoy fishing Wisconsin’s Great Lakes waters each year. Catering to these anglers are over 350 charter boats, hundreds of marinas and access sites, and countless bait and tackle shops. In the two lakes combined, anglers fished over 4,500,000 hours and harvested an estimated 750,000 trout and salmon in 1982. In Wisconsin, there are currently 21 licensed commercial fishermen on Lake Superior and 199 on Lake Michigan. In addition, there is an important Indian fishery on Lake Superior that includes the Red Cliff and Bad River Tribes. In 1981, commercial fishermen harvested over 23,700,000 pounds of fish with an estimated value of over $3,870,000 in Lakes Michigan and Superior combined. The demand placed on the fishery resources of the Wisconsin Great Lakes has never been greater.

To manage a system of this magnitude, the Wisconsin Department of Natural Resources integrates the functions of several different programs. Among these are Fish Management, Water Resources Management, Waste Water Management, Water Regulation and Zoning, Research, Law Enforcement, Legal Services, and Information and Education.

This document is a summary of the fish management portion of the Great Lakes management program in Wisconsin. Detail is given on the Great Lakes fisheries activities of 27 field personnel stationed at eight different locations (Figure 1). Administrative services to these personnel are provided by the Great Lakes and Boundary Waters Section. In addition, a brief summary is given about the role and accomplishments of the state hatchery system. Administration of hatchery activities are provided by the Inland Section. Programs within both sections are coordinated within the Bureau of Fish Management by the Director, James T. Addis.

Past fisheries projects completed between 1980 and 1983 are summarized in abstract form. Future projects to be conducted between 1983 and 1985 are summarized in terms of their goals and expected contribution to the Great Lakes management program. Hatchery development projects that will be funded in the future by revenues from the Great Lakes Salmon and Trout Stamp are also described.

Figure 1. Wisconsin Department of Natural Resources Great Lakes Field Station locations.
GREAT LAKES FISHERIES PERSONNEL 1983

Bureau of Fish Management — Madison
  James Addis  Director
  Lee Kernen  Great Lakes Section Chief
  David Ives  Commercial Fisheries Staff
  Charles Krueger  Specialist

Lake Superior
  Bayfield
  George King*  Supervisor, Lake Superior Work Unit
  Bruce Swanson  Fish Manager
  Dennis Pratt  Technician
  Pat Aschenbaur  Technician
  Laurie Norse, Jr.  Boat Captain, S/V Hack Noyes
  Jim Ludack  Boat Engineer
  Roger Anderson  Creel Clerk
  Scott Hulse  Project Position
  Terry Margenaub  Project Position (transferred to Bureau of Research 1983)

Brule
  Bill Weiher*  Area Fish Manager
  Steve Schram*  Fish Manager
  Arvo Saari*  Technician

Lake Michigan
  Green Bay
  James Moore*  Supervisor, Lake Michigan Work Unit

Doug Welch*  Technician
Marinette
  Brian Belonger  Fish Manager
  Thomas Gray  Technician, S/V Sheephead (Captain)
  Mike Hawley  Technician

Sturgeon Bay
  Mark Holey  Fish Manager, N. Lake Michigan
  Terrence Lychwick*  Fisheries Biologist
  Michael Toney  Fisheries Biologist
  Pat McKe  Technician
  Frank Schmidt  Boat Captain, S/V Barney
  Richard Pagel  Devine
  Tim Kroeff  Boat Engineer
  Ken Royseck  Natural Resources Assistant

Two Rivers
  Paul Peeters*  Natural Resources Assistant

Plymouth
  Paul Schultz  Fish Manager

Milwaukee
  Vacancy
  Jim VanBakel  Fisheries Biologist

*Have inland responsibilities also.

FISHERIES PROGRAM
1980-1983

The section that follows contains abstracts of projects completed between 1980 and 1983. The abstracts are organized by lake (Michigan and Superior) and by sport and commercial fishery. Complete reports of these projects are available from the Bureau of Fish Management in Madison. Also, included in this section are descriptions of the Great Lakes research vessels, hatchery program, and Bureau of Fish Management activities.
Lake Michigan

Sport Fisheries

Wisconsin's Lake Michigan Sport Fishery 1980
— P. Schultz, Plymouth and C. Krueger, Madison

The 1980 Lake Michigan sport fishing creel census for Wisconsin waters estimated that 334,906 salmonids were caught and 2,662,799 angler hours expended (Table 1 and Figure 2). The catch per effort was 0.13 fish per hour, the second highest reported since 1969. Coho and chinook salmon dominated the catch, at 33% and 33% respectively. Rainbow, lake, and brown trout contributed approximately 10% each. The 1980 catch was the second largest estimated since 1969 and was primarily attributable to increased angler effort.

Wisconsin's Lake Michigan Sport Fishery 1981-1982
— P. Schultz, Plymouth and C. Krueger, Madison

The 1981-1982 creel census on Lake Michigan showed a marked increase in angler effort over 1980 (Table 1 and Figure 2). Estimated angler hours in 1982 were 3,549,682, an increase of 33% from 1980. Total catch of salmonids was estimated as 394,939 fish for 1981 and 473,772 fish for 1982. The percentage of chinook salmon caught increased from 33% in 1980 to 47% in 1981 and 45% in 1982. Rainbow trout catch has sharply declined since 1980.

Salmonid Catch from Privately Moored Boats on Lake Michigan 1982
— P. Schultz, Plymouth and C. Krueger, Madison

The first moored boat census was conducted in 1982. The number of moored fishing boats in each harbor was counted by creel clerks. Catch data was supplied by volunteers who kept records for an entire fishing season (April-October). These data did not include data from charter boats.

In 1982, 2,075 permanently moored boats caught a total of 213,380 trout and salmon from the Wisconsin waters of Lake Michigan. The average catch per boat was 102.8 fish. These boats spent an estimated 773,246 angler hours fishing and had a catch rate of 3.62 hours per fish.

— R. Poff, Madison

The Lake Michigan charter fishery in Wisconsin waters from 1975 through 1980 reported an annual catch which varied from a low of 19,233 (1976) to a high of 34,526 (1980). Annual fishing pressure, in angler hours expended, has steadily increased from 67,578 (1976) to 122,463 (1980). The majority of charter fishing was done between June and September. Coho dominated the catch in May and June, lake trout in July and October, and chinook salmon comprised the major portion of the catch in August and September. The spring coho fishery was most successful in the Racine area. Mid-summer coho catches were more significant further north (Sheboygan to Kenosha). In October, lake trout catches were most significant in the northern waters. The overall catch rate for charter boat fishing was 3.5 hours per fish and was relatively constant from year to year. In contrast, the private boat trolling fishery averaged 7.1 hours per fish in 1980.

Wisconsin’s Lake Michigan Charter Fishery 1981
— C. Krueger, Madison and P. Schultz, Plymouth

The 1981 Lake Michigan charter fishery in Wisconsin waters reported 49,455 salmonids caught and 183,525 angler hours expended. A total of 172 charter licenses were issued in 1981, continuing the rise in license numbers sold that has occurred since 1979. The catch per effort in 1981 was 0.27 fish per angler hour (3.7 hours per fish), the lowest reported for the period of 1976 to 1981. Chinook salmon contributed 42% to the total catch. Lake trout contributed 35%. Species composition varied markedly among locations. Charter fishery catch and effort was highest in the months of July and August in 1981. Catch per effort was highest in April and May. The highest catch per effort was observed in the Two Rivers to Manitowoc area and the Racine to Kenosha area.

Figure 2. Sport fishery harvest of salmonoids exclusive of charter and moored boats from the State of Wisconsin waters of Lake Michigan, 1980-1982.

Charter fishing on the Great Lakes is enjoyed by thousands of anglers each year.
Table 1. Sport fishery effort and harvest exclusive of charter and private moored boats from the State of Wisconsin waters of Lake Michigan, 1980-1982.

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Finclip Returns in the Lake Michigan Sport Fishery
— P. Schultz and D. Dreikosen, Plymouth
Between May 1 and October 31, 1980, Lake Michigan creel census clerks sampled 9,649 trout and salmon during angler interviews (Marinette to Kenosha). Of these fish, 847 had finclips which could be used in further analysis. Lake trout comprised 79% of the finclipped fish in this study, brown trout 8%, coho salmon 5%, chinook salmon 4%, rainbow trout 3%, and brook trout 1%. The lake trout ranged in age from 4 to 14 years and from 22.0 to 32.4 inches (average).

Sea Lamprey Wounding of Lake Trout 1980
— T. Lychwick, Sturgeon Bay
Sea lamprey wounding and scarring data for lake trout was collected for the northern waters of Lake Michigan. The highest wounding rates were confined to lake trout greater than 25.0 inches in length. With only one exception, 1980 wounding rates declined significantly from 1979 rates in all locations for trout in size ranges greater than 25.0 inches. These data represent the lowest wounding rate observed since sampling began (1974).

Monitor Commercial Lifts for Incidentally Captured Lake Trout
— M. Toneys, Sturgeon Bay
The incidental catches of lake trout by the commercial gill net fishery can often be high and have a detrimental impact upon the lake trout populations. In the spring of 1982, 5 contracts were issued to commercial chub fishermen (3 in April, 1 in May, and 1 in June) to fish the area north of Bailey’s Harbor. Data collected during this assessment showed that spring nets fished in waters less than 35 fathoms captured substantial numbers of lake trout. Opening of a spring chub fishery in the northern part of Lake Michigan would require a depth or similar restriction to minimize the incidental catch of lake trout.

Evaluate Lake Trout Stocks in Lake Michigan
— T. Pellett, Sturgeon Bay
Efforts are currently being made to establish self-sustaining stocks of lake trout in Lake Michigan through massive stockings of juvenile fish. The success of these efforts are periodically assessed by attempting to capture lake trout fry over traditional spawning areas. In cooperation with Wisconsin Sea Grant, collection tows for lake trout fry over spawning reefs in the spring of 1982 proved unsuccessful; no fry were caught. To date, natural reproduction of lake trout planted in the Wisconsin waters of Lake Michigan has not been documented. Lake trout, however, are increasing in numbers as evidenced by larger numbers of adult fish being caught by anglers and commercial fishermen.

Changes in Mortality of Lake Trout (Salvelinus namaycush) in relation to Increased Sea Lamprey (Petromyzon marinus) Abundance in Green Bay, 1974-78
— J. Moore, Green Bay and T. Lychwick, Sturgeon Bay
Increased sea lamprey (Petromyzon marinus) abundance in
Green Bay during 1977 was documented utilizing sea lamprey counts and lake trout (Salvelinus namaycush) wounding rates as methods of measurement. Since lake trout rehabilitation began in 1965, sea lamprey predation has been consistently higher in Green Bay and Northern Lake Michigan than other areas of the lake. It appears that increased sea lamprey predation in Green Bay, above the former high levels resulted in decreased abundance and increased mortality of lake trout. The increase in lampreys is related to the colonization of the Peshtigo River, Marinette County, Wisconsin. This report was published in the Canadian Journal of Fisheries and Aquatic Sciences 37:2052-2056.

Performance of Mid-lake Reef Plants of Lake Trout
— M. Holey, Milwaukee

Several stocks of lake trout were planted on reefs in mid-Lake Michigan since 1962. Catch rates from small mesh gill nets during the WDNR's annual club assessment survey were used to compare the success of these plants. Data from these surveys showed that the Green Lake strain lake trout planted on Sheboygan Reef in 1976 had a much higher catch rate than other mid-lake plantings. These data suggest a higher survival rate of the Green Lake strain lake trout than other strains used. The data also indicated that if straying of fish does occur, it is generally to other mid-lake reefs rather than to inshore areas.

During the 1982 summer assessment, over 85% of the 1976 Green Lake strain lake trout on Sheboygan Reef were found to be mature. This is the first time that large numbers of Green Lake lake trout were found in spawning condition. Future surveys will establish the occurrence and/or success of spawning.

From these results it was recommended that fish from Green Lake strain brood or at least fish with a Green Lake strain genetic complement be used when stocking mid-Lake Michigan reefs for lake trout rehabilitation.

Incidental Catch and Total Annual Mortality Rates for Lake Trout in Selected Waters of Northern Lake Michigan
— T. Pellet and M. Tones, Sturgeon Bay

The incidental catch of lake trout in commercial fishing gear was updated to include recent data. The estimated total incidental catch for the years, 1977 through 1981 is 533,283, of which 269,903 were dead in the net. The major contributor to this incidental catch is large mesh gill nets used to capture whitefish. Small mesh gill net (used for broater chub fishing) was used in northern Lake Michigan only on a contract basis from 1977 to 1980. In 1981, the chub fishery in this part of the lake was reopened.

Total annual mortality of lake trout was calculated using catch curves constructed from data collected during annual August surveys. These estimates ranged from a low in 1978 of 31.4% to a high in 1980 of 46.1%. Annual mortality estimates were also calculated by cohort and ranged from a low of 23.9% for the 1975 year class to a high of 61.6% for the 1971 year class.

Strawberry Creek Salmon Weir Operations 1974-1981
— T. Pellett and T. Lychwick, Sturgeon Bay

During October and November of each year (1974 to 1981) returning adult chinook salmon were harvested at the Strawberry Creek weir, Sturgeon Bay, Wisconsin. The purpose of these operations was to provide eggs for the Wisconsin hatchery and stocking programs. In conjunction with this operation, length, weight and sex data were recorded for as many chinook salmon as feasible. For every year the weir was operated, over 50% of the chinook were 3+ years old with the year average being 70.1%. Age 2+ chinooks comprised 23.5% of the sample while 1+ year old fish made up 6.4% of the total. During the 7 year sample period, lengths of the chinook were variable. Age 3+ fish averaged 36.9 inches, age 2+ fish averaged 31.7 inches, and age 1+ fish averaged 23.1 inches in length. Age 3+ chinooks averaged 19.5 pounds, age 2+ fish averaged 11.8 pounds, and age 1+ chinook averaged 5.2 pounds.

Chinook salmon (Oncorhynchus tschawytscha)

Chinook Salmon Spawning Operations 1982
— T. Pellett, Sturgeon Bay

In the autumn of 1982, a total of 4,697,000 chinook salmon eggs were collected at Strawberry Creek, Door County. Approximately 3.1 million eggs went to WDNR fish hatcheries for 1983 stocking into Wisconsin Great Lake's waters. About 1.0 million were supplied to the USFWS for disease free stock for California hatcheries, and 200,000 eggs went to Salmon Unlimited-Racine for rearing and release into Lake Michigan. The remaining 320,000 went to South Dakota to be used in a reservoir stocking program.

The chinook salmon carcasses (over 60,000 pounds) and remaining eggs were sold under contract to an Algoma commercial fishing company. The 1982 harvest (in both numbers and weight of fish) was down from 1981 figures.

— T. Lychwick, Sturgeon Bay and C. Krueger, Madison

Four lots of approximately 20,000 chinook salmon were coded wire tagged and adipose finclipped during April 1982. One lot of salmon was stocked at Marinette, Strawberry Creek, Sheboygan, and Racine in late April and early May 1982. Five tagged salmon captured approximately one year later in 1983 have had their tags removed and decoded. Four salmon were recovered in Marinette area while one was recovered near Sheboygan. Salmon recovered a Marinette were stocked at two locations, Marinette (1) and Strawberry
Creek (3). The salmon captured near Sheboygan was stocked at Marinette, 145 miles to the north.

Population Characteristics of Brown Trout Stocked in Green Bay
— M. Hawley, Marinette

In 1977, marked brown trout fingerlings and yearlings were stocked at both Marinette and Oconto in Green Bay. This study followed these plants through maturity. Sexually dimorphic mortality rates were observed with the brown trout studied. Male brown trout had a higher mortality rate than females between the ages of 2 and 3 years. This may have been due to males staying on the spawning areas longer than the females. Stomach content analysis showed that brown trout fed mainly on alewife and smelt during their adult life and reduced their feeding in autumn. The brown trout studied exhibited a northward movement during June and August, and then returned to stream areas in the fall. The rate of return (in sample collections) for fingerling brown trout was compared to that for yearlings. The results suggested that 3.05 times as many fingerlings must be stocked to equal the yearling return rate at Marinette, and 2.19 times as many fingerlings must be stocked to equal the yearling return rate at Oconto.

Movements and Population Characteristics of Brown Trout in Green Bay
— B. Belonger, Marinette

To better understand the movements and population characteristics of brown trout in Green Bay, a tagging study was undertaken in the summer of 1981. One radio transmitter was surgically implanted in a 7 pound male brown trout on July 10, 1981. The fish was released and could not again be located until September 4. On September 10, another attempt to locate the tagged brown trout found it in the same place as on September 4, about 4 miles from the original tagging location. Because of this, the fish was assumed dead, signalling the end of this aspect of the study.

Gill nets were set under the ice in February to locate concentrations of brown trout to encourage the development of a winter sport fishery. Some fish were caught just above the bottom in water 60 feet deep. No concentrations of brown trout, however, were found.

Brown trout (Salmo trutta)

Racine Rainbow Trout Experimental Stocking Program
— P. Schultz, Plymouth

In a cooperative project with Salmon Unlimited, an attempt was made to imprint anadromous rainbow trout to the Root River, Racine County. This was done by exposing the rainbow trout to the river water during the early stages of their life. Fish were tagged before releasing to monitor their movements and return rate. Approximately 13,000 rainbows were tagged, of which 95 (0.7%) tags were returned. Only 6 of the returned tags were caught in Racine County waters. An alternative printing technique used was to expose the rainbow trout to a synthetic chemical while they were still in the hatchery. When the mature adults return to spawn, the imprinting chemical was dripped into the stream where the fish were stocked. The results of this experiment are not yet available.

Walleye Assessment in Green Bay 1982
— T. Lychwick and T. Pellet, Sturgeon Bay

Improvements in Green Bay water quality and spawning habitat initiated an attempt in the early 1970’s to rehabilitate the small remnant Green Bay walleye population. Between 1973 and 1982, over 1.7 million walleye fingerlings and 28.0 million walleye fry were stocked in Sturgeon Bay and Green Bay waters. With intensive stocking concentrated in Sturgeon Bay, some evidence for successful natural reproduction has been observed in the walleye population. Year classes exist for years when stocking did not occur. A sizable walleye population in the Fox River has been established following walleye fingerling and fry plants. Studies should be conducted to determine if successful natural reproduction is occurring in the Fox River walleye population. Additional stocking of walleyes along the west shore of Green Bay is recommended.

1981 Index Station Trawling in Southern Green Bay
— B. Belonger, Marinette

Index station trawling was undertaken in September of 1981 to assess the relative abundance of fish species in the shallow waters (6-20 ft.) of southern Green Bay. A total of 44 five minute tows sampled 5 index sites. The trawl used was a 25 foot semi-balloon trawl with a ½ inch stretch mesh cod end liner.

During the assessment, a total of 13,426 fish were caught. There were 18 species caught in 1981 which was low when compared with 24 in 1980 and 19 caught in 1979. The average number of fish per tow also dropped in 1981 to 305 from 731 in 1980 and 762 in 1979. Alewife, perch, smelt, bullhead, carp, spottail shiner, and trout perch were the seven major species caught and comprised 98.7% of the total catch based on average number per trawl hour. All of the major species caught were down 21-79% from 1980 values (average number per trawl hour). Below normal precipitation, above normal temperatures, and above normal algae growth may be reasons for the decline of fish in the 1981 sampling.

Commercial Fisheries

Perch Management Plan for Southern Green Bay
— B. Belonger, Marinette; J. Moore, Green Bay; and D. Ives, Madison

The yellow perch harvest in southern Green Bay has fluctuated over time, with a declining trend. Prior to the mid-1960’s, the harvest averaged about 1,000,000 pounds annually. Since then the annual harvest has been consistently less than 450,000 pounds. Reasons for this appear to be alewife interference and intensive fishing pressure. In an effort to rebuild the yellow perch population, several recommendations were given. Sport fishing recommendations included the establishment of a 25 perch bag limit for southern Green Bay and its tributaries up to the first dam. Commercial fishing recommendations were as follows: 1) Establish a harvest quota (200,000 pounds), 2) Shorten the fishing season. Open it on July 1 rather than May 20. 3) Establish one area closed to commercial fishing, approximately 12 square miles in size. At the same time, open the seasonal
closed area. This would result in 4 areas closed to commercial fishing in Green Bay. Rule changes are currently being promulgated (see Bureau of Fish Management Activities).

Yellow Perch Tagging Study in Southern Green Bay  
— B. Belonger, Marinette
As a method of protecting perch populations in Green Bay from over-exploitation, the use of areas of closed or restricted fishing has been proposed as a possible solution. In order to evaluate the feasibility and/or efficacy of these areas, a tagging study of yellow perch was undertaken. During the autumn of 1980 and the spring of 1981, 17,407 yearling or older yellow perch were tagged with Floy tags. During 1981, 374 (2.15%) of the tags were returned. Of the returned tags, 4.8% came from anglers, 89.0% came from commercial fishermen, and 6.2% came from WDNR surveys. All but one of these tags came from fish caught in southern Green Bay (one was from Sturgeon Bay).

Results of the study indicated that the tagged yellow perch were very active along the shore and thus were very susceptible to entrapment gear. Most yellow perch tagged in the southern part of the study area stayed there throughout the year. Similarly, perch tagged in the northern part of the study area remained near the site of tagging.

Yellow Perch Spawning Assessment in Southern Green Bay 1981  
— B. Belonger, Marinette
Since 1979, yellow perch have been annually assessed to determine the relative abundance of spawning age fish. The project emphasized collecting data on mature females since they are typically less abundant than mature males. In 1981 the catch per unit of effort (CPE—number of fish caught per 10 fyke net pot nights) for mature females was 990. This value was the lowest CPE for any year since this sampling began.

Modify Nets to Reduce Sub-legal Perch Catch  
— B. Belonger, Marinette
Periodic samples of yellow perch caught in standard commercial drop nets have shown that over half the perch caught were below the legal minimum size limit (7.5 in. — 191 mm). A high injury/mortality rate has been related to this sub-legal capture. In an effort to reduce the sub-legal catch of yellow perch, a commercial drop net was modified to allow smaller fish to escape.

The standard commercial drop net consists of a 250 foot lead net with an entrapment pot at either end. The pots are constructed of 2 inch stretch mesh net. In this study, one pot was unaltered and one was modified by the addition of escapement panels. Each escapement panel was made of a 12 inch square section of 2-1/4 inch stretch mesh nylon, number 15 twine totally preshrunk and dyed black. One panel was placed in the side of the pot and one panel was placed in each of the tunnel wings. A ¾ inch stretch mesh fyke net was additionally set to obtain characteristics of the area perch population.

During the sample period (October 5, 1982 — November 4, 1981) the nets were lifted every 2 to 6 days. A total of 1,424 perch were caught with the 3 nets: 582 in the standard pot net, 550 in the modified pot net, and 292 in the fyke net. The average size of perch caught in each net varied from 161.7 mm total length in the fyke net, to 182.1 mm in the standard pot, and 192.6 mm in the modified pot. Catch of legal sized perch was 16.4% in the fyke net, 34.5% in the standard pot net, and 52.4% in the modified pot net.

The results indicated some selectivity of the modified drop net pot for legal sized yellow perch. More data from testing other variables in net modification will be studied before final recommendations are made.

Two commercial fishing boats safely docked in a Lake Michigan harbor. Currently there are 21 licensed commercial fishermen on Lake Superior and nearly 200 on Lake Michigan.

Herring Rehabilitation in Green Bay  
— B. Belonger, Marinette
A project to rehabilitate herring populations in Green Bay was initiated in the autumn of 1982. Original plans called for 20,000,000 eggs to be taken from a shallow water herring strain found in northern Lake Huron with cooperation from the Michigan DNR. The eggs were to be hatched and raised to the fry stage prior to stocking into Green Bay. This year the herring unexpectedly spawned early, and efforts then turned to obtaining Lake Superior herring eggs. Approximately 900,000 eggs were taken and reared in hatchery batteries at the Marinette Water Works. Due to poor fertilization, only about half the eggs survived to eye-up stage.

Chances of obtaining 20 million herring eggs from the northern Lake Huron herring appear to be poor, so future plans are to attempt raising the herring to fingerling size rather than fry. This coming autumn (1983), nets will again be set to try catching herring in northern Lake Huron.

Summary of Lake Michigan Commercial Fishery Monitoring 1980  
— M. Toney and T. Lyehwick, Sturgeon Bay
During calendar year 1980, DNR personnel monitored lifts of four types of commercial gear (pound nets, trap nets, gill nets and experimental trawls) used to harvest whitefish in Wisconsin waters of Lake Michigan. Most information on whitefish was obtained from large-mesh gill net lifts and trawls. Assessment of incidental catch was the main concern in pound net sampling and only four trap net lifts were monitored. In addition, this report compares and contrasts the
occurrence of incidentals, especially lake trout, in the above four gears and small mesh gill net.

Incidental lake trout caught per unit of effort was highest for trawls (22.20) and lowest for the pound net (2.14). Small and large mesh gill nets were found to catch 5.35 and 4.18 lake trout per unit of effort, respectively. The percentage of lake trout killed (as a function of number caught) was 46.9% for small mesh gill nets and 46.6% for large mesh gill nets. In summary, lake trout caught in gill nets suffered a 50% mortality while those caught in entrapment gear exhibited 0% mortality.

Monitor Whitefish Trawling Operations
— M. Toneys and T. Lychnwick Sturgeon Bay; P. Peeters, Two Rivers

Using current allowable commercial fishing gear, large numbers of non-target illegal and sub-legal sized whitefish can be incidentally caught. Mortality of these non-target fish can be unacceptably high. Thus, an effort was made to determine the biological impact of using trawls to commercially harvest whitefish from Lake Michigan. The object of this study was to collect data on several trawl tows in an effort to minimize the capture and mortality of non-target fish. Contracts were made with a commercial fishing operation to trawl an area of Lake Michigan over a variety of conditions.

The study showed that trawls can effectively capture whitefish; however, the ratio of incidental lake trout to legal whitefish caught can be quite high (2:1). Many other species (salmon, trout) and sub-legal sized whitefish were also caught. The results indicated that trawls may have a potential for harvesting whitefish in Lake Michigan but some problems with incidental catch remain.

Monitor Commercial Whitefish Fishing Operations 1981
— M. Toneys, Sturgeon Bay

Using monthly commercial catch reports, the data for the 1981 whitefish harvest were compiled and summarized. The 1981 commercial harvest of whitefish was 886,853 pounds in the Wisconsin waters of Lake Michigan. This represented a 14% increase over the 1980 harvest. The majority of the catch (54%) was made in statistical district WM III (north of the Door/Kewaunee Co. line along the shore of Door County to slightly east of Washington Island and east to the Michigan/Wisconsin border). Data for the total catch of whitefish showed that 61.5% were caught in large mesh gill nets, 22.8% in trap nets, 13.6% in pound nets and 2.1% in trawls. Most of the whitefish caught in 1981 were from the 1977 and 1978 year classes. A 1982 harvest equal to or greater than the 1981 harvest was predicted based on estimates of coming year class sizes.

Population Assessment of Whitefish in Lake Michigan
— M. Toneys, Sturgeon Bay

Vital statistics on recruit and prerecruit whitefish populations were collected in order to properly manage the commercial harvest of these fish. In the spring of 1982, a total of 253 sub-legal whitefish (17 inches, total length) were captured in 3 days of fishing using graded mesh gill nets (2.4 inches, stretch mesh) in Green Bay. Data from this survey suggested a relatively weak 1979 year class but a strong 1980 year class. These data will be used to assist in predicting whitefish recruitment to the commercial fishery.

Status of Whitefish and Recommendations on Future Management in Lake Michigan
— T. Lychnwick, Sturgeon Bay and J. Moore, Green Bay

This report reviewed whitefish harvest in Lake Michigan from 1940 to 1980 with emphasis placed on the most recent decade (1970's). Between 1940 and 1973, only once did harvest exceed 1 million pounds. Since 1974, however, the annual harvest of whitefish has exceeded 1 million pounds annually (except for 1981). Fishing effort from 1949 to 1969 was 92.4 million feet of gill net (total) with an annual average of 4.4 million feet. Since 1970, though, the fishery effort has been 261.5 million feet of gill net, or an average of 29.1 million feet per year. Data on age structure, mortality and factors affecting year classes were also discussed. Recommendations for future studies were made for the Wisconsin waters of Lake Michigan. These recommendations include modifying assessment methods to gain data on age 1 and 2 whitefish, and studying the life history of whitefish to determine interspecies relationships.
Lake Superior

Sport Fisheries

Wisconsin’s Lake Superior Sport Fishery 1980
— B. Swanson, Bayfield
Anglers harvested approximately 35,000 salmonids in 1980 with lake trout, spalke, and salmon comprising the majority of the catch. High lake trout and spalke abundance has caused reductions in hours per fish. Spalke have been enthusiastically received by the fishing public.

Wisconsin’s Lake Superior Sport Fishery 1981
— B. Swanson, Bayfield
The total 1981 salmonid fishing pressure was up 16.2% over the 1972-80 average and was the highest number of trips per year since 1972. Estimated 1981 angler harvest was 40,000 salmonids. Because of the spalke fishery, the hours per fish have been cut nearly two-thirds for the near shore ice fishery. Salmon catches have increased steadily over the past decade, particularly coho. The average size of creelred lake trout at Saxon Harbor dropped significantly while the average size of lake trout creelred near Bayfield increased in 1981.

Wisconsin’s Lake Superior Sport Fishery 1982
— T. Margenu, Bayfield
An estimated 508,505 angling hours resulted from 111,711 individual trips on Wisconsin waters of Lake Superior and its major tributaries during 1982. From this effort, anglers caught an estimated 45,000 salmonids. Trollers out of Superior accounted for 30.6% of the private boat angler harvest (cold water). Spalke continue to dominate the winter fishery in Chequamegon Bay and near stream mouths comprising 78% of the salmonid harvest in these areas. The excellent spalke fishing has resulted in an increase in fishing pressure of over 200% and reduced the time spent to harvest a salmonid by 57% (Figure 3). Angling pressure on the Brule River has increased 33% since 1973.

St. Louis River and Western Lake Superior 1980-81 Creel Census
— S. Schram, Brule
An estimated 3,448 angler hours harvested approximately 528 salmonids in 1980 and an estimated 20,109 angler hours harvested approximately 7,046 salmonids in 1981 in western Lake Superior (Wisconsin waters). Of the salmonids caught, lake trout made up 74.4% of the 1980 catch and 86.0% of the 1981 catch. The catch per unit of effort increased in 1981 for lake trout, coho salmon, and rainbow trout, while decreasing slightly for chinook salmon and brown trout. The drastic increases in fishing pressure and fish caught in 1981 was thought to be primarily due to lake trout stocking and marina and public access development in the area.

In the St. Louis River, anglers fish an estimated 31,484 hours and harvested approximately 4,949 fish in 1980. During the 1981 fishing season, pressure was off, with an estimated 24,866 angler hours harvesting approximately 2,693 fish. In 1980, nearly half the fish caught were walleyes (49.7%). Northern pike (26.3%) and yellow perch (13.9%) comprised most of the remaining catch. In 1981, northern pike made up the majority of the catch (61.7%), while walleyes (29.07%) and yellow perch (7.4%) dropped in their contribution to the creel. The catch per unit of effort increased in 1981 for northern pike, while dropping for walleye and yellow perch.

Lake Trout Spawning Assessment 1980
— B. Swanson, Bayfield
The 1980 population estimate of spawning lake trout at Gull Island Shoal was approximately 21,000; nearly double the 1979 estimate of 11,000. Native lake trout constituted nearly 90% of the Gull Island Shoal spawning population. The Sand Cut Reef spawning population of lake trout was over 60% native fish, the highest value since sampling began. Devils Island Shoal lake trout population, however, has not recovered since severe declines in the 1950's. To improve the recovery rate of Devils Island Shoal, a refuge is recommended.

Lake Trout Spawning Assessment 1981
— B. Swanson, Bayfield
An estimated 12,000 to 13,000 lake trout spawned on Gull Island Shoal in 1981 with catch-per-unit-of-effort estimates the second highest since sampling began. Nearly 90% of the spawners were native. The 1974 and 1975 lake trout year classes (Age VI and VII) were abundant and spawner size lake trout mortality rates in the refuge area have declined. The return of hatchery lake trout stocked on Devils Island Shoal remains disappointing. Nearly 900,000 lake trout eggs were taken this past October, the most since lamprey control began.

Figure 3. Average number of hours required to harvest a salmonid (top) and total angler hours (bottom) in Chequamegon Bay, 1976-82.
Lake Trout Spawning Assessment 1982
— B. Swanson, Bayfield
The Gull-Michigan Island Shool lake trout population is continuing its general trend of increasing abundance of its native spawning population. The Sand Cut Reef spawning population increased to its highest level since lamprey control, possibly due to the lower lake trout fishing mortality in the sport only area surrounding the reef. Other Apostle Island spawning reef lake trout populations remain low. Direct reef stocking of yearling lake trout on Devils Island Shool for rehabilitation appears to be failure at this point in the experiment. Egg harvest (mostly Gull Island Shool) of 1.2 million eggs is the highest since post-lamprey egg taking operations began.

Astro Turf Installation on Lake Trout Spawning Reefs in the Apostle Island Area of Lake Superior
— B. Swanson, Bayfield
On October 26, 1982, a total of 32 artificial turf sandwiches were placed on Devils Island Shool. Each sandwich consisted of 7 layers of two artificial turf mats (30 X 90 cm) placed turf side to turf side. Lake trout eggs were placed between the layers of the artificial turf. A total of 532,000 eggs from Gull Island Shool lake trout were placed in the 32 sandwiches. Two strings of 16 sandwiches each were connected with cable and placed in water 37 to 47 feet deep (Figure 4).

If the astro turf sandwiches are as successful on Devils Island Shool as they were on Gull Island Shool, then this egg placement could result in nearly 15,000 adult lake trout in 1989. The annual totals of lake trout eggs placed on Devils Island Shool in astro turf sandwiches are listed in Table 2.

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Eggs</th>
<th>% Hatch &amp; Escape</th>
</tr>
</thead>
<tbody>
<tr>
<td>1980</td>
<td>52,400</td>
<td>78%</td>
</tr>
<tr>
<td>1981</td>
<td>273,000</td>
<td>88%</td>
</tr>
<tr>
<td>1982</td>
<td>532,000</td>
<td>87%</td>
</tr>
</tbody>
</table>

A paper in the Progressive Fish Culturalist was published in 1980 describing the methods used.

Coho Assessment on Lake Superior Tributaries 1981
— D. Pratt, Bayfield
Coho natural reproduction in Wisconsin’s tributaries to Lake Superior climbed quickly in the early 1970’s and stabilized in the late 1970’s. Of seven comprehensive watershed surveys completed thus far, young-of-the-year (YOY) cohos were found to be most abundant in the Onion River (11,678/acre). Approximately 120,000 YOY (summer) cohos are currently produced by Wisconsin streams. These coho migrate to Lake Superior, where they contribute to an estimated annual angler harvest of 1,500 to 7,000 coho.

Coho Assessment on Lake Superior Tributaries 1982
— S. Hulse, Bayfield
In 1982, coho made up as high as 54% (Whittlesey Creek) of the young-of-year and yearling salmonid community in the eight study streams. There was, however, an overall reduction in percent composition of young-of-year coho in the monitored streams from 1981. Whether this reduction indicates a stabilization of young-of-year class is unknown. A beaver dam on the Onion River in 1981 successfully blocked mature salmon from reaching their spawning grounds and was probably the cause of the reduced numbers of young-of-year in 1982.

Population Dynamics and Angler Harvest of Rainbow Trout in Pikes Creek, Wisconsin
— B. Swanson, Bayfield
The population statistics of Pikes Creek anadromous rainbow trout (steelhead) spawning runs have been monitored since 1977. These surveys are used in the management of Pikes Creek and as a comparison to steelhead runs in other Lake Superior streams. The yearly values for the major parameters and their 5 year averages are listed in Table 3.

<table>
<thead>
<tr>
<th>Year</th>
<th>Population Size</th>
<th>Number of Angler Trips</th>
<th>Number of Rainbows Harvested</th>
</tr>
</thead>
<tbody>
<tr>
<td>1977</td>
<td>1,050</td>
<td>349</td>
<td>105</td>
</tr>
<tr>
<td>1978</td>
<td>931</td>
<td>320</td>
<td>186</td>
</tr>
<tr>
<td>1979</td>
<td>1,021</td>
<td>321</td>
<td>145</td>
</tr>
<tr>
<td>1980</td>
<td>846</td>
<td>327</td>
<td>213</td>
</tr>
<tr>
<td>1981</td>
<td>1,098</td>
<td>476</td>
<td>414</td>
</tr>
<tr>
<td>Average</td>
<td>989</td>
<td>359</td>
<td>213</td>
</tr>
</tbody>
</table>

Creeled steelhead from Pikes Creek averaged 23.0 inches (total length) for males and 18.5 inches (total length) for females. Approximately 350 female steelhead spawn in Pikes Creek each year. The females have approximately 3,000 eggs each, so the annual egg deposition is about 950,000. Thus, an annual spawning population of 1,000 adult steelhead results in an estimated egg to adult return rate of 0.1%.

Report on Movements and Harvest of Brown Trout Stocked in Wisconsin Waters of Lake Superior
— T. Margenau, Bayfield
Brown trout stocked in Chequamegon Bay demonstrated the greatest tendency to remain near the stocking location.
Ninety percent of the angler return from these two areas were caught within 15 miles of their release point. Brown trout stocked at the Superior Entry and Bark Point showed the greatest tendency to stray compared to other locations. Sixty-five percent of the tag returns came from outside Wisconsin waters. Percentage of tag returns was greatest from the stocking of larger sized fish (8.3-8.5 inches).

Age, Growth, and Food Habits of Salmonids in Western Lake Superior
— S. Schram, Brule

Lake trout stocked as fingerlings grew slower than those stocked as yearlings and older fish exhibited wider ranges in growth than younger fish. Chinook salmon growth was rapid especially during the first year. Anglers caught salmon in May and June at ages II and III. Food habit analysis revealed smaller lake trout preying heavily on insects while larger lake trout and chinook salmon fed heavily on fish.

Population Characteristics of Northern Pike in a Lake Superior Estuary
— S. Schram, Brule

Northern pike (Esox lucius) were studied in the St. Louis River estuary to document spawning areas, determine movement patterns, and obtain data on age, growth, and mortality. Alouez Bay and Grassy Point were the major spawning areas in the lower estuary. The sex ratio during the spawning season was 1:1. Females had a slight growth advantage during the first year of life but were similar to males during the second year. After age III, females grew faster than males. Most northern pike were harvested within 5 km of their spawning areas. Total annual mortality was 45% which is low compared to inland studies. This lower mortality rate was probably a result of reduced angler vulnerability due to the dispersal of fish throughout the estuary and Lake Superior. Habitat preservation is given as the most important management goal. A Fish Management Report that describes this study will be published in 1983.

St. Louis River Walleye Study
— T. Margenau, Bayfield

Intensive sampling of the St. Louis River walleye spawning run was conducted in April-May of 1980-1982 near the Village of Fond du Lac, Minnesota. Over 5,700 walleyes were measured, weighed, inspected for disease, tagged and released. Males ranged in size from 13.0 to 26.9 inches in length and III-XVIII in age while females ranged in size from 16.0 to 30.5 inches in length and V-XX in age. Tag returns indicated that the walleyes return to Lake Superior from the Fond du Lac spawning area as early as May. Most of the tagged fish then dispersed along the south shore of Lake Superior as far east as the Apostle Islands. A few fish moved north along the lake shore as far as Silver Bay. Sport angler harvest occurred primarily in May and June and was comprised mostly of juvenile and male spawners. An assessment commercial fishery (Red Cliff Indian Tribe) targets mainly mature walleye.

Seasonal Movements and Mortality Estimates of Burbot in Western Lake Superior
— S. Schram, Brule

Burbot and lake trout were the primary fish predators of the Great Lakes prior to the invasion of the sea lamprey. While many studies have concentrated on lake trout, the life history of Great Lakes burbot has not been well documented. This study described the seasonal movement patterns and the mortality of burbot in western Lake Superior.

Results of this study indicated that burbot began concentrating off river mouths in late fall prior to making spawning runs. The burbot spawned in late December and early January, moved downstream and concentrated inshore from February to July. In early summer the fish moved eastward, were offshore in late summer, and returned to spawning streams in the fall. Total annual mortality of the burbot studied was estimated at 43%. A Fish Management Report that describes this study will be published in 1983.

Lake Superior Index Station Sampling 1980
— B. Swanson, Bayfield

The 1980 summer index station sampling for Lake Superior differed in procedure from the previous samplings. In order to increase the number of samples while decreasing time and fuel costs, samples were restricted to the area from Sand Island east to the Michigan border. The other half of Wisconsin's Lake Superior waters will be sampled the following year (1981). This method resulted in over a 60% increase in samples with less than a 15% increase in fuel and labor costs. Changes in the index station data indicated that water temperatures and clarity were up slightly from the previous 10 years of measurements. In the 1980 sampling survey, most fish species remained near their previous abundances.

Superior Harbor Index Station Sampling 1980
— S. Schram, Brule

Index stations were sampled in the St. Louis River Estuary (Superior Harbor), to establish baseline data on the fish populations. Four sampling methods were used, including a meter net, a 50 foot bag seine, four 4 foot fyke nets and a 230 volt A.C. electrofishing boat. Perch and walleyes had a strong 1980 year class. Salmonids appear to be increasing in abundance. Population trends for all species can be determined when additional data is collected. Stocking recommendations were discussed.

Superior Harbor Index Station Sampling 1981
— T. Margenau, Bayfield

A total of 15,520 fish, which included 43 species, were sampled during 1981 at Superior Harbor index station sampling. Black bullheads were the most abundant fish sampled. Walleye and yellow perch had weak 1981 year classes. Alewife numbers increased significantly from 1980. The presence of pink salmon in the Nemadji River and brown trout in the St. Louis River were documented for the first time. Areas critical to preservation of the fishery resource were identified.

Superior Harbor Index Station Sampling 1982
— S. Schram, Brule

A total of 12,338 fish, which included 40 species, were sampled during the 1982 index station sampling. Black bullhead was the most abundant fish sampled. Walleye and yellow perch had an improved year class over 1981 but still below that of 1980. Oxygen levels remained similar to past years. Stocking recommendations are presented.
Running Inventory with Population Estimates for Pikes Creek, Bayfield County  
— D. Pratt, Bayfield

Pikes Creek is a Lake Superior tributary which enters the lake at Pikes Bay in Bayfield County. Pikes Creek flows next to the Bayfield Fish Hatchery and was at one time the major hatchery water supply. The trout habitat portion of Pikes Creek is 6.9 miles in length. Pikes Creek was rated as the best anadromous rainbow trout stream (acre for acre) flowing into the Wisconsin waters of Lake Superior according to a 1978 management report. A 1978 stream survey sampled rainbow, brook and brown trout, and coho and Atlantic salmon. Rainbow trout made up the majority of the fish sampled. Protection of spawning beds and habitat improvement were given as major management recommendations to improve the productivity of Pikes Creek.

Running Inventory with Population Estimates for Sioux River, Bayfield County  
— D. Pratt, Bayfield

The Sioux River is a Lake Superior tributary in Bayfield County, Wisconsin. It has a 13.3 mile mainstream and two tributaries. Brown and/or rainbow trout have been stocked in the Sioux River almost every year since 1933. In a 1979 stream survey there were rainbow, brown and brook trout, coho salmon, splake, and a variety of cooler water and nongame fish species present. In comparison with a similar 1974 survey, it appeared that the populations of brown and rainbow trout did not significantly change in size although stocking rates greatly decreased. Management recommendations suggest that the stocking of trout be discontinued because the Sioux River contains self-sustaining fish stocks that exist without need for additional in-stream stocking.

Running Inventory with Population Estimates for Siskiwit River, Bayfield County  
— D. Pratt, Bayfield

Siskiwit River is a tributary to Lake Superior at Cornucopia Harbor, Bayfield County, Wisconsin. The Siskiwit is a diverse river consisting of three fishery types: warmwater, inland trout water, and anadromous trout water. Brook trout and some brown trout have been found in the middle portion of the stream not accessible to anadromous salmonids. The anadromous trout water section is located from Siskiwit Falls to Lake Superior, a distance of about 0.4 miles. In a 1981 stream survey, spawning rainbow trout, white and longnose suckers were sampled in the spring. Spawning brown trout, coho salmon, and splake were sampled in the autumn.

Running Inventory with Population Estimates for Little Sioux River, Bayfield County  
— D. Pratt, Bayfield

The Little Sioux River is a major tributary of the Sioux River, a Lake Superior tributary, in Bayfield County, Wisconsin. Brook trout were stocked in the Little Sioux from 1938 to 1953. In 1971, the Little Sioux River was one of the first Wisconsin Lake Superior tributary streams to produce naturally spawned coho salmon. Since 1971, the numbers of coho salmon found in the Little Sioux have increased and leveled off. The first documented specimen of a pink salmon in the Wisconsin waters of Lake Superior was captured in the Little Sioux River on September 10, 1971. Since 1971, pink salmon have been found on the odd numbered years with a possible even year strain currently developing. Fishing pressure was found to be primarily for anadromous spawning fish in the spring and autumn. A 1979 survey of the lower Little Sioux River found brown, rainbow and brook trout, coho salmon and splake, with brown trout being the most abundant. A 1980 survey of the upper Little Sioux River found brook, brown, rainbow and tiger trout, and splake, with brook trout being the most abundant species. Beaver dams on the Little Sioux River was listed as a major management problem which could be alleviated by encouragement of continued commercial trapping.

Running Inventory With Population Estimates for Four Mile Creek, Bayfield County  
— D. Pratt, Bayfield

Four Mile Creek is one of the Sioux River's major tributaries, in Bayfield County, Wisconsin. Brown trout were the dominant salmonid species found. Both resident and anadromous varieties appear to exist in this stream. The other major salmonid species found were rainbow trout, brook trout, and coho salmon. Quick runoff and ensuing bank erosion are considered most important factors in limiting future trout production.

Commercial Fisheries

Lake Superior Whitefish Assessment 1980  
— B. Swanson, Bayfield

The 1980 total whitefish harvest for the Wisconsin waters of Lake Superior was 354,000 pounds (dressed weight). This represented a slight increase over the previous year's harvest. Of this total whitefish harvest, the Red Cliff Indian tribe caught 168,000 pounds (47%) and the state licensed commercial fishermen caught 186,000 pounds (53%). The total dockside value of the 1980 harvest was estimated at $332,000. The fishing effort (feet of gill net set) remained above the estimated pre-lamprey fishery effort (1936-1952). Assessment data indicated that the 1981-1983 harvest and fishery effort should decline slightly from the 1980 average.

Commercial Fishing Effort for Whitefish and Lake Trout in the Apostle Island Area, Lake Superior 1980  
— T. Buslahn, Red Cliff Tribe, and B. Swanson, Bayfield

Fishing effort for whitefish and lake trout exerted by state (Wisconsin) licensed commercial fishermen and Red Cliff tribal licensed fishermen was computed and compared. Fishing effort was defined as the length of gill nets lifted (for gill nets) or as the number of trap or pound net lifts. One lift of a pound or trap net was assumed to equal 4,000 feet of gill net fished. In 1980, state licensed commercial fishermen exerted 6.9 million feet of gill net effort for whitefish and lake trout (53% of total). Red Cliff fishermen were estimated to exert 6.2 million feet of gill net effort for whitefish and trout (47% of total) during the same time period.

Lake Trout Quotas in Lake Superior  
— B. Swanson, Bayfield

The biological committee for lake trout quota establishment in the Wisconsin waters of Lake Superior was formed in 1980. The goal of this committee was to determine lake trout harvest levels which would permit sufficient adult escapement to allow adequate egg deposition for rehabilitation purposes. The area of examination was the Apostle Island region from Bark Point east to the Michigan state boundary. A Ricker Equilibrium Yield Model was used as the basic format. Different values of F (fishing mortality — instantaneous), stocking rates (recruitment), and minimum size limits (current 17.0 inches versus proposed 20.0 inches) were used as variables in the model. By using these variables and goals, an annual harvest of less than
120,000 pounds of lake trout was recommended. Further recommendations included the establishment of more refuges to protect the lake trout throughout their lives and allow the native population to increase. Similar studies completed in 1983 indicate that further increases in reproduction in the Gull Islands-Michigan Island Refuge are possible if the parent stock is allowed to continue to increase. This means there is no harvestable surplus stock to harvest from this population as of 1983.

Siscowet Fishery of the Wisconsin Waters of Lake Superior  
— D. Pratt, Bayfield

Siscowet trout (*Salvelinus namaycush siscowet*) is a deep water variety of lake trout that typically inhabits water depths in excess of 300 feet. The commercial harvest has been increasing and in 1979 was 175,000 pounds. Average age of the commercial catch has increased from 7.8 in 1975 to 8.4 in 1979. A study of the diet of commercially caught siscowet (averaging 21-23 inches) showed that sculpins were the most frequent food item. The presence of terrestrial insects in some stomachs suggest occasional surface feeding habits for the siscowet trout.

Great Lakes Research Vessels

There are three survey vessels used by the Wisconsin Department of Natural Resources in the Great Lakes program. The (S/V) Barney Devine is stationed at Sturgeon Bay and carries out its activities on Lake Michigan under the direction of (captain) Frank Schmidt. In Green Bay, Thomas Gray captains the S/V Sheephead which is stationed at Marinette. On Lake Superior the Hack Noyes is stationed in Bayfield and is captained by Laurie Norse, Jr. These survey vessels are responsible for the sampling of index stations, survey netting, assessments, collection of fish for contaminant analysis and a variety of other duties. Active from May to December, these vessels are an important part of the Great Lakes Management program.

Hatchery Activities

An important facet of the overall Great Lakes management program is the state hatchery system and the Great Lakes stocking program. Administrative services to this program are provided by the Inland Section within the Bureau of Fish Management.

Ron Poff     Inland Section Chief
Larry Claggett   Coldwater Staff Specialist
John Klingbiel  Warmwater Staff Specialist

In 1982, state hatcheries raised and stocked over 485,000 trout and salmon in Lake Superior and over 5,923,000 trout and salmon in Lake Michigan (Tables 4 and 5). An additional

Fish raceways at Wild Rose State Fish hatchery. Over 7 million fish are stocked each year in the Wisconsin waters of the Great Lakes.
Table 4. Wisconsin’s Lake Michigan Stocking Summary.

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¹Federally produced fish.
²Brook x brown hybrid.

Table 5. Wisconsin’s Lake Superior Stocking Summary.

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¹Combination of state and federally produced lake trout.
2,220,000 lake trout from federal hatcheries were stocked in the Wisconsin waters of Lakes Michigan and Superior.

There are several hatcheries which participate in spawning and rearing the diverse salmonids stocked in the Great Lakes. Chinook salmon eggs are collected and fertilized at Strawberry Creek, Door County. The eggs are hatched and the young fish are reared at Wild Rose and Westfield State Fish Hatcheries. The same two hatcheries plus Kettle Moraine Springs and Lake Mills Fish Hatcheries hatch and raise coho salmon. Wisconsin acquires fertilized coho eggs from the Michigan Department of Natural Resources, Platte River hatchery and spawn collecting station. In the future, coho salmon from the Sheboygan River are expected to be used to fill fertilized egg quotas. There are three strains of rainbow trout brood stock which are maintained and spawned at Osceola State Fish Hatchery. Fertilized eggs and fry are raised at Nevin, Kettle Moraine, Bayfield, Westfield, Wild Rose, and Brule River State Fish Hatcheries. Two brown trout strains are maintained in the state; one at St. Croix and one at Wild Rose Hatcheries. Brown trout are also reared at Brule River, Kettle Moraine, Nevin, Thunder River, and Langladie Hatcheries. Brook trout brood stock are kept at St. Croix Fish Hatchery. In addition, brook trout are raised at Brule River, Bayfield and Kettle Moraine Springs hatcheries. Some of the lake trout stocked into Lake Superior are spawned from Gull Island Shoal adult fish (Apostle Islands) and raised at Bayfield Hatchery. The remaining lake trout stocked into Lake Superior and all those stocked into Lake Michigan are spawned from federal domestic brood stock and reared at federal fish hatcheries.

In the future, approximately the same numbers of fish will be raised and released into the state’s waters as have been in recent years. More emphasis, however, will be placed on stocking different strains of the same species. This program direction will introduce additional genetic diversity, resulting in harder, better surviving, and more adaptable stocked fish. Bayfield Fish Hatchery is currently rearing a new brook trout strain: the Nipigon strain. These trout are descendants wild brook trout from Lake Nipigon, Ontario. A new rainbow trout strain is also being developed at Bayfield hatchery. These fish are descendants of Lake Superior rainbow trout (steelhead) from Pikes Creek. At the Kettle Moraine Springs Hatchery skamania rainbow trout (summer run) are being reared for stocking in Lake Michigan.

Revenue from sale of the Salmon and Trout Stamp to Great Lakes anglers is being used to help improve the state hatchery system. Several development projects are currently underway at Kettle Moraine Fish Hatchery with additional improvements scheduled there and at other hatcheries involved in the Great Lakes stocking program. This successful funding program will help ensure the continuation of fish stocking in the Wisconsin waters of the Great Lakes.

Bureau of Fish Management Activities

The following project descriptions are of activities carried out by personnel in the Great Lakes and Boundary Waters Section of the Bureau of Fish Management. The Bureau acts as an interface between the field, Districts, the legislature, and other state government. Planning, budget preparation, program review, and policy analysis are also important functions that occur within the Great Lakes Section. The project descriptions included reflect a portion of these varied activities.

Great Lakes Sport and Commercial Management Strategies
— L. Kernen, Madison

This project concerns the development of long range management objectives. The Strategic Plan must be regularly updated and revised to remain compatible with new developments in management strategies. Recent activities in this project, for example, include an examination of the limited entry process in commercial fishery licensing. Goals and objectives for quota controlled fisheries have developed from this examination process. In addition, the policies concerning the DNR involvement with the Great Lakes Commercial Fishing Boards has also been reviewed and is a continuing project. Development of administrative rules affecting sport and commercial fishing requires appearances to explain and support DNR recommendations before the Natural Resources Board and legislative committees.

Lake Michigan Fish Management Plan
— L. Kernen, Madison

The Lake Michigan lake trout rehabilitation plan has developed conceptually into a much broader lake management plan. Many different elements will be included in this plan such as lake trout stocking, habitat improvement, salmonid stocking rationale, sport and commercial fishing regulations, design for population assessment, and a genetic policy for fish stocked. Public participation through meetings with both the sport and commercial user groups has and will continue to play a major role in developing important management policies. These policies will help guide the direction of the Lake Michigan fisheries program for many years. Draft goals and objectives have been formulated for this plan and have been submitted for review to sport and commercial fishermen.

Interstate Programs and Policies
— L. Kernen, Madison

The Great Lakes form an extensive interstate water system. Such a system has the potential for great conflicts in resource use and management. For the effective management of Lakes Michigan and Superior, it is highly desirable to have compatibility between the Wisconsin Great Lakes Fish Management program and the management programs of other states. Periodic meetings convened by the Great Lakes Fishery Commission (GLFC) attempt to help in coordinating the management strategies of various states for a particular lake. The Wisconsin DNR attends these meetings and presents the Wisconsin Great Lakes management programs. For example, Wisconsin has played an important role in developing an allocation formula for distributing federal lake trout between the various states.

Contacts and requests from other state and federal agencies are handled at this level, and often result in trades of fish or eggs to strengthen Wisconsin’s program. Recent cooperative ventures include the acquisition of Nipigon brook trout from Ontario, sending Wisconsin chinook salmon eggs to California and North Dakota, acquiring skamania steelhead eggs from Indiana for chinook eggs from Wisconsin.

Great Lakes Salmon and Trout Stamp (Administration)
— C. Krueger, Madison

The Great Lakes Salmon and Trout Stamp program was instituted in 1982 in response to federal Great Lakes fisheries program cutbacks. The stamp funds will be used to replace these lost monies and continue the successful salmonid stocking program. All anglers who must purchase a regular license and fish for salmonids in Great Lakes waters must purchase...
the stamp. This includes not only the open water fisherman but also the stream angler fishing in Lake Michigan tributaries up to the first dam. Those anglers fishing for coolwater species (walleye or perch, for example) are exempt from purchasing the stamp. The species directly affected by this program are chinook and coho salmon, lake trout, rainbow, brown, and brook trout, and splake in Lakes Superior and Michigan. The program has proven quite successful so far with 1982 stamp sales exceeding 240,000. Guidelines for the expenditure of stamp revenues were drafted and adopted by the Department. A stamp design contest was conducted in April of 1982 with the winning 1983 design featuring a lake trout.

Salmon and Trout Stamp Administration — 1983 to 1988 Budget

— C. Krueger, Madison

The “Expenditure Plan for Great Lakes Salmon and Trout Stamp Revenues 1983-88” was written to describe the Salmon and Trout stamp program for the next 6 years. Development of the expenditure plan came following a request from the Legislative Fiscal Bureau. Within the budget plan are details for facility development and operations projects for the Great Lakes stocking program. Projects were described for the 6 year period that totalled $4,348,451. Revenues projected for the same period are $4,360,655 from sales of the Great Lakes Salmon and Trout Stamp.

Sea Lamprey Barrier Development — Lake Superior Tributaries

— C. Krueger, Madison

A grant from the Great Lakes Fishery Commission was (applied for and) approved for the study and construction of sea lamprey barriers in the Brule and Amnicon Rivers tributary to Lake Superior. The Brule River barrier will be constructed by removal of streambed material to create a drop of approximately 30 inches. The water fall will prevent sea lamprey from migrating upstream to spawn, thus interrupting their life cycle. This grant totalled $95,000. The barrier project on the Amnicon River involves a feasibility study to incorporate a barrier into the design of a highway bridge. This grant totalled $1,000.

In addition, approval was solicited and obtained to continue Great Lakes Fishery Commission funding ($100,000) of a barrier in the Middle River. A new barrier site has been selected and construction is expected to begin in 1983. Design for this barrier is similar to that for the Brule River.

The lamprey barriers will reduce the need to use chemical lampricides for sea lamprey control on these rivers.

Great Lakes Micro-computer Acquisition

— C. Krueger, Madison

The Great Lakes program acquired 3 Apple micro-computers for use in a variety of Fish Management activities. Acquisition required extensive documentation of program need for Division of Resource Management and Bureau of Information Management analysis. Computers are located at offices in Bayfield, Milwaukee, and Madison. Types of work being done using the micro-computers include: development of adaptive management strategies, length-weight and age-growth analysis, scale reading, age-length back calculation, population estimates, local creel census analysis, and commercial catch statistics. Plans call for the acquisition of a fourth computer to be located in the Lake Michigan District at Sturgeon Bay.

Statistics Workshop

— C. Krueger, Madison

A four day statistics workshop was held at Stevens Point in June, 1982 for fish managers. Topics covered included basic statistics, catch curves, creel census, and marking studies. Other subjects introduced the use of micro-computers for fish management purposes. Computer uses covered in the session were scale reading with the Apple micro-computer, how to program using BASIC computer language, and the use of computer simulation in adaptive management activities.

Great Lakes Training Session

— C. Krueger and L. Kernan, Madison

A training session was organized for Great Lakes program personnel and held at Ashland in September, 1982. Topics covered commercial and sport fisheries in Lakes Michigan and Superior as well as the Mississippi River. Micro-computer training sessions demonstrated the VISICALC, MISP, and DISBCAL (scale reading and age calculation) programs for use in fish management activities. The Salmon and Trout Stamp Program and the use of funds generated by sales of this stamp was discussed. The identification of strategies for the rehabilitation of lake trout stocks in the Wisconsin waters of
the Great Lakes was a primary objective of the workshop. Several sessions devoted to this topic furnished many innovative and promising new ideas to help achieve this goal.

Strategy for the Use of Lake Trout Strains in Lake Michigan — Genetic Segment of the Lake Trout Rehabilitation Plan for Lake Michigan
— C. Krueger, Madison; R. Horrall, U. of Wis.; and H. Gruenthal, U.S. Fish and Wildlife Service

The Lake Michigan Lake Trout Technical Committee requested in 1982 that the Genetics Subcommittee provide recommendations concerning lake trout strains to be stocked. The abstract of their report follows.

The stocking of hatchery lake trout has been a primary management tool since 1965 to reestablish populations in Lake Michigan. The lack of significant natural reproduction has been attributed to a variety of causes including the lack of adaptive traits in hatchery trout for survival in the wild. We believe that the genetic characteristics of hatchery trout used for stocking Lake Michigan can be enhanced by using genetic variability that is preadapted for survival in the wild and conserving this genetic variability by appropriate hatchery procedure. Based on this theory, lake trout strains are recommended for hatchery production and a strategy proposed for stocking Lake Michigan. Lake trout strains to be initially emphasized in the stocking program are Gulf Island Shool, Lewis Lake, Seneca Lake, and Lake Michigan Green Lake. Transfers of adult lake trout from Lake Superior wild populations are also recommended for the Lake Michigan stocking program. Each strain is identified as to their suitability for stocking on shallow and deep water reefs. In the final period of the strategy, lake trout for stocking will be produced from females collected directly from wild Lake Michigan populations that will hopefully develop from the stocking of the other strains listed.

Commercial Fishery Rule Development — Chubs — Lake Michigan
— D. Ives, Madison

In 1975, the chub fishery in Lake Michigan was closed due to a population collapse caused by over-harvest. The fishery was reopened in 1979 with a permit required, quota controlled fishery for the southern part of Wisconsin's Lake Michigan waters (south of a line due east of just north of Kewaunee). Since the reopening, the annual chub quota has annually increased due to increasing chub stocks. The northern part of the lake (north of a line running due east of Bailey's Harbor) was reopened to chub fishing in 1981. Regulations developed since the opening of the fishery have focused mainly on the quota size.

The Lake Michigan Commercial Fishing Board adopted an allocation plan which provided a personal quota for individual fishermen in addition to a lake-wide quota divided equally among three time periods. The total of all the personal quotas exceeded the lake-wide quota. This action created what has been called a 'racehorse fishery' where each fisherman attempts to fill his personal quota before the lake-wide quota is reached. As a result, the wholesale market experiences periodic gluts and the price paid to the fishermen suffered. Additionally, such a fishery is very hard to manage.

Recent developments to alleviate the 'racehorse fishery' problem have so far resulted in an allocation plan for the southern zone of Lake Michigan. This allocation plan grants individual fishermen catch quotas which total only 90% of the lake-wide quota. Quota size is based on a fishermans past performance with higher quotas going to the historically more successful fishermen. This should stop the 'racehorse fishery' action and spread the harvest out over the season, helping the market price and the fishery.

The northern zone of Lake Michigan also has a total chub quota but individual fishermen are not restricted in their portion of this quota. In addition, an experimental spring fishery will be opened from April to July, 1983 to 1985. Prior to this time, a spring chub fishery was not allowed due to high incidental lake trout catch. The experimental spring fishery will allow fishing outside of a line about 6 miles from shore roughly paralleling the Door County shoreline. The Bailey's Harbor line (southern boundary of the northern zone) will be changed from a due east line to a 135° southeast line. These experimental changes will be closely monitored to ensure that the incidental lake trout catch does not become a problem.

Commercial Fishery Rule Development — Perch — Green Bay
— D. Ives, Madison

In 1978, intensive evaluation and research on perch populations in Green Bay showed that the perch were substantially over-harvested. Essentially all of the fish were harvested before they were 3 years old. Commercial fishermen harvested 85% and anglers created 15% of the perch. The result was a short-lived, fast growing, rapid turnover population whose continued survival was almost totally weather dependent. The management goal set by the WDNR was to establish stable adult populations made up of more year classes (and thus be more weather independent).

To achieve this goal the WDNR proposed a commercial catch quota which would require individual permits and weekly reports to be filed by the fishermen. The Lake Michigan Commercial Fishing Board adopted an allocation scheme based on the past performance of each fisherman. In this way, each fisherman is given a certain percent of the quota. Under this scheme however, there can be no new fishermen entering the fishery until the quota exceeds the 1972 to 1982 harvest levels.

The proposed rule changes governing the Green Bay perch fishery allow a commercial harvest quota presently set at 200,000 pounds and a daily angler bag limit of 25 perch. These rules are still not approved but will probably go into effect in the near future (1983).

In Lake Superior, several varieties of lake trout exist. Pictured here are the lean lake trout (upper) and the siscowet or fat lake trout (lower). Note that the siscowet has a shorter, more "U" shaped head.
Commercial Fishery Rule Development — Walleye — Green Bay  
— D. Ives, Madison  
The walleye commercial fishery in Green Bay was closed in 1978 because the native stocks were depleted to dangerously low levels. The complete closure was enacted with a sunset clause provision: to reopen in 1982 if a substantial improvement could be shown. In 1982, data concerning the walleye populations in Green Bay was reviewed and it showed that there was not enough natural reproduction taking place to support a commercial fishery. At this time (1983), the commercial fishery for walleye in Green Bay remains closed.

Commercial Fishery Rule Development — Lake Trout — Lake Superior  
— L. Kernen, and D. Ives, Madison  
A commercial catch quota on lake trout in the Wisconsin waters of Lake Superior was initiated in 1979. This quota was set at 180,000 pounds; 80,000 pounds of which were designated for non-Indian licensed commercial fishermen. The Lake Superior Commercial Fishing Board allotted the quota among the 21 licensed fishermen based on the gear they owned. All lake trout caught by licensed commercial fishermen must be tagged by the fishermen to enforce the quota system. In addition to the quota establishment, a substantial refuge was formed where no fishing of any kind was allowed. Other refuge areas were also designated as exclusive to sport fishing.

Support and Liaison for Lake Michigan and Lake Superior Commercial Fishing Boards  
— D. Ives, Madison  
Commercial Fishing Boards were created under s. 15.345(1) and (2), Wis. Stats. as a Board attached to the Department of Natural Resources. The Lake Michigan CFB has 7 members, the Lake Superior CFB has 5 members, all of which are appointed by the Governor. Their responsibilities are to review and consider applications for license transfers, to establish criteria for the allotment of catch quotas and to establish criteria for identifying inactive licenses.

It is the duty of the commercial fish staff specialist to set up and provide technical support for Commercial Fishing Board Meetings. These include 4 quarterly meetings for each Board per year, as well as 1-2 special meetings which may be required.

Administration of Great Lakes Commercial Fishing Licenses  
— D. Ives, Madison  
The amount of fish available to commercial harvest in the Great Lakes represents a limited resource. With more efficient and expensive gear, the commercial harvest has increased to the point of threatening fish stocks. Efforts to reduce the number of commercial fishermen has resulted in the limited entry license system. This system requires a minimum fishing effort to be expended (30 lifts per year) and a licenses to be applied for in a timely manner. Since 1979, 22 licensed commercial fishermen were denied renewal because they did not meet the minimum effort criteria. Furthermore, the number of licenses allowed cannot exceed the highest number issued in the last 2 years. The table that follows shows a steady decline has occurred in the number of licensed fishermen, indicating that the limited entry system is working (Table 6).

<table>
<thead>
<tr>
<th>Year</th>
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<th>Lake Superior</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979</td>
<td>239</td>
<td>21</td>
</tr>
<tr>
<td>1980</td>
<td>229</td>
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<tr>
<td>1982</td>
<td>199</td>
<td>21</td>
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</table>
SUMMARY OF FUTURE PROJECTS 1983-1985

In the section that follows, a listing of projects planned for the near future is given. Many of these projects are continuations of present ongoing projects and some are new projects. For each project, the title, time period of completion, and a brief description are given. The project descriptions are organized by the lake they primarily impact (Lake Michigan and Lake Superior). Hatchery operations and development projects that will be funded by Salmon and Trout Stamp revenues are summarized in the last section.

LAKE MICHIGAN

Operations

Lake Michigan Salmonid Creel Census — Southeast District 1983-1985
This project will evaluate the stocking of trout and salmon in terms of return to anglers. Total harvest, total effort, catch per effort, species composition of catch, and geographical distribution of catch will be estimated in the waters from the Sheboygan County and south. This project provides essential feedback concerning the current stocking program and will suggest program alterations to maximize stocking effectiveness.
PMN 254

Salmonid Collection for PCB Analysis 1983-1985
This project will provide salmon and trout collections for routine monitoring of PCB concentrations. These data will be used to maintain public health advisories concerning the consumption of stocked salmon and trout in Lake Michigan.
PMN 260

Stock Lake Trout and Evaluate 1984-1985
This project will stock approximately 500,000 lake trout annually and evaluate survival through spawning in Lake Michigan. Stocking and assessment activities will take place on Wind Point Shoal, Black Can Reef, Northeast Reef, and Sheboygan Reef. This project will evaluate the Domestic (Superior), Green Lake, Seneca Lake and Jenny Lake strains, and identify which should be stocked. Movement and association to stocking location of planted lake trout will also be determined.
PMN 281

Coho Salmon Broodstock Selection 1984-1985
This project will collect fertilized coho salmon eggs and determine spawning run timing in the Sheboygan River. In addition, this project will obtain milt from early running coho populations in Alaska to hybridize with Lake Michigan coho eggs. The development of coho salmon strains that return to stocking locations in late August and September will enhance harvest of these fish. Currently, coho salmon return to Wisconsin streams in late October and November when angling activities are minimal. Assessment activities will compare timing of spawning between pure Lake Michigan and Lake Michigan-Alaska hybrid strains. The hybrid strains will be produced for three years. This operations activity will provide one million fertilized coho salmon eggs for hatching and rearing at the Kettle Moraine Springs and Lake Mills hatcheries.
PMN 259

Coho salmon (Oncorhynchus kisutch)

Promote Adaptive Management Use in Fisheries Problem Solving 1983-1985
This project will develop innovative management strategies to Great Lakes fisheries problems through the use of computer simulation modeling of population dynamics. Computer software will be that currently being used by the Great Lakes Fisheries Commission in the Adaptive Management workshops.
PMN 282

Salmon Pond Rearing 1983-1985
This project will include all activities necessary to operate the springtime chinook salmon ponds along the Lake Michigan shoreline and in the autumn the spawn taking facility at Strawberry Creek. This project includes costs in pond preparatory maintenance, fingerling rearing, egg taking, guarding Strawberry Pond, and collecting biological data on returning adults. The S/V Barney Devine will operate 50 hours to monitor returning adult salmon. This project will collect approximately four million chinook salmon eggs and provide final rearing and imprinting for 800,000 salmon.
PMN 473

This project will stock 80,000 coded wire tagged chinook salmon each year 1982-1984. One lot of 20,000 uniquely marked salmon will be stocked each year at Marinette, Strawberry Creek, Sheboygan, and Racine. Tag returns are expected through 1987 with project completion in 1988.
This project will identify stocking locations that maximize the survival to harvest of stocked chinook salmon in Lake Michigan. In addition, the age composition, growth patterns, and catch distribution (seasonal and geographical) will be described. Coded wire tags will be implanted into fingerling
salmon at the Wild Rose Hatchery. Tags will be returned through the regular contact creel census and voluntary returns through the Great Lakes sport fishing clubs. Chinook salmon currently comprise 40% of the total Lake Michigan salmonoid sport catch.

PMN 463

Lake Michigan Salmonid Creel Census 
— Lake Michigan District 1983-1985

This project will evaluate the stocking of trout and salmon in terms of return to anglers. Total harvest, total effort, catch per effort, species composition of catch, and geographical distribution of catch will be estimated in the waters from Manitowoc County north. This project provides essential feedback concerning the current stocking program and will suggest program alterations to maximize stocking effectiveness.

PMN 475
PMN 478

Stock Brook Trout Strains and Evaluate 1983-1985

This project will stock 15,000 wild Nipigon and 15,000 domestic strain brook trout in Lake Michigan and will compare their survival to harvest. Each strain will be given an identifying mark prior to stocking. Growth, survival, food habitats, distribution, movement, and angler catch will be monitored for each strain through 1986. This study will identify the best brook trout strain for stocking in Lake Michigan.

PMN 303

Stock Lake Trout and Evaluate 1983-1985

This project will stock 100 to 200 thousand lake trout of different strains on historic spawning reefs in northern Lake Michigan. Survivability, movement, growth rates, and reproduction will be compared among strains. Assessment data will be obtained through the monitoring of commercial and sport fisheries and by assessment fishing aboard the Department’s survey vessel. This project will contribute to the reestablishment of lake trout and identify lake trout strains that are best for stocking in Lake Michigan.

PMN 476

Stock Splake and Evaluate 1984-1985

This project will stock four lots of 10,000 splake in Green Bay near Marinette. Two lots of yearlings and fingerlings will be planted. F, crosses will be made using female Lake Michigan lake trout and hatchery or wild Lake Nipigon male brook trout. Evaluation will be made through the regular creel census and experimental gear.

The goal of this project is to create a winter fishery for splake in the Marinette area. A similar fishery has been developed in Chequamegon Bay of Lake Superior.

PMN 429

Stock Rainbow Trout Strains and Evaluate 1984-1985

This project will stock Shasta, Pikes Creek, and skamania rainbow trout in the Oconto River and evaluate their return to anglers. The two strains will be floy tagged prior to stocking. Tags will be returned via the lake floy tagged creel census, voluntary angler returns, assessment fishing, and electrofishing surveys. This project will identify which of these three strains are most suitable for stocking into Lake Michigan.

PMN 486

Salmon and Trout Contaminant Analysis 1983

This project will identify the relationship between contaminant levels in parents and progeny of chinook salmon and lake trout. These data will be used to estimate the quantities of fertilized eggs required to be collected to produce the desired stocking quotas. Toxaphene has been recently identified as a contaminant of adult fish and eggs and is known to be extremely toxic to fish. This project will include analyses for toxaphene. In addition, data from this project will be used to update health advisories concerning the human consumption of stocked Lake Michigan fish.

PMN 260

Assessment of Whitefish Populations 1983-1985

This project will assess the relative abundance of lake whitefish and Menominee whitefish populations in Lake Michigan. Data collected will include age composition, length frequency, weights, and sex. Tagging studies will be implemented to provide estimates of mortality. Assessment will be made by contract commercial fishing, monitoring commercial catches, and test netting.

PMN 210
PMN 480
PMN 481

Monitor Harvest and Determine Harvest Quota for the Chub Population in Lake Michigan 1983-1985

This project will monitor and assess the chub population by commercial catch reporting, contract commercial fishing, and test netting. Data collected will be used to determine the harvest quota for the commercial chub fishery.

PMN 253
PMN 479

Fishery Dynamics of Yellow Perch Populations in Green Bay 1983-1985

This project will assess the age composition, length frequency, growth patterns, sex ratios, and geographical distribution of the yellow perch catch. Data will be collected via monitoring commercial catch and test netting (S/V Sheephead). This study will also evaluate perch catches from modified entrapment gear.

PMN 484
PMN 483
PMN 485

Assessment of Coolwater Fish Populations in Lake Michigan 1983-1985

This project will provide biological data on yellow perch, smallmouth bass, walleye, northern pike, and muskellunge populations. Data will be collected by test gill nets, fyke nets, trawling, and electrofishing. Population abundance, spawning areas, movement, growth, and age composition will be determined for these populations. Data on walleye populations in Green Bay will be used to set biologically sound commercial and sport regulations.

PMN 487
PMN 493
PMN 462

Fishery Dynamics of Yellow Perch in the Milwaukee Harbor Area 1983-1985

This project will describe the age class structure, young of the year recruitment, growth rates, movement patterns, and estimate the angler effort and harvest of yellow perch in the Milwaukee Harbor area (McKinley Pier to Oak Creek). Data collection will be through a creel census and electrofishing. Perch were floy tagged in the summer of 1982. Some data is currently being collected. This project is funded through the Coastal Zone Management Program and segregated license money.

PMN 218
Development
Strawberry Creek Salmon Rearing and Weir Pond Renovation 1983-1985
This project will provide for a reconstruction of the rearing and weir pond on Strawberry Creek near Sturgeon Bay. In 1983, the pond will be redredged and the banks stabilized. Electrical service will also be added to the facility. In 1984, development will include a water control structure for the creek, well, and fence. At this facility, approximately four million chinook salmon fertilized eggs are annually collected. These eggs provide all of the chinook salmon for stocking into Lakes Michigan and Superior.
PMN 473

Manitowoc Salmon Rearing Pond Renovation 1984
This project will dredge the outlet area adjacent to the Manitowoc salmon and trout rearing pond. Improvement of the outlet will aid in the movement of salmon and trout juveniles from the pond to the Manitowoc River. This pond annually holds 250,000 chinook salmon for final rearing and imprinting.
PMN 473

LAKE SUPERIOR

Operations
Lake Trout Egg Stocking and Assessment 1983-1985
This project will stock one million lake trout eggs annually on inactive historical lake trout spawning reefs. The objective of this project is to establish naturally reproducing lake trout populations. Fry and fingerling survival will be monitored during the spring and summer months.
PMN 856

Stock Lake Trout Yearlings and Evaluate 1984-1985
This project will stock 50,000 coded wire tagged and 50,000 morpholine imprinted hatchery reared lake trout on historical spawning reefs. The objective of this project is to compare movement and survival of various sizes and imprinting treatments. The results of this project will refine lake trout stocking methodology to maximize survival and homing to spawning reefs.
PMN 856

Stocked and Native Lake Trout Spawning Assessment 1983-1985
This project will monitor spawner abundance, estimate mortality rates between spawning age classes, and describe the relationship between stocking location and spawning site selection of planted trout. In addition, approximately 1.4 million fertilized eggs will be collected from Gull Island Shoal for egg stocking reefs and hatchery production of lake trout and splake.
PMN 856

Lake Superior Salmonid Creel Census 1983-1985
This project will estimate angler effort and catch of stocked salmon and trout from Lake Superior and its tributaries. Data will be collected on movement, survival, growth, and reproduction of stocked salmonids. This project will provide essential tag return data to evaluate the stocking of chinook salmon, wild strain lake trout, splake, wild Nipigon brook trout, wild-domestic brown trout, and wild Pikes Creek rainbow trout.
PMN 858
PMN 812

Collection of Wild Trout Eggs for Hatchery Production 1983-1985
This project will collect eggs and melt from rainbow (steelhead), brown, and brook trout in Lake Superior tributaries for hatchery production. A total of approximately 300,000 fertilized eggs will be obtained by this activity.
PMN 858

Stock Trout and Salmon and Evaluate 1983-1985
This project will annually stock 500,000 salmonids and evaluate specific strains. Included within this project is the evaluation of stocking 100,000 wild Nipigon brook trout, 50,000 wild-domestic hybrid brown trout, 100,000 wild Lake Superior rainbow trout, 200,000 splake, and 50,000 chinook salmon. This project will also assess the impacts, if any, of coho salmon on the natural production of rainbow trout in eight Lake Superior tributaries.
PMN 813

Identification of Stream Trout Populations that Require Stocking 1983-1985
This project will assess juvenile production of anadromous trout within Lake Superior tributaries. The amount of suitable stream habitat will be compared to numbers of juvenile trout present. Stocking will be initiated if inadequate numbers of trout occur in the available habitat. This project will provide the comprehensive data base required to implement an effective stocking program for anadromous salmonids.
PMN 858

Dynamics of Chub Populations 1983-1985
This study will conduct gill net surveys at eight stations during July and August. Data will also be collected by monitoring commercial catches. Information on abundance, speciation, size, age, sex ratio, and predation will be gathered.
PMN 851

Dynamics of Whitefish Populations 1983-1985
This project will collect data on the population parameters of whitefish populations in Lake Superior. Data will be collected by monitoring commercial catches and by test netting. A tagging study will also be conducted to determine discreteness of stocks and homing tendencies.
PMN 857

Population Dynamics of Lake Herring Populations 1983-1985
This project will conduct fisheries surveys on traditional spawning grounds in the Apostle Islands and Superior areas. Data will be gathered by fishing experimental gill nets with the S/V Hack Noyes during mid-November through early December. Information on relative abundance, sex ratio, size range, and egg deposition will be gathered.
PMN 859

Dynamics of the St. Louis River Walleye Population 1983-1985
This study will collect data on the population parameters of walleye in or adjacent to the St. Louis River. Data on age, population size, growth, sex ratio, and year class abundance will be collected.
PMN 855
STATEWIDE HATCHERY PROGRAM

The hatchery projects described below are those that will be receiving funds from the sales of Great Lakes Salmon and Trout Stamps. Administration, planning, and coordination of development and engineering activities are provided by the Inland Section of the Bureau of Fish Management. Each of these projects are regarded by the Bureau as integral to the hatchery program.

Operations

Kettle Moraine Springs Salmon and Trout Hatchery 1984-1985

This project will provide the necessary materials and manpower to fully utilize the expanded fish production potential gained through the completion of the hatchery development program. All associated production costs from fish food to miscellaneous system maintenance supplies are covered within this budget.

PMN 201
PMN 202

Lake Mills Salmon Hatchery 1983-1985

This project will provide expenses required to operate the Lake Mills National Fish Hatchery to rear 300,000 yearling coho salmon for stocking into Lake Michigan. These expenses include manpower, utilities, supplies, and fish food. The federal government is closing this facility in March of 1983 and is offering the hatchery for state use. Coho stocking in Lake Michigan was reduced from 500,000 in 1978 to 216,000 in 1982 due to loss of propagation funds from the Anadromous Fish Act. Coho production for the Lake Mills and Kettle Moraine Springs hatcheries will allow coho stocking to return to or slightly exceed former levels of 500,000 yearlings.

Development

Kettle Moraine Springs Salmon and Trout Hatchery Projects 1983-1985

A. Colo salmon raceways — This project will convert the east side field pond into concrete raceways. These raceways will use a separate water supply from the rest of the hatchery. As a result, this rearing area will be ideal for raising coho salmon, since the diseases associated with salmon will be isolated from the rest of the facility. Approximately 200 to 300 thousand yearling coho salmon are expected to be produced.

PMN 285

B. Water supply development — This project will renovate the falling central water collection system. This portion of the project will allow the hatchery to maintain production levels. This project will also develop the water supply on the west side of the hatchery grounds. Water collected in this area will be used in the coho raceways and will contribute to the production of the 200 to 300 thousand coho yearlings.

PMN 283
PMN 286

C. Stocking Truck — This project will purchase a heavy duty pickup truck, a “fifth wheel” type of trailer, and distribution tanks. In the past, a truck was borrowed from the Wild Rose Fish Hatchery; however, distribution schedules consistently overlapped. Increased salmon and trout production as a result of the development projects will further increase demand for the use of such a vehicle.

D. Salmon and Wild Trout Hatchery — This project will construct a new building for hatching eggs that will use a separate water supply from the rest of the hatchery. Equipment will include egg hatching tanks, plumbing, and a freezer for storage of fish food. This hatchery building will be able to accommodate one million coho salmon eggs and will supply all of the coho fry for Kettle Moraine Springs and Lake Mills hatcheries.

PMN 283

E. Effluent Pond — This project will construct an effluent pond to treat hatchery water. As fish production increases at Kettle Moraine Springs, the increased excretory waste will require more efficient treatment to maintain WPDES standards.

F. Convert Trout Pond to Concrete Raceways — This project will convert the old earthen ponds in the east central area of the hatchery grounds to raceways. Currently, these ponds have poor water circulation, require continual maintenance, and are difficult to disinfect if contaminated with disease. Converting to concrete raceways should eliminate these problems and will contribute to the production of 80,000 trout.

PMN 285

G. Purchase Land to Protect Water Supply — This project will purchase land adjacent to the hatchery grounds in upper watershed area. This land will protect current hatchery water supplies from diversion and contamination. Additional water supplies exist on this property which could be developed to further increase the production of Kettle Moraine Springs.

Nevin Trout Hatchery Renovation 1985

This project will dredge the effluent settling basin and rearing pond. Dredging of the effluent basin is required to permit improved effluent handling and to maintain WPDES standards. The rearing pond requires dredging in order to maintain its current productive capacity. In addition, minor construction will occur on the Catfish Pond that will increase productivity by 50,000 brown trout. This hatchery currently produces 70,000 brown and 180,000 rainbow trout for Lake Michigan.
Westfield Salmon Rearing Station Renovation 1985
This project will renovate the water recirculating system used at this rearing station. This station rears approximately one million chinook salmon for stocking Lake Michigan.

Langlade Trout Rearing Station Renovation 1984-1985
This project will construct three new ponds, renovate rearing building, and explore the groundwater potential on the east side. Two of the ponds will replace the north battery of raceways which are deteriorating. Renovation of the rearing house will permit an increase in the winter carrying capacity at Langlade. This project will develop facilities to produce an additional 100,000 yearlings and 50,000 fingerling trout. This additional production will be used to rear summer and spring run rainbow trout (steelhead) for stocking into the Oconto River, Stoney Creek, and Kewaunee River.

Thunder River Trout Rearing Station Renovation 1985
This project will rebuild rearing pond banks, stabilize raceway floors, extend sub-surface drains, and lay pipeline to pollution control pond. In addition, a 500 gpm pump (pollution control) and a 16 hp tractor will be purchased. This project will allow Thunder River to continue to produce 100-120 thousand brown trout for stocking Lake Michigan. This station may also be used for rearing Atlantic salmon since it has a warmer water supply.

Bayfield Trout Hatchery Renovation 1984-1985
This project will provide for repair of the well, drains, and doors of this hatchery. The major expenditure of this project will be the renovation of the well in 1985. High pressure pipes and valves leading from the well are wearing out due to sand fines that occur in the water. This hatchery produces all of the lake trout, splake, brook trout, and rainbow trout stocked in Lake Superior.

Brule River Trout Hatchery Renovation and Expansion 1983-1985
This project will primarily expand the capabilities of this facility to hatch and rear wild strains of brook, brown, and rainbow trout. Expenditures in 1983 and 1984 provide space to hatch 20,000 wild-domestic brown trout and to install “demand feeders” for rearing. Hatchery expansion will begin in 1985 with engineering plans. The facility will include space for 12 rearing tanks, 4-5 egg incubators, and fish food storage. When complete (1986), this hatchery will be able to hatch and rear trout though the fry stage an additional 700,000 trout.

Osceola Trout Hatchery and Broodstock Station Renovation 1984-1985
This project will renovate water delivery systems to the hatching and rearing area. Hatchery water manifolds will be elevated and water collection boxes replaced to increase egg hatching efficiency. This hatchery currently provides all of the rainbow trout eggs (approximately 1.5 million) used in the Lake Michigan stocking program.

TIMETABLE FOR FUTURE PROJECT REPORTS

Final reports of all projects are required to document data analysis and conclusions so that management policy alterations may be implemented if necessary. The reports provide the feedback information about the program to guide strategic plan revision. In addition, project reports communicate valuable information between Districts and personnel working on different lakes. Reports are to be submitted through District channels and forwarded to the Bureau of Fish Management. Federally funded Coastal Zone Management projects also require quarterly progress reports. Projects with their report due dates are listed in Table 7.
### TABLE 7. Schedule of Project Reports for Fiscal Year 1984-85.

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<tr>
<th>Project</th>
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<th>Report Due</th>
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<td><strong>Lake Superior</strong></td>
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<td><strong>Bayfield</strong></td>
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<td>Reestablish Self-Sustaining Lake Trout Populations</td>
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<td>Lake Trout Egg Stocking and Assessment</td>
<td>856</td>
<td>CZM</td>
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<td>Stock Lake Trout Yearlings and Evaluate</td>
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<tr>
<td>Stocked and Native Lake Trout Spawning Assessment</td>
<td>856</td>
<td>CZM</td>
</tr>
<tr>
<td>Stock Salmon and Trout and Evaluate</td>
<td>813</td>
<td>3/15</td>
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<tr>
<td>Lake Superior Salmonid Creel Census</td>
<td>812</td>
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<td>(Evaluate Salmonid Stocking in Western Lake Superior)</td>
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<tr>
<td>Increase Salmon and Trout Fishing Opportunities</td>
<td>858</td>
<td>3/15</td>
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<td>Identify Stream Trout Populations Requiring Stocking</td>
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<td>Collect Wild Trout Eggs for Hatchery Production</td>
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<td>Monitor the St. Louis River Walleye Production</td>
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<td>Promote Adaptive Management Use in Fisheries Problems Solving</td>
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<td>6/30</td>
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<td>Increase Lake Trout Spawning on Reef Areas in Lake Michigan (Stock Lake Trout and Evaluate)</td>
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<td>Assess Coolwater Fish Populations in Southern Lake Michigan</td>
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<td>Develop Use of Shoreline Fish Resources</td>
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<td>Conduct Toxic Substance Survey (PCB Analysis)</td>
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<td>Determine the Harvest Quota for the Lake Michigan Chub Fishery</td>
<td>253</td>
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<td>Fishery Dynamics of Yellow Perch in Milwaukee Harbor Area</td>
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<tr>
<td>Lake Michigan Salmonid Creel Census (Lake-wide)</td>
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*Code Used | Funding Source          | Report Due |
---|-------------------------|------------|
AFC        | Anadromous Fish — Commercial | 12/15      |
CFA        | Commercial Fish Act       | 9/15       |
CZM        | Coastal Zone Management   |            |

Quarterly: 1/5, 4/5, 7/5, Final: 10/5