

## STUDY PERFORMANCE REPORT

**State:** Michigan

**Project No.:** F-81-R-2

**Study No.:** 486

**Title:** Assessment of lake trout populations in Michigan's waters of Lake Michigan.

**Period Covered:** October 1, 2000 to September 30, 2001

**Study Objectives:** To determine the population structure, health, and reproductive success of lake trout in Michigan's waters of eastern Lake Michigan. To determine if spawning adults are present at the three stocked spawning reefs within the northern refuge and at traditional spawning reefs that lie within (Big Reef) and outside (Fisherman's Island and Dahlia Shoals) the boundaries of the northern refuge.

**Summary:** During the 2000 field season, lake trout sampling efforts focused on assessments of populations in eastern Lake Michigan from April to August, and spawning reef assessments in northern Lake Michigan in October and November. A total of 383 lake trout were captured throughout Lake Michigan during the 2000 field season, 6 of which were collected during fall spawning reef assessments conducted in northern Lake Michigan. The age composition of the lake trout in May-July assessments ranged from 2 to 12 years. The majority of these fish fell into the 3- to 7-year old age groups. We collected stomach samples from 157 lake trout in 2000. As observed in 1999, the incidence of bacterial kidney disease (BKD) in Lake Michigan lake trout populations remained low in 2000, especially when compared to levels observed in 1997. Data collection for the year 2001 is ongoing and we are in the process of entering information into standardized database files. As in the past, we did not detect any feral lake trout in Lake Michigan.

### **Job 2. Title: Search for feral lake trout.**

**Findings:** Our sampling provided no evidence of natural reproduction by lake trout in Lake Michigan. All lake trout stocked in Lake Michigan are marked, and the number of unmarked fish collected from each statistical district is within the range expected for clipping or tagging error for all years sampled (1996-2000). The majority of the lake trout evaluated in gillnetting assessment surveys had fin clips indicating they were stocked fish. In 1996, 51 of 1,427 fish (4%) did not have fin clips and most of these unclipped fish were captured in MM-6. In 1997, only 5 of the 850 (<1%) lake trout captured had no fin clips and in 1998, 38 of 754 (5%) lake trout captured did not have fin clips. Of the unclipped fish in 1998, 20 of 38 were collected from MM-3. In 1999, 9 of 345 (3%) lake trout collected did not have clips. Lake trout evaluated in 2000 gill netting assessments followed a similar pattern with 12 of 388 (3%) fish observed without clips. Data collection for the year 2001 is ongoing. We will continue to watch for evidence of natural reproduction, however, currently there is no evidence to show conclusively that there are feral lake trout in Lake Michigan.

In 1998, 1999 and 2000, 2, 3, and 4 million lake trout eggs were stocked in protective astro-turf bundles at Big Reef in northern Lake Michigan. Fall trawling surveys have been conducted in 1999, 2000, and 2001 around Big Reef to determine if any of the millions of lake trout eggs

stocked hatched and survived. Thus far, no juveniles have been found. Surveys will continue through 2003.

Investigators are collaborating on a project funded through the Great Lakes Fishery Commission and the Ludington Pump Storage Trust entitled, "Effects of egg and fry predators on lake trout recruitment in Lake Michigan." A large component of the project is to identify potential lake trout spawning habitats in northern Lake Michigan and determine egg deposition rates of existing lake trout populations. Comparisons will then be made among lake trout populations observed in Lake Huron, Lake Ontario, and Lake Champlain. The project will provide a better indication of our potential for detecting feral lake trout in Lake Michigan as well as identify potential bottlenecks to production and survival in the early life stages of naturally produced lake trout.

**Job 3. Title: Coordinate with other studies, process and analyze data; write reports.**

**Findings:** We initiated a new lake-wide spring/early summer monitoring program in 1998. All agencies on Lake Michigan have agreed to follow standardized protocols that will enable us to better compare data and provide a lake-wide perspective on fishery population assessments. Since 1999, agencies on Lake Michigan have also adopted standard fall spawning assessment protocols using funding from the Great Lakes Fisheries Trust for a multiple-agency effort to assess the use of habitat by spawning lake trout in northern Lake Michigan. We are playing an active role in the implementation of each of these assessment programs. Further, we have coordinated closely with other agencies to develop age-structured lake trout population models for northern Lake Michigan and have compiled past and present assessment data to contribute to this effort. For the last 2 years, we have played a major role in producing a report submitted to the Great Lakes Fishery Commission on behalf of the Lake Michigan Technical Committee. The report represents a summary of all collaborative Lake Michigan sampling efforts directed at lake trout.

**Job 4. Title: Evaluate relevant literature on lake trout.**

**Findings:** Literature on lake trout physiology, behavior, and habitats are being collected and catalogued in an Endnote bibliographic software file. Twice monthly, we evaluate Current Contents (a literature search program) search results from fisheries journals. Relevant articles and publications are obtained and integrated into the database.

**Job 5. Title: Establish the distribution pattern, relative abundance, and origin of lake trout collected throughout eastern Lake Michigan from May through August.**

**Findings:** We have implemented and followed a revised salmonid sampling protocol since 1997 to better define spatial and temporal variation in fish distributions. Our lake-wide netting efforts covered the Michigan waters of the lake, progressing from south to north during two cruises, spring and summer. In 2000, because of time constraints, we only completed the first sweep of the lake during the spring cruise. In 2001, nets were set during both time periods, but only in MM-6 and MM-8. A set consisted of two gill net gangs, each gang measuring 1,600 ft in length, 30 ft in depth, and with panels of graded stretch mesh from 3 to 7 inches. One gang was set at the surface fishing in 0-30 ft of water. The other gang was suspended at a minimum of 30-60 ft or at a depth where the bottom of the net rested in 55°F (13°C) water. It was common to catch lake trout in surface and suspended gill nets (Table 1). A second mode of sampling lake trout in the spring/summer period was through targeted bottom gill nets set as part of the newly adopted lake-wide lake trout assessment plan (Table 2). Due to low catch rates in 1998, we doubled the net length from 800- to 1,600-ft gangs in 1999. These nets had graded stretch mesh of 3-5.5 in.

During April and May of 1999, six bottom gill nets were set at each of three Lake Michigan sites (Manistique, Arcadia and Northern Refuge) and in 2000, six nets were set at each of two sites (Saugatuck and Arcadia). Information was collected in 2001 from bottom gill net surveys at three Lake Michigan sites (Good Harbor, Arcadia, and Saugatuck) and is currently being entered into standardized databases.

Since 1994, lake trout have been readily captured in surface, suspended, or bottom gill nets (Table 1). In the future, we intend use data collected from these different nets to evaluate if lake trout diets vary for fish captured in nets at different depth strata. The results will help researchers determine if long-term lake trout population assessments can be conducted in concert with other salmonid sampling protocols.

Four species commonly captured in spring assessment sampling efforts included lake trout, burbot, lake whitefish, and lake herring. In bottom gill nets set in 1999, overall average lake trout catch rates (number per 1,600 ft of net) were lowest in Manistique (1), and highest in the Northern Refuge (15) (Table 2). We also captured the greatest numbers of burbot in the Northern Refuge area, whereas lake whitefish were more prevalent at Arcadia. We did not observe lake herring in 2000 spring gill net collections. In 2000, the lake trout catch rates at Arcadia were higher than in 1999 (Table 3). The highest catch rates for lake whitefish were observed in 2000 at Saugatuck. Respectable lake trout catch rates were also observed at this site (Table 3).

The age composition of lake trout collected in May-July, 1999 assessments ranged from 2 to 9 years. The majority of fish were in the 5- to 7-year old age groups (Table 4). In 2000, the age groups represented at Arcadia appear to have expanded from those observed in 1999 (Table 4). Lake trout collected in the year 2000 from Saugatuck ranged in age from 2-12 years. The majority of the Saugatuck fish were represented in the 3-6 year old age groups (Table 4).

**Job 6. Title: Determine the timing of spawning, distribution patterns, relative abundance, and origin of lake trout collected on traditional spawning reefs from October through November.**

**Findings:** In 1999, the Great Lakes Fishery Trust (Trust) approved a proposal to sample multiple reefs in northern Lake Michigan. Six tribal agencies, two federal agencies, and the state are collaborating on this project. This Trust-funded project has provided the opportunity to collaborate and combine data from each of the agencies involved and has greatly increased the number of sites evaluated in northern Lake Michigan (Table 5). We evaluated four sites in both 1999 and 2000 (Table 6). The assessment goal is to evaluate the abundance of spawning lake trout at a given location by deploying a minimum of three nets in each of two years. In 2001, we will conduct fall spawning assessments at two sites following the standard protocol (Table 5).

Catch rates at both near-shore and off-shore stocked and non-stocked sites were evaluated to determine whether stocked lake trout are using historically important spawning sites or staying near the locations where planted. In both 1999 and 2000, catch rates at non-stocked offshore sites were low (Table 5). When comparing our catch rates with data collected by other collaborators, it is evident that lake trout in northern Lake Michigan are most abundant on stocked sites and prefer near-shore zones (Claramunt et al. 2001).

**Job 7. Title: Obtain information on diets of lake trout in surface vs. bottom nets, throughout the spring and summer and during spawning, and from different spatial locations in eastern Lake Michigan.**

**Findings:** We are participating in a collaborative lake-wide effort to consolidate information and publish a paper describing the diets and foraging relationships of lake trout collected throughout Lake Michigan in 1994 and 1995. A draft of this paper had been submitted to the co-authors for review in the summer of 2001. The laboratory evaluation of 1996 and 1997 stomach contents is now complete and a paper will be written in the near future comparing the 1996 and 1997 diet data from burbot and lake trout collected in the same nets. We collected stomach samples for diet analysis from 456 lake trout in 1998, 245 fish in 1999 and 157 fish in 2000. Evaluation and analysis of these samples are incomplete. We collected stomach samples from fish in 2001 assessment nets. The 2001 catch and collection information is being entered into standard database files, and diet analysis is incomplete.

**Job 8. Title: Monitor prevalence of bacterial kidney disease in populations of lake trout in eastern Lake Michigan.**

**Findings:** We tested lake trout for the presence of BKD with the enzyme-linked immunosorbant assay technique (Kwik Dtect, Diagnostics, Inc., Wilton, CT) for laboratory and field use. Incidence of BKD was high in 1997 (31%, N=723), decreased in 1998 (1%, N=499) and remained low in 1999 (0%, N=306) and 2000 (0%, N=182; Table 7). We have collected samples from fish collected in 2001 assessment efforts, and have not evaluated or analyzed samples at this time.

**Job 9. Title: Analyze Data; Write annual report.**

**Findings:** Data analyses are ongoing. We produced this annual progress report as scheduled.

**Literature Cited:**

Claramunt, R., M. Toney, P. McKee, R. Hess, E. Olsen, and J. Jonas. 2001. Status of lake trout rehabilitation in Lake Michigan. Report, Lake Michigan Great Lakes Fishery Commission Committee.

**Prepared by:** Jory Jonas

**Date:** September 30, 2001

Table 1.—Number of lake trout captured annually in bottom, suspended, and surface gill nets set in Michigan's waters of Lake Michigan.

Year	Bottom gill net	Suspended gill net	Surface gill net
1994-1997 (mean)	427	52	439
1998	145	51	211
1999	214	72	59
2000	331	21	31

Table 2.—Standard sampling locations for Lake Michigan lakewide assessments of lake trout and the agency<sup>a</sup> performing the collections during April and May of each year.

Location	1998	1999	2000
Arcadia	MDNR	MDNR	MDNR
Cherry Home-GTB	Not sampled	GTB	Not sampled
Clay Banks	WIDNR	WIDNR	WIDNR
East Reef	WIDNR	Not sampled	WIDNR
Little Traverse Bay	Not sampled	LTBB	LTBB
Lee Point-GTB	Not sampled	GTB	GTB
Leland	GTB	GTB	Not sampled
Ludington	Not sampled	Not sampled	LRB
Manistee	Not sampled	Not sampled	LRB
Manistique	MDNR	MDNR	Not sampled
Northern Refuge	Not sampled	USGS	Not sampled
Old Mission-GTB	Not sampled	GTB	GTB
Saugatuck	Not sampled	Not sampled	MDNR
Sheboygan Reef	Not sampled	WIDNR	Not sampled
Sheboygan Shore	WIDNR	WIDNR	WIDNR
Washington Island	WIDNR	WIDNR	Not sampled
Waukegan	ILDNR	ILDNR	ILDNR

<sup>a</sup> GTB=Grand Traverse Bands  
 ILDNR=Illinois Department of Natural Resources  
 LRB=Little River Band  
 LTBB=Little Traverse Bay Band  
 MDNR=Michigan Department of Natural Resources  
 USFWS=United States Fish and Wildlife Service  
 USGS=United States Geological Service, Biological Resources Division

Table 3.—Average catch of the four most commonly captured species per overnight set of 1,600-foot graded-mesh bottom gill nets (CPUE) in Michigan waters of Lake Michigan during April-July, 2000. Six nets were set per site.

Site Name	Year	Lake trout	Burbot	Lake herring	Lake whitefish
Manistique	1999	1	2.7	0.0	0.8
Refuge	1999	15.0	10.0	0.0	0.3
Arcadia	1999	12.3	3.7	0.0	2.2
	2000	20.7	8.8	0.0	3.3
Saugatuck	2000	14.7	0.3	0.0	16.5

Table 4.—Age composition of lake trout collected in bottom gill net surveys expressed as a percent of the total number of fish sampled (N) in Michigan waters of Lake Michigan (April-July 2000).

Site name	Year	N	Age										
			2	3	4	5	6	7	8	9	10	11	12
Arcadia	1999	74	3	9	9	11	51	15	1	0	0	0	0
	2000	124	1	2	31	44	14	5	1	1	0	2	0
Saugatuck	2000	88	1	24	31	20	11	3	5	1	1	1	1
Manistique	1999	6	0	0	0	33	33	33	0	0	0	0	0
Refuge	1999	89	4	7	8	20	37	16	4	3	0	0	0

Table 5.—Sites for fall lake trout spawning assessments in Lake Michigan, 2001.

Site	Statistical District	Grid	Agency <sup>a</sup>
Norheim Reef	WM-4	1303	USFWS
Good Harbor	MM-5	814	USFWS
North Reef	MM-5	714	USFWS
Manitou Shoal	MM-5	713	USFWS
Jacksonport Reef	WM-3	806	USFWS
Claybanks	WM-3	905	USFWS
Fishermans Island	MM-3	616	LTBB
Menonaqua	MM-3	519	LTBB
Bay Harbor	MM-3	518	LTBB
7 Mile Point	MM-3	518	LTBB
Pt. Aux Barques	MM-2	310	CORA
GTB-Cherry Home	MM-4	615	GTB
GTB-Lee Point	MM-4	815	GTB
GTB-Old Mission	MM-4	716	GTB
GTB-Northport Point	MM-4	715	GTB
Middle Ground	MM-3	613	MDNR
Grand Traverse Shoal	MM-3	716	MDNR
Waukegan-Shore	IL	2302	ILDNR
Waukegan-Reef	IL	2303	ILDNR
Julian's Reef	IL	2504	ILDNR
Portage Point	MM-6	1111	LRB
Lusington Shoal	MM-6	1309	LRB
Point Betsie	MM-5	911	LRB
Trout Island Shoal	MM-3	314	USGS
Hog Island Reef	MM-3	316	USGS
Boulder Island	MM-3	413	USGS
Gull Island	MM-3	414	USGS
Lansing Shoals	MM-3	216	USGS

- <sup>a</sup> CORA=Chippewa Ottawa Resource Authority  
 GTB=Grand Traverse Bands  
 ILDNR=Illinois Department of Natural Resources  
 LRB=Little River Band  
 LTBB=Little Traverse Bay Band  
 MDNR=Michigan Department of Natural Resources  
 USFWS=United States Fish and Wildlife Service  
 USGS=United States Geological Service, Biological Resources Division

Table 6.—Lake trout catch per net night per 800 ft of bottom gill net (CPUE) on spawning reefs in northern Lake Michigan during 2000. All sites represent off-shore locations and were not stocked.

Site name	Year	Number of nets	CPUE
South Fox	1999	4	3.0
	2000	4	0.8
North Fox	1999	4	2.0
	2000	4	0.3
Irishmen's	1999	4	1.0
	2000	2	2.0
Big Reef	1997		2.8
	1999	4	1.0
Middle Ground	2000	4	0.0

Table 7.—Prevalence of bacterial kidney disease (BKD) in lake trout from Michigan waters of Lake Michigan, 1995-2000.

Year	Percent testing positive	95% confidence limits
1995	11.9	2.4
1996	1.4	1.6
1997	31.4	3.4
1998	0.6	0.7
1999	0.0	0.0
2000	0.0	0.0