

STUDY PERFORMANCE REPORT

State: Michigan

Project No.: F-53-R-14

Study No.: 486

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

Period Covered: April 1, 1997 to March 31, 1998

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 (NGS Crew) 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 1997 field season lake trout sampling efforts focused on assessments of populations in eastern and northern Lake Michigan from April-August and spawning reef assessments in northern Lake Michigan in October and November.

A total of 850 lake trout were captured throughout Lake Michigan during the 1997 field season, 116 of which were collected during fall spawning reef assessments in northern Lake Michigan. As expected, a greater size and age range of fish were collected in summer netting efforts than in fall spawning reef assessments. Fish collected on fall spawning reefs tended to be older and larger. The majority of the fish collected in northern Lake Michigan originated from plantings in the northern refuge area. Incidence of BKD in lake trout populations had increased significantly in during 1997. We collected stomach samples from 763 lake trout in 1997. As in the past, we did not detect the presence of any feral lake trout.

Job 2. Title: Search for feral lake trout.

Findings: The number of unmarked fish collected from each statistical district is within the range expected for clipping or tagging error. In 1996, 5% from Statistical District MM-8, 5% from District MM-7, 15% from District MM-6, 1.4% from District MM-5 and 1.9% from District MM-3 were unmarked fish. Due to the high ratio of marked to unmarked fish in Statistical District 6, scales were evaluated to determine if anything other than typical hatchery growth was observed inside the first annuli. All unmarked fish exhibited similar growth patterns to known hatchery-raised fish. Only five of the 850 lake trout captured in 1997 had no fin clips. There is no reason to believe that there has been a significant increase in the number of feral lake trout in Lake Michigan.

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

Findings: We will begin a new lake wide spring/early summer monitoring program in 1998. All agencies on Lake Michigan have agreed to a protocol. We are looking optimistically toward the future when we will have data sets that are comparable with other agencies which will help provide a lake wide perspective to fishery population assessments. The fall spawning

assessments are also in the revision process in coordination with other agencies. We are playing an active role in the implementation and revision of both the spring/summer, and fall spawning assessments. Further, we will be coordinating closely with other states to standardize common analyses on present and past data sets. Preliminary meetings have already occurred. We also will be working closely with the U.S. Fish and Wildlife Service to initiate the placement of astroturf substrates on Big Reef a historically important lake trout spawning reef located in northern Lake Michigan.

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 library. Twice monthly Current Contents searches are conducted on all relevant fisheries journals to identify current journal articles and publications that might be of interest.

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 implemented a revised salmonid sampling protocol in 1997 to better define spatial and temporal variation in fish distributions. Our lake wide netting efforts covered the entire lake in two south to north sweeps during the spring and summer. We set 30 foot deep suspended gill nets, hoping to be able to better define the distribution of salmonine populations at depth strata in Lake Michigan. One gang (3,200 ft) was suspended at the surface fishing from 0-30 ft of water. The other gang (3,200 ft) was suspended at a minimum 30-60 feet or at a depth where the bottom of the net would rest in 52 degree water. Two (nearshore and offshore) gangs (1,200 ft) of six-foot deep bottom gill nets were set once in each statistical district during each of the two sweeps of the eastern shore of Lake Michigan.

There was not an identifiable trend in the number of lake trout collected in surface, suspended, or bottom gill nets (Table 1). Further, there did not seem to be a trend in the strain composition of the catch at the different depth strata (Table 2). It will be interesting to see how diets may vary at the different depth strata.

In bottom gill nets, the greatest numbers of burbot were collected in the northern statistical districts, while chinook salmon, lake herring and lake whitefish were more common in the southern districts (Table 3). Lake trout were most common in the central districts MM-5, 6, and 7 (Table 3).

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: For the second year, spawning reef assessments were conducted on non-stocked reefs to determine utilization of habitat by stocked lake trout in the northern refuge of Lake Michigan. Two offshore (Dahlia Shoals and Big Reef) and one onshore (Fisherman's Island Reef) reef were evaluated. Reef sites chosen were those having the highest commercial catches during the spawning season in the late 1920's and 1930's (Dawson et al. 1997). High catch rates may reflect high historic spawning activity on the associated reefs. Of the three sites chosen for

evaluation, only Fisherman's Island was stocked directly with lake trout. Stocking ceased on Fisherman's Island in 1991, when at the request of the state, lake trout stocking was shifted to Grand Traverse Bay. Evaluation of catch rates helps us determine whether stocked lake trout are using historic or stocked sites, a combination of both, or neither.

In 1997 spawning reef assessments, we captured the majority of the lake trout at the near shore site (Fisherman's Island) with an average catch rate of 23 fish per night (Table 4). The offshore sites were not utilized by spawning lake trout to any great extent, average catch rates were 3 fish per night (Table 4). Fin clip distributions on Fisherman's Island have remained similar from 1996 to 1997 (Table 5). We are continuing to find ADLP clipped fish with coded-wire tags (Table 5). In 1996, 41% of the fish collected from Fisherman's Island reef were from offshore plants plantings (Richard's, Boulder, and Gull Island reefs) and in 1997, 47% of the lake trout sampled were known to have originated from offshore. In 1997 on Dahlia Shoal, 60% of the fish sampled originated from offshore plantings and 35% of the lake trout sampled were from the offshore plantings on Big Reef. The majority of the fish captured on each of the three non-stocked reefs were age 5 or 6 (Table 6). The age structure on Fisherman's Island reef did not change appreciably from 1996 to 1997 (Table 7). The above information provides evidence that lake trout of spawning ages are straying from the northern refuge area, and seem to be orienting towards the shoreline. We intend to further explore other offshore sites in 1998 and to extend our near shore sampling to determine if lake trout are selecting specific near shore habitat.

The Marquette strain dominated the catch on all reefs (Tables 6 and 8), followed by the Lewis Lake and Apostle Island strains on Fisherman's Island reef (Tables 6 and 8). In 1997, of the 39 females collected on Fisherman's Island, two were immature, 26 were mature, eight were ripe and three were spent. The presence of ripe and spent females would indicate that some level of spawning is occurring on the near shore Fisherman's Island reef. Extremely low densities of fish resulted in low densities of females on the offshore reefs. Most of the females collected on offshore reefs were mature and one was ripe. On Big Reef of the 12 females collected, three were immature and nine were mature. While on Dahlia Shoal of three females collected, two were mature and one was ripe.

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: Stomach samples were collected from 763 lake trout for diet analysis in 1997. The evaluation of 1996 and 1997 stomach contents is not yet complete. We have evaluated all stomachs collected in 1995, and will participate in a collaborative lake wide effort to consolidate information and publish a paper. The paper will describe the diets and foraging relationships of lake trout collected throughout Lake Michigan in 1994 and 1995.

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

Findings: Lake trout were tested for the presence of BKD with the ELISA (enzyme-linked immunosorbant assay) technique (Kwik Dtect¹) for laboratory and field use. Results of monitoring the prevalence of BKD in lake trout populations indicate that BKD levels have

¹ Diagnostics, Inc., Wilton, CT

increased substantially. Levels of BKD were nearly three times higher than those recorded in 1995 or 1996 (Table 9). Of the 723 lake trout evaluated from Michigan's waters of eastern and northern Lake Michigan 227 fish tested positive for BKD. The highest levels of BKD were observed in the central (MM-5) and southern sections (MM-7 and MM-8) of the lake (Table 10).

References Cited:

Dawson, K. A., R. L. Eshenroeder, M. E. Holey, and C. Ward. 1997. Quantification of historic lake trout (*Salvelinus namaycush*) spawning aggregations in Lake Michigan. Canadian Journal of Fisheries and Aquatic Sciences 54:2290-2302.

Table 1.—Catch rates of lake trout in bottom, suspended, or surface gill nets in Lake Michigan in 1994-96 and in 1997.

Net Type	1994-96 (mean)	1997
Bottom gill net	484	351
Suspended gill net	114	207
Surface gill net	391	221

Table 2.—Strain composition (percent) of lake trout captured in bottom, suspended, and surface gill nets in Lake Michigan.

Net Type	Strain					
	Apostle Island	Green Lake	Jenny Lake	Lewis Lake	Marquette	Ontario
Bottom gill net	8.7	3.9	2.4	18.1	44.1	20.5
Suspended gill net	2.2	10.9	6.5	8.7	39.1	28.3
Surface gill net	3.7	4.9	6.2	22.2	24.7	33.3

Table 3.—Catch per 1,200 ft of graded mesh bottom gill nets (CPUE) in statistical districts MM-3 through MM-8 in Lake Michigan during 1997.

Statistical District	Species	Number of Nets	CPUE
MM-6	Burbot	4	0.8
MM-3	Burbot	3	8.3
MM-4	Burbot	2	7.0
MM-5	Burbot	2	11.5
MM-6	Burbot	4	7.0
MM-7	Burbot	4	3.0
MM-8	Burbot	4	1.2
MM-5	Chinook	2	0.5
MM-7	Chinook	4	0.3
MM-8	Chinook	4	15.0
MM-3	Lake Herring	3	0.3
MM-7	Lake Herring	4	0.3
MM-8	Lake Herring	4	1.7
MM-3	Lake Trout	3	5.7
MM-4	Lake Trout	2	1.5
MM-5	Lake Trout	2	54.0
MM-6	Lake Trout	4	6.0
MM-7	Lake Trout	4	19.0
MM-8	Lake Trout	4	2.3
MM-3	Lake Whitefish	3	3.0
MM-4	Lake Whitefish	2	0.5
MM-5	Lake Whitefish	2	9.0
MM-6	Lake Whitefish	4	3.3
MM-7	Lake Whitefish	4	29.8
MM-8	Lake Whitefish	4	11.3

Table 4.—Lake trout catch per net night per 1,200 ft. of bottom gill net (CPUE) on spawning reefs in northern Lake Michigan during 1996 and 1997.

Year	Location	Number of Nets	CPUE
1996	Fisherman's Island	4	23
1997	Fisherman's Island	4	22
1997	Dahlia Shoal	4	3
1997	Big Reef	6	3

Table 5.—Number of lake trout by fin clip type that were collected on non-stocked spawning reefs in 1996 and 1997. In parenthesis are the number of lake trout within the fin clip type with coded-wire tags. The capital letters NS indicate that the reef was not sampled.

Location	Clip	Year	
		1996	1997
Fisherman's Island	AD	38 (32)	49 (36)
Fisherman's Island	ADLP	9 (6)	5 (5)
Fisherman's Island	ADLV	3	9
Fisherman's Island	ADRV	2	2
Fisherman's Island	ADRP		1 (1)
Fisherman's Island	D	2	2
Fisherman's Island	DLV		1
Fisherman's Island	LP	3	4
Fisherman's Island	LV	10	3
Fisherman's Island	RP	11	5
Fisherman's Island	RV	7	7
Fisherman's Island	NC	6	1
Big Reef	AD	NS	8 (6)
Big Reef	ADLP	NS	1 (1)
Big Reef	ADLV	NS	2
Big Reef	LP	NS	1
Big Reef	RV	NS	4
Big Reef	NC	NS	1
Dahlia Shoal	AD	NS	6 (6)
Dahlia Shoal	LP	NS	1
Dahlia Shoal	RV	NS	2
Dahlia Shoal	RVRP	NS	1

Table 6.—Age and strain composition of coded-wire tagged lake trout collected from non-stocked spawning reefs in northern Lake Michigan in 1997.

Reef	Strain	Age	Number	Number per 100,000 Fish Stocked
Big Reef	Marquette	5	1	0.66
	Marquette	6	1	0.80
	Marquette	7	2	1.54
	Apostle Island	5	1	0.40
	Jenny Lake	8	1	1.40
	Gull Island	12	1	?
	Unknown	4	1	
	Unknown	5	1	
	Unknown	6	4	
	Unknown	7	1	
	Unknown	8	1	
	Unknown	11	2	
	Dahlia Shoal	Marquette	5	2
Marquette		6	2	1.61
Marquette		7	1	0.78
Apostle Island		5	1	0.40
Unknown		4	2	
Unknown		6	2	
Fisherman's Island	Marquette	5	6	4.06
	Marquette	6	5	6.04
	Marquette	7	11	9.02
	Marquette	8	3	3.23
	Marquette	12	2	?
	Apostle Island	5	4	1.59
	Ontario	5	1	0.41
	Lewis Lake	6	4	3.01
	Lewis Lake	7	4	3.13
	Lewis Lake	8	1	0.42
	Unknown	4	3	
	Unknown	5	12	
	Unknown	6	12	
	Unknown	7	5	
	Unknown	8	2	
	Unknown	9	6	
	Unknown	10	4	
	Unknown	11	2	

Table 7.—Age composition of lake trout collected on Fisherman's Island reef in 1996 and 1997.

Year	Age									
	4	5	6	7	8	9	10	11	12	13
1996	5	14	35	15	7	2	4	5	1	3
1997	3	23	23	20	6	6	4	2	2	

Table 8.—Lake trout strains and number per 100,000 stocked collected on non-stocked spawning reefs in northern Lake Michigan in 1997.

Reef	Strain	Number per 100,000 Fish Stocked
Big Reef	Apostle Island	0.4
	Marquette	3.0
	Jenny Lake	1.4
	Gull Island	?
Dahlia Shoal	Marquette	3.7
	Apostle Island	0.4
Fisherman's Island	Marquette	22.34
	Lewis Lake	6.55
	Ontario	0.41
	Apostle Island	1.59

Table 9.—Prevalence (percent and 95% confidence limits) of BKD in lake trout from Michigan waters of Lake Michigan, 1995-97.

Year	Percent Positive	95% Confidence Limits
1995	11.88	2.39
1996	1.38	1.55
1997	31.40	3.38

Table 10.—Prevalence (percent and 95% confidence limits) of BKD in lake trout from statistical districts MM-3 through MM-8 of Lake Michigan during 1997.

Statistical District	Percent Positive	95% Confidence Limits
MM-3	3.21	1.09
MM-4	4.35	8.33
MM-5	44.10	6.87
MM-6	7.29	5.20
MM-7	43.88	4.67
MM-8	41.23	9.04

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