STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-81-R-4

Study No.: 485 **Title:** Assessment of chinook and coho salmon populations and their prey in eastern Lake Michigan

Period Covered: October 1, 2002 to September 30, 2003

Study Objectives: To assess the health of chinook and coho salmon stocks in Lake Michigan through continuous monitoring of distribution, relative abundance, growth, mortality, diet composition, and clinical indicators of disease.

Summary: Data collection through fishery-independent sampling programs is an essential component of fisheries stock assessment and management. Chinook and coho salmon populations are important to the fish community as a control of exotic forage fishes (Krueger et al. 1995) and their populations support a highly valuable recreational fishery (Bence and Smith 1999).

Michigan Department of Natural Resources (MDNR) experimental sampling of Pacific salmon in Michigan waters of Lake Michigan began only in 1990, and we were not routinely successful in collecting these fish until 1994. This study is a continuation of the sampling program initiated in 1990. During 2003, chinook salmon (N=76 fish) were collected in Statistical Districts MM-6 and MM-8. Complete biological data were recorded for chinook salmon and other salmonines collected; these data, including samples for bacterial kidney disease (BKD) detection, are currently being evaluated.

In addition to this annual report, a detailed analysis of chinook and coho salmon sampling strategies, distribution, relative abundance, growth, mortality, diet, and disease has been reported in a draft manuscript for the Fisheries Division's Research Report series (Claramunt et al. 2003). Publication of this Fisheries Research Report is expected in 2004.

Findings: Jobs 1, 3, 4, 5, 6, 7, 8, and 9 were scheduled for 2002-03, and progress is reported below.

Job 1. Title: Establish the distribution pattern, relative abundance, and origin of chinook and coho salmon in eastern Lake Michigan.

Distribution and Relative Abundance. – Sampling during the early years of the survey

(1990-1993) indicated a unique period in which catch rates were low, and less variable across management units. In the 1994-96 seasons, sampling was conducted in one sweep of the lake, moving from south to north beginning in the spring. This design was based on the assumption that distribution of salmonine species in Lake Michigan remained constant throughout the sampling period. A revised sampling protocol was implemented in 1997 to better define the spatial and temporal variation in fish distribution. The sample design is a stratified-random design that targets both inshore and offshore thermal habitats using surface and suspended graded-mesh gill nets. By covering at least two statistical districts in the lake, and by sampling one unit in both the spring and summer, we were able to better define the relative abundance of chinook salmon populations in Lake Michigan. Catches of coho salmon have been very low in recent years, and no coho were collected in the 30 net sets during 2003 (Table 1).

Based on analysis of the catch and biological data from this survey, catch rates in MM-6 were found to be closest to the long-term average and more representative of chinook and coho stocks in Lake Michigan compared to the catch rates in other management units. Therefore, seasonal sampling (spring and summer comparison) in 2003 was focused in statistical district MM-6. In this district, a total of 12 net sets were conducted in the spring (June 3 -17) and 8 net sets were conducted in summer (July 28 – August 6; Table 2).

In addition to the seasonal component of the survey, a spatial comparison was made between statistical districts MM-6 and MM-8. For this comparison, an additional 10 net sets were conducted between June 23 – July 15 in MM-8. Surface and suspended gill nets were set for both the seasonal and spatial comparisons. Complete biological data, including information on age and growth, incidence of bacterial kidney disease (BKD), diet, and lamprey wounding were recorded for all salmonines collected. Processing of these data and samples is ongoing.

In Claramunt et al. (2003), chinook salmon catch-per-effort (CPE) was calculated as the number of chinook salmon per 1,000 ft of graded-mesh monofilament gill net set for four hours. Similarly, CPEs were calculated in 2003 to provide an index of relative abundance. Mean CPEs with $\pm$1 SE were 1.9$\pm$0.5 for MM-6 and 0.8$\pm$0.5 for MM-8. The 1990-2002 average CPEs for these two units were 3.4$\pm$0.8 and 5.1$\pm$1.3 for MM-6 and MM-8, respectively. Preliminary analysis of the survey CPEs suggests that the relative abundance of chinook salmon is down from 2002 and below the long-term (1990-2002) average.

Catch rates from the survey also tend to be higher in the spring compared to catches in the summer assessment cruises. During 2003, chinook salmon were sampled in the spring and summer in MM-6. However, catch rates did not differ; CPEs were 1.9+0.68 and 1.94+0.94 for the spring and summer periods, respectively. Many of the long-term trends in distribution and relative abundance of chinook salmon in the survey catch were not consistent with the 2003 data. Unlike most years, in 2003 southern Lake Michigan did not have higher survey catch rates nor were CPEs higher in the spring period. However, a higher percentage of chinook salmon were captured compared to other salmonines than that observed in previous years (Table 1).

Job 3. Title: Coordination with other studies, process and analyze data; write report.–This performance report was completed on schedule. The information presented was also used in preparing MDNR research summaries to the Great Lakes Fishery Commission and Lake Michigan Technical Committee. Coordination activities included study design assistance and fish collection for a Great Lakes Fishery Trust-funded study investigating disease incidence and energy dynamics in Lake Michigan chinook salmon (Mike Jones and Jim Bence, Michigan State University unit of the Partnership for Ecosystem Research and Management - PERM, principal investigators). A five-year report (Claramunt et al. 2003) is being finalized for submission to the MDNR Research Report series.

Job 4. Title: Determine growth rates of chinook and coho salmon in eastern Lake Michigan.–Biological data (length, weight, sex, maturity, tags, clips, age, diet, and observable diseases) were recorded for each of the chinook salmon collected (Schneeberger et al. 2001). Biological data were also recorded for the bycatch of all other salmonines. Growth will be evaluated as age-, sex-, and species-specific total length and weight. Both actual and back-calculated growth rates will be determined. These analyses are currently being completed for 2003 samples.

Job 5. Title: Determine survival rates of chinook and coho salmon in eastern Lake Michigan.–Determination of chinook salmon survival rates using cohort and catch-curve analyses is ongoing. The results of these analyses will be presented in the five-year report.

Job 6. Title: Obtain data on diet of chinook and coho salmon.–A total of 76 chinook stomach samples were collected in 2003. Stomachs were frozen at time of collection and are stored at the Charlevoix Station for analysis. During the winter of 2003, the 1998-2002 chinook salmon diet samples were processed. However, several years of coho salmon stomach samples remain to be processed. The 2003 chinook salmon diet samples are currently being analyzed. The chinook salmon diet data from 1990-2003 will be analyzed with bioenergetics models and the results presented in final, peer-reviewed publications.

Job 7. Title: Monitor prevalence of bacterial kidney disease in populations of chinook and coho salmon in eastern Lake Michigan.–We examined each fish for visible symptoms of disease and collected swabs that we will analyze using laboratory tests for BKD. These tests use a modified rapid ELISA (enzyme-linked immunosorbant assay) technique (KwiK-Dtect™ DiagXotics, Inc., Wilton, CT) developed specifically for use in the laboratory or field.

Job 8. Title: Measure relative abundance, species composition, and size structure of forage.– Vertical gill nets have been used (1997 – 2001) to assess forage fishes during the same time that chinook and coho salmon were being sampled. Forage samples were not collected using vertical gill nets in 2002 or 2003; instead, forage fishes were sampled using hydroacoustics and midwater trawls according to a lake-wide protocol (Fleischer et al. 2001). Forage fish data will be reported to the Lake Michigan Committee in March 2004.

Job 9. Title: Publish report.– The 5-year summary report was not completed as scheduled in December 2002, due to personnel shortages and re-assignment of duties at the Charlevoix Fisheries Research Station. This report will be submitted by February 1, 2004, for publication in December 2004.

References

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Fleischer, G.W., J. Dettmers, and R.M. Claramunt. 2001. Acoustics lake-wide assessment plan for Lake Michigan. Lake Michigan Technical Committee, Great Lakes Fisheries Commission, Ann Arbor, Michigan.

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Dated: September 30, 2003

Table 1.–Species composition of the catch (number of fish) from salmonine assessment netting in eastern Lake Michigan, 1990-2003.

Year	Brown Trout	Chinook Salmon	Coho Salmon	Lake Trout	Steelhead
1990	35	373	34	296	14
1991	1	402	1	41	5
1992	0	253	4	39	1
1993	0	557	0	17	0
1994	7	719	4	405	42
1995	5	898	20	449	105
1996	20	1072	12	661	411
1997	33	409	24	428	15
1998	8	479	42	262	17
1999	25	186	181	131	19
2000	6	188	35	50	5
2001	8	149	22	52	19
2002	0	76	3	52	10
2003	0	76	0	28	4

Table 2.–Total number of net sets for the salmonine survey, 1990-2003.

Year	MM-1	MM-2	MM-3	MM-4	MM-5	MM-6	MM-7	MM-8
1990	2					54		4
1991						27		
1992						48		
1993						81		
1994		1	9		3	11	3	6
1995			4		5	10	7	12
1996			4		7	6	6	9
1997			14	4	14	20	16	16
1998			12	8		23		22
1999			10			19		19
2000			6			9		10
2001			4			17		25
2002						16		
2003						20		10