STUDY PERFORMANCE REPORT

State: Michigan **Project No.:** F-81-R-7

Study No.: 230495 **Title:** Assessment of lake trout populations in Michigan waters of Lake Superior

Period Covered: October 1, 2005 to September 30, 2006

Study Objectives: (1) To determine relative abundance, length and age composition, sex, maturity, sea lamprey wounding, growth, and mortality for lean and siscowet lake trout in Michigan's Lake Superior lake trout management areas. (2) To periodically determine relative abundance, diet, and demographic variables (age, growth, etc.) of lake trout forms, other predator fish, and forage fish at various depth strata in Lake Superior. (3) To calculate total allowable catch (TAC) for lake trout in Michigan's Lake Superior management areas.

Summary: Spring and summer lean lake trout and siscowet lake trout surveys were conducted during 2006. Spring survey relative abundance of lean lake trout increased during the past 5 years in all management units except MI-3. Relative abundance of siscowet in the spring has generally been lower than leans in the last 10 years. The average percentage of hatchery leans in the spring survey was 4% in 2006. In the summer pre-recruit survey, trends in lean relative abundance have been more variable than in the spring. Relative abundance of leans was highest in MI-4 and MI-5. During 2006, summer siscowet relative abundance was higher than lean abundance in most management units. Based on statistical catch-at-age models for wild leans, average instantaneous total mortality rates (2003-2005) for ages 6 through 11 lake trout were: 0.26 $year^{-1}$ in MI-5, 0.42 $year^{-1}$ in MI-6, and 0.41 $year^{-1}$ in MI-7. Sea lamprey predation was the dominant mortality source in all three populations. Sport fishing was the dominant fishing mortality source in MI-5 and MI-6, and commercial fishing was the principal fishing mortality source in MI-7.

Findings: Jobs 1 through 9 were scheduled for 2005-06, and progress is reported below.

Job 1. Title: Conduct spring lean lake trout survey.–Lean lake trout *Salvelinus namaycush namaycush* were sampled in the spring starting on 25 April and ending 01 June 2006. Personnel aboard the R/V Judy sampled 4 stations in MI-3, 9 stations in MI-4, 6 stations in MI-5, and 15 stations in MI-6. Chippewa Ottawa Resource Authority personnel sampled eight stations in MI-7. Over 2,700 fish were collected in the survey with about 1,600 lake trout.

All spring data collected during this performance period were entered into a computer database and proofed for errors by Marquette Fisheries Research Station personnel. Stratified-random subsamples of the total fish catch from each management unit from the spring survey will be assessed for age using scales and/or otoliths collected from each lake trout.

Job 2. Title: Conduct pre-recruit lean lake trout survey.–Pre-recruit lake trout were sampled in the summer of 2006 starting on 01 August and ending 12 September 2006. Personnel aboard R/V Judy sampled five stations in MI-2, seven stations in MI-3, eight stations in MI-4, four stations in MI-5, four stations in MI-6, and two stations in MI-7 (Figure 1). Of about 3,200 fish collected, approximately 1,930 were lake trout. All data have been entered into a computer database and were proofed for errors. Stratified-random subsamples of the total fish catch from each management unit will be assessed for age using scales and/or otoliths collected from each lake trout.

Job 3. Title: Conduct standardized lake-wide siscowet lake trout survey.–The siscowet lake trout *S. namaycush siscowet* survey was conducted in lake trout management units MI-5 and MI-6 beginning on 31 May and ended on 20 June 2006. There were six sampling stations in MI-5 and 11 sampling stations in MI-6 (Figure 1). The sampling stations were stratified with one station per 36.6 m (20 fathom) depth interval from the shallowest depth bin to the maximum depth strata. The maximum depth sampled in MI-5 was 194 m and the maximum depth sampled in MI-6 was 399 m in the deepest location in Lake Superior and the entire Great Lakes. Siscowet lake trout were collected at every sampling station (depth strata), including the deepest site in Lake Superior. There were 572 fish collected during this survey, of which 481 were lake trout (429 siscowets). All data have been entered into a computer database and were proofed for errors. Lake trout ages will be assessed during the winter months using otoliths collected during sampling.

Job 4. Title: Conduct lean lake trout spawning survey and tag lean lake trout.–This job was not performed because the research station budget was too small to fund sampling and tagging of lean lake trout in 2006.

Job 5. Title: Analyze Survey Data.

Spring survey 2006.–Relative abundance of lean lake trout was higher in 2006 than in 2005 in management units MI-3 and MI-4. Overall, lean lake trout relative abundance has generally been increasing in the last 5 years except in MI-3, where it has been declining. Siscowet relative abundance was lower than lean abundance in all areas in the last 10 years. Since 2001, siscowet relative abundance has generally been declining in MI-3, MI-5, and MI-7. Across all management units, hatchery fish composed 4% of all lean lake trout sampled during the spring survey. The lowest proportion of wild fish was in MI-4 due to continued stocking of hatchery fish in this management unit.

Siscowet survey 2006.–Siscowet lake trout were collected at every depth strata in both MI-5 and MI-6 and were more abundant than lean lake trout in waters deeper than 73 m. Siscowet catch increased with depth in MI-5, but in MI-6 siscowet were abundant in nearly all depth strata. The highest catch of siscowet was in the deepest waters of each management unit. Lean lake trout were most abundant in waters less than 73 m, which is consistent with prior knowledge on depth distribution of this lake trout form. Burbot *Lota lota* were the only other species of fish found at depths greater than 256 m. Deepwater coregonines (cisco *Coregonus artedi*, bloater *C. hoyi*, kiyi *C. kiyi*, and shortjaw cisco *C. zenithicus*) were found at all depth strata down to 256 m. Round whitefish *Prosopium cylindraceum*, lake whitefish *C. clupeaformis*, and longnose sucker *Catostomus catostomus* were collected at depths less than 107 m.

Pre-recruit survey 2006.–Since 1998, relative abundance of pre-recruit lean lake trout increased in MI-2, MI-5, MI-6, MI-7 and declined in MI-3. Siscowet relative abundance has generally declined since 2003 in MI-2, MI-3 and since 2002 in MI-4. Trends in siscowet relative abundance in MI-5, MI-6, and MI-7 have been more variable. During 2006, siscowet relative abundance was higher than lean abundance in all units except MI-2. The highest densities of siscowets in Michigan waters were in MI-7. Lean lake trout relative abundance was highest in MI-4 and MI-5.

Job 6. Title: Analyze diet data.–As of the date of this report, diet samples collected in 2006 were still being processed. There were 1,146 stomachs collected in the spring survey, 463 stomachs collected in the siscowet survey, and 1,247 stomachs collected in the pre-recruit survey.

Job 7. Title: Model lean lake trout populations.–As mandated by the 2000 Consent Decree of the 1836 Great Lakes Fishing Treaty between the State of Michigan and Native American Tribes, statistical catch-at-age models were updated for wild lake trout populations in MI-5, MI-6, and

MI-7 during 2005 (Figure 1). These models were used to develop the 2006 harvest quotas (also termed Total Allowable Catch or TAC) for lake trout.

The average instantaneous total mortality rates (Z) for ages 6 through 11 lake trout during 2003 to 2005 were: 0.26 $year^{-1}$ in MI-5, 0.42 $year^{-1}$ in MI-6, and 0.41 $year^{-1}$ in MI-7. These rates were below the target maximum rate of 0.59 $year^{-1}$ (A=45%). With the exception of background natural mortality (M), sea lamprey predation was the dominant mortality source in all three populations. In MI-6 and MI-7, sea lamprey mortality has doubled since 2002. The dominant fishing mortality source was sport fishing in MI-5 and MI-6, and commercial fishing in MI-7. Spawning stock biomass produced per recruit (SSBR) has been used to assess overall population health status, and is defined as the cumulative mature biomass produced per female recruit through its life given a set mortality schedule. The current SSBR was based on the average mortality rates, female maturity schedule, and weight at age estimates during 2003 through 2005. In all three models, current SSBRs were above target SSBRs indicating that the populations have mortality rates that are probably not inhibiting population growth and reproductive potential.

Job 8. Title: Assess lake trout morphotypes.–For the past 2 years, gonad and blood samples have been collected in June and September from adult female and male siscowet and lean lake trout in the Marquette area. The objectives are to assess differences in the initiation of gonadal maturation between siscowet and leans and whether these morphotypes become sexually active ("ripe") at different times of the year. The gonadal samples have been analyzed histologically and are being classified according to specific stages of oogenesis and spermatogenesis. The blood samples will be analyzed for specific reproductive hormone levels to determine the progression of gonadal maturation. The ultimate goal is to compare spawning times and locations for siscowet and lean lake trout.

Job 9. Title: Write reports.–Stock assessment reports for 2006 Lake Superior lake trout total allowable catch limits for 1836 Treaty waters were written and are currently under review. This progress report was written as scheduled.

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Dated: September 30, 2006

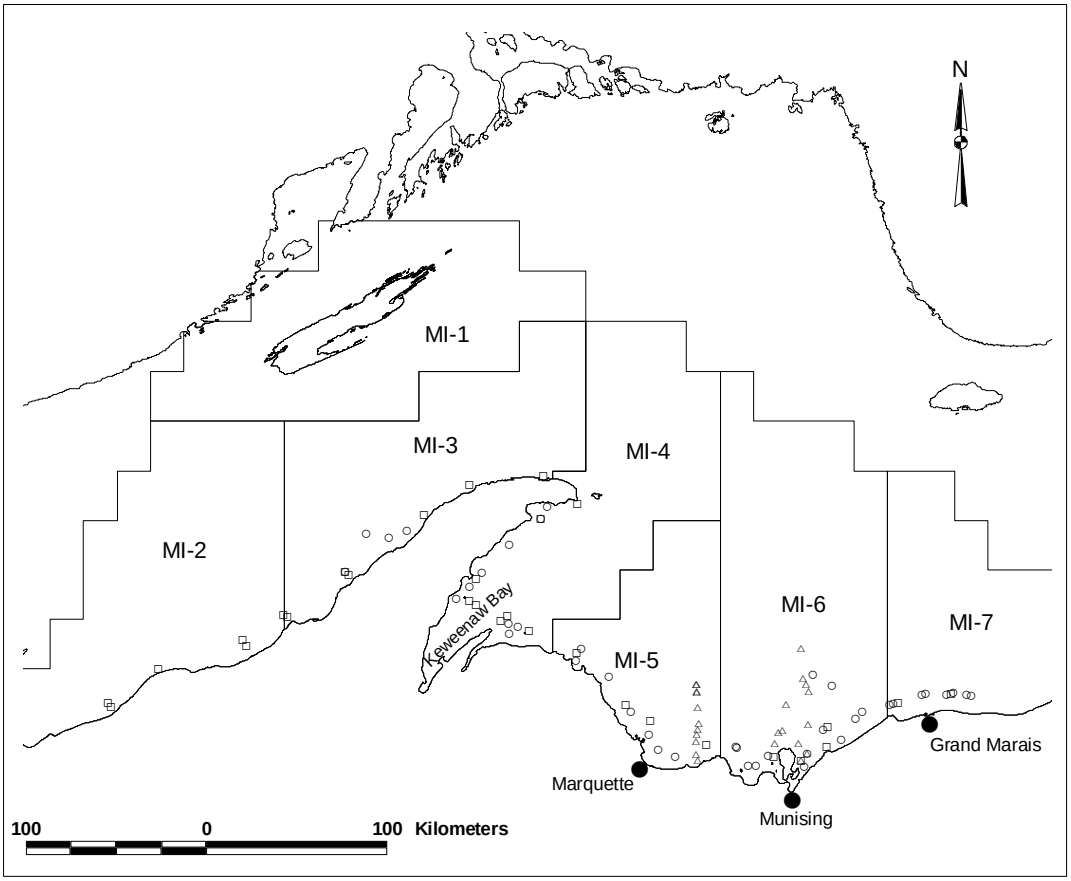

Figure 1.–Lake trout management units and lake trout survey sampling stations in Michigan waters of Lake Superior from October 2005 through September 2006. Circles represent spring survey stations, squares represent summer pre-recruit survey stations, and triangles represent siscowet lake trout survey stations.