STUDY PERFORMANCE REPORT

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

Study No.: 495 **Title:** Assessment of lake trout populations in Michigan waters of Lake Superior

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

Cooperators: Bay Mills Indian Community, Brimley, Michigan; Biology Department, Northern Michigan University; Chippewa Ottawa Resource, Sault Ste. Marie, Michigan; Department of Fisheries and Wildlife, Michigan State University; Great Lakes Indian Fish and Wildlife Commission, Odanah, Wisconsin; Isle Royale National Park, National Park Service; Peterson Fisheries, Hancock, MI; Keweenaw Bay Indian Community, Baraga, Michigan; Sivertson Fisheries, Duluth, Minnesota; Red Cliff Band of Lake Superior Chippewas, Bayfield, Wisconsin; and U. S. Geological Survey, Biological Research Division, Ashland, Wisconsin.

Study Objectives: (1) To annually (or semi-annually) determine relative abundance, length and age composition, sex and maturity, sea lamprey wounding, growth, and mortality for lean and siscowet lake trout in Michigan's Lake Superior lake trout management units. (2) To periodically determine relative abundance, diet, and biological variables (age, growth, etc.) of lake trout varieties, 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 units.

Summary: During this performance period, four lake trout surveys were conducted including a fall spawner, a spring, a summer pre-recruit, and a siscowet survey. During 1999 to 2003, relative abundance of lean lake trout in spring surveys was highest in MI-4 and MI-5, and lowest in MI-3 and MI-7. During the same time period in the pre-recruit survey, lean lake trout abundance increased in MI-2, MI-3, MI-4, and declined in MI-6 and MI-7. Siscowet relative abundance in spring and pre-recruit surveys was lower than lean lake trout in all areas. During June and July 2003, a siscowet survey was conducted in MI-5 and MI-6 to assess the relative abundance of leans and siscowets across all depths sampled. Siscowet abundance was greater in deeper areas, and lean lake trout abundance was greater at shallower sampling depths. In general, siscowets were the most abundant fish caught at all sites sampled in the siscowet survey. As required by the 2000 Consent Decree of the 1836 Great Lakes Fishing Treaty, statistical catch-at-age models for MI-5, MI-6, and MI-7 were updated and harvest quotas were generated for the 2003 fishing season.

Findings: Jobs 1 through 7 were scheduled for 2002-03, and progress is reported below.

Job 1. Title: Assess commercial-sized lake trout.– During the fall of 2002, Marquette Fisheries Research Station (MFRS) personnel conducted a lean lake trout *Salvelinus namaycush* spawning survey in the Marquette area (MI-5). The spawning sites sampled included: Presque Isle Harbor and Partridge Island Reef. The total number of lake trout caught was 606 with 92.4% of wild origin. There were 518 lake trout tagged with anchor tags and 18 recaptures from previous years. Otoliths were archived and weights were recorded for 65 lake trout that were dead in the nets.

Commercial-sized lean lake trout were sampled in the spring starting on 29 April and ending 06 June 2003. A contracted commercial fisher (Peterson Fisheries) under permit from GLIFWC

fished six stations in management unit MI-3 (Figure 1). Personnel aboard the R/V Judy sampled 10 stations in MI-4, 6 stations in MI-5, and 10 stations in MI-6. Chippewa Ottawa Resource Authority personnel sampled eight stations in MI-7. The total number of fish sampled in the spring survey was 2,227, including 1,677 lake trout.

All spring and fall data collected during this performance period were entered into a computer database and proofed for errors by MFRS 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 fish.

During this performance period, commercial-sized lean lake trout were also sampled in MI-1 (Isle Royale) by Sivertson Fisheries (September-October 2002) and the National Park Service (June-August 2003). These data are in the process of being entered in the database.

Job 2. Title: Assess pre-recruit lake trout.–Pre-recruit lake trout were sampled in the summer starting on 05 August and ending 11 September 2003. 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). The total number of fish sampled was 4,006, including 2,177 lake trout. All data have been entered into a computer database and were proofed for errors. Fish ages will be assessed during the winter months using scales and/or otoliths collected during sampling.

Job 3. Title: Assess lake trout variety composition.–During June and July 2003, a siscowet lake trout survey was conducted in MI-5 (Marquette area) and MI-6 (Munising area). Nets were set in each 120-ft depth bin out to the greatest depth in the management unit. There were six sampling stations (depth bins) in MI-5 and eight stations in MI-6 (Figure 1). The maximum depth sampled was 643 ft in MI-5 and 919 ft in MI-6. Overall, siscowet lake trout was the dominant species captured in both management units (Figure 2). In depths greater than 239 ft, siscowets were the predominant fish caught. With the exception of the 0 to 119 ft depth bin in MI-6, siscowets were collected at all sampling stations. Lean lake trout were observed at most depths sampled in MI-5, but only in the shallowest three depth bins in MI-6. The total number of fish caught was 685 with 506 siscowets and 41 lean lake trout. All data have been entered into a computer database and were proofed for errors. Fish ages will be assessed during the winter months using scales and/or otoliths collected during sampling.

Job 4. Title: Analyze assessment data.–*Spawner survey 2002*–Average lean lake trout relative abundance (CPUE= catch per unit effort) during the spawning season was 246 fish per km of net per net night. This was higher than spawner relative abundance during the fall of 2001.

Spring survey 2003–Relative abundance was indexed as the Geometric Mean Catch Per Unit Effort (GMCPUE) which was in units of fish per km of net per net night. Lean lake trout GMCPUE was highest in MI-4, MI-5, and MI-6 and averaged between 20.4 and 28.4 during 1999 to 2003 (Figure 3a). The lowest GMCPUEs were observed in MI-3 and MI-7, ranging between 10.3 and 12.7. Abundance of siscowets was lower than lean lake trout in all management units and has averaged less than 7 during 1999 to 2003 (Figure 3b). In 2003, the proportion of lean lake trout sampled that were of hatchery origin ranged from 4.7% in MI-3 to 21.6% in MI-4.

Pre-recruit survey 2003–Pre-recruit (<432 mm) lean lake trout relative abundance has increased during the past 5 years in MI-2, MI-3, MI-4, and has declined in MI-6 and MI-7 (Figure 4a). During 1999 to 2003, lean lake trout GMCPUEs ranged between 8.5 in MI-6 to 24.9 in MI-4. Siscowet relative abundance was lower than lean lake trout in all areas, but was comparable in

MI-6 and MI-7 (Figure 4b). The proportion of hatchery lake trout ranged from 0% in MI-3 and MI-6 to 13.5% in MI-4 during 2003.

Job 5. Title: **Analyze diet data.**–Diet samples from the spring survey have been analyzed, and data have not been completely entered in the computer. Summer and siscowet survey diet samples are currently being analyzed.

Job 6. 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 (Figure 1). These models were used to develop harvest quotas (also termed Total Allowable Catch or TAC) for lake trout. Overall, model results indicated abundant wild lake trout populations in MI-5 and MI-7 with mortality rates below the target maximum rate (A=40%) established by the Great Lakes Fishery Commission.

The MI-6 model had to be further modified in order to attain convergence and provide more realistic stock size estimates. There is great uncertainty in the overall scale of the stock sizes estimated. The model estimates of abundance were lower than expected and were inconsistent with fishery and survey catch-per-unit-effort data. Further work is underway to evaluate MI-6 data and model code.

The modeling results were used to estimate lake trout harvest quotas for 2003. Currently, hatchery lake trout models have been partially developed for MI-5, MI-6, and MI-7. Data have been partially assembled for MI-2, MI-3, and MI-4 wild and hatchery lake trout models.

Job 7. Title: **Prepare reports.**–Draft reports on lake trout TAC recommendations for 2003 have been written for the 1836 Treaty Technical Fisheries Committee. This progress report was prepared on schedule.

Prepared by: S. P. Sitar
Dated: September 30, 2003

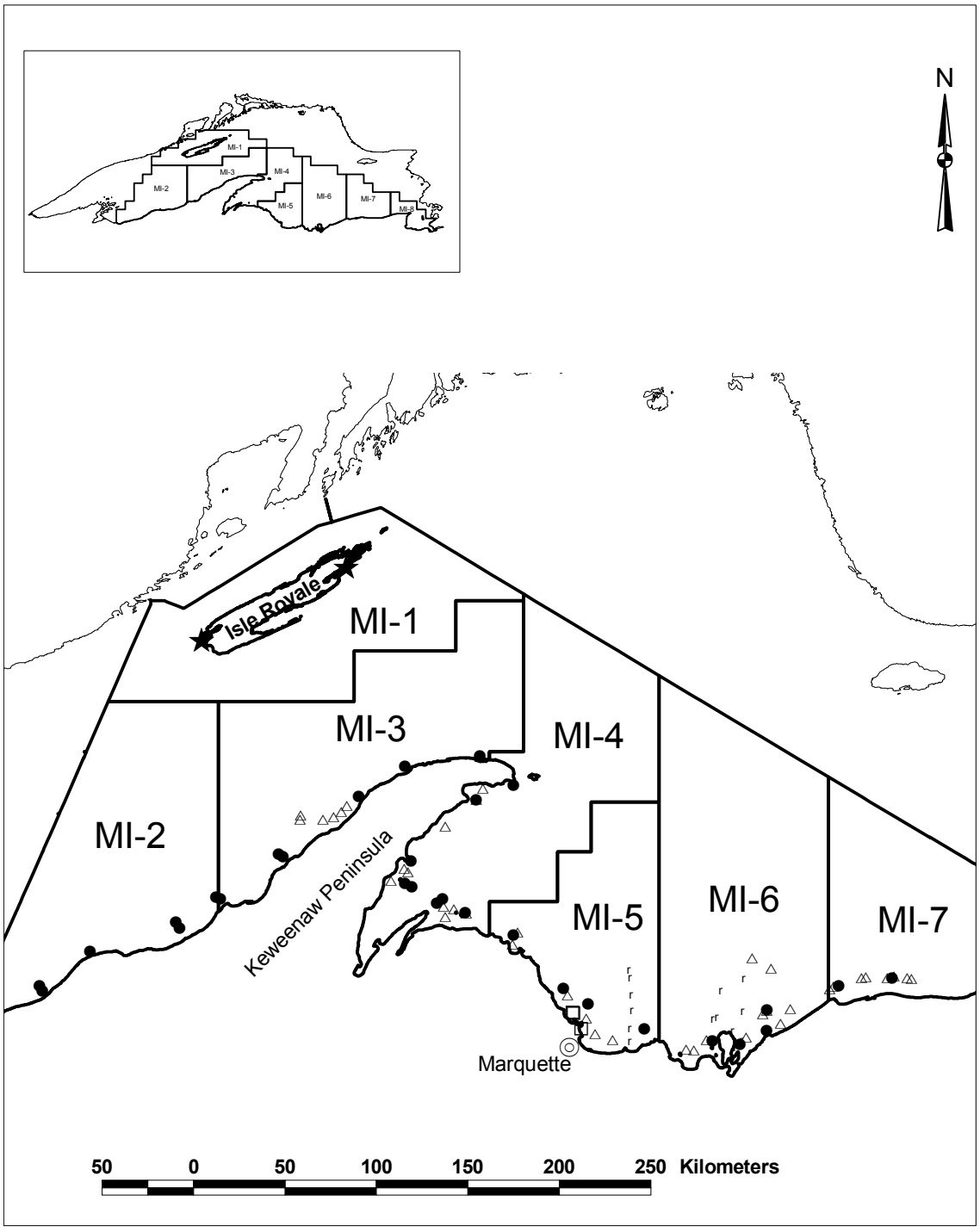

Figure 1.–Lake trout management units and lake trout survey sampling stations in Michigan waters of Lake Superior. Triangles represent spring survey stations, circles represent summer pre-recruit survey stations, asterisks represent siscowet survey stations, open squares represent fall survey stations, and stars represent Isle Royale survey stations.

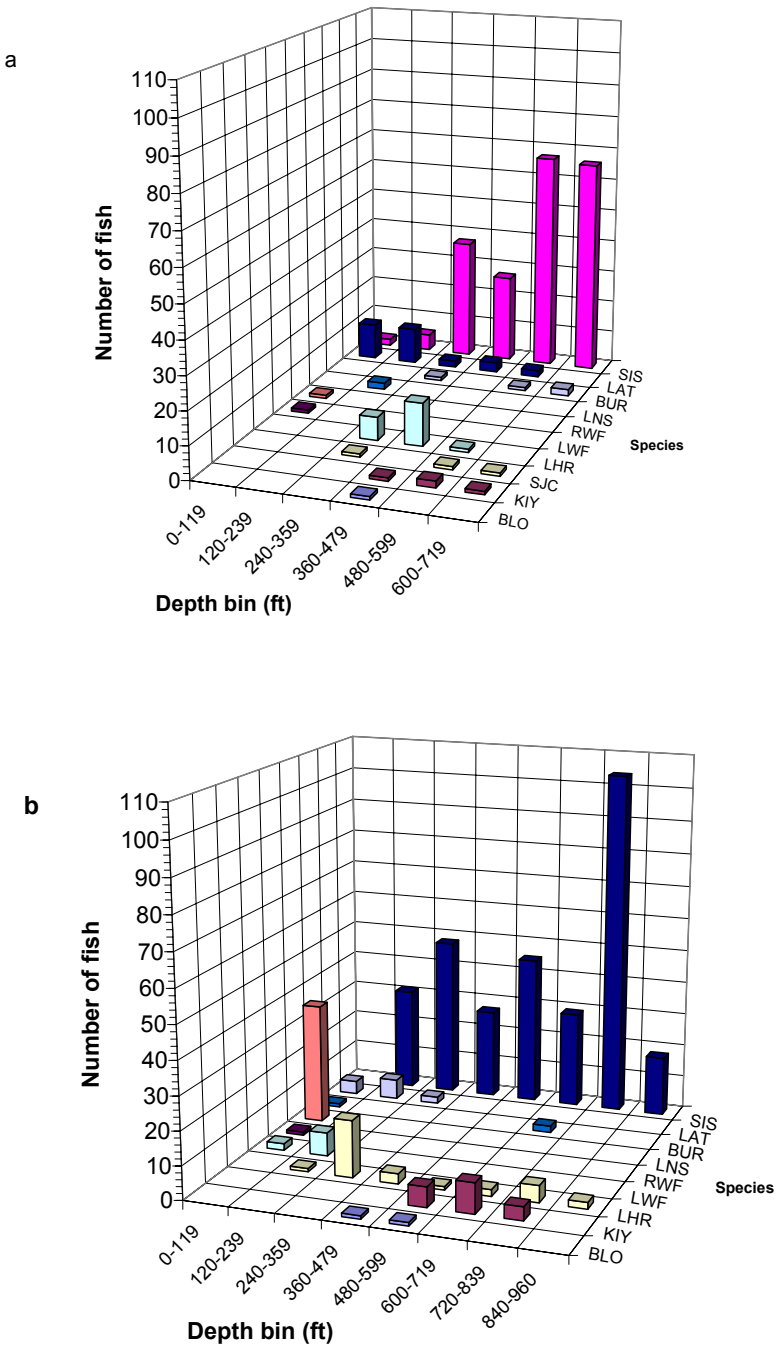

Figure 2.–Siscowet survey catch composition in (a) MI-5, Marquette and (b) MI-6, Munising during June and July of 2003. There was one sampling station in each depth bin that was sampled with 823 m of bottom gill-net fished overnight. Each net contained nine panels (panel dimension was 91.4 x 1.8 m) with stretched mesh sizes of 5.1, 6.4, 7.6, 8.9, 10.2, 11.4, 12.7, 14.0, 15.2 cm. BLO= bloater, KIY= kiyi, SJC= short jaw cisco, LHR= lake herring, LWF= lake whitefish, RWF= round whitefish, LNS= longnose sucker, BUR= burbot, LAT= lean lake trout, and SIS= siscowet lake trout.

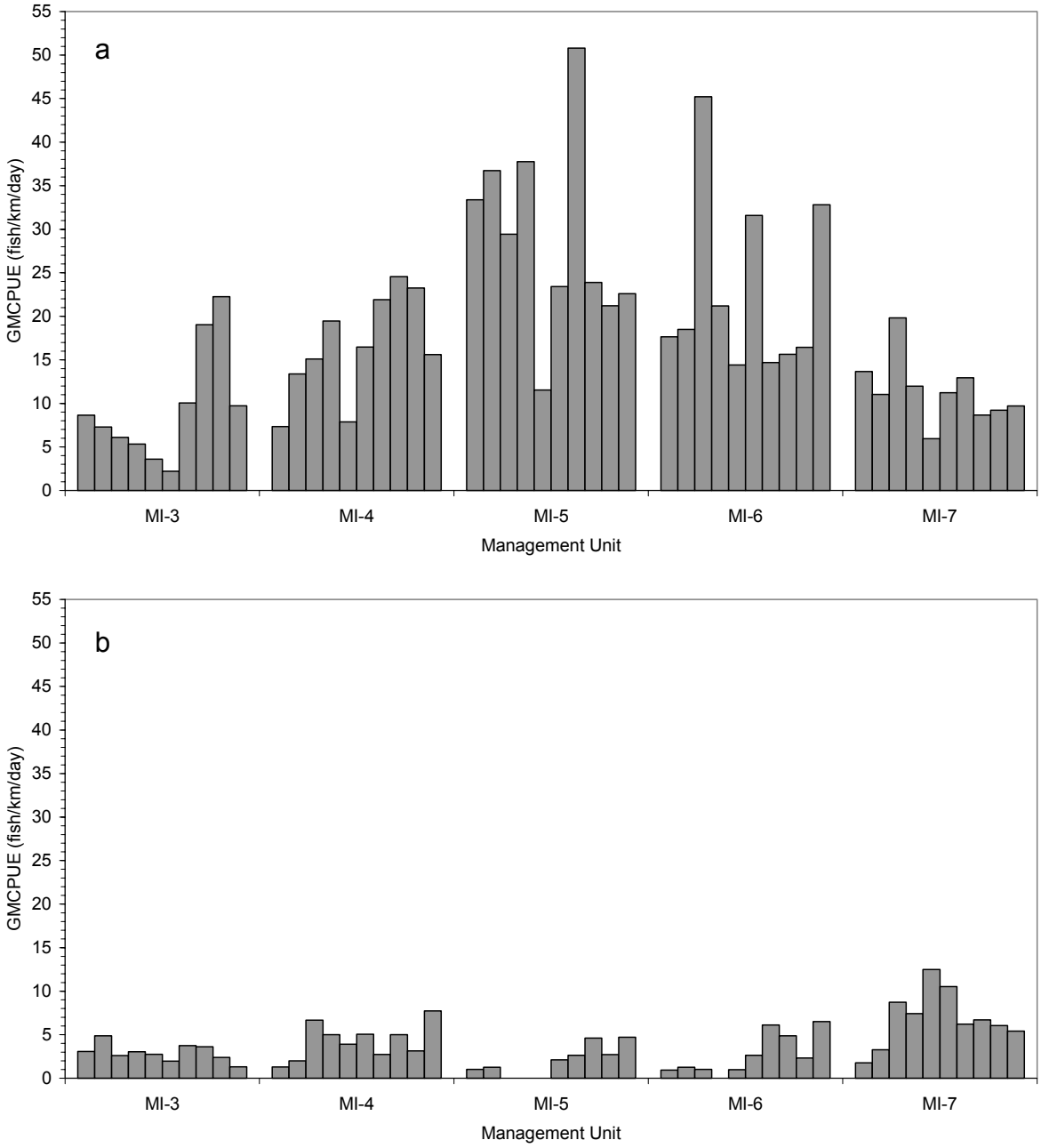

Figure 3.–Relative abundance of (a) wild lean and (b) siscowet lake trout during spring surveys from 1994 to 2003 in Michigan waters of Lake Superior. The graphs are presented with vertical bars in chronological order from left to right for each management unit. Relative abundance index based on the Geometric Mean Catch-Per-Unit-Effort (GMCPUE) expressed as the number of fish per km of net per net night based on 11.4 cm stretched-mesh bottom gill nets.

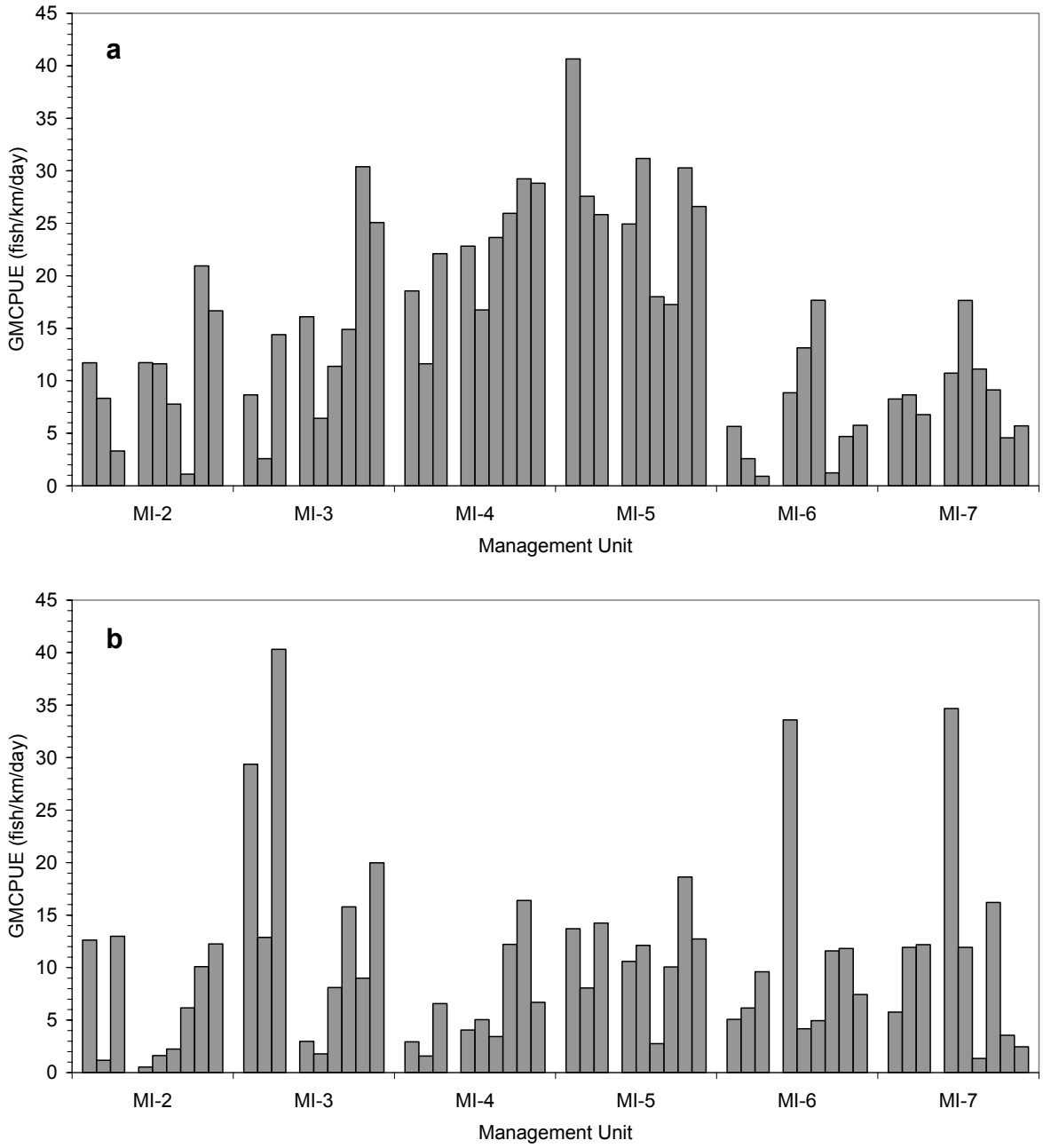

Figure 4.–Relative abundance of pre-recruit (< 432 mm total length) (a) lean and (b) siscowet lake trout during summer surveys from 1994 to 2003 in Michigan waters of Lake Superior. The graphs are presented with vertical bars in chronological order from left to right for each management unit. Relative abundance index based on the Geometric Mean Catch-Per-Unit-Effort (GMCPUE) expressed as the number of fish per km of net per net night based on graded-mesh bottom gill nets (stretched mesh sizes=5.1, 5.7, 6.4, 7.0, 7.6, 8.9 cm). No pre-recruit survey was conducted in 1997 as indicated by gap on figure.