Lake Michigan Committee Meeting
March 27, 2015
Ypsilanti, Michigan

T f2014 Lake Michigan Lake Trout Working Group Report

This report provides a brief overview of the status of lake trout populations and restoration efforts in Lake Michigan, based on the spring lakewide assessment plan (LWAP) survey and the fall spawner survey (Figure 1). We provide a quick graphical representation of pertinent data that is structured to review the objectives articulated in *A Lake Trout Restoration Guide for Lake Michigan* (Bronte et al. 2008*).* Spring and fall lake trout survey data are evaluated in terms of measurable objectives that generally follow lake trout ontogeny and are compared to recommended population benchmarks that are thought to be necessary to increase the probability of significant and sustained natural reproduction by hatchery reared fish. This report addresses each of the major objectives outlined in the Restoration Guide mentioned above and provides a short summary of the progress towards those objectives. The graphical presentations provide current measures within a time series (when available), and current measures are compared with target values to gauge progress towards restoration.

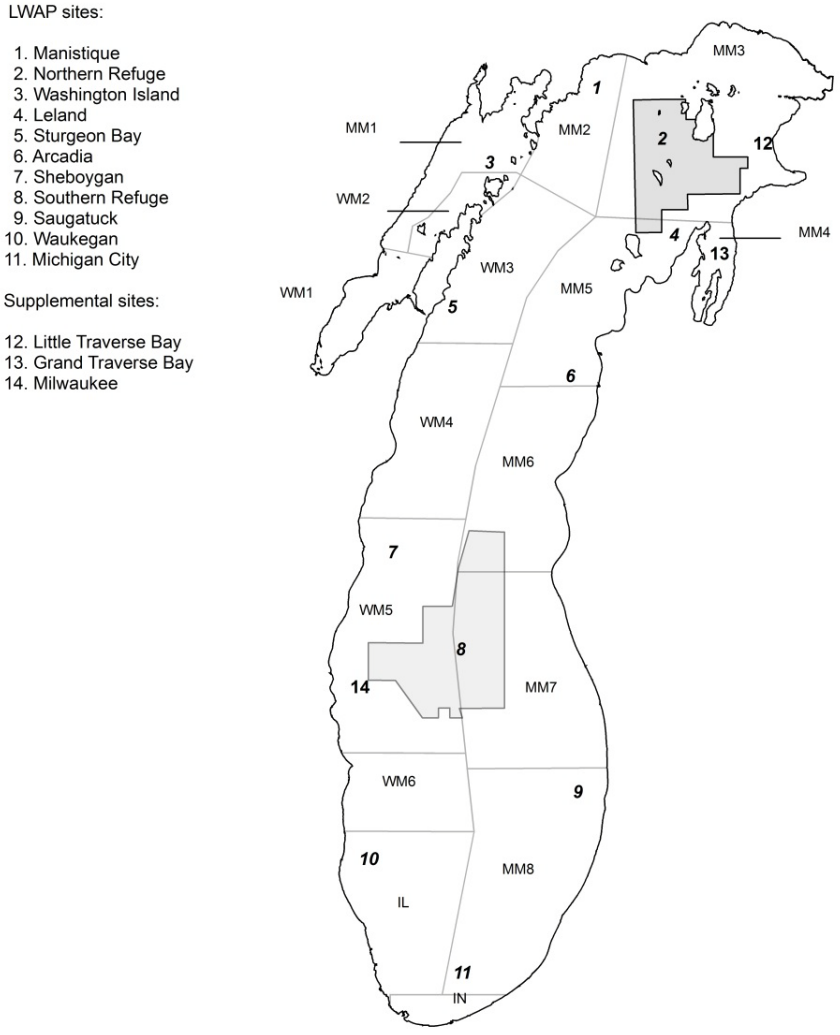


Figure 1. Map of the 11 LWAP sites (Schneeberger et al. 2001) and 3 supplemental sites. In general, each reported gillnet lift is within 18 km of the site numerical label. Statistical district boundaries are outlined and shading is used to outline the Northern and Southern Refuges.

Overall Goal: In targeted rehabilitation areas, reestablish genetically diverse populations of lake trout composed predominately of wild fish able to sustain fisheries.

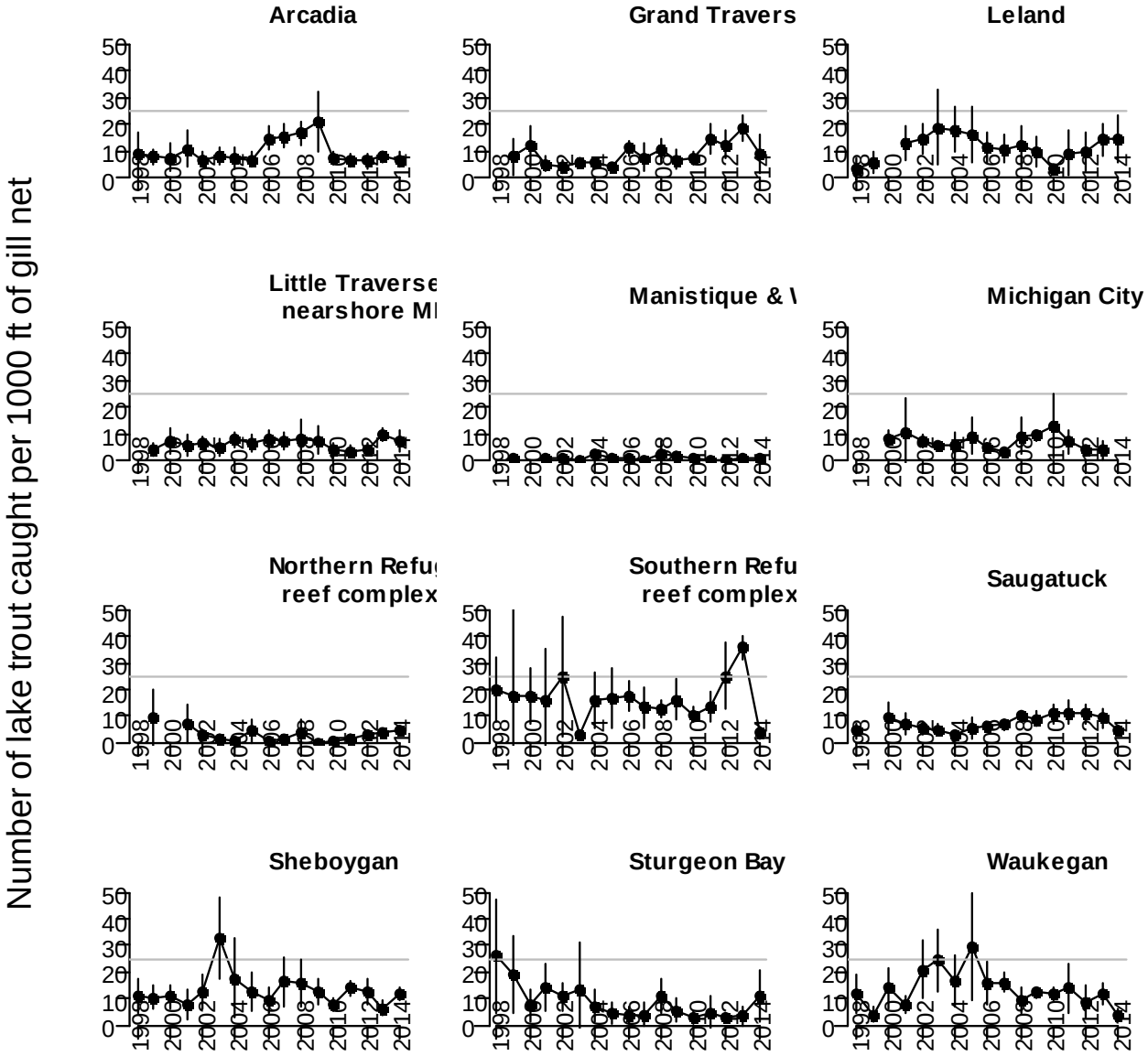
Objective 1 (Increase genetic diversity): Increase the genetic diversity of lake trout by introducing morphotypes adapted to survive and reproduce in deep-water, offshore habitats, while continuing to stock shallow-water morphotypes.

Results: Following a recommendation to introduce a deep-water morphotype to the underutilized deep-water habitats, the Lake Michigan Committee (LMC) agreed to begin stocking a limited number of Klondike Reef strain (SKW) from Lake Superior beginning in 2012. In 2014, 206,486 SKW strain yearlings were stocked on Northeast Reef in the Southern Refuge. The majority of lake trout stocked into Lake Michigan are lake trout of lean strains. Presently, the USFWS hatcheries maintain broodstocks for the following strains of lean lake trout: SLW (Seneca Lake, NY), LLW (Lake Michigan remnant from Lewis Lake, MT), and a remnant nearshore strain HPW from Parry Sound, Lake Huron. As of 2014, the use of two other lean strains, namely the GLW strain (southern Lake Michigan remnant strain that was maintained from stocked fish in Green Lake, Wisconsin) and the SAW strain (Apostle Islands, Lake Superior), has been discontinued and the associated broodstocks are no longer maintained at USFWS hatcheries.

Objective 2 (Increase overall abundance): By 2014, increase densities of lake trout populations in targeted rehabilitation areas to levels observed in other Great Lakes locations where recruitment of wild fish to the adult population has occurred. To achieve this objective, catch per unit effort (CPUE) in spring assessments should consistently exceed 25 lake trout/1000 feet of graded-mesh (2.5 – 6.0 inch) gill net fished. Spring assessments included the gillnet survey performed under the lakewide assessment protocol (LWAP; Schneeberger et al. 2001) and a similar gillnet survey that is completed under the Fishery Independent Whitefish Survey protocol (Fishery Independent Lake Whitefish Survey Protocol 2002). With regard to the FIWS survey, we only included results from the survey work completed between April – June in our analyses, and catch and effort for gillnet mesh sizes < 2.5 inch were not included in our analyses.

Results: In 2014, 158 gill net lifts were completed lakewide to measure spring lake trout abundance. This included 6 lifts at each nearshore LWAP site except for Michigan City where nets were compromised by *Cladophora*, 12 lifts in the Southern Refuge, and 32 lifts within the Northern Refuge reef complex. Roughly 25% of the lifts stemmed from the FIWS survey that added effort to sites in Michigan waters between Saugatuck and Manistique (Figure 1). Mean lakewide lake trout abundance in spring 2014, based on averaging mean CPUE across all sites, was 7.1 lake trout per 1000 ft of gill net, well below the 25 fish per 1000 ft of gill net benchmark. In spring 2013, mean lakewide lake trout abundance was 10.5 fish per 1000 ft of gill net. Spring abundance has, at times, approached or exceeded the benchmark level at Sheboygan, Waukegan, and the Southern Refuge (Figure 2). Although CPUE increased at Sturgeon Bay and in the Northern Refuge reef complex between 2013 and 2014, CPUE in the Southern Refuge underwent a drastic decline between 2013 and 2014. Given the colder-than-average water temperatures during spring 2014, it is possible that lake trout distributions shifted outside of the 50-200 ft water depths targeted by the spring survey at several locations in the lake during spring 2014.

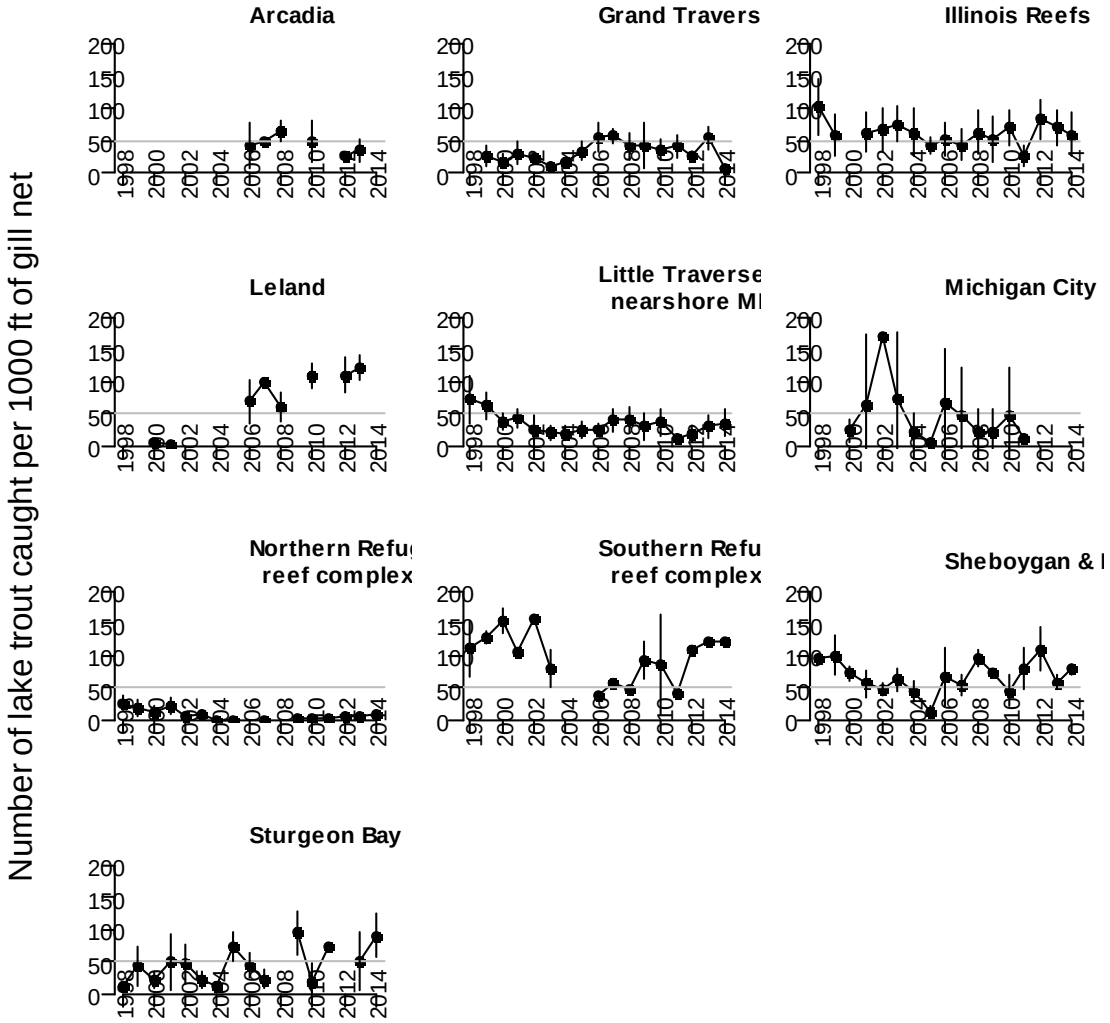
Figure 2. Spring survey lake trout catch per unit effort (mean number of fish/1000 ft of graded-mesh gill net) for the 11 LWAP sites and two supplemental sites, 1998-2014. Vertical bars represent ± 2 SE.



Objective 3 (Increase adult abundance): By 2020, achieve densities of spawning adult lake trout in targeted rehabilitation areas comparable to those observed in other Great Lakes locations where recruitment of wild fish to the adult population has occurred. To achieve this objective, CPUE in fall assessments should consistently exceed 50 fish/1000 ft of graded-mesh (4.5-6.0 inch) gill net fished.

Results: Twenty eight spawner survey lifts from 7 site designations were completed in October-November, 2014; eastern Lake Michigan sites from Michigan City north to Leland were not surveyed in 2014. Fall CPUE in 2014 exceeded the benchmark of 50 fish per 1000 ft of gill net in southern and western areas of Lake Michigan including the Southern Refuge and nearshore reefs in Illinois, near Milwaukee, and near Sturgeon Bay (Figure 3). Spawner abundance in the Northern Refuge has increased in recent years (mean of 8 lake trout per 1000 ft of gill net in 2014), but spawner abundances at the nearby reefs of Little Traverse Bay were considerably higher (mean of 36.6 fish per 1000 ft of gill net) than those in the Northern Refuge.

Figure 3. Fall lake trout spawner survey catch per unit effort (mean number of fish/1000 ft of graded-mesh gill net) for reefs within or near the spring LWAP sites, 1998-2014. Vertical bars represent ± 2 SE.



Objective 4 (Build spawning populations): By 2024, spawning populations in targeted rehabilitation areas stocked prior to 2008 should be at least 25% females and contain 10 or more age groups older than age 7. These milestones should be achieved by 2032 in areas stocked after 2008.

Results: In general, the observed percentage of females in the fall lake trout spawner survey has met the benchmark value of 25% (Figure 4). Moreover, 10 age groups older than age 7 were represented in the 2014 fall lake trout spawner survey catch (Figure 5). Thus, based on the available data, Objective 4 has been fully met.

Figure 4. Proportion of female lake trout caught in fall lake trout spawner survey, 1998-2014; horizontal gray line represents the LTWG fall survey benchmark value of 25%.

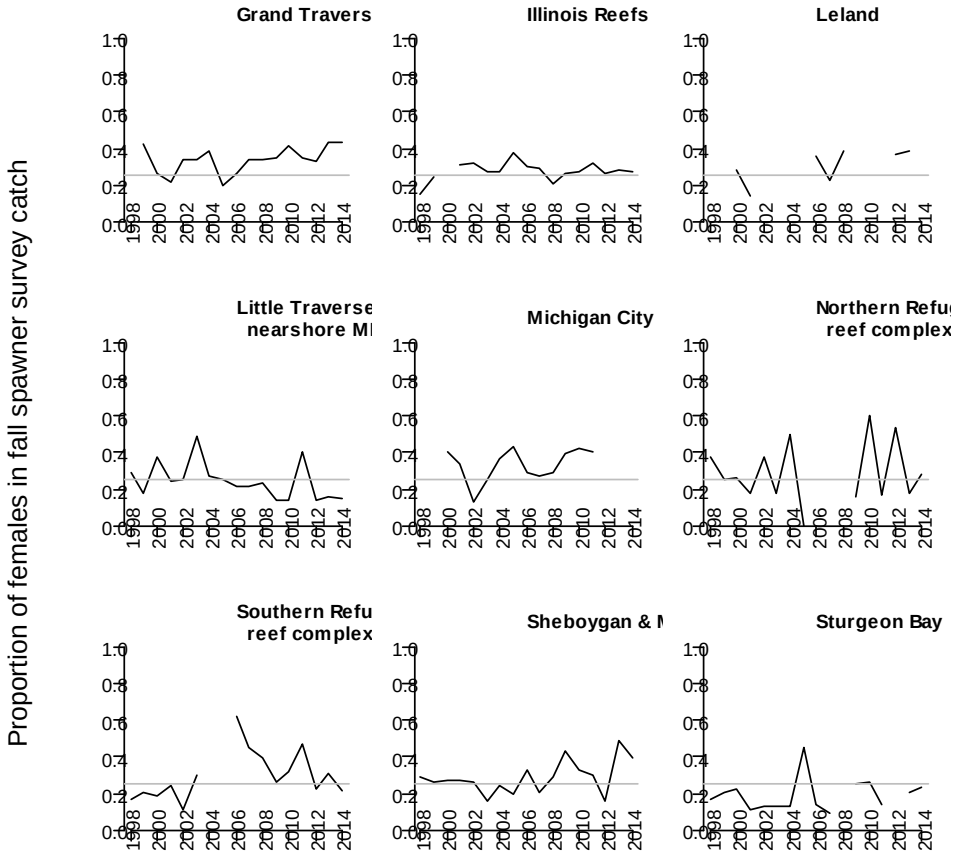
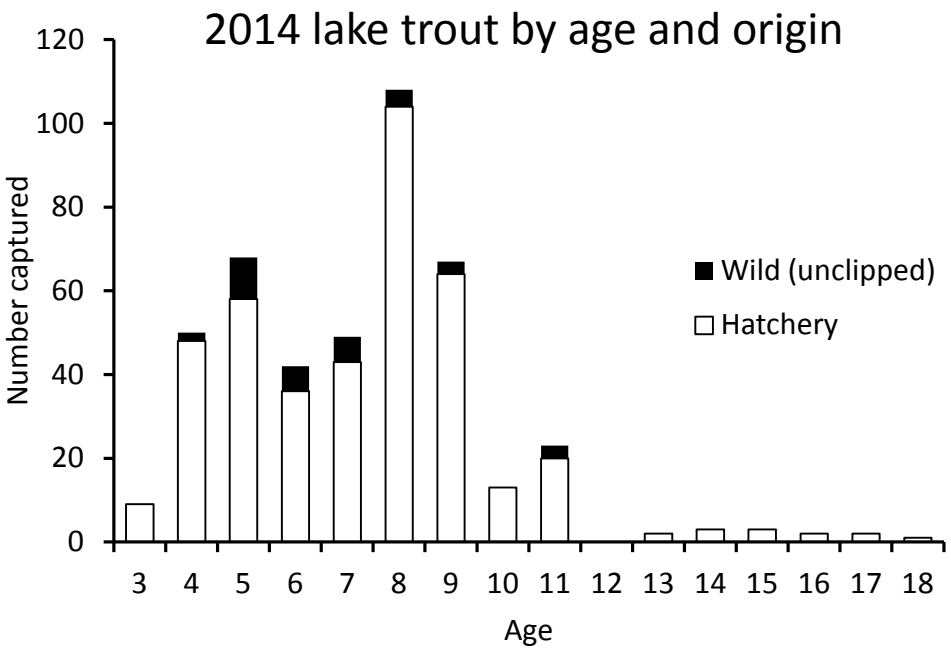


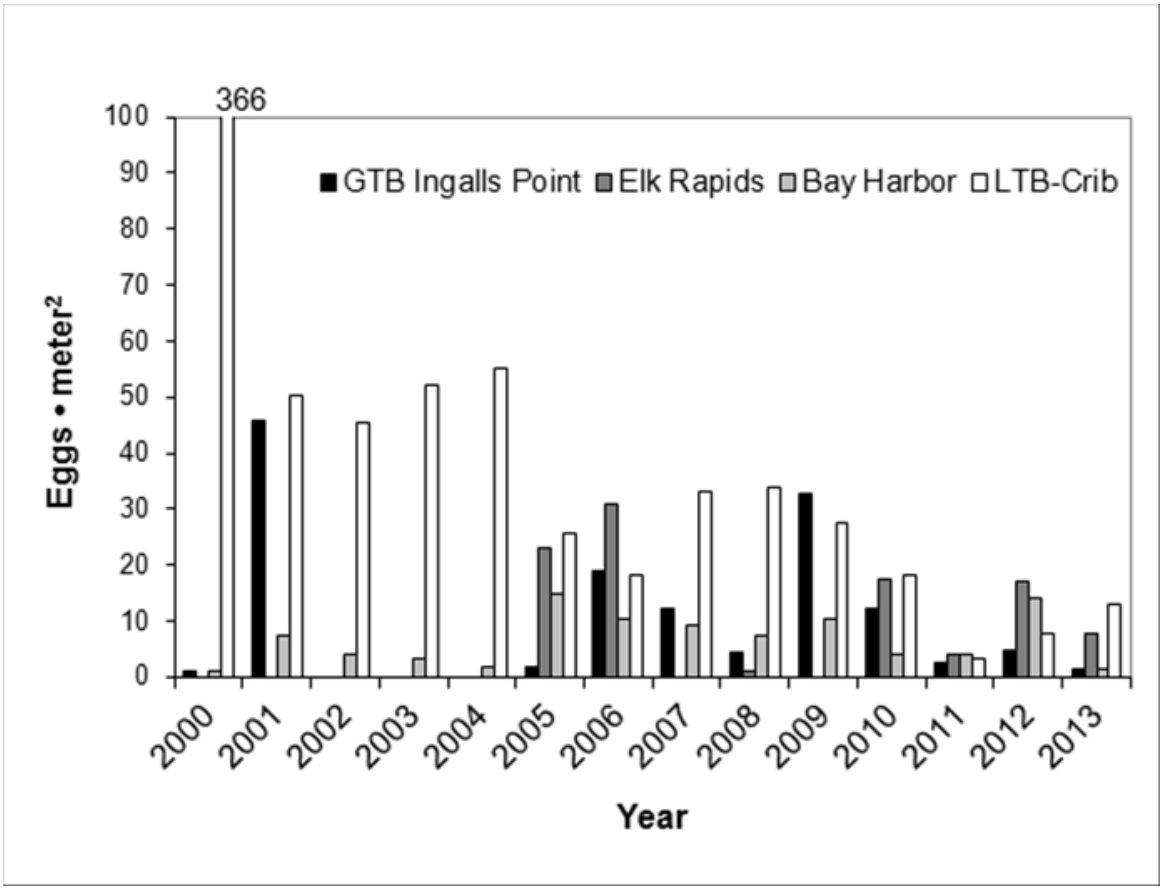
Figure 5. Age composition of lake trout captured during the 2014 fall lake trout spawner survey, based on data for Little Traverse Bay, Grand Traverse Bay, the Northern Refuge, and Sturgeon Bay.



Objective 5 (Detect egg deposition): By 2021, detect a minimum density of 500 viable eggs/m^2 (eggs with thiamine concentrations > 4 nmol/g) in previously stocked areas. This milestone should be achieved by 2025 in newly stocked areas.

Results: Egg deposition rates have remained low at the sites where egg deposition has been measured in northern Lake Michigan during 2000-2013. Nearly all of the measured densities of lake trout eggs have been less than 60 eggs/m^2 (Figure 6).

Figure 6. Number of lake trout eggs observed per square meter in northern Lake Michigan fall egg deposition surveys, 2000-2013. Egg deposition was measured using standard egg bag methodologies (Jonas et al. 2005).



Objective 6 (Detect recruitment of wild fish): Consistent recruitment of wild lake trout in targeted rehabilitation areas should occur as follows: by 2022 detect age-1 fish in bottom trawls, by 2025 detect age-3 fish in spring graded-mesh gillnet assessments, and by 2028 consistently detect sub-adults.

Results: Multiple sources of data confirmed that lake trout natural reproduction in Lake Michigan has increased during the past 10 years, particularly in Illinois waters and in the vicinity of the Southern Refuge. The Great Lakes Mass Marking Program's headhunter survey of recreationally caught lake trout provided the greatest number of wild recoveries with wide geographic coverage of Lake Michigan ports. The 2014 recreational fishery sampling showed a strong latitudinal gradient in the distribution of wild lake trout. The percentage of recreationally caught lake trout of wild origin varied from 22% in the southern districts (IL, IN, MM8, and WM6) to 13% in the middle districts (WM5, WM4, WM3, MM5, MM6, and MM7) to < 3% in the northern districts and Grand Traverse Bay (MM2, MM3, and MM4) (Table 1). This trend was corroborated by results from the standardized spring and fall gillnet assessments (Figure 7). In Illinois waters, more than half (54%) of the lake trout recovered from the 2014 fall spawner survey were unclipped, while 19% of the lake trout caught in the spring gillnet survey were unclipped. Relatively high spring and fall recovery rates of unclipped lake trout were also observed in WM5 (Figure 7), which includes the Southern Refuge. Lake trout show a high affinity for returning to their natal reefs for spawning (Bronte et al. 2007), and so these results suggested that reefs in IL and WM5 have been the primary sources of natural recruits in the lake.

Detectable levels of natural recruitment have been reported along the western shore of Lake Michigan, as far north as the northern Door Peninsula (Hanson et al. 2013). Some natural recruitment also appeared to be occurring in MM3, where 11% of the lake trout were unclipped in the 2014 fall spawner survey, and the percentage of unclipped lake trout has exceeded 5% in 8 of the last 10 years (Figure 7). The majority of these unclipped lake trout were caught in Little Traverse Bay rather than the Northern Refuge. We must acknowledge that some of the wild lake trout caught in gill nets or by anglers in Lake Michigan may have originated in Lake Huron and then migrated from Lake Huron to Lake Michigan. Natural reproduction by lake trout in Lake Huron has dramatically increased following the complete collapse of the Lake Huron alewife population during 2002-2004.

This increase in lake trout natural reproduction in Lake Michigan during the past 10 years coincided with an extended period of reduced abundance of alewives, which are suspected of interfering with lake trout reproduction via predation on lake trout fry and via reduction of thiamine levels in lake trout eggs, thereby lowering egg survival. Results from the Great Lakes Science Center (GLSC) Lake Michigan bottom trawl survey, which began on a lakewide basis in 1973, have provided a valuable time series for tracking recruitment of wild juvenile lake trout in Lake Michigan. Prior to 2005, less than 2% of the lake trout caught in the GLSC bottom trawl survey were unclipped. In contrast, since 2005, 27 of the 133 lake trout, or 20% of the lake trout, caught in the GLSC bottom trawl survey were unclipped. In 2014, of the 6 lake trout caught in the GLSC bottom trawl survey, 3 lake trout (50%) were unclipped and one of these was an age-0 wild fish (only 53 mm in total length) caught at the Frankfort transect in September. The first age-0 wild lake trout caught in the GLSC bottom trawl survey was captured in 2010.

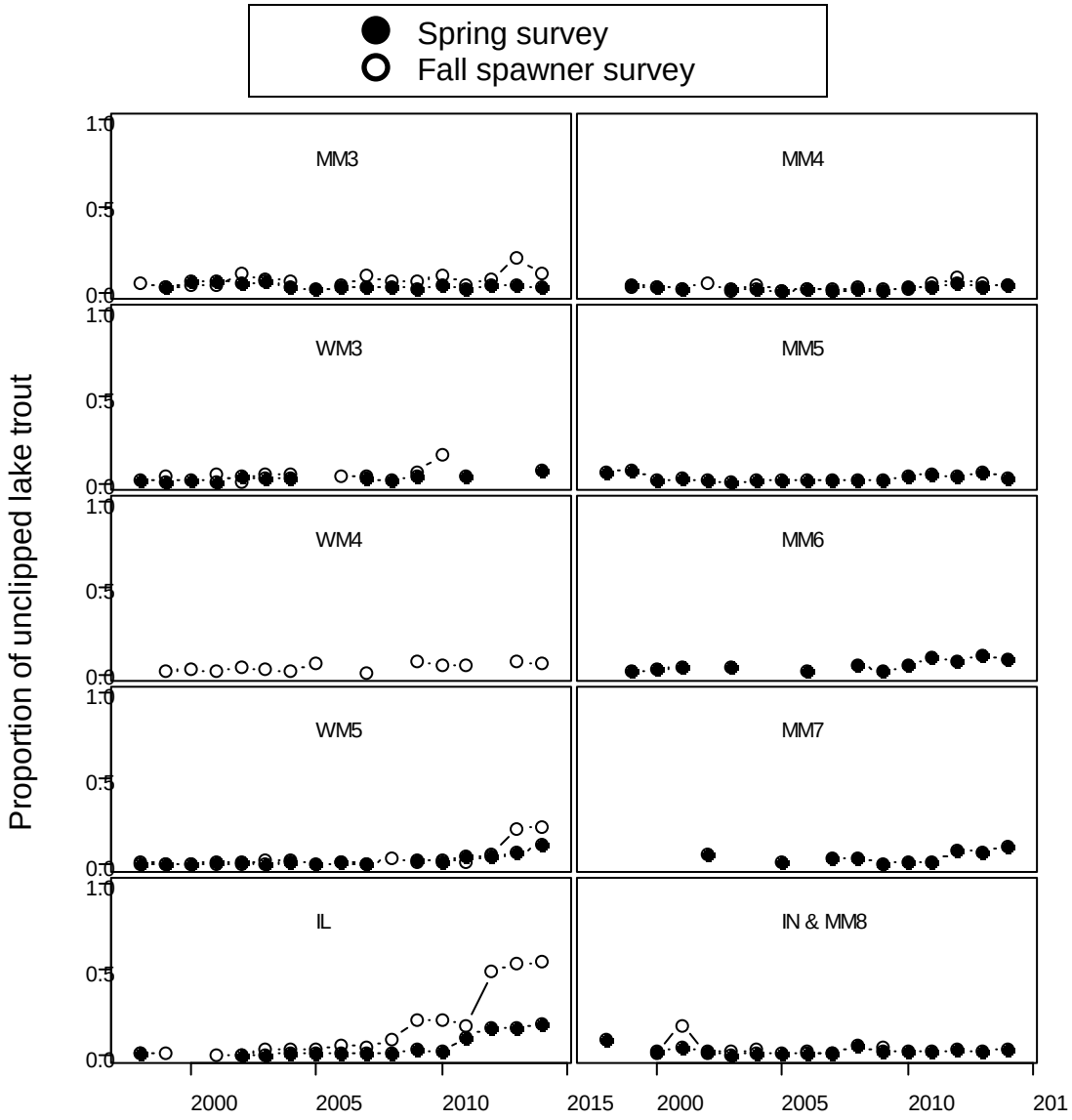


Figure 7. Proportion of unclipped lake trout recovered in spring and fall spawner gillnet surveys, by statistical district, 1998-2014.

Table 1. The proportion of unclipped lake trout in 2014 from three sources: the headhunter survey from the Great Lakes Mass Marking Program (GLMPP), the spring survey (LWAP), and the fall spawner survey (SPAWN). The total number of lake trout examined for fin clips is provided within parentheses.

Statistical District	GLMMP	LWAP	SPAWN
IL	0.39 (41)	0.19 (27)	0.54 (374)
IN	0.19 (860)		
MM2	0 (11)	0 (9)	
MM3	0.03 (90)	0.03 (450)	0.11 (149)
MM4	0.02 (51)	0.05 (197)	0.04 (23)
MM5	0.13 (188)	0.03 (124)	
MM6	0.14 (491)	0.08 (123)	
MM7	0.08 (536)	0.11 (56)	
MM8	0.15 (314)	0.04 (78)	
WM3	0 (17)	0.07 (100)	
WM4	0.09 (229)	0 (4)	0.06 (290)
WM5	0.19 (847)	0.11 (183)	0.22 (640)
WM6	0.36 (255)		

Objective 7 (Achieve restoration): By 2037, 75% or more of the lake trout in deep- and shallow-water habitats should be age-10 and younger and of wild origin.

Results: While populations are far from restoration targets, considerable progress has been made toward restoration of the Lake Michigan lake trout population. Wild origin lake trout now represent half of the spawners at some of the southern Lake Michigan reefs and are present in at least detectable numbers at reefs along the western shore of Lake Michigan and in Little Traverse Bay of northern Lake Michigan. Though the age data were limited, wild spawners were represented in 7 age classes of lake trout ranging between 4 and 11 years of age (Figure 5). In the Southern Refuge, spawner densities currently exceed the target spawner abundance level of 50 fish per 1000 ft of gill net. Northern Refuge spawner density still remains well below this target level, but spawner CPUEs are increasing to substantial (36 fish per 1000 ft of gill net) levels on nearshore reefs in Little Traverse Bay, which is located close to the Northern Refuge. Spring survey abundances presently fall short of the rehabilitation benchmark (25 fish per 1000 ft of gill net) throughout all Lake Michigan statistical districts, including rehabilitation priority zones. With continued stocking and continued production of wild recruits, lake trout population biomass should increase provided that mortality (sea lamprey predation and fishing) is effectively managed.

Lake trout stocking

The U. S. Fish and Wildlife Service stocked a total of 2.95 million yearling (14-16 months old) lake trout into Lake Michigan in 2014. Of these 2.95 million yearlings, 1.48 million and 0.74 million yearlings were stocked in the Northern Refuge reef complex and the Southern Refuge reef complex, respectively. An additional 0.73 million yearlings and 0.48 million fall fingerlings were stocked at nearshore sites in other areas of the lake for rehabilitation purposes and to support recreational fisheries. Refer to the *Summary of 2014 Lake Trout and Salmonid Stocking in Lake Michigan* report for specific details on lake trout strains and locations stocked.

The Lake Michigan Lake Trout Working Group

David Boyarski,	Wisconsin Department of Natural Resources, Sturgeon Bay, WI
Brian Breidert,	Indiana Department of Natural Resources, Michigan City, IN
Charles Bronte,	U.S. Fish and Wildlife Service, New Franken, WI
Ben Dickinson,	Indiana Department of Natural Resources, Michigan City, IN
Kevin Donner,	Little Traverse Bay Bands of Odawa Indians, Harbor Springs, MI
Mark Ebener,	Chippewa Ottawa Resource Authority, Sault Ste. Marie, MI
Roger Gordon,	U.S. Fish and Wildlife Service, Elmira, MI
Dale Hanson,	U.S. Fish and Wildlife Service, New Franken, WI
Mark Holey,	U.S. Fish and Wildlife Service, New Franken, WI
Jory Jonas,	Michigan Department of Natural Resources, Charlevoix, MI
Charles Madenjian,	U.S. Geological Survey, Ann Arbor, MI
Erik Olsen,	Grand Traverse Band of Ottawa and Chippewa Indians, Suttons Bay, MI
Steve Robillard,	Illinois Department of Natural Resources, Des Plaines, IL
Ted Treska,	U.S. Fish and Wildlife Service, New Franken, WI
Barry Weldon,	Little River Band of Ottawa Indians, Manistee, MI
Greg Wright,	Chippewa Ottawa Resource Authority, Hessel, MI

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