Inland Seas Angler

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Highlights of the Annual Lake Committee Meetings

Great Lakes Fishery Commission proceedings, Windsor, ON

This third of a series of annual special reports is a summary of Lake Huron. These lake committee reports are from the annual Upper Lakes Committee meetings hosted by the Great Lakes Fishery Commission in March 2014. We encourage reproduction with the appropriate credit to the GLSFC and the agencies involved. Our thanks to Jim Johnson, MI DNR; Dale Hanson, Charles Bronte and Mark Holey, USFWS; the staffs of the GLFC and USGS for their contributions to these science documents. Thanks also to the Great Lakes Fishery Commission, its staff, Chris Goddard & Marc Gaden, for their efforts in again convening and hosting the Upper Lake Committees meetings in Duluth.

Lake Huron

Index of Reports

Abbreviation	Expansion
CPH	Catch per hectare
CWT	Coded Wire Tag
DFO	Dept. of Fisheries and Oceans
KT	1,000 metric tons
MDNR	MI Dept. of Natural Resources
OMNR	ON Ministry Natural Resources
USFWS	U.S. Fish and Wildlife Service
YAO	age 1 and older
YOY	Young of the year (age 0)

Status and Trends of Pelagic Prey Fish in Lake Huron, 2013 (USGS)

Abstract

The USGS Great Lakes Science Center (GLSC) 2013 survey was conducted during September and October and included transects in Lake Huron's main basin, Georgian Bay, and North Channel. Pelagic fish density was 1,033 fish/ha in 2013 and increased 62% over the 2012 estimate. Total biomass in 2013 (6.07 kg/ha) was similar to the 2012 estimate (6.97 kg/ha). Mean numeric density of alewife was substantially greater in 2013 than in 2012, but the 2013 estimate has low precision. Age-O rainbow smelt abundance increased from 2012, whereas age-l + rainbow smelt decreased. Age-O bloater abundance increased over 2012 estimates. Density and biomass of large bloater in 2013 was similar to 2012 levels. Emerald shiner density and biomass increased during 2013. Two adult cisco were captured in Georgian Bay. Based on comparable biomass estimates during 2012 and 2013, prey fish availability during 2014 will likely be similar to 2013. Lake Huron has pelagic fish biomass similar to that observed in recent lake-wide acoustic surveys of Lake Michigan and Lake Superior, but species composition differs in the three lakes. There is an increasing gradient of diversity and native species occurrence from Lake Michigan to Lake Superior, with Lake Huron being intermediate in the prevalence of native fish species like coregonines and emerald shiner.

Survey and analytical methods

The pelagic prey fish survey in Lake Huron is based on a stratified-random design with transects in five geographic strata: eastern main basin (ME), western main basin (MW), southern main basin (SB), Georgian Bay, and the North Channel (NC) (Figure 1).

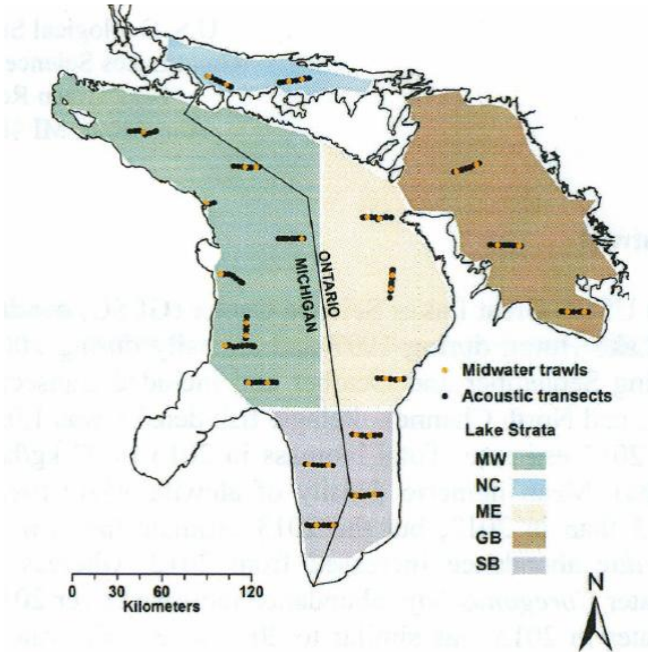

Figure 1. Hydroacoustic transects and midwater trawl locations sampled 2013 in Lake Huron.

The 2013 pelagic fisheries survey was completed during 10 September - 9 October, and all sampling was conducted by the GLSC using the *RN Sturgeon.* Twenty acoustic transects of roughly 20 km in length were sampled, resulting in approximately 430 km of acoustic data. Thirty-five midwater trawl tows were conducted in conjunction with acoustic data collection. During 2011-2012, the survey was carried out jointly between GLSC and the United States Fish and Wildlife Service (USFWS). USFWS used a 120 kHz split-beam echo sounder (Sirnrad EK60) to sample transects located in the MW stratum. In all years, sampling was initiated one hour after sunset and ended no later than one hour before sunrise.

Species and size composition were determined using a 15-m headrope midwater trawl (USGS) or a 21-m headrope midwater trawl (USFWS). Tow locations and depths were chosen to target fish aggregations, but we attempted to collect multiple tows per transect when fish were present so that trawl data within a stratum were available from each scattering layer formed by fish. Scattering layers were typically associated with the epilimnion, metalimnion, and hypolimnion. Trawl depth was monitored using a Netmind™ system (USGS) or a Sirnrad PI44 catch monitoring system (USFWS). Most midwater trawl tows were of 20 minutes duration, with tow times extended up to 25 minutes when few fish were present. Temperature profiles were obtained using a bathythermograph on each acoustic transect. All fish captured in the midwater trawl tows were identified, counted, and weighed in aggregate (g) by species. Total length in millimeters was measured on no more than 100 randomly selected individuals per species per tow. Individual fish were assigned to age categories (predominantly age-O, or predominantly age 1+) based on size using the following break points: alewife =100 mm; rainbow smelt = 90 mm; bloater = 120 mm. Based on previous age estimates for these species, these lengths approximate the lengths of the smallest age-1 fish of these species.

Alewife

The decline of alewife in Lake Huron began in 2003 and abundance has remained low in subsequent years. Since 2004, few alewives have been captured in pelagic fish surveys, and almost all have been age-0 fish. However, during 2013 alewife density increased substantially relative to 2012, representing one of the highest values observed in the time series (Figure 2). Alewife biomass, which increased marginally during 2013 to approximately 30% of the long-term mean, remains low in Lake Huron (Figure 2).

Alewife density estimated in 1997, 2005-2006, 2008, and 2013 was considerably higher than other years in the time series. However, we note that density differences, though large, did not mean that alewife have been especially abundant in any survey year. During 1997, their year of highest abundance, they were only 3.1% of total fish density. Temporal biomass differences were due in part to differences in size/age structure between 1997 and other years. In 1997 age 1+ alewife were captured, but primarily age-0 alewives were captured during 2004-2013. Age-0 alewife biomass remains low and since 2004 they have never comprised more than 2.5 % of pelagic fish biomass.

Alewife have shown no sign of returning to higher abundance. During the 2013 survey, 140 alewife were captured in the midwater trawl (approximately 4% of all fish captured). All but one of these was age-0 and most alewife came from a single trawl tow in the western main basin. These results are consistent with results from the 2013 annual bottom trawl survey which indicated that alewife abundance remains very low.

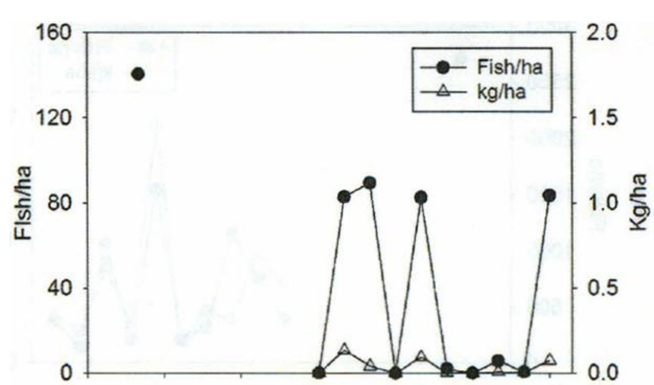

Figure 2. Acoustic estimates of alewife density and biomass in Lake Huron, 1997-2013

Rainbow smelt

Abundance of age-0 rainbow smelt has been variable over the time series with the highest densities occurring during 1997, followed by 2009 and 2006 (Figure 3). During 2013, age-0 rainbow smelt density increased 2.8-fold from 2012 estimates and to 47% of the long-term mean (Figure 3). Age-0 rainbow smelt biomass showed a 1.6-fold increase from 2012 estimates and increased to 49% of the long-term mean. Age 1+ rainbow smelt biomass and density decreased in 2013 from that in 2012 (Figure 4). Density of age-1+ rainbow smelt during 2013 was 54% of 2012 estimates and 32% of the long-term mean. Age-1+ rainbow smelt biomass in 2013 was 56% of 2012 estimates and 36% of the long-term mean.

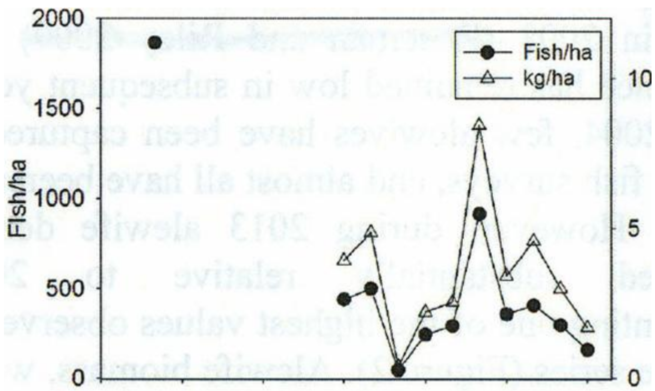

Figure 3. Acoustic estimates of age-0 (<90 mm) rainbow smelt density and biomass in Lake Huron, 1997-2013.

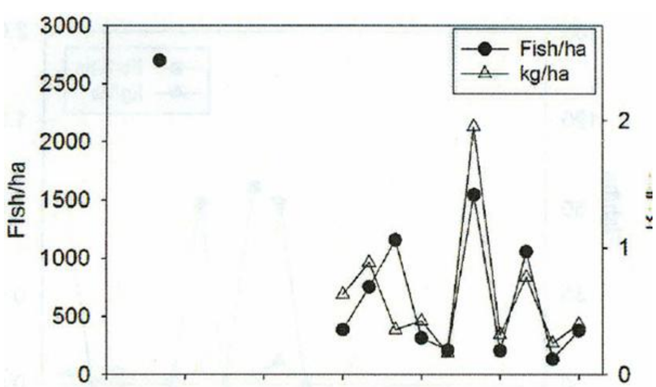

Figure 4. Acoustic estimates of age+1 (>90 mm) rainbow smelt density and biomass in Lake Huron, 1997-2013.

Lake-wide biomass and density estimates for age-1 + rainbow smelt were the second lowest for the time period. Following the highest observed age-1 + abundance in 1997, estimates of rainbow smelt density and biomass were substantially lower during 2004-2013. Although the decline has been considerable relative to 1997, during 2004-2013 acoustic survey results indicate rainbow smelt density and biomass have shown no trend for either the age-0 or age-1 + size group. Density and biomass estimates from the 2013 bottom trawl survey in Lake Huron's main basin also indicated an increase in age-0 and a decrease in age-1 + rainbow smelt biomass and density.

Bloater

Estimates of age-0 bloater density in 2013 increased fivefold over the 2012 estimate and the 2013 year class was the third largest in the time series. Following the smallest year class observed in 1997, age-0 bloater density has increased but has been highly variable since 2004. Similarly, age-0 bloater biomass increased sixfold from 2012 estimates. Estimates of age-1+ bloater density and biomass in 2013 were similar to 2012 and were 71% and 68%, respectively, of the long-term mean.

Density and biomass estimates of age-1 + bloater were less variable than age-0 bloater abundance during 2004-2013, but have declined from 1997 estimates. Both density and biomass of age-1+ bloater showed an increasing trend from 2004-2008, followed by a decrease from 2009-2010. Abundance of age-1 + bloater remained relatively unchanged during 2011-2013. Abundance of age-0 bloater estimated from the GLSC bottom trawl survey were higher than acoustic/midwater trawl estimates, but both surveys detected an increase during 2013. Bottom trawl estimates of age-1 + bloater abundance were higher than acoustic/midwater trawl estimates, but estimates from both surveys were more closely aligned in 2013 than in the previous two years.

Cisco

Our acoustic and midwater trawl surveys primarily operate in deeper waters during the fall, and therefore do not sample cisco in nearshore spawning areas. During October in northern Lake Huron, cisco are primarily distributed in shallow, near shore areas. Catches in midwater trawls are too sporadic to be able to use trawl proportions to apportion acoustic densities. For example, only two cisco were caught in 2013, and during 2004-2012, catches were low during acoustic surveys. GLSC sampling (all types) has captured only 110 cisco since 1980. However, because recovery of cisco is a Fish Community Objective (FCO) for Lake Huron, some measure of progress toward their restoration to the pelagic fish community is desired. In order to measure cisco density during pelagic fish surveys we used the approach of Yule et al. (2006), who used acoustic target strength to identify targets as large cisco, with -35.6 dB as the lower limit to the target strength of large cisco (fish >250 mm). We used this method with the caveat that not all of these targets are cisco and this approach may overestimate cisco abundance. Further, we compare the density of cisco-sized targets to that measured in Lake Superior in 2011. We found that there has been no evidence of a trend in the lake-wide density of large cisco-sized targets in the period 2004-2013. Fall gill net catches of cisco in northern Lake Huron also showed no trend during 1991-2013.

Mean density of targets >-36 dB in Lake Huron varied between 0.36 and 2.6 fish/ha. The 2013 estimate for density of cisco-sized targets (0.36 fish/ha) was the lowest for the time period. Furthermore, this analysis showed that density of large cisco-sized targets in Lake Huron was much lower than observed by Yule et al. (2013) during a lake-wide acoustic survey of Lake Superior in 2011.

Emerald shiner

Emerald shiner density and biomass increased in 2013 from near record lows in 2012. Lake-wide mean density was 93% of the long-term mean for the time series, while biomass was 84% of the long-term mean. Emerald shiner were captured in the western and southern Main Basin and were not observed in Georgian Bay or the North Channel. Emerald shiner were a small proportion (1.6%) of total pelagic fish biomass during 2013.

Among-basin comparisons offish biomass

One factor that makes Lake Huron unique among the Laurentian Great Lakes is the presence of three large, hydrogeomorphically distinct basins that make up significant portions of the total lake area. For example, Georgian Bay makes up approximately 25% of the total area of Lake Huron and is 77% of the area of Lake Ontario. These basins differ in mean depth and area, and in past years, fish biomass. In 2013, pelagic fish biomass was higher in the North Channel and the main basin than Georgian Bay (Figure 5), but differences in biomass among basins were not significant.

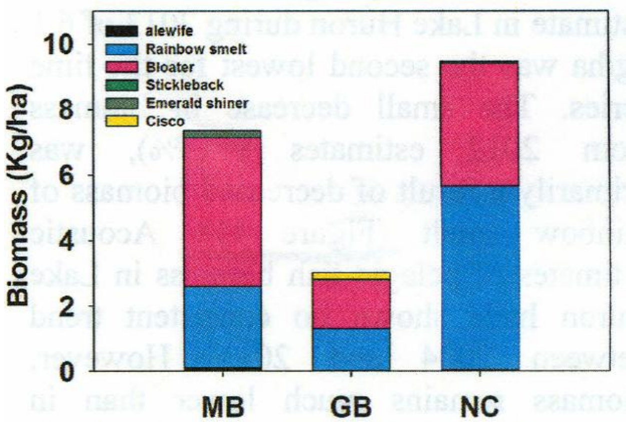

Figure 5. Acoustic estimates of total pelagic fish biomass among Lake Huron's three basins, 2013

In addition to differences in fish biomass the three basins have had different temporal trends in biomass and community composition. In both Georgian Bay and the main basin, fish biomass has declined since 1997 and remains low, while there is no evidence of a declining trend in North Channel. Community composition differences are predominantly the result of variation in the proportion of biomass made up by rainbow smelt and bloater. Most biomass in Georgian Bay has been in the form of rainbow smelt (58%), while biomass in the main basin has consisted of similar proportions of rainbow smelt and bloater. North Channel, where rainbow smelt have made up 74% of biomass, has had even greater rainbow smelt dominance than Georgian Bay. To date, the only factor identified as having consistently influenced the biomass and community composition differences among these basins is bottom depth.

Lake-wide fish biomass

The lake-wide pelagic fish biomass estimate in Lake Huron during 2013 of 6.1 kg/ha was the second lowest for the time series. The small decrease in biomass from 2012 estimates (~13%), was primarily a result of decreased biomass of rainbow smelt (Figure 6). Acoustic estimates of pelagic IS iomass in Lake Huron have shown no consistent trend between 2004 and 2013. However, biomass remains much lower than in 1997. Most of this decrease in biomass is the result of decreased abundance of rainbow smelt and bloater

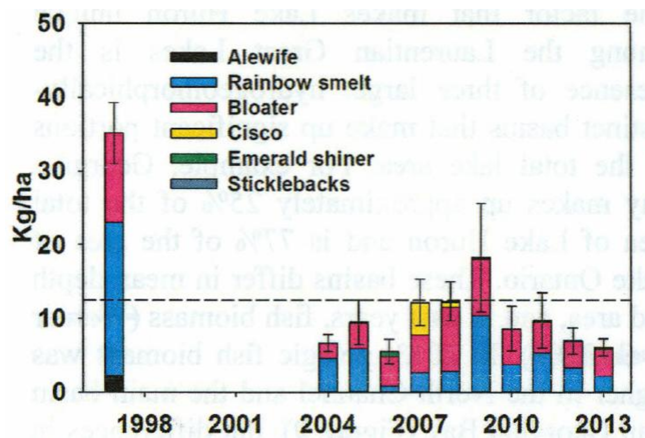

Figure 6. Lake-wide fish biomass in Lake Huron, 1997-2013.

This survey, as with any other type of fishery survey, includes assumptions about the sampling and data analysis techniques. For example, we assumed that the areas sampled were representative of the lake as a whole. This survey sampled areas of Lake Huron from 10 to 250 m in depth. This depth range encompassed about 85% of the total surface area of Lake Huron. However, this survey did not sample nearshore zones and large shallow embayments, especially Thunder Bay, Saginaw Bay, and Parry Sound. These areas could be responsible for high rates of pelagic fish production, but could not be sampled safely due to the draft of our research vessel (3 m). Given the small surface areas of these shallow-water embayments relative to the total surface area, densities would need to be considerable to influence the lake-wide mean. We conducted enough midwater tows to achieve an acceptable degree of confidence in fish community composition. An additional assumption was that fish size was a reasonable proxy for fish age. We used size to assign age and assumed no overlap in age among size classes. This assumption was likely violated, especially for rainbow smelt. While this might have slight effects on our estimates of age-0 and age-1 + density and biomass, it would have no impact on our estimates of total density for a species.

During 2014, prey availability for piscivores will likely be similar to that seen in other recent years. Alewife biomass remains low, and there has been no trend in pelagic fish biomass since 2004. The Lake Huron forage base still remains low compared to previous decades when alewife, rainbow smelt, and bloater were more abundant. Lake-wide pelagic biomass in Lake Huron in 2013 (6.1 kg/ha) was nearly identical to biomass in Lake Michigan and similar to Lake Superior during 2011 (6.8 kg/ha). There is, however, a key difference between the three lakes. In Lake Michigan, alewife are still prevalent and comprise about 77% of the pelagic biomass, while in the other two lakes, the biomass of this species is negligible. Additionally, native coregonines and other species are rare or absent in Lake Michigan. Both Huron and Superior have much greater contribution to density and biomass from native species. In the case of Lake Superior, kiyi are numerically dominant at depths > 100 m, while cisco make up most of the biomass. In Lake Huron, rainbow smelt are numerically dominant, while rainbow smelt and bloater have been alternating roles as the dominant contributor to total biomass. Additionally, there have been relatively consistent (but low) catches of emerald shiner and cisco in Lake Huron midwater trawling. In the case of emerald shiner, it is likely that their reappearance was the result of a release from predation on fry following the collapse of alewife. Cisco also were not present in lake trout diets in Lake Huron during 2009-2011 indicating that cisco are not prevalent in the pelagic prey fish community in U.S. waters of the main basin. ✧

Status and Trends of the Lake Huron Offshore Demersal Fish Community, 1976-2013

Abstract

The USGS Great Lakes Science Center has conducted trawl surveys to assess annual changes in the offshore demersal fish community of Lake Huron since 1973. Sample sites include five ports in U.S. waters with less frequent sampling near Goderich, Ontario. The 2013 fall bottom trawl survey was carried out between 25 October - 21 November 2013 and included all U.S. ports as well as Goderich, ON. The 2013 main basin prey fish biomass estimate for Lake Huron was 47 kilotonnes, less than half of the estimate in 2012 (97 Kt), and approximately 13 percent of the maximum estimate in the time series. The biomass estimate for YAO alewife in 2013 was lower than in 2012, remained much lower than levels observed before the crash in 2004, and populations were dominated by small fish. Estimated biomass of rainbow smelt also decreased and was the second lowest observed in the time series. Estimated YAO bloater biomass in Lake Huron was also reduced compared to 2012. YOY alewife, rainbow smelt, and bloater abundance and biomass increased over 2012. Biomass estimates for deepwater and slimy sculpins, trout-perch, ninespine stickleback, and round goby in 2013 were lower than in 2012 and remained low compared to historic estimates. Wild juvenile lake trout were captured again in 2013, suggesting that natural reproduction by lake trout continues to occur.

The 2013 Lake Huron fall bottom trawl survey was carried out during 25 October – 21 November. A total of 43 trawl tows were completed and all standard ports were sampled, including Goderich, Ontario. Twenty fish species were captured in the 2013 survey: rainbow smelt, alewife, bloater, deepwater sculpin, slimy sculpin, trout-perch, lake whitefish, round whitefish, ninespine stickleback, threespine stickleback, lake trout, spottail shiner, burbot, round goby, yellow perch, gizzard shad, longnose sucker, white sucker, emerald shiner, and white bass.

Alewife abundance in Lake Huron remained low in 2013. YAO alewife density and biomass estimates decreased from 2012, and remained much below levels observed before the population crashed (Fig. 2). YOY alewife density and biomass showed a slight increase in 2013, but remained relatively low (Fig. 2). YAO rainbow smelt density in Lake Huron in 2013 decreased compared to 2012 and remained relatively low (Fig. 3). YOY rainbow smelt abundance and biomass increased dramatically compared to 2012 and were the highest observed since 2006. YAO bloater density and biomass in Lake Huron have been increasing in recent years, but the 2013 estimates were much lower than observed in 2012. YOY bloater abundance and biomass in 2013 showed a marked increase over 2012 and were the highest estimates observed in the survey.

Slimy sculpins have rarely been captured in the Lake Huron bottom trawl survey since 2006, and very few were captured in 2013 despite high catches in 2012. Abundance and biomass estimates for deepwater sculpins in Lake Huron in 2013 were also lower than in 2012 and were relatively low compared to historic estimates. The 2013 abundance and biomass estimates for ninespine stickleback and trout perch were also lower than in 2012 and were among the lowest in the time series. Round goby abundance and biomass estimates for 2013 were lower than those observed in 2012 (Fig. 7).

The total main basin prey biomass estimate (5 - 114 m) in 2013 was 47 kilotonnes, about half of the estimate in 2012 (Fig. 8). This estimate is higher than the extreme low estimates in 2006-2010, and represents approximately 13 percent of the maximum lakewide biomass estimate observed in 1987. Approximately 37 percent of the 2013 biomass estimate was made up of YAO bloater. The density of wild juvenile lake trout observed in 2013 was lower than the 2012 estimate, which was the highest density observed since juvenile lake trout began to appear in the catches in large numbers in 2004 (Fig. 9). Juvenile lake trout were apparently at low density in Lake Huron in 2013.

The abundance of prey fish in Lake Huron has remained at very low levels since the collapse of the offshore demersal fish community, although survey catches in 2012 suggested that several species were beginning to increase in abundance. The estimated lakewide biomass of prey fish in 2012 was the highest reported since 2001, but the 2013 estimate is approximately half as high as 2012. The estimated biomass of YAO rainbow smelt and alewife in 2013 were lower than in 2012 and remained low compared to earlier data, and these populations were dominated by small fish. The reduction in the abundance of these exotic species is consistent with fish community objectives for Lake Huron, but does not bode well for Chinook salmon populations in the lake, which rely on these species as prey.

YAO bloater showed a consistent positive trend in biomass for 2009-2012, but the 2013 estimate was much reduced from 2012. The abundance of this native species is currently at a moderate level, higher than the extreme low estimates observed in 2001-2006. YAO bloater are one of the only species that has increased in abundance in recent years, and continued monitoring of this species will determine whether conditions in the lake are conducive to the survival and recruitment of native coregonids. YOY bloater abundance and biomass in 2013 were the highest ever observed, which may be a result of successful reproduction by the large YOA population in 2012.

Deepwater and slimy sculpins, ninespine sticklebacks, and trout-perch are currently minor components of lake trout diets in the Great Lakes, but were probably more important before the invasion of the lakes by alewife and rainbow smelt. In 2013, biomass estimates for deepwater and slimy sculpins, sticklebacks, and trout-perch were lower than in 2012, and remained relatively low compared to historical high estimates. Assessments of deepwater and slimy sculpin diets are currently underway at the GLSC to assess the composition of their diets as invertebrate communities continue to change.

Round gobies have recently become a significant part of the diet of lake trout in some areas of the Great Lakes, including Lake Huron. Round gobies were first captured in the Lake Huron trawl survey in 1997, reached peak abundance in 2003, and declined in abundance until 2011. Our results suggest that round goby are currently at a moderate level of abundance in the offshore waters of Lake Huron, although sharp fluctuations in the time series suggest that abundance estimates for this species may be particularly sensitive to the effects of factors such as fish movement due to temperature or other factors.

The estimated lakewide biomass of common offshore prey species in Lake Huron has increased each year since 2009, but decreased in 2013. The peak estimated biomass of prey fish in Lake Huron occurred in the late 1980s, and has declined steadily since then; a similar decline has occurred in Lake Michigan. It is possible that these declines are associated with the invasion of the lakes by several exotic species including the spiny water flea, zebra mussels,quagga mussels, and round gobies, all of which have been introduced since the mid-1980s. Similar declines in some species (particularly coregonines) have occurred in Lake Superior, however, where these exotic species have not invaded.

Naturally-produced juvenile lake trout were first captured in relatively large numbers by the Lake Huron fall survey in 2004, the year after the alewife population collapsed. Catches generally declined after 2004, but rebounded to high levels in 2011 and 2012 before declining in 2013. This suggests that the conditions that are conducive to natural reproduction of lake trout in Lake Huron may be sporadic. These wild juvenile lake trout are now recruiting to gill net surveys as adults, which is the first lakewide evidence of natural recruitment of wild adult lake trout outside of Lake Superior since the 1950s, and is an important step towards lake trout rehabilitation in Lake Huron.

The results of this survey show that there has been great variability in the abundance or biomass of a number of fish species (YOY benthopelagic planktivores, round goby, wild juvenile lake trout) over the last decade. Low levels of prey fish abundance have persisted since approximately 2006, although the 2012 survey provides evidence that the abundance of some species may be starting to rebound. These results, along with other analyses, may indicate that the offshore demersal fish community in Lake Huron is currently in an unstable state.

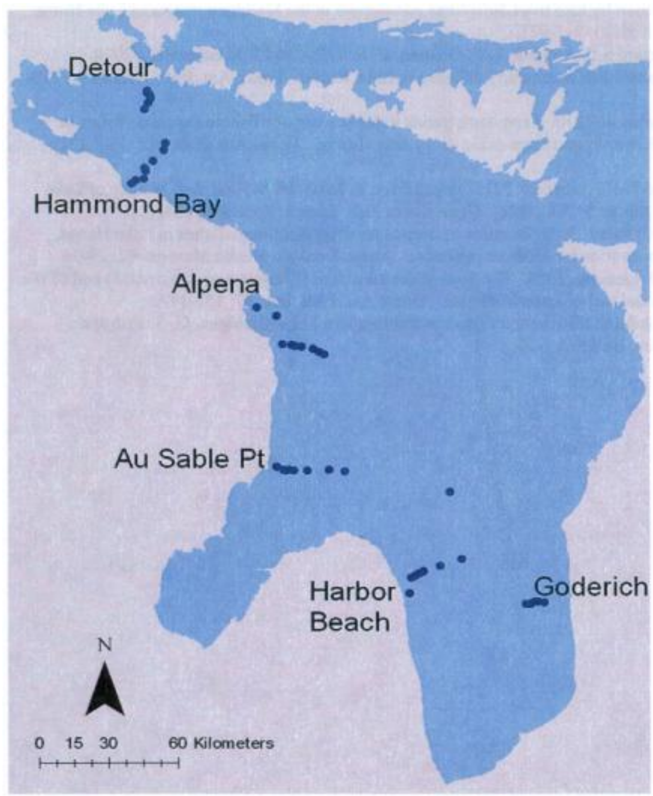

Figure 1. Bottom trawl sampling locations in Lake Huron, 2013

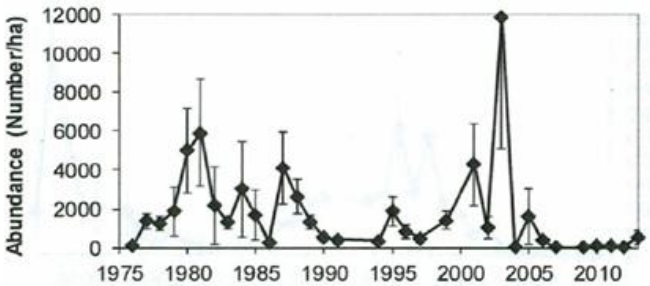

Figure 2. Density of young-of-the-year alewives as number of fish per hectare in Lake Huron, 1976-2013.

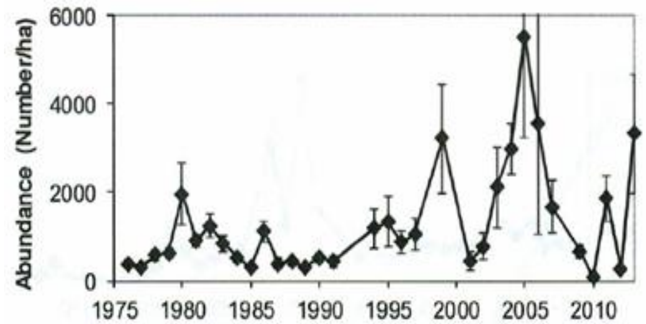

Figure 3. Density of young-of-the-year rainbow smelt as number of fish per hectare in Lake Huron, 1976-2013.

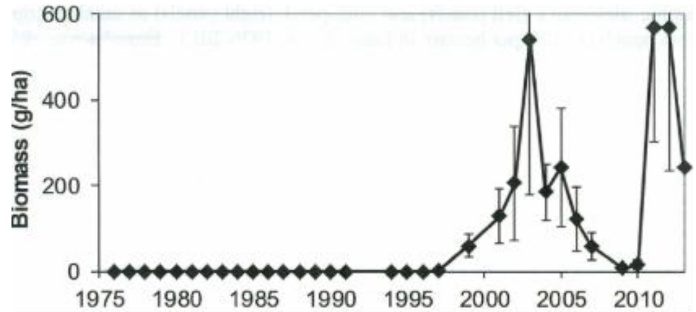

Figure 4. Biomass of round goby as number of fish per hectare in Lake Huron, 1976-2013.

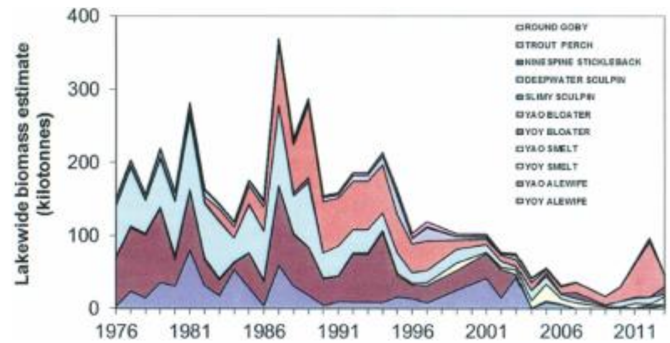

Figure 5. Offshore demersal fish community biomass in themain basin of Lake Huron, 1976-2013.

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Trends in recreational harvest, Main Basin of Lake Huron, 1986-2013

Lake Huron's recreational fishery was profoundly affected when alewives collapsed in 2004. Chinook salmon proved to be particularly dependent upon availability of alewives and the Chinook population declined sharply as a consequence of the alewife collapse. Other Main Basin predators appeared to be more adaptive and switched from reliance on alewives to a more diverse diet composed of a mixture of prey, including rainbow smelt and the round goby, a relatively new invader. Here we present a brief overview of trends in recreational fishing effort (angler use expressed as fishing hours) harvest (numbers of fish caught and kept) and targeted catch rate (number of fish caught per 100 hours of fishing) in Michigan waters of the Main Basin (exclusive of Saginaw Bay). These trends provide insights into which species of fish have more successfully negotiated the changes in Lake Huron's food web and portray recreational fishing opportunities that have emerged in recent years.

Certain ports have been surveyed for angler use and harvest more consistently than others. These are termed "Index Ports." The 10 Index Ports are Rogers City, Rockport, Alpena, Harrisville, Oscoda, Tawas, Port Austin, Harbor Beach, Port Sanilac, and Lexington. Harvest statistics from these Index Ports are given when portraying trends across time. In presenting most recent harvest, data from all Main Basin ports surveyed on Michigan waters of Lake Huron are presented. Catch rates are for those targeting the species complex in question. In other words, catch rates for walleye are for anglers that told survey personnel they were fishing for walleye. Catch rates for brown trout, Chinook salmon, lake trout, etc. were derived from interviews of those who said they were fishing for "trout or salmon." We began collecting targeted catch rate information in 1997.

HARVEST TRENDS

Harvest trends are closely correlated with fishing pressure. When fishing pressure is down (fewer anglers), that usually leads to fewer fish being caught. The collapse of alewives and Chinook salmon were closely followed by a sharp decline in fishing pressure **(Fig. 1**). Angling hours averaged near 1,100,000 per year from 1986-2004, but for the period following 2004, average annual fishing pressure fell to just 316,000 hours per year. This decline of 71% in fishing hours led to a similar decline in angler harvest. Catch rates for the remaining trout and salmon species remained almost unchanged.

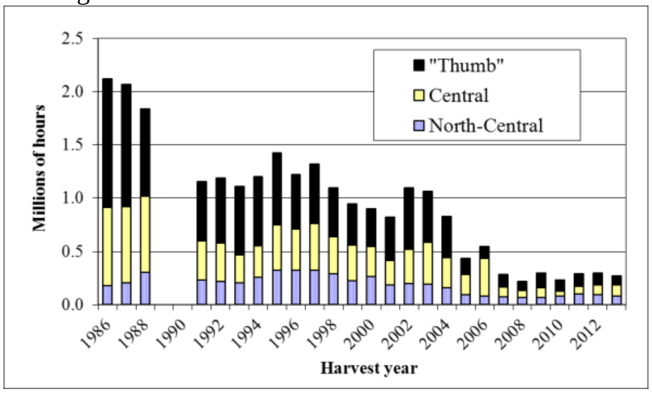

Fig. 1 - Trends in recreational fishing effort, 10 Main Basin Index Ports, Lake Huron. Alewives collapsed in 2004, leading to declines in Chinook harvest and total fishing pressure.

Salmonids

Clearly the popularity of Chinook fishing was a reason for relatively high fishing effort prior to 2005. Catch rates and harvest of Chinook salmon are given in **Fig 2.** Chinook harvest and catch rates averaged nearly 73,000 per year and 10 fish per 100 hours prior to 2004, but fell to an average of only 4,500 Chinooks caught per year and a catch rate of less than 4 per 100 hours after 2006. Catch rates have increased slightly in recent years due to a rise in Chinook catches in the north, particularly at Rogers City.

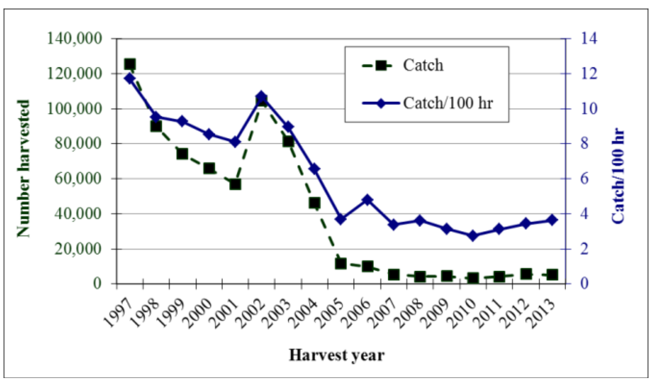

Fig 2 - Trends in targeted (anglers fishing for trout or salmon) catch and catch rate of Chinook salmon, Main Basin Index Ports, Lake Huron.

With the decline in salmon, lake trout became the leading salmonid in the Main Basin's offshore catch **(Fig 3**). Lake trout harvest declined sharply after 2004 because of the loss of fishing pressure, but catch rates remained relatively high through 2009; more recently there was a decline in catch rate from near 10 per 100 hr from 2004-2009 to 6 per 100 hrs. in 2013. The decline in the recreational fishery is at odds with the DNR's stock assessment, which shows a steady or slightly increasing number of lake trout in each management unit of the Main Basin. Therefore, the sport fishery declines may represent more challenging fishing conditions, especially in 2013, and not necessarily a decline in lake trout numbers.

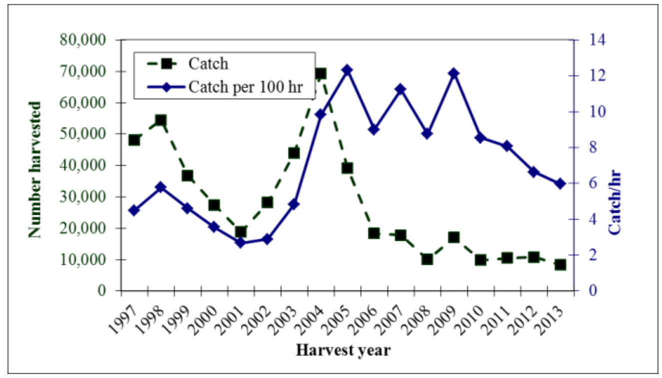

Fig 3 - Trends in targeted lake trout catch and catch rate (catch per 100 hours), 10 Main Basin index ports, Lake Huron.

Catch rates for steelhead reached a record high for the time series in 2012, but fell sharply in 2013 (**Fig 4).** The declines in 2013 may be as much related to weather conditions in 2013 as to abundance of fish; the weather was generally more windy and the thermocline about 25 ft deeper in 2013 than in 2012, making fishing for steelhead more challenging. Despite the declines in 2013, catch rates for steelhead remained nearly twice as high in 2013 as during the 1997-2008 period.

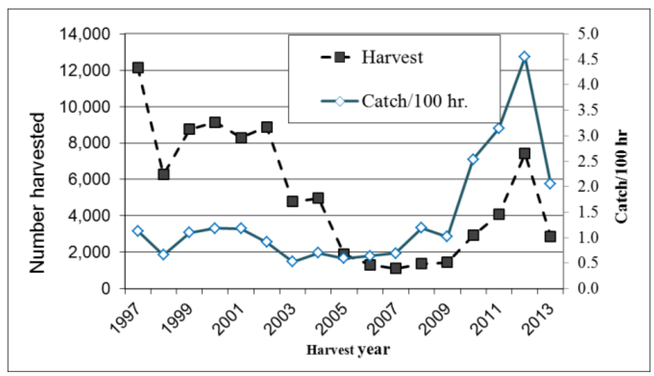

Fig 4 - Trends in targeted steelhead catch and catch rate (per 100 hours), 10 Main Basin index ports, Lake Huron. Although catch rates declined in 2013, they remained above the 1997-2010 average.

As for other salmonids, pink salmon tend to peak every other year and 2013 was a low year for harvest and catch rate. Estimated harvest of pinks was just 116 fish at the index ports, the fourth lowest since 1986. Coho salmon harvest totaled 829 fish at the index ports, the fourth lowest of the 1986-2013 time series. Neither coho or pink salmon are stocked. Brown trout harvest totaled 622 at the index ports in 2013, the fifth-lowest catch since 1986. Brown trout stocking was suspended in 2011 due to very poor post-stocking survival.

Atlantic salmon have been stocked by Lake Superior State University (LSSU) since 1986. In 2010, the DNR began stocking Atlantics, with a small experimental stocking in Whitney Drain. In 2011, 22,000 were stocked in the St. Marys River to complement the 31,000 stocked by LSSU. In 2012 and 2013 the DNR continued to match or exceed the LSSU stockings in the St. Marys River and in 2013 stocking began at three sites on the Main Basin – the lower AuSable River, lower Thunder Bay River, and at Lexington. The 2013 stockings were too young to have contributed to harvest in 2013. From 2000-2010, harvest of Atlantic salmon from the Main Basin (Detour to Lexington, St. Marys River harvest is not included) of Lake Huron averaged 506 fish per year. Harvest in 2011, 2012, and 2013 was 548, 2,269, and 500 fish respectively. In 2012, a total of 47 Atlantic salmon observed in the creel were checked for fin clips; 30 bore the right pectoral clip that was given by LSSU and 17 (36%) were not clipped and presumably stocked by DNR. The lower harvest estimate for 2013 may be consistent with reports of generally more challenging fishing conditions in 2013 than in 2012. All salmonid species except Chinook salmon exhibited lower catch rates in 2013.

Perch and walleyes

Walleyes are considered recovered in Saginaw Bay and stocking was suspended in 2006. They are now supported entirely from natural reproduction. Walleye became a major player in the Main Basin recreational fishery shortly after this recovery. Most walleyes caught in the Main Basin are believed to be from the Saginaw Bay population. After spawning there is a pronounced out-migration of Saginaw Bay walleyes to the Main Basin. Catch rates of walleyes and trout/salmon have been nearly equal at Main Basin ports since 2010 **(Fig 5**). The combined catch rates of both walleyes and salmonids, added together, ranged between 12 and 17 per 100 hours since 2007, which rivals the salmonid-only catch rates that prevailed when Chinook salmon were still abundant..

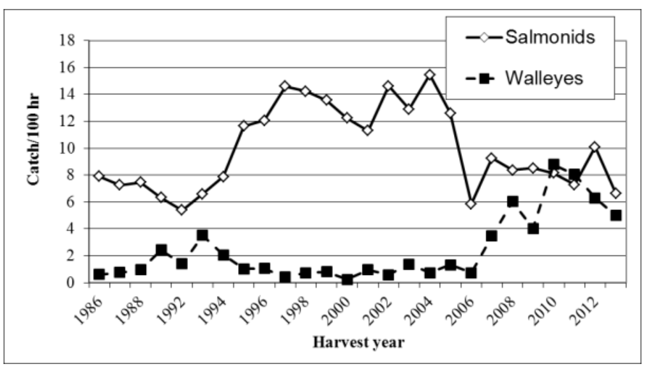

Fig 5 - Trends in catch per 100 hours of fishing, comparing walleyes and combined trout-salmon at Lake Huron's 10 Index Ports. Walleye catch rates have rivaled those of salmonids since 2010.

Species compositions **(Fig 6,** yellow perch excluded) of harvests varied considerably between ports in 2013, with Chinook salmon continuing to be a mainstay of some of the northern ports, Rogers City in particular, and walleye and/or lake trout more prominent in the central and southern ports. Yellow perch, northern pike, and cisco (lake herring) led the catch at the Les Cheneaux Islands area (not an index port).

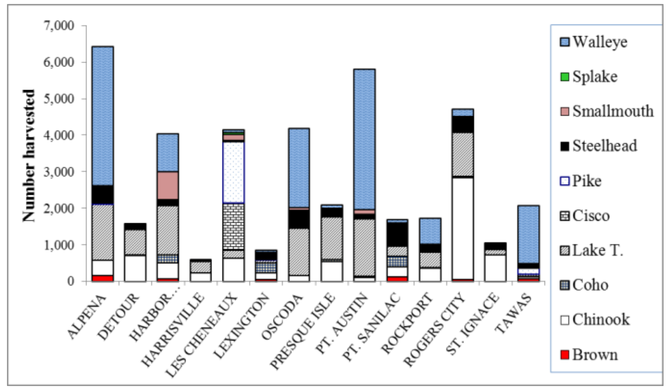

Fig 6 - Composition of major species in the catch (excluding yellow perch) of creel survey ports on the Main Basin of Lake Huron in 2013. Chinook salmon continued to contribute importantly at the more northerly ports, while walleyes and lake trout were more prominent in central and southern ports.

During the 1980s, yellow perch harvest from Main Basin ports in the "Thumb" region commonly exceeded a 100,000 per year (Fig 7).

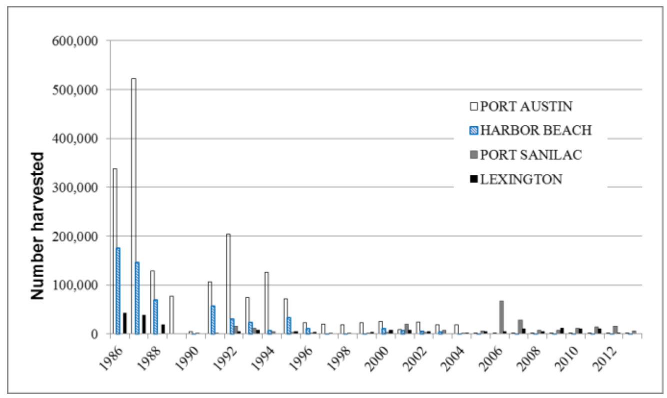

Fig 7 - Trends in recreational perch harvest, "Thumb" ports, Lake Huron. Perch almost disappeared from the fishery after the early 1990s and have never recovered.

In 2013, significant perch fisheries seemed to be available only at Tawas (which is technically part of Saginaw Bay) and the Les Cheneaux, where 23,520 and 57,609 perch were taken respectively during the ice-free season (Fig 8). The "Thumb" ports show no indication that their perch fisheries might recover any time soon.

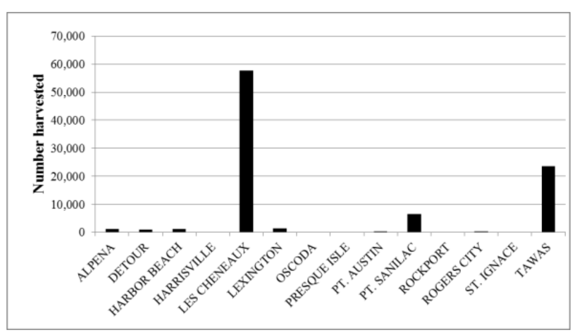

Fig 8 - Harvest of yellow perch at creel survey ports, Main Basin, Lake Huron, 2013. Harvest remained low at the once-important "Thumb" ports of Pt. Austin, Harbor Beach, Pt. Sanilac, and Lexington. ✧

Sea Lamprey Control In Lake Huron 2013

During 2013, adult sea lamprey abundance in Lake Huron was estimated to be 126,421 (95% CI; 115,644-156,881), which represents a significant reduction when compared with the 2012 estimate. However, adult abundance remains greater than the target, despite substantial increases in control efforts since 2010, including the implementation of large-scale treatment strategies in the St. Marys River and tributaries to the North Channel and northern Lake Michigan. The number of A1-A3 marks on lake trout from spring assessments in 2013 has not yet been analyzed.

Lake Huron has 1,761 tributaries (1,334 Canada, 427 U.S.). One hundred twenty one tributaries (59 Canada, 62 U.S.) have historical records of larval sea lamprey production. Of these, 83 tributaries (39 Canada, 44 U.S.) have been treated with lampricide at least once during 2004 -2013. Forty-nine tributaries (22 Canada, 27 U.S.) are treated on a regular cycle. Table 1 and Figure 1 provide details on the application of lampricides to Lake Huron tributaries and lentic areas during 2013.

- Lampricide applications were conducted in 28 tributaries (11 Canada, 17 U.S.), 2 lentic areas (1 Canada, 1 U.S.) and 383 ha of the St. Marys River. This includes the 24 tributaries and 2 lentic areas that were treated as part of the continued large-scale treatment strategy.

- The second year of a large-scale strategy that treated infested streams in northern lakes Huron and Michigan was completed during 2013. Consecutive treatments were conducted on 16 Lake Huron streams during 2012 and 2013; an additional 8 Lake Huron streams were treated a single time during 2013.

- Joe Straw and Carr creeks were treated for the first time since 1975 and 1978, respectively.

- Joe Straw, Carr, Huron Point, Ceville, and Flowers creeks were treated under extremely low discharge conditions.

- The Shiawassee River was treated from the remaining dam abutments at the Shiatown dam, which was removed in the summer of 2013. Larval surveys upstream from the old dam were negative.

- Due to excessive discharge and/or time constraints, lampricide treatments of the Wanapitei River and Old Voyageur Channel (tributaries to the French River) and the Magnetawan River were not completed. All of these streams were scheduled for a second treatment as part of the large scale treatment strategy. The next treatment of these streams will be scheduled based on their normal treatment cycle.

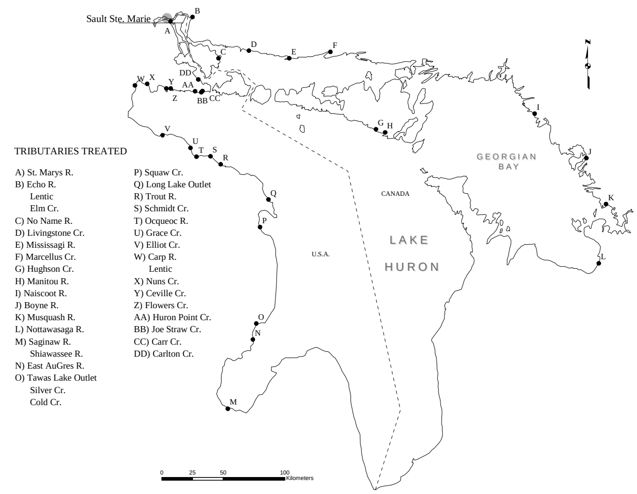

Fig 1. - Location of Lake Huron tributaries treated with lampricides during 2013.

The Commission discontinued the Sterile-Male-Release Technique (SMRT) in the St. Marys River beginning in 2012. Long-term monitoring of egg viability and larval populations are used to assess changes that may be attributable to termination of the SMRT.

- In 2013, the average egg viability from 11 nests was 79%. This was similar to the average egg viability in 2012 (74%), and much higher than the average egg viabilities from 1997-2011 when SMRT was ongoing (29%; range 4% – 48%).

- In 2013, 100 larval sea lampreys were collected from the St. Marys River by deep water electrofishing (DWEF). Eighty five percent of the total catch was estimated to be age-1 (17-47mm) and is an indication of recruitment from the 2012 spawning year class. This is the highest proportion of age-1 larvae since 1993 when DWEF assessments began, and may be linked to higher egg viability as a result of the discontinuation of SMRT.

The Commission has invested in 17 barriers on Lake Huron. Of these, 13 were purpose-built as sea lamprey barriers and 4 were constructed for other purposes, but have been modified to block sea lampreys migrations.

- The electrical field of the combination low-head/electrical barrier in the Ocqueoc River was activated March 12, 2013. From March 12 through May 29 the barrier was electrified 58 days. After May 29, the water levels remained low so the electrical barrier was not re-activated.

Ensure Blockage to Sea Lamprey Migration

- Cheboygan River – Planning to block adult sea lampreys at the Cheboygan lock and dam complex and to eradicate lampreys from the upper river continued:

    - Control and research agents met with the U.S. Army Corps of Engineers and the Michigan DNR to discuss alternatives for preventing escapement at the Cheboygan River lock. The DNR is pursuing a refurbishment of the aging structure and the federal partners are interested in making the lock "lamprey proof" using Great Lakes Fishery and Ecosystem Restoration funding through the U.S. Army Corps of Engineers.

- A pilot study was conducted in the Upper Cheboygan River to provide evidence of a landlocked sea lamprey population and to inform lock refurbishment plans. Fyke nets were used to determine run timing and obtain morphology and statolith microchemistry data on adult lampreys in the upper river. Adult sea lamprey abundance in the upper river was also estimated by weekly fin clipping (marking) male sea lampreys captured in the lower river (Lake Huron source) and released in the upper river (Schaefer method). Collective results provided evidence that a small landlocked population of adult sea lampreys inhabited the upper Cheboygan River during 2013 and that escapement through the lock was minimalSaugeen River – The Denny's Dam Reconstruction Project is currently on hold pending consultation between the Saugeen Ojibway Nation and the Ontario Ministry of Natural Resources (OMNR).

- Consultations to ensure blockage at barriers in 4 tributaries were completed with partner agencies for 11 sites.

Assessment of Candidate Streams

- Bighead River–Department staff met with OMNR personnel in April, 2013 to discuss a proposal to construct sea lamprey barriers on the Bighead and Pine rivers. Although the reception was generally positive, concerns were raised about impacts to fish passage, and to some extent, the proposed sites. The Department is still awaiting feedback from the OMNR. To avoid potential safety concerns related to a previously proposed site in the town of Meaford, an alternative barrier site has been identified on private land a few kilometers upstream. Data collection commenced in 2013 and will continue during the 2014 field season.

- Pine River (Nottawasaga River) – During the meeting with the OMNR, the Department proposed a barrier site in the Town of Angus. OMNR staff indicated that a site within Canadian Forces Base Borden would be preferable from a public safety perspective. Two prospective sites have been identified within the confines of the base and data collection will continue in 2014.

Larval Assessment

- Larval assessments surveys were conducted on a total of 133 tributaries (85 Canada, 48 U.S.) and offshore of 10 tributaries (5 Canada, 5 U.S.).

- Surveys to estimate abundance of larval sea lampreys were conducted in 15 tributaries (4 Canada, 11 U.S.).

- Surveys to detect the presence of new larval sea lamprey populations were conducted in 66 tributaries (61 Canada; 5 U.S) and offshore of 2 Canadian tributaries. One new infestation was discovered in the Whitefish River.

- Post-treatment assessments were conducted in 27 tributaries (6 Canada, 21 U.S.) and offshore of 3 tributaries (3 Canada) to determine the effectiveness of lampricide treatments conducted during 2012 and 2013.

- Surveys to evaluate barrier effectiveness were conducted in 12 tributaries (3 Canada, 9 U.S.).

- Production potential studies were completed in two Canadian tributaries to Lake Huron; the Saugeen and the Upper Nottawasaga rivers. These investigations evaluated the production potential for sea lamprey upstream from critical barriers by sampling habitat and native lamprey populations as a surrogate for sea lampreys. The population of *Ichthyomyzon* larvae is estimated to be 554,591 in the main Saugeen River from Denny's Dam to the Maple Hill Dam. The estimate of *Ichthyomyzon* larvae for the Upper Nottawasaga Watershed upstream from the Nicolston Dam is 74,478.

- Larval assessment surveys upstream from the Caro Dam in the Cass River (Saginaw River tributary), were conducted in 2013 after a single sea lamprey larva was found in Sucker Creek in 2012. An additional two larvae and one juvenile were found in 2013. The dam was likely compromised during a 2010 flood event and resulted in limited spawning. The tributary did not rank for treatment in 2014.

- Monitoring of larval sea lampreys in the St. Marys River continued during 2013. A total of 779 geo-referenced sites were sampled using deepwater electrofishing gear. Surveys were conducted according to a stratified, systematic sampling design. The larval sea lamprey population for the entire St. Marys River is estimated to be 0.9 million (95% confidence limits 0.59 – 1.1 million); 85% of the raw catch were age-1 larvae, which corresponds with 2012 observations of increased egg viability following the cessation of the SMRT.

Canadian commercial fisheries in northern Lake Huron continued to provide feeding juvenile sea lampreys in 2013, along with associated catch information including date, location and host species. The total number of sea lampreys captured each year, along with effort data provided by the OMNR, can be used as an index of juvenile abundance in northern Lake Huron (Figure 2). The preliminary total sea lamprey catch for 2013 (523) is the lowest in over 20 years. Effort is not yet available for 2013.

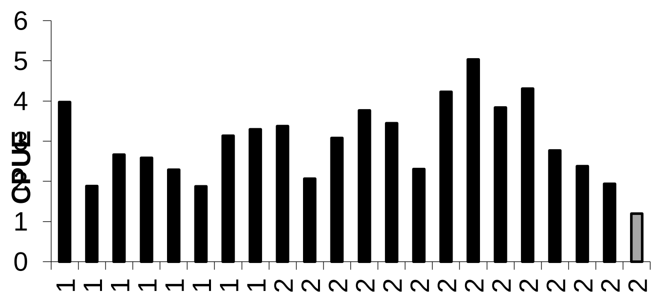

Fig 2 – Northern Lake Huron commercial index showing number of juvenile sea lampreys per 10,000 yards of gillnet for 1992-2013

Adult Assessment

- A total of 36,241 sea lampreys were trapped at 16 sites in 15 tributaries (Figure 6).

- The estimated population of adult sea lampreys was 126,421 (95% CI; 115,644-156,881) and was greater than target range of 76,000 ± 20,000 (Figure 3).

- A total of 6,198 adult sea lampreys were captured in traps operated in the St. Marys River at the Clergue Generating Station (Clergue) in Canada, and the USACE, Cloverland Electric plants and compensating gates in the U.S. The estimated population in the river was 11,695 sea lampreys and trapping efficiency was 53%.

- A field experiment to increase trap efficiency by manipulating flow at the compensating gates and at the Clergue was conducted on the St. Marys River. Results showed that increases in water flow around traps at the Clergue increased sea lamprey movement and their availability to traps, but did not affect trap capture. Increases in water flow did result in increased trap capture at the compensating gates near the upstream end of the St. Marys River rapids. Additionally, surveys performed by professional divers indicated that marked sea lampreys migrate to the trap site and mix with unmarked sea lampreys. Divers also found that sea lampreys could be manually removed downstream from the Clergue. Finally, shifting the flow in the St. Marys River rapids from one side to the other did not increase our ability to observe and sample sea lamprey nests. .

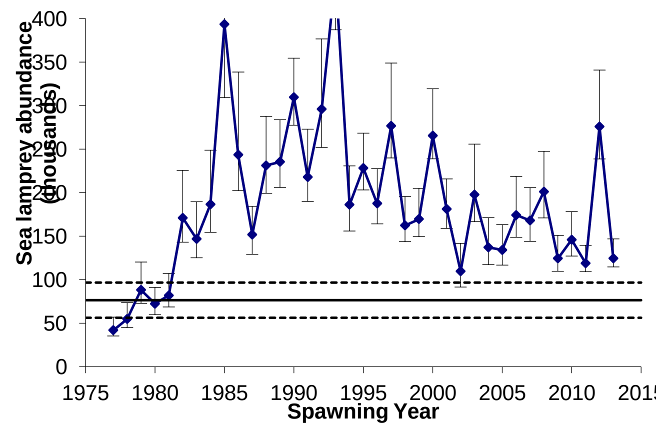

Fig 3 - Annual lake-wide population estimates of adult sea lampreys in Lake Huron, 1980 – 2013.

An eel-ladder style trap (ELST) was tested at the Ocqueoc and Cheboygan river trapping sites. This was the second year of a two year study to compare trap success and bias of the ELST compared to traditional funnel traps. Results of this research are currently being analyzed, but early observations indicate that sea lampreys will use the ladders and have a 100% retention rate in the associated trap. A Commission research completion report, *Field comparison of eel-ladder-style and traditional lamprey traps* (Reinhardt et al.), will be submitted in 2014. ✧

End