Inland Seas Angler

GREAT LAKES BASIN REPORT©

Special Report – Lake Huron & Lake Superior

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Highlights of the Annual Lake Committee Meetings

Great Lakes Fishery Commission proceedings held in Windsor, ON

This second of a series of annual special reports is an extensive summary of the Lakes Huron and Superior annual Lake Committees.

These lake committee reports are from the annual Lake Committee meetings hosted by the Great Lakes Fishery Commission of March 2010. We encourage reproduction with the appropriate credit to the GLSFC and for the agencies involved. The Lake Michigan report went out May 4th; other Lake Committee reports will be released shortly.

Our thanks to the USGS Great Lakes Science Center, GLFC, USFWS, and the State DNRs for their contributions to these science documents. While they are abridged and have been edited for brevity, we have submitted extensive information that gives an overview of the status, conditions and prognosis of the Great Lakes and our fish.

We especially thank the following for their assistance in getting us the many electronic documents, graphs, tables and reports: Jim Johnson, MI DNRE; Mark Holey, USFWS; and Maureen Walsh and Jackie Savino, USGS Great Lakes Science Center; and their respective support staffs.

Thanks also to the Great Lakes Fishery Commission, its staff and Marc Gaden & Chris Goddard, for their efforts in again convening and hosting all the Lake Committee meetings in Windsor, ON.

Lake Huron

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Lake Superior

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Key

FWS = Fish & Wildlife Service
LHC = Lake Huron Committee
USGS = U.S. Geological Survey
CPE = Catch per effort
1 kiloton (kt) (1 kt = 1000 metric tons)

Recreational Harvest Summary, Lake Huron, 1987–2009 (LHC)

The Michigan Department of Natural Resources and Ontario Ministry of Natural Resources monitored trends in the offshore, traditionally trout/salmon ports by focusing on 10 Michigan "Index" Ports – the 10 ports on the Main Basin of Lake Huron that receive the most consistent sampling from year to year. Total Michigan catch and harvest composition estimates for all species, including walleyes, are based upon all Michigan ports sampled, including Saginaw Bay and the St. Marys River.

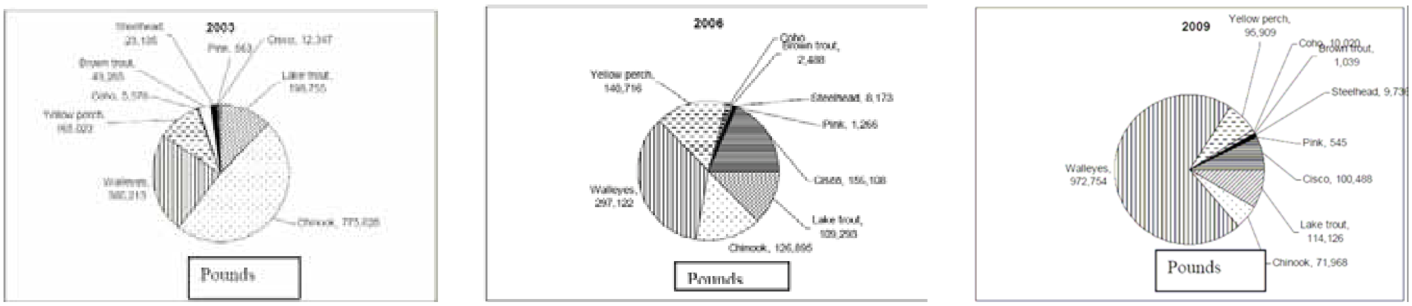


Fig 1 – Trends in composition of Michigan recreational yield, including Saginaw Bay. Walleyes have replaced salmonids as the dominant species in the harvest, even at some deepwater, traditionally trout/salmon ports

The collapse of alewives in 2004 precipitated pronounced change in harvest trends and fishing behavior for the Lake Huron recreational fishery. Since 2003, walleye have replaced salmonids as the leading species harvested in Michigan waters, even at some ports that had traditionally been the focus of the salmonid fishery **(Fig 1)**. While walleye harvest increased, harvest of trout and salmon species declined (**Figs 1 and 2, Table 1**).

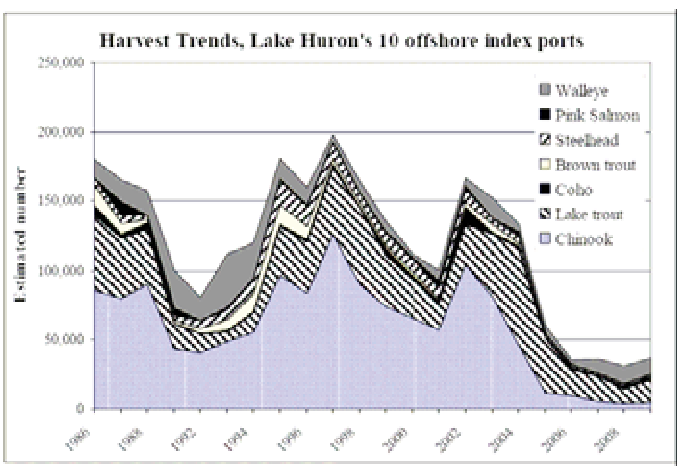


Fig 2 – Trends in catches 10 Main Basin Index Ports. Salmonid species declined sharply after 2004, the year of alewife collapse

The decline in Chinook salmon harvest was dramatic (**Fig 3**) and led to a sharp reduction in angler hours at Michigan's 10 Main Basin Index Ports of Lake Huron **(Fig 4)**, where trout and salmon had been the mainstay of the fishery. Chinook harvest reached a record low in 2008 in both Michigan and Ontario and remained very low in 2009 (**Fig 3, Table 1**).

Chinook salmon were rare in the harvest at ports south of Alpena on the Michigan side of Lake Huron. Even at Oscoda, which is the second largest Michigan stocking site on Lake Huron, the harvest estimate (creel and charter combined) in 2009 was only 511 Chinooks. Chinook declined sharply after the 2004 collapse of alewives, which in turn caused a loss of over 1,000,000 hours of fishing at these deepwater ports, with significant impacts to local economies The decline in 2004 was more dramatic in Michigan waters **(Fig 3)** than in Ontario (**Table 1**); however, in 2008 there was a pronounced decline in harvest at the Ontario index ports.

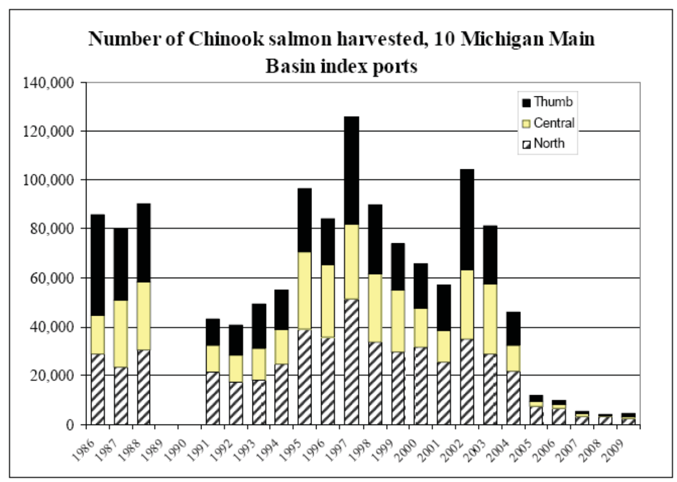


Figure 3.–Trends in Chinook salmon harvest at the 10 Index ports, Michigan waters of the Main Basin of Lake Huron.

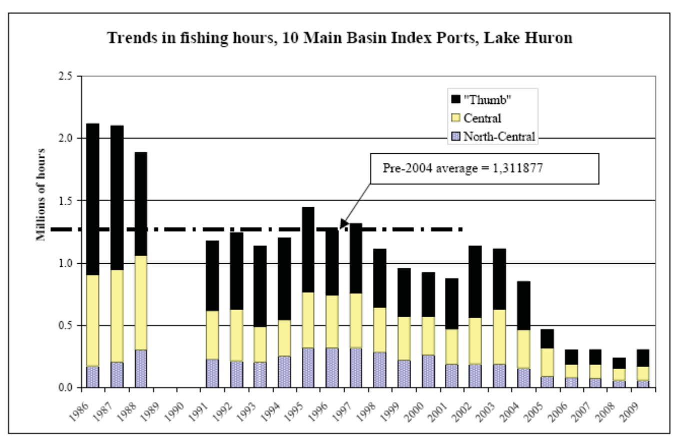


Fig 4 - Trends in hours fished at the ten Index Ports, Michigan waters of Lake Huron. Fishing pressure at these deepwater ports declined in response to the lack of Chinook salmon after 2004.

This was caused by a combination of low numbers of Chinook salmon and declining effort. Effort recovered at the Manitoulin ports in 2009 (approximately twice that observed in 2008) but Chinook salmon harvest remained low while lake trout and rainbow trout numbers increased when compared to harvests in 2008 **(Table** 1). Lake trout harvest and effort directed at lake trout have increased at the Manitoulin Island sites since 2000. Even as Chinook harvest has declined, the proportion of wild origin has remained high in all areas of Lake Huron. Wild fish composed an average of 81% of Chinooks examined at Michigan and Ontario ports from the 2000–2003 year classes and made up 89% of the weaker 2006–2008 year classes.

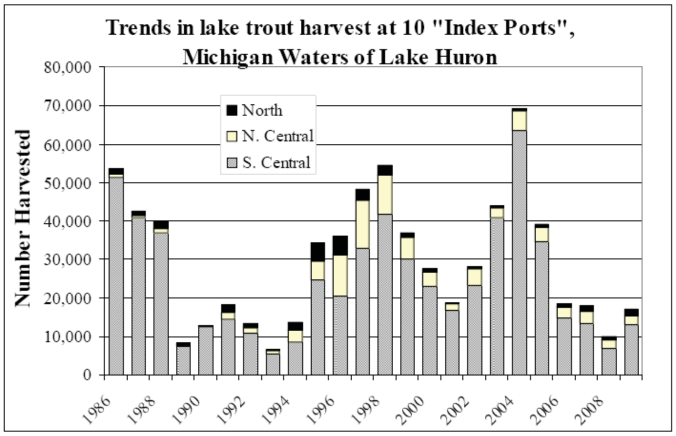


Fig 5 - Trends in harvest of lake trout at the 10 Main Basin Index Ports, Michigan waters of Lake Huron

Lake trout harvest also declined at the Michigan Index Ports **(Fig 5)**. Catch rates of lake trout actually rose to record-high levels after the alewife collapse. The decline in lake trout harvest, therefore, was not caused by declines in availability of lake trout but was a function of reduced fishing pressure. Evidently, the rise in lake trout catch rates was not enough, in the view of recreational fishers, to offset declines in salmon availability. The decline in angling pressure at Main Basin ports, including Manitoulin Island, could also be related to rising fuel costs, the relatively long offshore travel required to reach better lake trout fishing sites, and, in Michigan, diversion of fishing pressure to Lake Michigan, where Chinook salmon catch rates remained high.

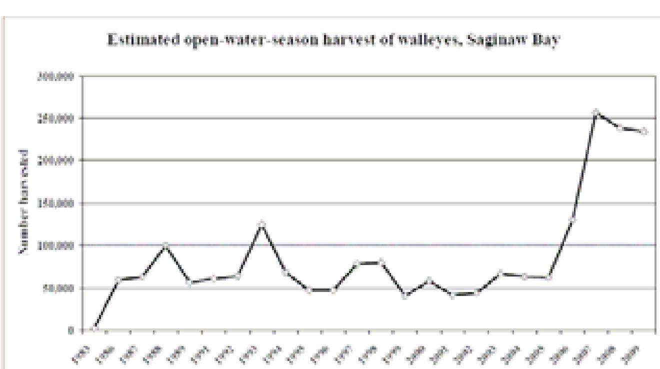


Fig 6 - Trends in walleye harvest during open-water season, Saginaw Bay. The pronounced rise after 2005 represents recruitment of the 2003 and subsequent exceptionally large year classes

Alewives evidently had been suppressing walleye reproduction and, following the alewife collapse, walleyes produced several of the largest year classes on record in Saginaw Bay. By 2006, walleyes of the massive 2003 year class reached harvestable size, which precipitated a switch in targeting and harvest species composition from salmonids to walleyes in both the Charter and Recreational fisheries of Michigan (**Fig 1**). Walleye harvest in Saginaw Bay is now nearly a quarter million fish annually (**Fig 6**), which does not include the ice fishing season. While fishing pressure has been in steady decline at Main Basin ports, fishing effort has declined comparatively slightly on Saginaw Bay (**Fig 7)**, probably because of the attraction of its recovering walleye population.

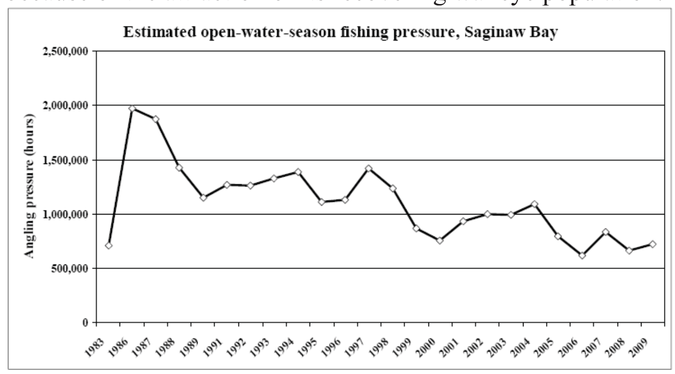


Fig 7 – Trends in recreational fishing effort on Saginaw Bay

Yellow perch, however, are at all-time low levels in the recreational harvest, even in Saginaw Bay where they had once dominated the harvest **(Fig 8)**. The decline in yellow perch, combined with rising fuel prices, probably explain the slight decline in fishing pressure in Saginaw Bay. Yellow perch have recovered in the Les Cheneaux Islands, which are located along Michigan's north shore of Lake Huron, due principally to the control of the archipelago's cormorant population.

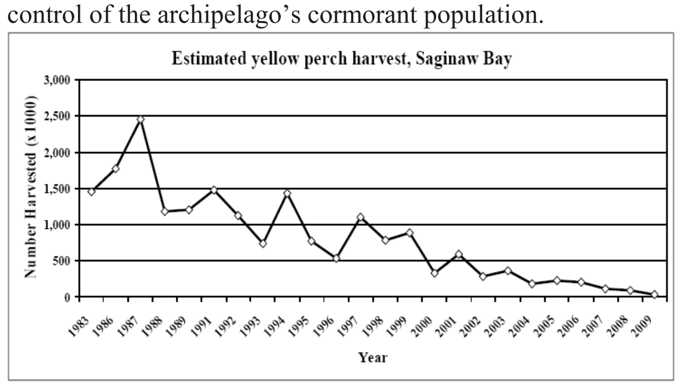


Fig 8 – Trend in harvest of yellow perch from Saginaw Bay. The decline in perch availability probably explains the loss of fishing pressure shown in Figure 7

Steelhead **(Fig 9)** and brown trout harvest **(Fig 10)** reached record low levels 2007 and 2008. The decline was exacerbated by shrinking fishing effort and was most severe for brown trout, which have all but disappeared from the fishery. In response to the collapse of brown trout, Michigan has chosen to end its program of stocking approximately 300,000 spring yearlings per year in favor of an experimental stocking of 90,000 larger fall yearlings, 60,000 of which are stocked at just three sites. The fall yearlings are expected to be large enough at stocking (300 mm) to survive predation by the now abundant walleyes.

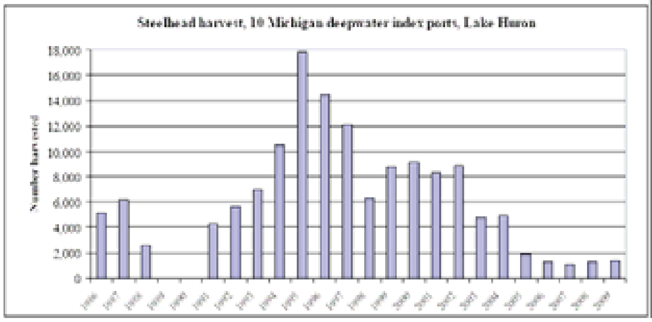


Fig 9 - Trends in number of steelhead harvested at Michigan's 10 Index Ports

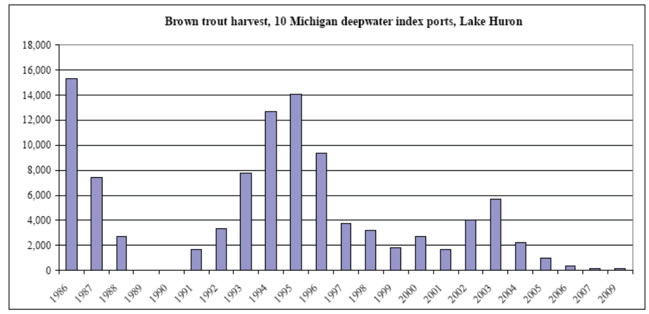


Fig 10 - Trends in number of brown trout harvested at Michigan's 10 Index Ports. The brown trout collapse after 2005 has led to a decision to change stocking strategies for brown trout in Michigan

Species	1995	1998	1999	2000	2001	2002	2003	2005	2006	2007	2008	2009
Pink salmon	2,348	378	694	747	1,413	730	44	80	270	50	63	36
Coho salmon	106	238	493	300	116	174	5	128	129	91	80	52
Chinook salmon	7,824	2,780	3,650	5,799	4,600	5,393	7,139	2,627	2,491	2,235	130	238
Rainbow trout	761	281	812	624	634	801	240	905	379	326	89	269
Atlantic salmon			8	30	146	12	8		29	20	22	25
Brown trout	79	18	161		5	31						
Lake trout				125	621	557	672	631	333	1,068	336	1,023
Salvelinus sp.	363	165										
Lake whitefish							9		11	7		4
Yellow perch										21		
Total		3,861	5,818		7,535	7,697	8,117	4,370	3,641	3,818	719	1,647

Table 1 - Estimated recreational harvest (number of each species) at sites on Manitoulin Island. These sites are shown because they represent the best time series for Ontario waters of Lake Huron.

Species	1995	1998	1999	2000	2001	2002	2003	2005	2006	2007	2008	2009
Pink salmon	11,271	7,635	265	10,374	4,264	2,180	332	172	497	232	150	325
Coho salmon	1,691	11,618		14,362	4,426	1,168	48	870	526	917	421	379
Chinook salmon	66,778	22,240	27,733	22,375	29,087	25,501	39,572	26,763	25,692	26,740	7,091	14,379
Rainbow trout	7,251	8,335	882	5,780	9,337	3,323	3,146	3,856	5,892	4,126	1,120	3,234
Atlantic salmon		203		305	688		29			56	195	158
Brown trout	363	580	51		285	23			158		0	0
Lake trout			583	727	3,215	1,604	2,683	3,871	1,608	2,798	1,304	3,176
Salvelinus sp.	1,621	5,609							183			
Lake whitefish												
Yellow perch				270							16	
Total	88,975	56,220	29,514	54,193	51,302	33,799	45,810	35,532	34,556	34,869	10,297	21,651

Table 2 – Estimated recreational effort (rod hours) at sites on Manitoulin Island. These sites are shown because they represent the best time series for Ontario waters of Lake Huron

✧

Trends in the Chinook Salmon Fishery of Lake Huron, 2000–2009 (LHC)

The Michigan DNRE has monitored trends in the Chinook fishery by estimating harvest and catch rates at 10 "Index Ports" on the west shore of Lake Huron. Chinook salmon abundance in Lake Huron, as indicated by catch statistics from these index ports, declined sharply after the alewife collapse of 2004 **(Figs 1 and 2)**. The decline in Chinook abundance was especially pronounced in the central and south portions of Michigan's Main Basin, as indicated by catch rate trends (**Fig 2**).

Recruitment declined sharply after 2003, as indicated by declining harvest and catch rates (**Figs 1 and 2**), by low fall-return fisheries at Michigan stocking sites, and declining numbers of spawning-phase Chinook salmon returning to Michigan's Swan River egg taking station **(Fig 3).**

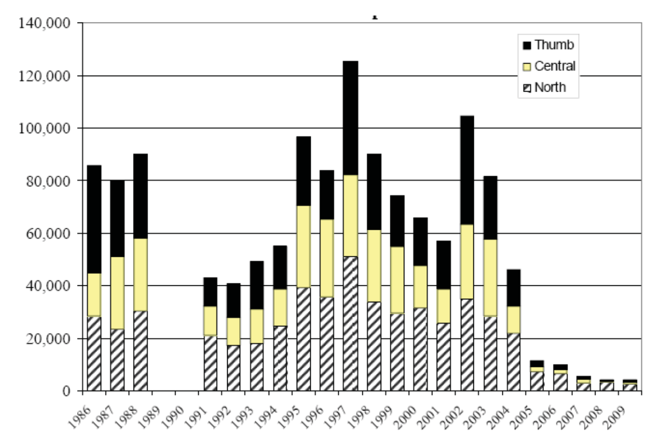


Fig 1 - Number of Chinook salmon harvested, 10 Michigan Main Basin index ports

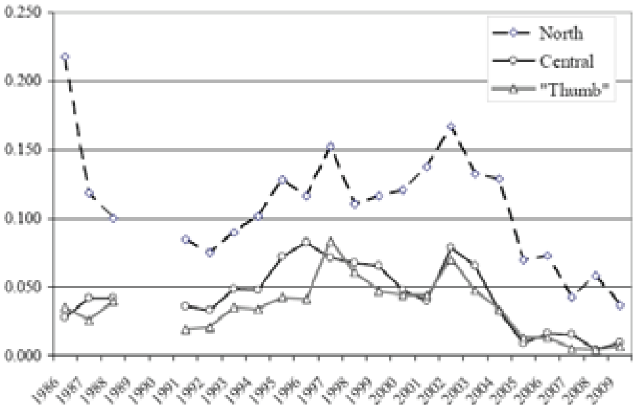


Fig 2 - Chinook catch rates per angler hour, 10 Main Basin index ports. Catch rates declined most at ports south of Alpena.

The alewife collapse also led to declines in nutritional status of Chinook salmon in Lake Huron. Weight and condition of age-2 and age-3 Chinook salmon measured from Michigan's recreational catch declined sharply after 2003 and reached record-low levels in 2004–2005. In 2007 eggs collected from Michigan's Swan Weir were of such poor quality they were not used for fish culture that year. Since 2005, condition and average weights partially recovered and by 2009 were nearing long-term averages (Figure 4). Low recruitment and survival of juvenile Chinook salmon, rather than nutrition, now appears to be the principal factor limiting Lake Huron's Chinook salmon population.

Even as Chinook salmon declined in both number and physical condition, natural reproduction continued to account for most

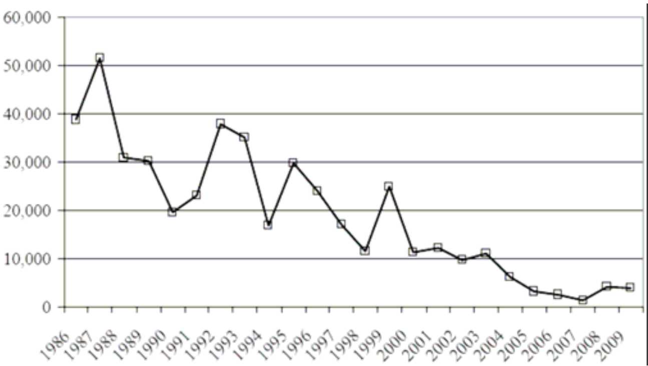


Fig 3 - Harvest of spawning-phase Chinook salmon at Michigan's Swan Weir. Swan River drains a limestone quarry in north-west Lake Huron near Rogers City. All fish harvested from the Swan are of hatchery origin.

of the salmon observed in the fishery during 2003–2009. All stocked fish were marked in 2000–'03 and 2006–'09. The 2000–'03 year classes, produced prior to the alewife collapse, were comprised of 81% wild fish (lakewide average). The incidence of wild fish of the 2006–'08 cohorts, produced after the alewife collapse, averaged 89%.

In the Michigan recreational fishery, mean 2005–2007 stocking rates at each port accounted for little of the variation in harvest between ports. Only one stocking site, Swan Bay (near Swan Weir), produces a significant fall return fishery composed principally of hatchery fish. Excluding the Swan Bay stockings, the regressions of stocking rate and port-specific harvest are ***negative.*** ✧

Status and Trends of Pelagic Prey Fishes in Lake Huron, 2009 (USGS)

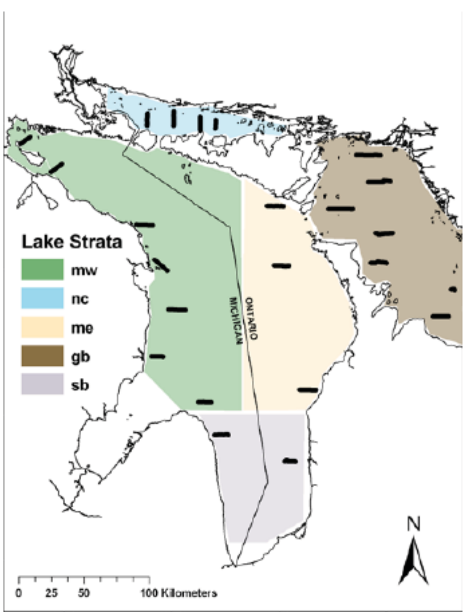


Fig 1 - Map showing transects sampled during lakewide acoustic/midwater trawl survey, 2009

Abstract

The 2009 survey included transects in Lake Huron's Main Basin, Georgian Bay, and North Channel. Main Basin estimates of pelagic fish density and biomass were higher in 2009 compared to recent years because of increases in both bloater and rainbow smelt with 2009 estimates comparable to 1997 estimates.

We also observed substantial increase in threespine stickleback abundance, although they contributed little to total community biomass due to small size. Alewife remain nearly absent, emerald shiner density was low and comparable to 2008, and no cisco were captured. As with 2008, during 2009 we did not observe significant differences in fish density or biomass among Lake Huron's three basins. Prey availability is likely to be higher during 2010 because main basin fish density tripled and fish biomass doubled compared to 2008. However, size of individual prey was smaller and most density increase was driven by high numbers of small rainbow smelt. Prey availability during 2010 and later will be influenced strongly by survival and growth of the 2009 rainbow smelt year class.

Results- Main Basin

Alewife

Since 2004, we have captured few alewives, and all were age-0 fish. During 2009, both alewife density and biomass remained near record lows **(Fig 2)**. Main Basin alewife density was significantly higher in 1997 compared to 2004, 2007, and 2009, and main basin alewife biomass was significantly greater in 1997 compared to all other years. Biomass differences among years were due to presence of adult alewife in 1997, with only age-0 alewife captured between 2004 and 2009. Age-0 alewife biomass remains chronically low and since 2004 alewife have never comprised more than 2.5 % of main basin pelagic fish biomass. Alewife have shown no sign of returning to their former high abundance.

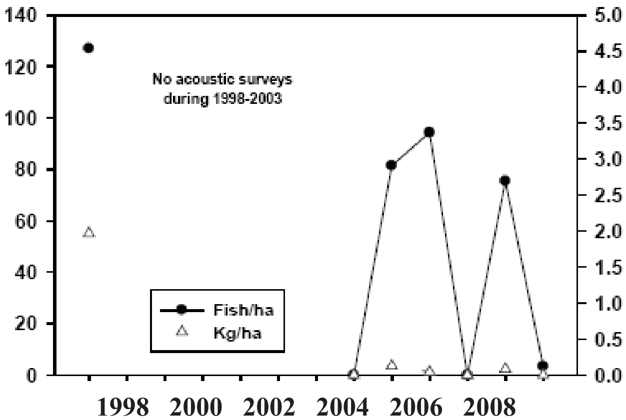


Fig 2 - Acoustic estimates of alewife density and biomass in Lake Huron's Main Basin, 2004-2009

Rainbow smelt

Main Basin rainbow smelt density and biomass increased sharply during 2009 compared to 2008, with significant increases observed in both age-0 and age-1+ rainbow smelt **(Figs 3, 4)**. Density and biomass were significantly higher during 1997 and 2009 compared with other years for age-0 and age-1+ fish, but 1997 and 2009 estimates did not vary significantly. Density increase was driven by a large year class that occurred during 2009. Age-0 rainbow smelt were ubiquitous, and were especially prevalent near Goderich, Ontario and on the Michigan shoreline. We also observed increased density of age-1+ rainbow smelt, especially along northern main basin transects.

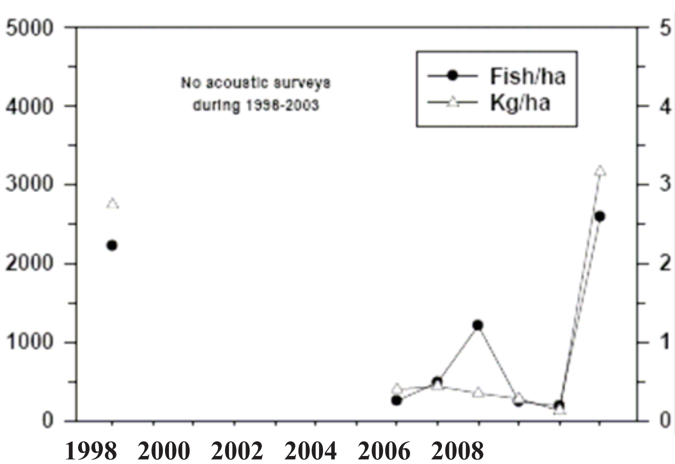


Fig 3 - Acoustic estimates of age-0 (< 90 mm) rainbow smelt density and biomass in Lake Huron's Main Basin, 2004-2009

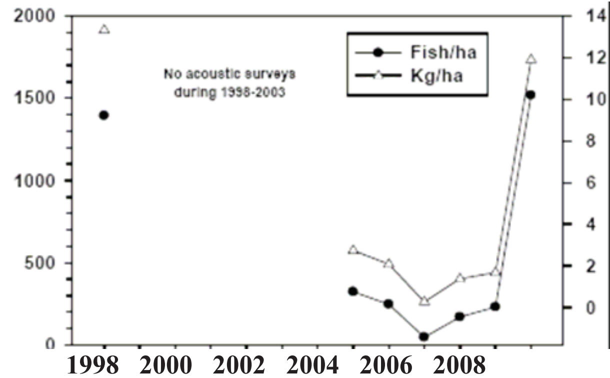


Fig 4 - Acoustic estimates of age-1+ (> 90 mm) rainbow smelt density and biomass in Lake Huron's Main Basin, 2004-2009

Bloater

Density of age-0 bloater in the main basin remained high during 2009 **(Fig 5)**. Density of age-0 bloater during 2008 was significantly higher than 2009 and both 2008 and 2009 densities were significantly greater than previous years. Biomass of age-0 bloater followed a similar trend; 2008 and 2009 estimates were higher than other years but did not differ from one another. We also observed a slight increase in density of age-1+ bloaters during 2009 **(Fig 6)**. Main Basin density of age-1+ bloaters was significantly higher during 2009 compared with 2004 and 2005, but did not differ from other years. However, we observed no differences in age-1+ bloater biomass among years.

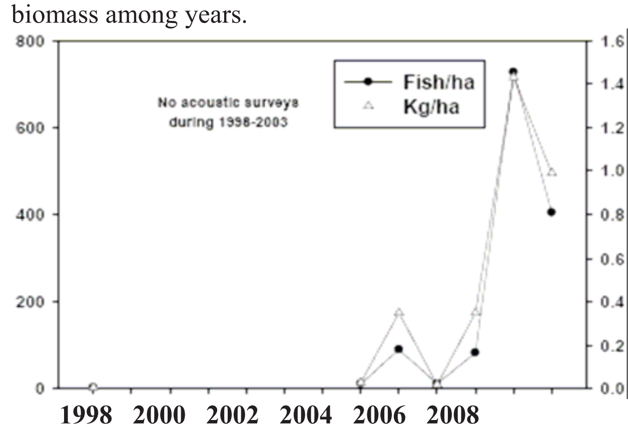


Fig 5 - Acoustic estimates of age-0 (< 120 mm) bloater density and biomass in Lake Huron's Main Basin, 2004-2009

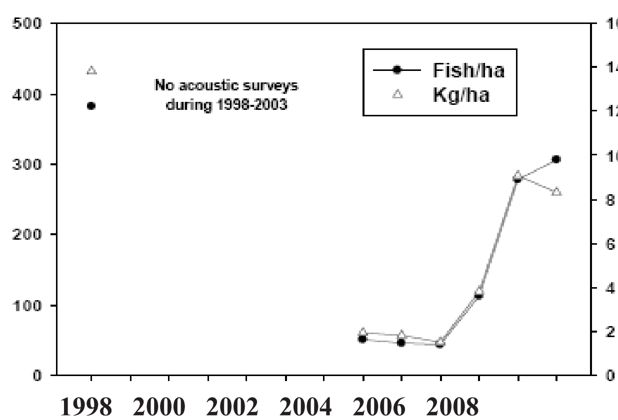


Fig 6 - Acoustic estimates of age-1+ (> 120 mm) bloater density and biomass in Lake Huron, 2004-2008

Emerald shiner

Emerald shiners were not collected until 2005 but have been found each year since (**Fig 7**). The only significant trend in the data series is that mean Main Basin density and biomass of emerald shiner were higher during 2006 compared with other years. However, they have been captured annually since 2005.

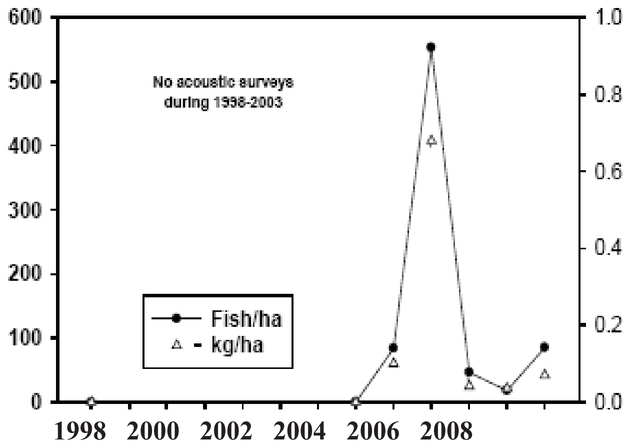


Fig 7 - Acoustic estimates of emerald shiner density and biomass in Lake Huron, 2004-2008,

Cisco

No Cisco were captured during 2009 **(Fig 8)**. When present, they can comprise a significant proportion of pelagic biomass due to their large size, but they have been captured rarely, and likely remain uncommon in the areas we sampled.

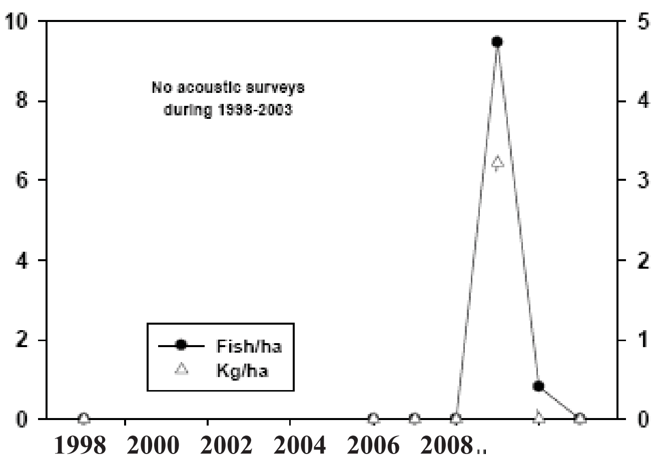


Fig 8 - Acoustic estimates of cisco and unidentified coregonid density and biomass in Lake Huron

Main Basin Fish Community

Main basin total pelagic fish density nearly tripled between 2008 and 2009. This was primarily due to increased density of rainbow smelt, with little change in other species. Fish densities during 1997 and 2009 were significantly higher than other years, but densities among those years did not differ. Main Basin total pelagic fish biomass doubled between 2008 and 2009 **(Fig 9)**. Similar to density, pelagic fish biomass during 1997 and 2009 were significantly greater than other years.

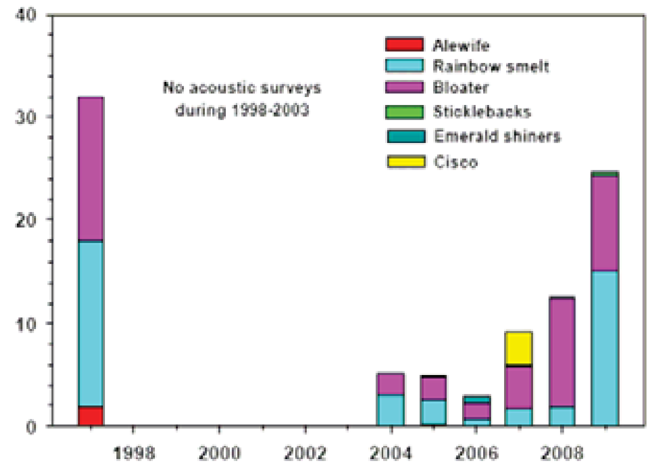


Fig 9 - Acoustic estimates of total pelagic fish biomass in Lake Huron's Main Basin, 2004-2009

1997 versus 2009

Total fish density and biomass in 1997 and 2009 were similar; however, species composition and size structure differed between the two years. Adult alewife were present in 1997, but were absent in 2009. Conversely, threespine sticklebacks and emerald shiners were present in 2009 but were rare or absent in 1997. We also observed differences in size structure of the two most abundant species: rainbow smelt and bloater. In 1997, mean length of both species was significantly larger than in 2009. Prey size structure was clearly larger in 1997 compared with 2009.

Among-Basin Comparisons

Total density and biomass did not vary across basins during 2009 **(Fig 10)** which was similar to 2008 findings. During 1997-2007 we observed consistent differences in total fish density and biomass among Lake Huron's three basins, with the North Channel having higher biomass than the Main Basin or Georgian Bay.

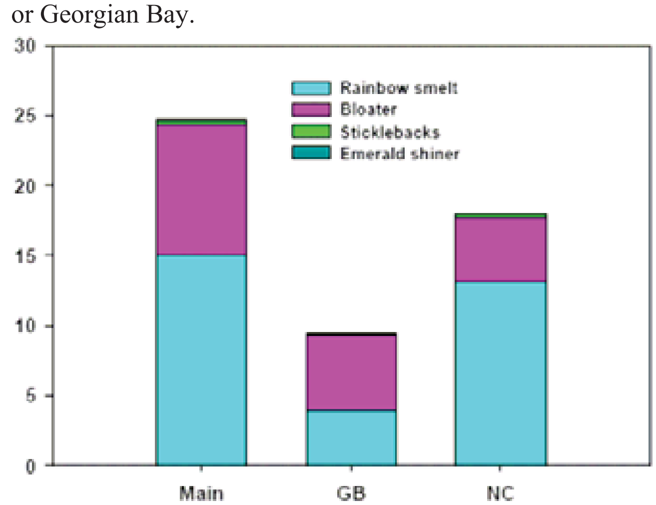


Fig 10 - Acoustic estimates of total pelagic fish biomass in Lake Huron's Main Basin (Main), Georgian Bay (GB) and North Channel (NC), 2009

Among Lake Comparisons

During 2009, Lakes Michigan and Huron had virtually identical estimates of pelagic biomass, but the fish communities were different. Lake Michigan remains dominated by alewife, with lower biomass of rainbow smelt and bloater, while the Lake Huron fish community is dominated by bloater and rainbow smelt.

Discussion

Lake Huron's Main Basin pelagic fish density and biomass increased during 2009. Compared to 2008, fish density nearly tripled, and fish biomass doubled. Most of the change was due to increased rainbow smelt abundance. Density increases of age-1+ bloater likely can be attributed to strong year-classes in 2005 and 2007, but the 2009 bloater year class appeared strong as well.

During 2009, threespine sticklebacks were again abundant in all three basins and a few ninespine sticklebacks were collected as well. While Threespine stickleback is not native to the upper Great Lakes, they have been present since the early 1980's. They have been collected rarely in bottom trawl surveys. Prior to 2008 they comprised only a small fraction of total density in acoustic surveys but they have been a substantial proportion of total density for two consecutive years.

Threespine sticklebacks comprise only a small proportion of total fish biomass due to their small individual size.

The greatest single change between 2008 and 2009 was the increase in rainbow smelt density. This occurred primarily in the main basin, where we observed high densities in Canadian waters near Goderich, Ontario and between Cheboygan and Alpena along the Michigan shoreline. Rainbow smelt densities were high in both areas, especially at shallower depths. Age-0 rainbow smelt density in 2009 was almost 14 times higher than the 2008 estimate, and more than double the previously highest density of 2006. In addition, age-1+ rainbow smelt density in 2009 was 4.7 times higher than the previous high measured in 2004.

Emerald shiners were scarce compared to their peak lakewide abundance during 2006, but they have returned as part of the pelagic fauna. Their recent lower abundance may be due to high piscivore densities combined with low abundance of alternative prey.

The 2009 fish community survey was similar to 2008 in two ways. During 2004-2007, density and biomass in the North Channel were higher than that in either Georgian Bay or the Main Basin, but in 2008 there were no significant differences across basins.

This survey sampled offshore 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 address nearshore zones and large embayments, especially Thunder Bay, Saginaw Bay, and Parry Sound. These areas could be responsible for a substantial amount of pelagic fish production, but could not be sampled safely due to the draft of our research vessel (3 m). We believe that our biomass estimates may have been higher had these areas been included because nearshore areas are well known as nursery habitats and could have supported higher densities of small fishes than offshore waters. This is especially true of rainbow smelt that we observed at shallow depths during 2009.

During 2010, forage availability for piscivores will likely be higher because both fish density and biomass have increased, and rainbow smelt are a preferred prey of salmonids. While this is a positive development, we urge caution when making decisions about predator fish management. While total pelagic density and biomass have seemingly returned to 1997 levels, it is important to recognize that differences between present and 1997 conditions are substantial. Alewife are now absent and both rainbow smelt and bloater are smaller in size. Furthermore, historical data from bottom trawl surveys suggest that 1997 was a year of relatively low prey abundance compared to other years.

Thus, we do not believe that conditions during 2010 represent complete return of the prey fish community that supported high predator biomass and a thriving Chinook salmon fishery. Lake Huron prey availability during 2010 will be influenced greatly by growth and survival of age-0 rainbow smelt hatched during 2009. While densities were the highest recorded since Lake Huron acoustic/midwater trawl surveys began, those fish will need to survive and grow in order to sustain a prey fish community with both a high biomass and larger size structure. Both attributes may be needed to sustain the piscivore biomass that occurred in the past. ✧

Status/Trends of Lake Huron Offshore Demersal Fish Community, 1976-2009 (USGS)

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 (**Fig. 1)** with additional sampling near Goderich, Ontario, since 1998. The 2009 main basin prey fish biomass estimate for Lake Huron was 16.53 kt, the lowest estimate in the time series, and less than five percent of the maximum biomass estimated in 1987. The estimated biomass of adult alewife and rainbow smelt in 2009 were the lowest observed in the time series, and populations were dominated by small fish. Adult bloater densities in Lake Huron have been increasing in recent years, but the 2009 biomass estimate was less than that estimated by the last full survey in 2007. Biomass estimates for trout-perch, ninespine sticklebacks, and slimy and deepwater sculpins in 2009 were the lowest observed in the time series. The 2009 biomass estimate for round goby was the lowest since 1998, the year after the species was first captured in the survey. Lake Whitefish abundance and biomass remain depressed compared to the 1990s, but biomass appears to be

increasing. No wild juvenile lake trout were captured in the 2009 survey for the first time since 2004. Relatively large numbers of juvenile walleye were captured near Au Sable Point in 2009, the first time that walleye in this size range have been captured since the inception of the survey.

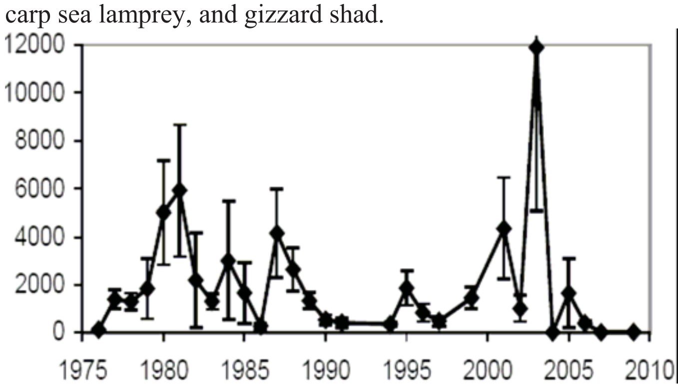
Fig 1 - Bottom trawl sampling locations, 2009

Introduction

Lake Huron supports valuable recreational and commercial fisheries that may be at risk due to recent widespread ecological changes in the lake. Recent major ecosystem changes in Lake Huron include the invasion of dreissenid mussels and drastic declines in the abundance of the native amphipod *Diporeia*, decreases in Lake Whitefish and Chinook salmon catches, significant changes in the abundance and species composition of the zooplankton community, the invasion of the round goby, and the collapse of the offshore demersal fish community.

Results

A total of 44 trawl tows were completed and all ports were sampled. The lake remained stratified during the survey. Eighteen species were captured in the 2009 survey: rainbow smelt, alewife, bloater, deepwater sculpin, trout-perch, Lake Whitefish, ninespine stickleback, slimy sculpin, lake trout, walleye, spottail shiner, round goby*,* yellow perch, common carp sea lamprey, and gizzard shad.



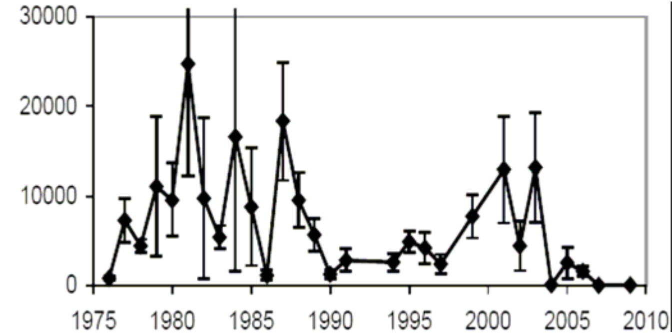


Fig 2 - Number (top) biomass (bottom) density of young-of-the-year (YOY) alewives per hectare, 1976-2009

Alewife, rainbow smelt, and bloater

Alewife abundance in Lake Huron remained low in 2009. Adult alewife density was the second-lowest observed (after 2004) and biomass was the lowest observed in the time series **(Fig. 2)**. Age-0 alewife density and biomass showed a slight increase in 2009, but remain near the all-time low for the time series **(Fig. 2)**. The majority of the alewives captured were less than 90 mm.

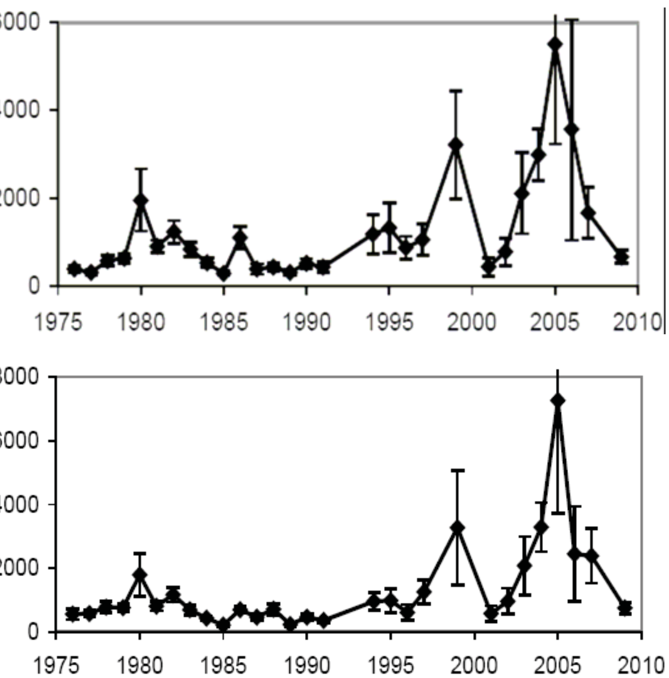


Fig 3 - Number (top) biomass (bottom) density of young-of-the-year (YOY) rainbow smelt per hectare, 1976-2009

Adult (YAO) rainbow smelt density continued to decline in Lake Huron, reaching the lowest abundance and biomass observed in the time series in 2009 **(Fig. 3)**. YOY rainbow smelt abundance and biomass were also reduced compared to recent years, with the lowest abundance and biomass estimates observed since 2002. The rainbow smelt population in Lake Huron was dominated by age-0 fish in 2009, with less than one percent of the population larger than 100 mm.

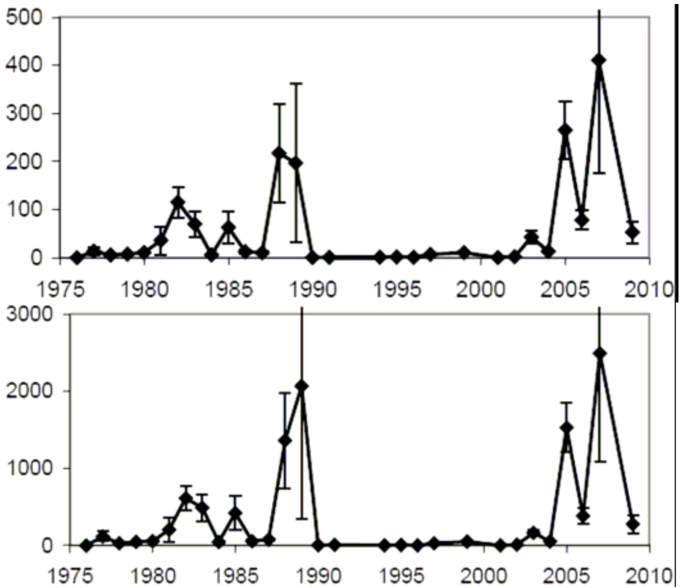


Fig 4 - Number (top) biomass (bottom) density of young-of-the-year (YOY) bloater per hectare, 1976-2009

Adult (YAO) bloater densities in Lake Huron have been increasing in recent years, and the 2009 abundance estimate was the highest observed since 1995, although the biomass estimate was smaller than 2007 **(Fig. 4)**. YOY bloater abundance was lower then observed since 2005, but was higher than most years in the 1990s **(Fig. 4)**. More than 20 % of bloaters captured in the 2009 survey were greater than 100 mm**.**

Other prey species

Abundance and biomass estimates for slimy and deepwater sculpins in Lake Huron were the lowest observed in the time series **(Figs. 5 and 6)**. The 2009 abundance estimate for deepwater sculpins represented four percent of the previous low estimate (2007) and <0.04 percent of the maximum estimate (1995). Slimy sculpins have not been captured in the Lake Huron bottom trawl survey since 2006.

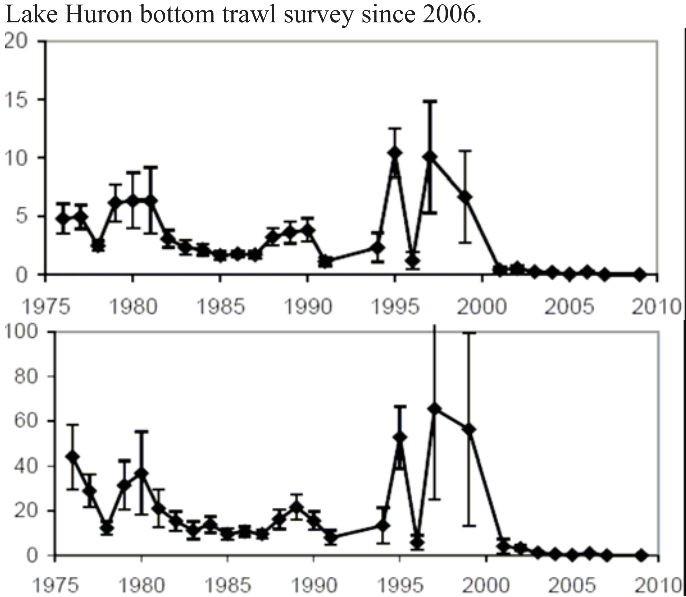


Fig 5 - Number (top) biomass (bottom) density of slimy sculpin per hectare, 1976-2009

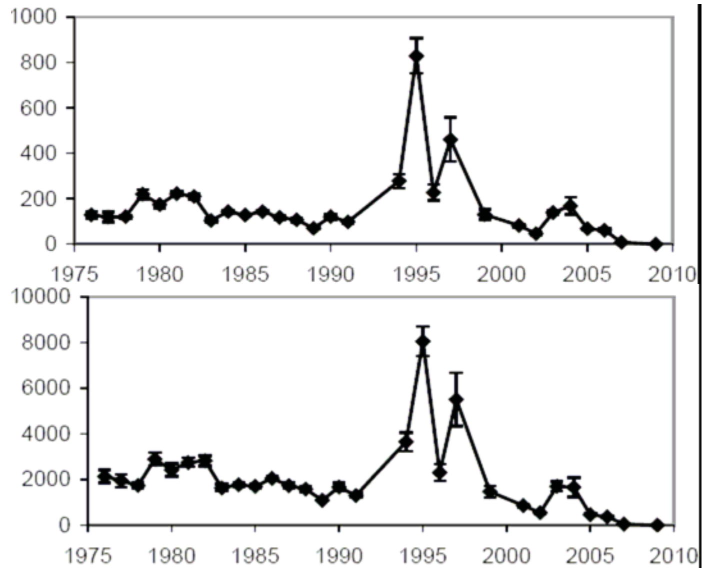


Fig 6 - Number (top) biomass (bottom) density of deepwater sculpin per hectare, 1976-2009

The 2009 abundance estimate for ninespine stickleback was the third-lowest in the time series, while the biomass estimate was the lowest. Trout-perch abundance was the second-lowest estimate in the time series; biomass was the lowest. The 2009 biomass estimates for ninespine stickleback and trout-perch were 2.8 percent and 1.1 percent of the maximum estimates for those species, respectively. The 2009 abundance and biomass estimates for round goby were the lowest since 1998, the year after the species was first captured in the survey.

Lakewide prey biomass

The total main basin prey biomass estimate was 16.53 kt, the lowest estimate in the time series **(Fig. 7).** This estimate is less than half (45.7%) of the biomass estimated in the last complete survey in 2007, and represents 4.5 % of the maximum biomass estimated in 1987. Approximately 69 %of the 2009 biomass estimate was made up of YAO bloater.

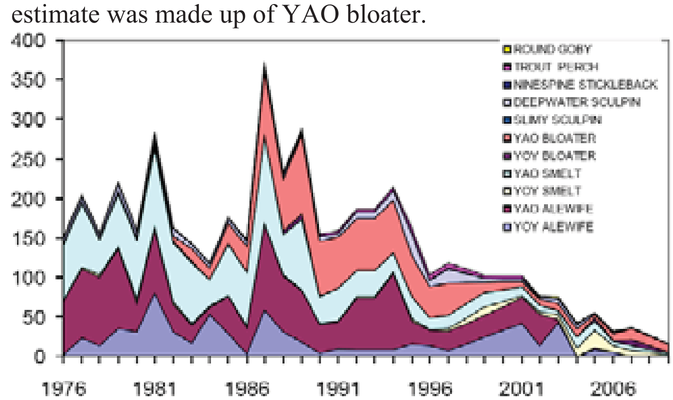


Fig 7 - Offshore demersal fish community biomass in the main basin, 1976-2009. Data were not collected in ‘92, ‘93, ‘98, 2000, and ‘08

Other species of interest

Lake Whitefish abundance and biomass remain depressed compared to the peak values observed in the early 1990s, but biomass has increased in the past few years **(Fig. 10)**. No wild juvenile lake trout were captured in the 2009 survey for the first time since 2004 **(Fig. 8)**. Relatively large numbers of juvenile walleye were captured near Au Sable Point in 2009 **(Fig. 9)**. This is the first time that walleye in this size range have been captured since the inception of the survey.

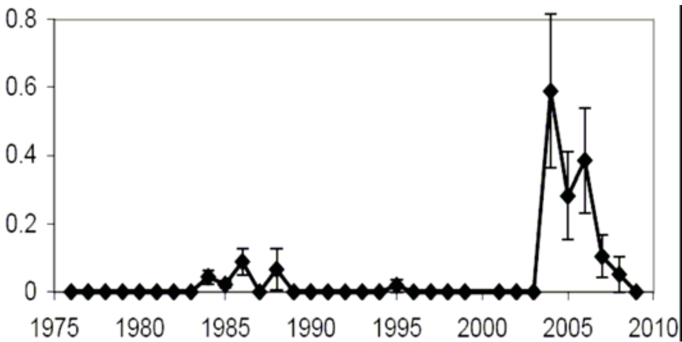


Fig 8 - Density of wild juvenile lake trout collected in fall bottom trawls, 1976-2009

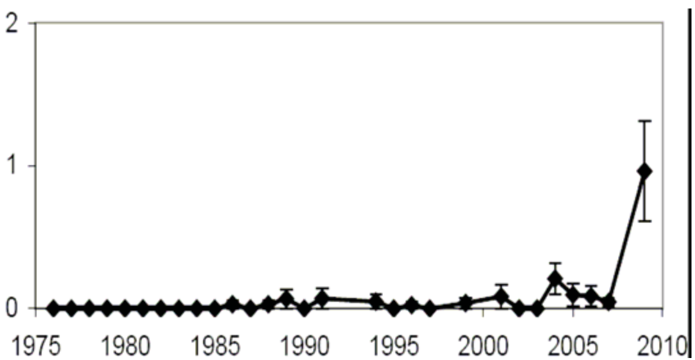


Fig 9 - Density of walleye collected in fall bottom trawls, 1976-2008.

Discussion

The abundance of prey fish in Lake Huron has continued to decline since the collapse of the offshore demersal fish community was reported. The estimated lakewide biomass of prey fish in 2009 was the lowest recorded since the survey began, and is less than half of that estimated in the last complete survey in 2007. The estimated biomass of YAO alewife and rainbow smelt in 2009 were the lowest observed in the time series, and the existing populations were dominated by small fish. The reduction in abundance of these exotic species is consistent with fish community objectives for Lake Huron, but does not bode well for lake trout and Chinook salmon populations in the lake.

YAO bloater are the only prey species in Lake Huron to show a positive trend in abundance in recent years. YAO bloater abundance has increased since approximately 2001, and the 2009 abundance estimate was the highest observed since 1995.

All three of the primary prey fish species in Lake Huron (alewife, rainbow smelt, and bloater) have shown the highest estimated abundance of YOY fish in the time series since 2003. Estimated YOY alewife abundance reached an all-time high in 2003, the year that the adult population crashed, and YOY bloater abundance estimates were very high in 2005 and 2007.

Sculpins, 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. Biomass estimates for sculpins, sticklebacks, and trout-perch in 2009 were the lowest observed in the time series, suggesting that these species will not compensate for low abundance of the primary prey species.

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 have declined in abundance since. Our results suggest that round goby are currently at low abundance in the offshore waters of Lake Huron.

The estimated lakewide biomass of common offshore prey species in Lake Huron has reached the lowest level observed since 1976. 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 zebra mussels, quagga mussels, and round gobies, all of which have been introduced since approximately 1990.

The reproductive success of walleye in Saginaw Bay has increased greatly since approximately 2003 (Fielder et al. 2007). Juvenile walleye were captured in 2009 for the first time in the history of the Lake Huron fall survey, suggesting that juvenile walleye may now be using offshore areas of the lake near Saginaw Bay as nursery habitat. Catches from future surveys will determine if this is a continuing trend.

The results of this survey indicate that the abundance and biomass of prey species in the main basin of Lake Huron remain are at the lowest levels observed since the inception of the survey. The continuing decline in prey fish abundance may have serious implications for the growth, condition, and survival of lake trout and Chinook salmon populations in the lake. ✧

Harvest and Effort of Commercial Fisheries of Lake Huron through 2009 (LHC)

Lake Huron continues to support an important and valuable commercial fishery. Commercial fisheries exist in the jurisdictions of all three management agencies on Lake Huron and in all three basins.

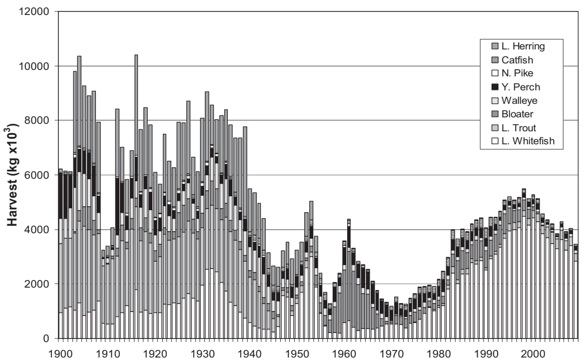


Fig 1 – Total lake-wide commercial harvest by species, 1900-2009

Lake-wide harvest of all species combined was down slightly in 2009 relative to 2008 **(Figs 1 and 2)**. Market conditions continue to play an influential role in the behaviour of the fisheries of Lake Huron as increasing production costs have reduced fishing effort in some locations, especially more remote areas of the lake. Additionally, widespread ecosystem change and shifting food-web dynamics continue to be in important consideration in the management of the commercial fisheries on Lake Huron.

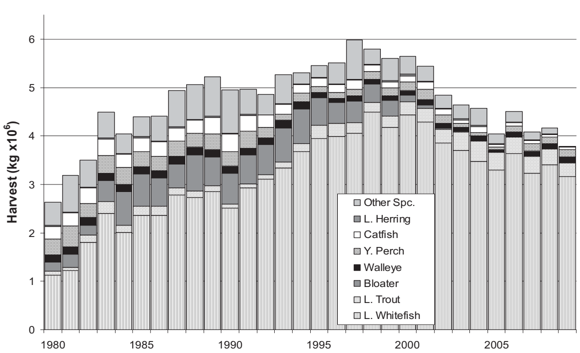


Fig 2 – Total lake-wide commercial harvest by species, 1980-2009

Current Harvest versus Historical Harvest

Lake-wide harvest continues to be below levels reported in the first half of the 20th century but still noticeably higher than the period between 1940 and 1980 **(Fig 1)**. The current species composition of the harvest continues to be dominated by Lake Whitefish with other species contributing less than 20% to the overall harvest **(Fig 2)**. This is markedly different than species composition during the early to middle part of the twentieth century when lake herring, deepwater chub, and lake trout where large components of the Lake Huron commercial fisheries landings.

Most of the commercial landings continue to come from the Ontario side of the main basin, although substantial landings are reported in the fisheries licensed by CORA and MDNR. Lake–wide harvest of all species was down slightly in 2009 relative to 2008.

Recent Trends in Commercial Fishing Effort

Trap net effort was down again in 2009, continuing a downward trend that extends back to at least the 1990's. Large-mesh gill net effort of 4.5-5.5" stretch measure continues to be the dominant gill net gear. Large-mesh gill net effort was up slightly from 2008. Large mesh gill net effort has been relatively stable over the past decade and has not shown the same decline as trap and small-mesh gill net effort.

Most of the large-mesh gill net effort continues to be deployed in the Ontario waters of the main basin. The amount of large-mesh gill net deployed in Georgian Bay has steadily increased since 1990. Small-mesh gill nets of 2.25"-3.75" stretch measure continue to be used on a very limited basis. Almost all of the small mesh effort deployed in 2009 was by Ontario fishermen targeting yellow perch in the southern main basin. There continues to be limited small mesh effort targeting lake herring and round whitefish in the northern part of the main basin. Virtually all of the commercial fishing activity licensed by MDNR is conducted with trap nets although 30,800 set hooks were reported targeting catfish in Saginaw Bay.

Recent Trends in Lake Whitefish Harvest

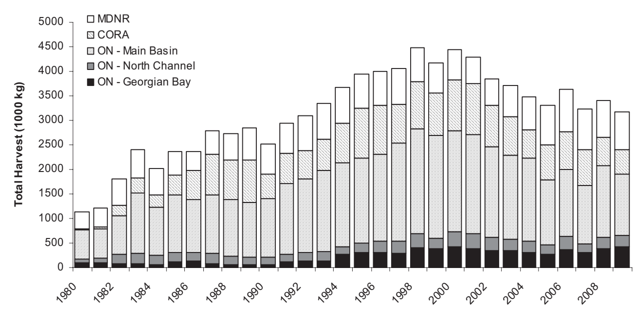


Fig 3 - Total lake-wide commercial harvest of lake whitefish by management agency and lake basin, 1980-2009.

Harvest of Lake Whitefish was down slightly in 2009 relative to 2008. Harvest reported from Georgian Bay, the North Channel and CORA waters of the main basin actually increased slightly in 2009. Harvest continues to be above the levels reported throughout most the 1980's.

Recent Trends in Lake Trout Harvest

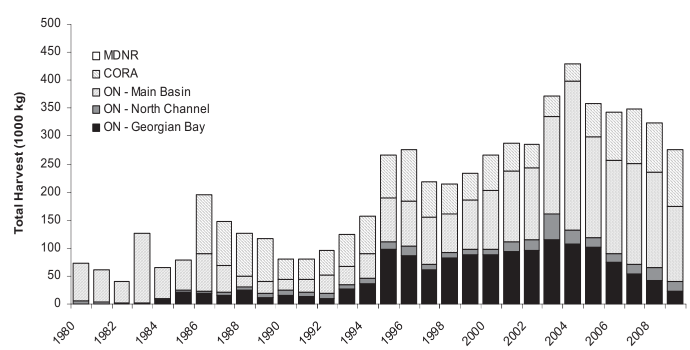


Fig 4 - Total lake-wide commercial harvest of lake trout by management agency and lake basin, 1980-2009.

Harvest in 2009 was down noticeably relative to the previous 7 years. The largest decrease was reported from the Ontario side of the main basin. The harvest from Georgian Bay has steadily declined since 2004. Lake-wide harvest continues to be above any harvest reported between 1980 and 2000.

Recent Trends in Yellow Perch Harvest

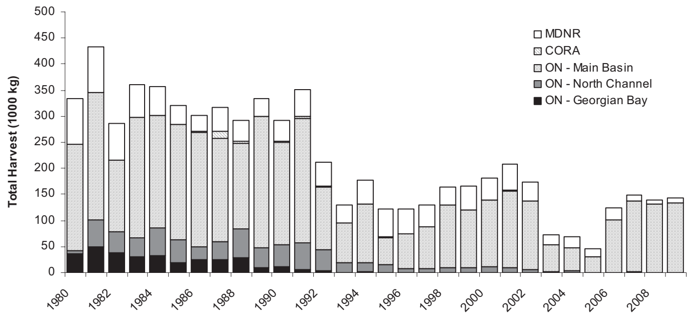


Fig 5 - Total lake-wide commercial harvest of yellow perch by management agency, 1980-2009.

Overall, the harvest of yellow perch in 2009 was up slightly from 2008, and is still noticeably higher than the period between 2003 and 2005.

Virtually all of the yellow perch harvest was reported from the Ontario side of the main basin. Yellow perch harvests from the North Channel and Georgian Bay have been very low since the mid 1990's.

Recent Trends in Walleye Harvest

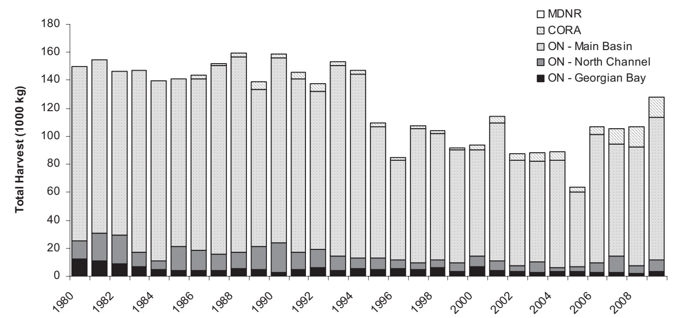


Fig 6 - Total lake-wide commercial harvest of walleye by management agency, 1980-2009

Overall, the harvest of walleye in 2009 was up noticeably from 2008, and was the highest reported harvest since 1994. Most of the walleye harvest was reported from the Ontario side of the main basin. ✧

Lake Trout Production and Stocking (USFWS)

Lake Trout Restoration Update

Lake Trout Yearlings

During 2009, the U.S. Fish and Wildlife Service released 4,076,191 yearling lake trout into the upper Great Lakes at 43 locations, in accordance with Lake Committee rehabilitation plans. Of the total, 175,912 were released from shore, and 3,900,279 were released offshore using the M/V Baird. All lake trout were either fin clipped or coded-wire tagged following marking guidelines. Distribution included 1,385,531 fish into Lake Huron and 2,690,660 fish into Lake Michigan.

The USFWS also released a total of 691,000 yearling lake trout, including Seneca Lake Wild (SLW), Superior Traverse Island Wild (STW), Klondike Reef Wild (SKW), and a hybrid Seneca strain at six sites in the lower Great Lakes. Lake Erie received 169,000 yearlings off Dunkirk, NY; Lake Ontario received 522,000 yearlings at five sites in the lake. All fish were stocked offshore by the USFWS and the New York Department of Environmental Conservation. All yearlings stocked received an adipose fin clip and coded wire tag. Fish for this effort were raised at White River National Fish Hatchery in Vermont, while the Allegheny National Fish Hatchery is undergoing renovations.

Lake Trout Fall Fingerlings

During 2009, the USFWS released 496,416 lake trout fingerlings from Iron River NFH and Pendills Creek NFH into lakes Huron and Michigan between October 18 and November 5. Lake Michigan received 296,394 fish which were shore stocked at seven sites. Lake Huron received 200,022 fish which were stocked at one offshore site using the Baird. No lake trout fall fingerlings were stocked in the lower Great Lakes.

Spring 2010 Stocking Plans

The USFWS is preparing to stock approximately 4,154,500 yearling lake trout into the upper Great Lakes in 2010, including:

► 1,950,000 from Jordan River NFH,
► 1,254,500 from Iron River NFH, and
► 950,000 from Pendills Creek NFH

The Baird will continue to deliver lake trout yearlings to offshore sites in Lake Huron and Lake Michigan in 2010.

Lake trout will be produced at White River NFH until Allegheny NFH is functional again. With the assistance of New York Department of Environmental Conservation, approximately 450,000 lake trout are scheduled to be stocked into the lower Great Lakes in 2010. Lake Erie is scheduled to receive approximately 100,000 - 160,000 yearlings, and Lake Ontario will receive the remaining fish. Because of egg import restrictions, only one strain, a Seneca hybrid from the Vermont hatchery system, is scheduled to be released in May 2010. Once again all yearlings will receive an adipose fin clip and coded wire tag. All stocking is currently scheduled to occur offshore.

Lake Trout Yearling Quality and Production Potential

In 2004, the USFWS adopted revised criteria for assessing the quality of propagated lake trout. Because rearing environments are unique at each hatchery, fish quality targets for visceral fat, eyes, gills, and fins were established for each strain reared at Iron River NFH, Jordan River NFH, and Pendills Creek NFH. All fish stocked during 2009 met or exceeded the quality targets, although yearling size varied over time and across hatcheries during the season.

Current and potential yearling production:

Hatchery	Projected 2010 Numbers	Delayed Hatch	Station Expansion
Jordan River	1,950,000	2,100,000	2,100,000
Iron River	1,254,500	1,400,000	1,400,000
Pendills Creek	950,000	950,000	1,800,000
TOTALS	**4,154,500**	**4,450,000**	**5,300,000**

Existing capability allows the USFWS to rear some fall fingerlings in addition to our yearling lake trout. Our hatcheries were able to produce and stock 496,416 lake trout fingerlings in 2009 and could sustain that level during the next few years. Our hatcheries could eventually produce up to 950,000 fingerlings each year; however, this would require additional operational and new construction funding which is not currently appropriated. Since our production programs concentrate on yearlings, our ability to provide fingerlings is dependent on many conditions, and we cannot guarantee their availability.

Lake Trout Broodstock Management

Brood Stock Production Strains - Yearling lake trout stocked in the upper Great Lakes in 2009 came from three brood stock strains including: Superior Apostle Island (SAW), Lewis Lake (LLW), and Seneca Lake (SLW). Lake trout eggs for spring 2010 yearlings were provided by three USFWS facilities: Sullivan Creek NFH, Michigan (SLW); Iron River NFH, Wisconsin (SAW); and Saratoga NFH, Wyoming (LLW). In addition to these strains, the wild Lake Superior Klondike Reef (SKW) strain is maintained, and a limited number of eggs were hatched for yearling production in 2011.

Lake Trout Health

Fish Health Screening - The LaCrosse Fish Health Center (LFHC) conducts two fish health inspections each year at the six NFHs in the Midwest Region. Approximately 3,279 tissue and ovarian fluid samples were screened in 2009 for nine certifiable fish pathogens as listed in the USFWS Aquatic Animal Health Policy and the Great Lakes Fish Disease Model Program. No certifiable fish pathogens were detected, therefore each facility maintains its Class A (specific pathogen free) status. The LFHC also conducts a fish quality assessment of yearling lake trout prior to stocking.

In 2009, 213 fish tissue samples were collected from fish captured in the streams supplying water to Iron River NFH (Schacte Creek), Jordan River NFH (5 & 6 Tile), Pendills Creek NFH (Videan's Creek), and Sullivan Creek NFH (Sullivan Creek) and screened for seven pathogens listed in the USFWS Aquatic Animal Health Policy and the Great Lakes Model Program. No pathogens were detected in facility water supplies.

Lake Trout Broodstock Health

Lake trout and brook trout broodstock held at Sullivan Creek NFH, Michigan and Iron River NFH, Wisconsin were specific pathogen free in 2009 (spring and fall fish health inspections were conducted). In Fall 2009, Klondike eggs from Klondike Reef, Lake Superior were transferred to the Genoa NFH Isolation Facility.

Hatchery Construction Projects

<u>Jordan River NFH</u>

A project to update the facility's effluent treatment system will be awarded by the end of March 2010, with construction to begin in May.

<u>Pendills Creek NFH</u>

Replacement of the existing production raceways began in May 2008 and was substantially completed by October of 2009.

<u>Allegheny NFH</u>

The Allegheny NFH received funding in FY '09. A $1.68 million construction contract was awarded on March 12, 2010 to Wm. T. Spaeder Co., Inc. of Erie, PA. This contract is for the construction of a degassing/aeration tower.

Lake Huron Lake Trout Spawning Survey

During the fall of 2009, the USFWS using the Baird attempted to conduct lake trout spawning surveys at two offshore Lake Huron reefs—Yankee Reef and Six Fathom Bank Refuge (SFB). Due to high winds and inclement weather, the USFWS was only able to assess SFB. The catch of unclipped, presumably wild lake trout captured at SFB was the second highest on record (27.43%). A total of 31 unclipped lake trout were captured, and the CPE of unclipped lake trout was 25.8 fish per 1000' of gill net. Yearling stocking at SFB ceased in 1998.

A similar increase of unclipped lake trout was observed at Yankee Reef during the fall spawning assessment conducted in 2008. Although upward trends of wild lake trout are quite recent, there appears to be some evidence of natural recruitment at these offshore reefs. The increases in relative abundance of unclipped lake trout at SFB in 2009 and Yankee Reef in 2008 provides some measure of encouragement for the USFWS' efforts towards lake trout rehabilitation in this region of Lake Huron. Spawning surveys at both reefs are scheduled for the fall of 2010.

Great Lakes Mass Marking

The USFWS received $1.7 million in FY 08 and $1.5 million in FY09 for the purchase of mass marking equipment. Those monies were used to purchase 2 Autofish trailers, 1 manual trailer, and to upgrade the electrical supplies at regional NFHs and at Marquette State Fish Hatchery. Residual funds will be used for additional equipment purchases and hatchery electrical upgrades where approved tagging projects take place in the future.

In FY '10, Congress awarded the Service $1.0 million to begin tagging operations. The newly established Great Lakes Regional Marking Committee, the inter-agency oversight group recommended by the Mass Marking Task Group, and the Council of Lake Committees have approved three pilot projects in FY '10 that will tag about 5 million USFWS lake trout for lakes Michigan and Huron, 1.0 million State-reared Chinook salmon for lakes Michigan and Huron, and 0.9 million State-reared Chinook salmon for Lake Ontario. FY '10 funds have paid for electrical upgrades and other infrastructure improvements at the Wild Rose (WI DNR) and Platte River State (MI DNR) Fish Hatcheries in preparation for marking of chinook salmon in March and April, and have purchased all CWTs and expendable equipment ($0.5 million) required for all three tagging projects.

In FY09, the USFWS and MI DNR worked with Northwest Marine Technologies to improve the processing rate for lake trout through the AutoFish trailers, and through-put is now at an acceptable level. ✧

Sea Lampreys in Lake Huron 2009 (USFWS)

Introduction

Enhanced treatment strategies to improve the efficacy of conventional lampricide treatments in other Lake Huron tributaries were added to several treatments this year. These strategies included: targeting lampricide concentrations greater than minimum lethal concentration; extending lampricide treatment blocks by one or two hours; conducting secondary applications of lampricide to treat backwaters, springs, and small feeder streams. Enhanced treatment strategies were used in 16 of 18 treatments during 2009.

Tributary Information

Lake Huron has 1,761 tributaries (1,334 Canada, 427 U.S.). One hundred seventeen tributaries (56 Canada, 61 U.S.) have historical records of larval sea lamprey production. Of these, 71 tributaries (36 Canada, 35 U.S.) have been treated with lampricide at least once during 2000 - 2009. Forty-seven tributaries (21 Canada, 26 U.S.) are treated on a regular cycle.

► Lampricide treatments were completed in 18 tributaries (8 Canada, 10 U.S.) and the St. Marys River.

► A total of 138 ha (86 Canada, 52 U.S.) of larval habitat in the St. Marys River was treated with granular Bayluscide 3.2% Granular Sea Lamprey Larvicide. All work relating to the St. Mary application was performed by DFO personnel. For the first time, this work was conducted using an innovative technology employing a high pressure spray system to apply granular Bayluscide.

► The Chippewa, upper Ocqueoc and Black Mallard rivers were treated when stream discharge was greater than normal.

► Tawas Lake Outlet and its tributary Cold Creek were treated as well as the Tawas Lake tributaries of Silver Creek and Sims Creek. Treatment collections indicated that larvae migrated downstream from Cold Creek into Tawas Lake Outlet rather than originating from spawning adults in the outlet proper.

► Saddler Creek, a tributary of the East AuGres River, was treated further upstream than in past treatments.

► Treatment of the Spanish River was deferred due to excessive discharge caused by heavy rains. Two tributaries, Birch and La Cloche creeks, were successfully treated earlier in the year. The Spanish River has been rescheduled for treatment during 2010.

► Treatment of Marl Creek was deferred due to extreme flow variations caused by a large scale irrigation system operating with the stream. The treatment has been rescheduled for April 2010, prior to the start-up of the irrigation pumps.

Alternative Control
Sterile-Male-Release Technique

► A total of 459 spawning-phase male sea lampreys were delivered to the sterilization facility from Lake Superior trapping operations; 6,971 from Lake Michigan trapping operations; 12,947 from Lake Huron trapping operations; and 1,925 from Lake Ontario trapping operations.

► A total of 19,212 sterilized male sea lampreys were released in the St. Marys River from May to July. The estimated resident population of spawning-phase sea lampreys in the St. Marys River was 13,424. Assessment traps removed 5,287 sea lampreys, an estimated reduction in reproduction of 39% through trapping. The ratio of sterile to resident male sea lampreys remaining in the St. Mary River was estimated at 3.8:1.

► In the St. Mary River, the theoretical reduction from trapping and enhanced sterile male release was estimated at 87% during 2009. The theoretical reduction in reproduction from trapping and the enhanced sterile male release program averaged 86% during 1997-2009. Prior to the enhanced program (1991-1996), the theoretical reduction in reproduction averaged 58%.

► The release of sterile males combined with the removal of sea lampreys by traps reduced the theoretical number of effective fertile females in the St. Marys River from about 5,088 to 643 during 2009.

► In the St. Mary River rapids, 1 normal male lamprey was observed spawning and 9 nests were sampled (approximately 2,350 eggs). Average egg viability in nests was 26% (range 0% - 98%). Average egg viability (weighted by nests per year) during 1997-2008 was 30%.

► The potential for using sterilized females for sea lamprey control continued in the Trout River (Rogers City, Michigan). About 20,000-30,000 female lampreys are available annually that could allow expansion of this integrated management technique. The primary objective of the four-year study is to determine if application of a high number of sterile females to a tributary can prevent or forestall additional lampricide treatments. Secondary objectives of the study include determining if sterile females are surviving and participating in spawning, and to investigate the viabilities of eggs in random samples.

A total of 5,009 sterilized female sea lampreys were released into the Trout River between May 30 and June 21. Sea Lampreys were observed resting, nest building, and/or actively spawning in 58 nests. Observations of 712 sterile females, 5 normal females, 1 sterile male and 58 normal males were made between June 2 and June 30. Eggs were sampled from 78 nests and had an average viability of 5.6% (range 0% - 100%).

Barriers

Presently, there are 17 sea lamprey barriers on Lake Huron. An intensive effort to inventory and ground truth the information contained in the National Inventory of Dams (NID) has been undertaken for barriers located on U.S. tributaries to the Great Lakes. During 2009, 19 additional barriers were inventoried, totaling 217 in the Lake Huron basin.

Assessment

Larval

► Larval assessment surveys were conducted on a total of 88 tributaries (38 Canada, 50 U.S.) and offshore of 14 tributaries (1 Canada, 13 U.S.).
► Surveys to estimate the abundance of larval sea lampreys were conducted in 33 tributaries (14 Canada, 19 U.S.) and offshore of 3 tributaries (1 Canada, 2 U.S.).
► Surveys to detect the presence of new larval sea lamprey populations were conducted in 19 tributaries (5 Canada, 14 U.S.) and one offshore Canadian tributary. No new populations were discovered.
► Post-treatment assessments were conducted in 14 tributaries (6 Canada, 8 U.S.) to determine the effectiveness of lampricide treatments during 2008 and 2009.
► Monitoring of larval sea lampreys in the St. Marys River continued during 2009.

Eight hundred and eighty-nine 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. Mary River is estimated to be 3.3 million (95% confidence limits: 2.1 - 4.4 million).

Spawning-phase

► 27,197 sea lampreys were trapped in 20 tributaries during 2009
► The estimated population of spawning-phase sea lampreys in Lake Huron for 2009 was 121,653, which was greater than the fish-community objective target of 73,000.
► A total of 5,630 spawning-phase sea lampreys were captured in traps operated in the St. Marys River at the Great Lakes Power facility in Canada and the U.S. Army Corps of Engineers and Edison Sault Electric facilities in the U.S. The estimated population in the river was 13,424 sea lampreys and trap efficiency was 42%
► A total of 12,947 spawning-phase male sea lampreys were delivered to the sterilization facility from trapping operations on the Lake Huron tributaries Au Sable (70), Cheboygan (6,608), East AuGres (360), Echo (791) Thessalon (1,041), Greene (5), Ocqueoc (1,395), St. Marys (2,597), and Tittabawassee (80) rivers.

Parasitic-phase

The target rate for sea lamprey marking on lake trout in Lake Huron is 5 fresh wounds per 100 fish. ✧

Lake Superior

Prey Fish Populations in Lake Superior, 2009 (USGS)

Abstract

Some 63 stations distributed around the perimeter of the lake were sampled with 12-m Yankee bottom trawls towed cross-contour. The lakewide mean relative biomass estimate for the entire fish community was 1.22 kg/ha which is the lowest in the 32-year survey history. Biomass across jurisdictions was relatively even; levels in Canada East, Canada West, Michigan, Minnesota and Wisconsin waters were 1.99, 1.29, 1.12, 1.12, and 0.62 kg/ha, respectively. Dominant species in the catch, in order of relative abundance, were rainbow smelt, lean lake trout, siscowet lake trout, bloater, and Lake Whitefish. Compared to 2008 levels, rainbow smelt, Lake Whitefish, bloater and Cisco biomass decreased while lean lake trout biomass increased. Year-class strengths for the 2008 Cisco and bloater cohorts were well below average. A decline in smelt year class strength reversed a trend of increasing strength from 2003-2008. The 2008 Cisco age structure was dominated by age-6 and older fish, which accounted for 79% of the ciscoes captured.

Densities of all sizes of hatchery lake trout continued a pattern of decline observed since 1993-1996. Densities of small and intermediate-size wild (lean) lake trout continued a decreasing trend observed since 1996-1998. Density of large lean lake trout has been relatively stable since 1986. Siscowet have shown a pattern of variable but increasing density since 1980. For 2009, densities of small- and intermediate-size siscowet decreased while densities of large siscowet remained unchanged. In the 2009 survey, proportions of total lake trout density that were hatchery, lean and siscowet were 5, 61, and 34%, respectively.

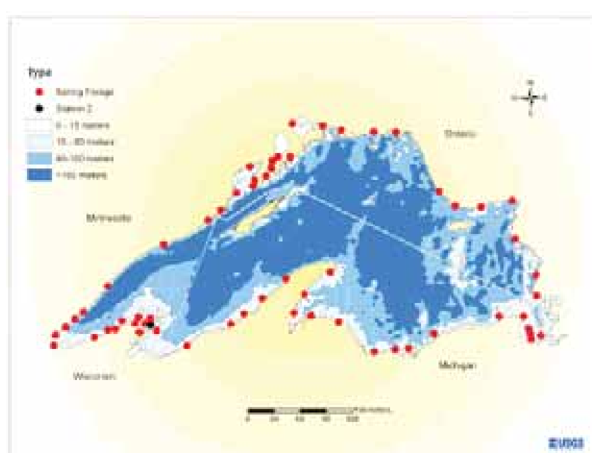


Fig 1 - Locations of 63 stations (red and black dots) sampled during the 2009 annual spring bottom trawl survey

Spring Survey

A total of 63 stations distributed around the perimeter of Lake Superior were sampled with bottom trawls during daylight hours between 27 April and 19 June 2009 (Fig. 1). A single sample was taken at each station with a 12-m Yankee bottom trawl towed cross-contour.

A very large catch of fish was collected at Station 2 in Wisconsin waters of Lake Superior (**Fig. 1**). This catch contained 4,421 fish weighing 250 kg, which represented 25% of all fish caught and 69% of the total biomass in the spring survey. Most of the site 2 catch consisted of bloaters (52%) and shortjaw Cisco (23%). This one sample accounted for 66% of all Cisco, 53% of all whitefish, 80% of all bloater, and 95% of all shortjaw Cisco captured in spring 2009. Estimates of biomass for Cisco, bloater, and shortjaw Cisco at this site were 8 standard deviations greater than the lake-wide means, while Lake Whitefish was 6 standard deviations greater than their mean. Because this one sample had an extreme effect on lake-wide and regional estimates, we omitted this sample from subsequent results. Inclusion of data from Station 2 did not change any trends noted in this report, but by excluding it we feel our overall results more accurately represent lake-wide conditions.

Cisco

Year-class strength for the 2008 Cisco cohort was estimated at 0.21 fish/ha, the seventh weakest year-class observed over the 32-year survey and one of six year classes of ≤ 1 fish/ha observed since 1999 **(Fig. 2)**. Year-class strength for the 2008 cohort in U.S. waters was 0.22 fish/ha and 0.18 fish/ha in Canadian waters. For comparison, the density of the strong 2003 year class was estimated at 182.25 fish/ha and moderate 2002 and 2005 year classes were estimated at 35.12 and 24.66 fish/ha, respectively **(Fig. 2)**.

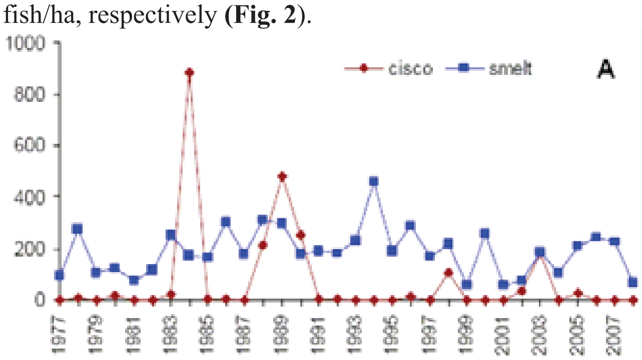


Fig 2 - Year-class strength (number of age-1 fish/ha) for Cisco and rainbow smelt for all nearshore sampling stations for cohorts produced from 1977 to 2008.

Mean relative biomass of age-1 and older Cisco (0.02 kg/ha) in 2009 was lower than in 2008 (0.31 kg/ha) **(Fig. 3)** and is the second lowest value in the 32-year record. The lowest relative biomass recorded was 0.01 kg/ha in 1978. The 2009 decrease continues the downward trend in biomass observed since 2004-2006 when biomass averaged ≥ 1.80 kg/ha and is below the long term 1978-2006 average of 2.90 kg/ha.

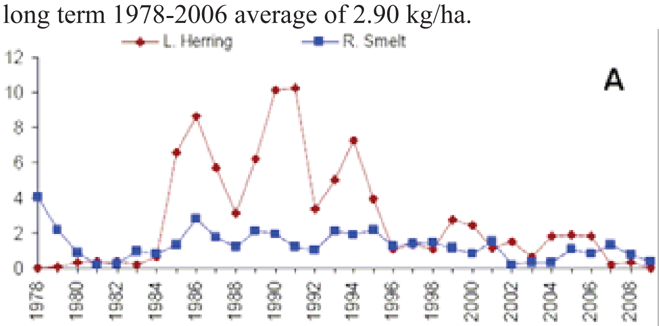


Fig 3 - Mean relative biomass (kg/ha) of age-1 and older Cisco and rainbow smelt for all nearshore sampling stations, 1978-2009

Declines in relative Cisco biomass were observed in all jurisdictions between 2008 and 2009 and continue the downward trend across all jurisdictions since 2004-2006 (**Fig. 4**). Relative biomass estimates as a percent of long-term means were low in W. Ontario (4.6%) and very low in Wisconsin (0.05%), Minnesota (0.39%), Michigan (0.11%) and E. Ontario (0.00%). This pattern is consistent with low Cisco recruitment since 2003 and the tendency of adult ciscoes to utilize pelagic habitat not sampled by the bottom trawl.

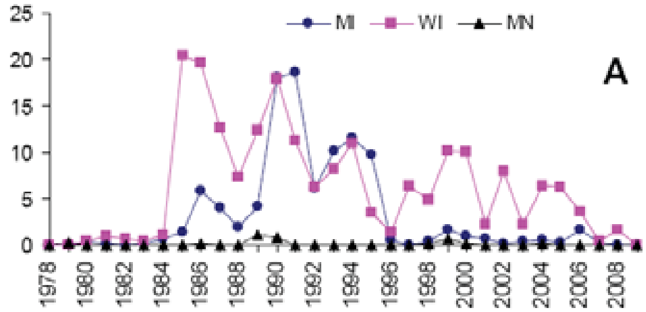


Fig 4 - Mean relative biomass (kg/ha) of age-1 and older Cisco in nearshore waters of MI, WI, and MN, 1978-2009

The mean relative density of all Cisco showed a declining trend from 44.86 fish/ha in 2006 to 2.38 fish/ha in 2008 and 0.47 fish/ha in 2009. The 2009 Cisco age structure was dominated by the 2003 year class (age-6) and older fish, with ≥ age-6 ciscoes collectively accounted for 79% of the mean relative density **(Fig. 5)**. The 1998, 2002, 2003, 2005 cohorts and the most recent 2008 cohort accounted for 20, 27, 26, 4 and 14% of the mean relative density, respectively. Older cohorts (≥ age-7) represented 53% of the mean relative density **(Fig. 5)**.

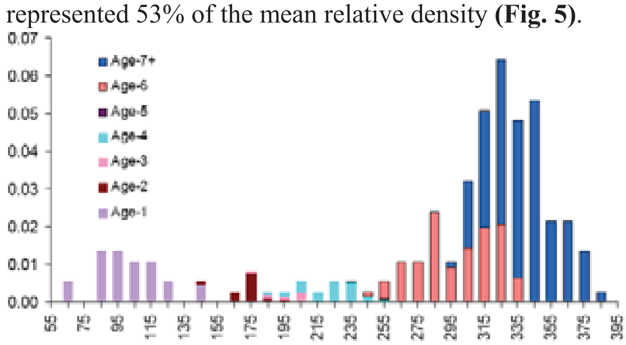


Fig 5 - Estimated age-length distribution of Cisco caught at all nearshore sampling stations in Lake Superior in 2009

Rainbow Smelt

Year-class strength of rainbow smelt decreased from 226.26 fish/ha for the 2007 cohort to 65.3 fish/ha for the 2008 cohort **(Fig. 2)**. Year-class strength for the 2008 cohort was 38.4% of the average over the 32-yr survey period (189.8 fish/ha). The 2008 year-class was stronger in U.S. waters (96.0 fish/ha) compared to that in Canadian waters (16.9 fish/ha).

Mean relative biomass for age-1 and older rainbow smelt decreased 50% from 0.76 kg/ha in 2008 to 0.38 kg/ha in 2009 (**Fig. 3**) and was 30% of the 31-year mean of 1.30 kg/ha. Relative biomass of rainbow smelt declined in Wisconsin and Minnesota waters from 0.77 and 0.15 kg/ha in 2008 to 0.25 and 0.05 kg/ha in 2009, respectively **(Fig. 6)**. In contrast, biomass increased in Michigan waters from 0.34 to 0.71 kg/ha (Fig. 6A). Rainbow smelt biomass in W. Ontario waters decreased from 2.59 kg/ha in 2008 to 0.28 kg/ha in 2009 **(Fig. 6)** while biomass in E. Ontario waters increased slightly from 0.17 kg/ha in 2008 to 0.24 kg/ha in 2009.

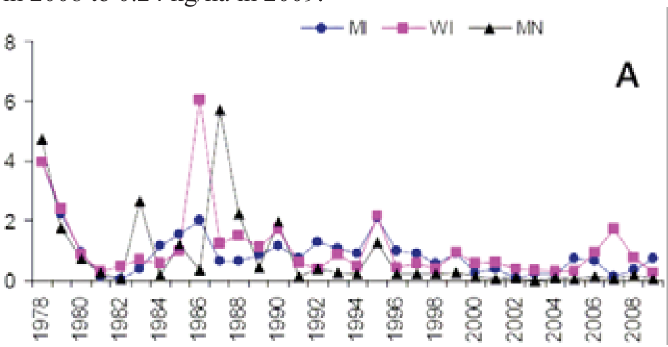


Fig 6 - Mean relative biomass (kg/ha) of age-1 and older rainbow smelt in nearshore waters of MI, WI and MN, 1978-2009

Bloater

Like the 2006 and 2007 cohorts, strength of the 2008 bloater year-class remained low (0.8 fish/ha) compared to the 2005 cohort (15.84 fish/ha; **Fig. 7)** and well below the 31-year average of 10.8 fish/ha. Year-class strength was greater in U.S. waters (1.23 fish/ha) compared to Canadian waters (0.08 fish/ha).

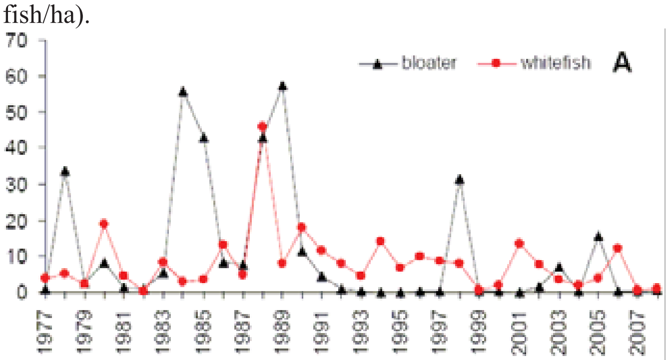


Fig 7 - Year-class strength for bloater and lake whitefish for all nearshore sampling stations for cohorts produced from 1977 to 2008

Mean relative lake-wide biomass of age-1 and older bloater declined from 0.19 kg/ha in 2008 to 0.10 kg/ha in 2009 and contrasts with a recent peak of 1.36 kg/ha in 2006 **(Fig. 8)**. The 2009 relative biomass estimate was the lowest value observed since 1978 when it was 0.13 kg/ha. Between 2008 and 2009, bloater biomass declined in all U.S. jurisdictions, from 0.64 to 0.09 kg/ha in Michigan, 0.29 to 0.002 kg/ha in Wisconsin, and 0.01 to 0.001 kg/ha in Minnesota **(Fig. 9)**. Bloater biomass increased from 0.10 to 0.24 kg/ha in W. Ontario and from 0.02 to 0.10 kg/ha in E. Ontario.

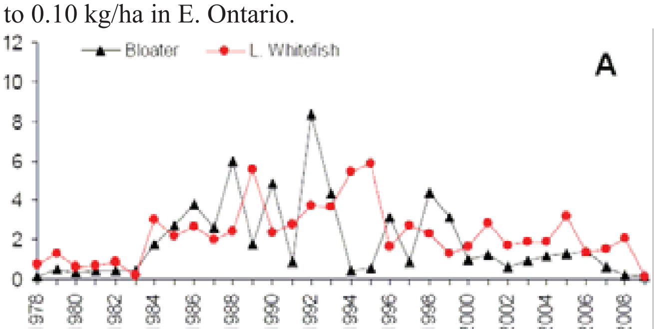


Fig 8 - Mean relative biomass (kg/ha) of age-1 and older bloater and lake whitefish for all nearshore sampling stations, 1978-2009

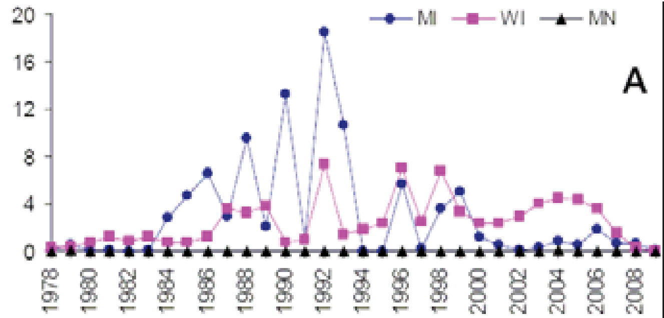


Fig 9 - Mean relative biomass (kg/ha) of age-1 and older bloater in nearshore waters of MI, WI and MN, 1978-2009

Lake Whitefish

Lake whitefish year-class strength increased slightly from 0.54 fish/ha for the 2007 cohort to 0.98 fish/ha for the 2008 cohort **(Fig. 7**). The 2008 year-class was stronger in U.S. (1.58 fish/ha) than in Canadian waters (0.04 fish/ha). Average lake-wide year-class strength for lake whitefish over the 32-year survey period was 8.04 fish/ha.

Mean relative biomass for age-1 and older lake whitefish in all waters decreased from 2.04 kg/ha in 2008 to 0.09kg/ha in 2009 **(Fig. 8)**. The 2009 decrease represents a departure from a pattern of relatively stable biomass dating back to 1996. Whitefish biomass decreased across all U.S. and Canadian jurisdictions. In Wisconsin, biomass decreased dramatically from 11.77 kg/ha in 2008 to 0.06 kg/ha in 2009, in Michigan from 1.05 to 0.04 kg/ha, and in Minnesota from 0.63 to 0.00 kg/ha (**Fig. 10)**. In Canadian waters, biomass decreased in W. Ontario from 0.38 to 0.18 kg/ha and E. Ontario from 0.26 to 0.17 kg/ha.

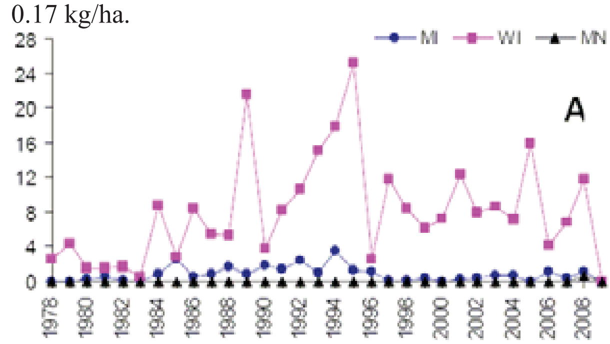


Fig 10 - Mean relative biomass (kg/ha) of age-1 and older lake whitefish in nearshore waters of MI, WI and MN, 1978-2009

Other Species

Ninespine stickleback

Estimates of mean relative biomass for ninespine stickleback decreased from 0.04 kg/ha in 2008 to 0.01 kg/ha in 2009 **(Fig. 11)**. Lake-wide mean relative biomass for all waters between 1978 and 1996 was 0.21 kg/ha.

Sculpins

Mean relative biomass for all three sculpin species combined (spoonhead, slimy C. and deepwater) declined in 2009, paralleling the declining trend observed for ninespine sticklebacks since 1993 **(Fig. 11)**. In the recent 2006-2009 interval, annual estimates of sculpin relative biomass have remained low (0.03 kg/ha). Slimy sculpins were 50% of total sculpin biomass in 2009, followed by deepwater (44%) and spoonhead (6%) sculpins. Although deepwater sculpins dominated the assemblage in 2006-2008, slimy sculpins were the dominant species in the group from 1978-2005, with the exception of 1984 when deepwater sculpins represented 55% of the biomass. Slimy sculpins averaged >68% of the total sculpin biomass across all years, but represented a higher percentage from 1978 to 1983 (81%) compared to 1984 to 2001 (64%) and 2002-2009 (37%).

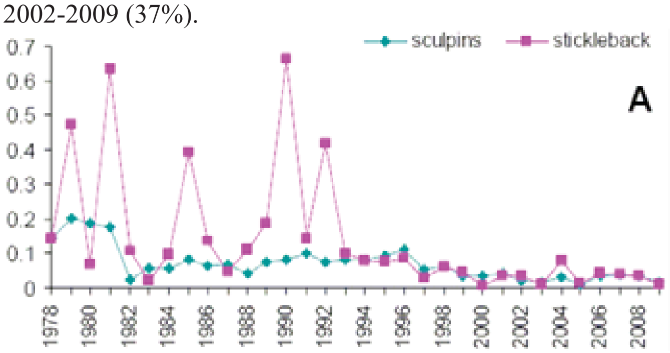
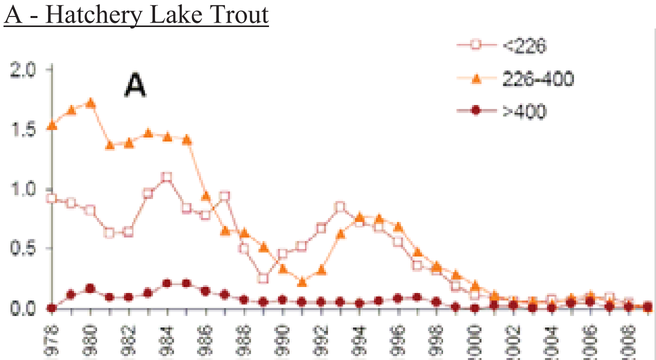


Fig 11 - Mean biomass (kg/ha) of age-1 and older ninespine stickleback and sculpins (slimy, spoonhead, and deepwater combined), for all nearshore sampling stations, 1978-2009

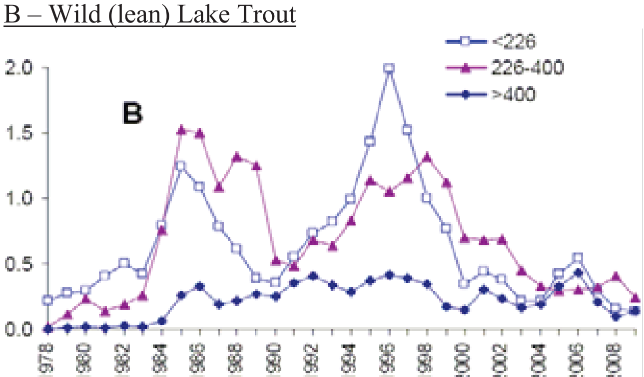
Lake Trout

Biomass of hatchery lake trout declined from near zero in 2009 **(Fig. 11)**. Biomass of wild lake trout increased from 0.15 kg/ha in 2008 to 0.24 kg/ha in 2009 while biomass of siscowet decreased from 0.17 to 0.12 kg/ha. Trends in biomass of wild, hatchery, and siscowet lake trout differed over the 32-year sampling record. Hatchery lake trout biomass declined after 1986 to very low levels by 1999 and remained low except for 2005 when we caught nine large fish in western Lake Superior **(Fig. 11)**. Before 1984, wild (lean) lake trout biomass was < 0.10 kg/ha (average 0.04 kg/ha). From 1984 through 2001

A - Hatchery Lake Trout



B – Wild (lean) Lake Trout



C – Siscowet Lake Trout

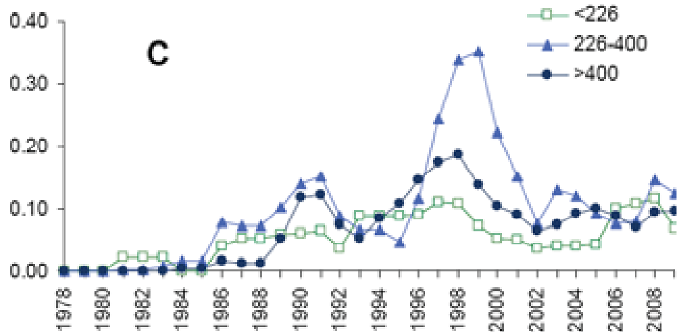


Fig 12 - Mean density (fish/ha) of age-1 and older lake trout for all nearshore sampling stations, 1978-2009. Densities shown for three length bins: <226 mm, 226-400 mm, and >400 mm TL. (**A**) hatchery lake trout, (**B**) wild (lean) lake trout, (**C**) siscowet lake trout.

biomass increased, varying from 0.27 to 0.88 kg/ha (average 0.55 kg/ha), and afterwards shifted downward, varying from 0.11 to 0.65 kg/ha (average 0.27 kg/ha). Siscowet biomass began to increase after 1988 and afterwards fluctuated between 0.022 and 0.37 kg/ha (average 0.15 kg/ha).

Consistent with the decline beginning in 1993-1996, densities of small, intermediate and large hatchery lake trout declined to 0.01, 0.02, and 0.01 fish/ha in 2009, respectively **(Fig. 12A)**. Densities of small and large wild lake trout remained similar in 2008 and 2009, thus pausing a decreasing trend that started in 1996-1998 (**Fig. 12B**). From 2008 to 2009, density of small wild lake trout declined slightly from 0.15 to 0.14 fish/ha; both values were the lowest in the 1978-2009 time series. Density of large wild lake trout increased from 0.10 kg/ha in 2008 to 0.14 kg/ha in 2009, reversing a decline from a recent peak of 0.43 kg/ha in 2006. Density of intermediate size lean trout decreased from 0.41 in 2008 to 0.24 fish/ha in 2009. Siscowet showed a pattern of variable but generally increasing density since1980 **(Fig. 12C)**. From 2006 to 2008, densities of small and intermediate size siscowet lake trout increased from 0.10 to 0.12 and 0.08 to 0.15 fish/ha, respectively but in 2009 densities decreased to 0.07 and 0.12 fish/ha, respectively. Densities of large siscowet lake trout have fluctuated between 0.10 and 0.07 fish/ha since 2000. In 2009 the proportions of total lake trout density that were hatchery, wild and siscowet were 5, 61, and 34%, respectively.

Lake Superior Fish Community

Since 2005, mean biomass of all fish species caught during the spring bottom trawl survey declined 87% **(Fig. 13)**. Decreased biomass in 2006-2009 was a result of declines in estimated biomass of Cisco, bloater, Lake Whitefish, rainbow smelt and lake trout. In 2009, principal species contributing to community biomass were rainbow smelt (31%), lean lake trout (19%), siscowet lake trout (10%), bloater (8%), and Lake Whitefish (7%). Cisco represented 2% of the community biomass, same as for shortjaw Cisco, and behind pygmy whitefish (6%), longnose sucker (5%), burbot (4%), and trout-perch (3%). This structure contrasts with the 2006 community when Cisco represented the highest percentage of biomass for any species (26%), followed by bloater (20%), Lake Whitefish (20%), and rainbow smelt (12%).

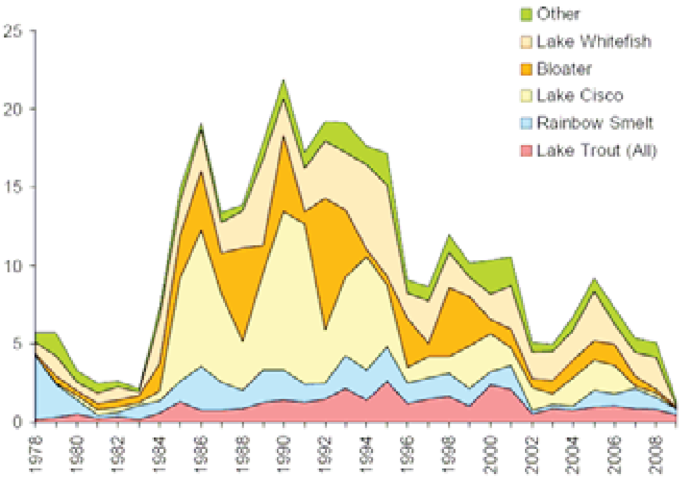


Fig 13 - Mean biomass (kg/ha) of the fish community caught in bottom trawls at all nearshore sampling stations, 1978-2009

Changes in estimated community biomass over the 32-year time series have been largely the result of changes in abundance of major prey species **(Fig. 13)**. Rainbow smelt was the dominant prey fish prior to 1981 and afterwards dominance shifted to native prey species; Cisco, bloater, and lake whitefish. Principal factors associated with changes in the community have been recovery of lake trout, increased mortality of rainbow smelt, sustained recruitment of Lake Whitefish, and variable recruitment of large year classes of Cisco and bloater.

Annual variation in community biomass since 1984 has been driven by recruitment variation in Cisco, bloater and Lake Whitefish. Recruitment of large year classes of Cisco in 1984, 1988-1990, and 1998 resulted in subsequent increases in preyfish biomass (**Fig. 13**). Recruitment of the most recent large year class in 2003 yielded smaller and less sustained increases in biomass than previous years. During our November 2009 spawning Cisco survey of western Lake Superior, we collected large numbers of age-0 ciscoes and deepwater ciscoes in midwater trawl samples. This catch suggests major year classes of ciscoes and deepwater ciscoes were produced in 2009. Surveys in 2010 will determine recruitment success. We suspect that the presence of recovered lake trout populations and attendant predation has dampened the more recent Cisco recruitment events. In the future, we expect prey fish biomass to continue to fluctuate as a result of recruitment variation, however, predation mortality may lead to a continued decline in prey fish biomass. Declines in prey fish biomass in Lake Superior are consistent with recent declines in lean lake trout lipid content. ✧

Sea Lampreys in Lake Superior 2009 (FWS)

Sea lamprey abundance in Lake Superior was within target levels during 2009. The estimated population of spawning-phase sea lampreys during 2009 was 26,698 and was within the fish-community objective target range of 38,000 for the second consecutive year. Lake-wide estimates of spawning lamprey numbers increased above the target range beginning in 1999 and remained above targets until 2008.

The causes of the increase in sea lamprey numbers during the late 1990s are unclear. Sea lampreys may have survived treatments, been produced from streams that were not treated, or come from areas in the lake that had not been treated. All known and potential sources of sea lampreys were surveyed during 2004-2006. Treatments have been increased and all of these sources have been treated. Enhanced treatment strategies to improve the efficacy of lampricide treatments were added to several treatments this year. These strategies included: targeting lampricide concentrations greater than minimum lethal concentrations; extending lampricide treatment blocks by one or two hours; conducting secondary applications of lampricide to treat backwaters, springs, and small feeder streams. Enhanced treatment strategies were used in 24 of 27 treatments during 2009.

Tributary Information

Lake Superior has 1,566 tributaries (833 Canada, 733 U.S.). One hundred fifty-three tributaries (57 Canada, 96 U.S.) have historical records of larval sea lamprey production. Of these, 95 tributaries (36 Canada, 59 U.S.) have been treated with lampricides at least once during 2000-2009. Fifty-nine tributaries (18 Canada, 41 U.S.) are treated on a regular cycle.

Lampricide Control

► Lampricide treatments were completed in 27 tributaries (7 Canada, 20 U.S.).
► The West Sleeping River was treated for the first time during 2009.
► The Arrowhead River was treated for the first time since 1983.
► The first time treatment of Big Trout Creek was hampered by low stream discharge and the presence of numerous beaver impoundments with a portion of the stream deemed untreatable. The entire system is scheduled for retreatment during 2010.

Alternative Control
Barriers

Presently, there are 15 sea lamprey barriers on Lake Superior.
The Black Sturgeon Dam, located 17 km upstream of the mouth of the Black Sturgeon River, serves a vital sea lamprey control function, protecting more than 2,500 km of watershed from larval sea lamprey infestation. However, it has been identified as an impediment of walleye rehabilitation in Black Bay in an Ontario Ministry of Natural Resources report. During 2009, a Fisheries Management Zone 9 Advisory Council (Council) was formed to review fisheries issues in Canadian waters of Lake Superior, beginning with those related to the Black Sturgeon Dam. The Council has concluded that to allow unimpeded access of invasive species to the entire watershed is undesirable. Two options are currently under consideration: 1) refurbish the existing dam and retrofit trap and sort fish passage; 2) construct a new sea lamprey barrier at the former Camp 1 site (67 km upstream of the mouth) and decommission

the existing dam. The Department and the Commission remain convinced that any option that would increase sea lamprey production and subsequent risk to the fish community of Lake Superior is unacceptable.

Assessment

Larval

► Larval assessment surveys were conducted on 133 tributaries (68 Canada, 65 U.S.) and offshore of 29 tributaries (13 Canada, 16 U.S.).

► Surveys to estimate the abundance of larval sea lampreys were conducted in 38 tributaries (18 Canada, 20 U.S.) and offshore of 15 tributaries (10 Canada, 5 U.S.).

► Surveys to evaluate the presence of new larval sea lamprey populations were conducted in 52 tributaries (40 Canada, 12 U.S.). Three new populations were discovered in D'Arcy Creek and Old Woman River (Canada) as well as a small population in the Sioux River (U.S.).

► Post-treatment assessments were conducted in 38 tributaries (18 Canada, 20 U.S.) to determine the effectiveness of lampricide treatments conducted during 2008 and 2009.

► Surveys to detect barrier effectiveness were conducted in 8 tributaries (2 Canada, 6 U.S.).

► Biological collections for researchers or training purposes were conducted in 8 (1 Canada, 7 U.S.) tributaries.

► A rotary screw trap was placed in the Agawa River during the fall of 2009 to collect metamorphosed sea lampreys migrating to Lake Superior. The trap captured a total of 20 metamorphosed sea lampreys during the 8 week s of operation. The trap will be redeployed in the spring.

Spawning-phase

► 4,131 sea lampreys were trapped in 21 tributaries during 2009.

► The estimated population of spawning-phase sea lampreys during 2009 was 26,698 and was within the fish-community objective target range of 38,000 for the second consecutive year.

► A total of 459 spawning-phase male sea lampreys were delivered to the sterilization facility from trapping operations on the Bad (313) and Brule (146) rivers.

Parasitic-phase

The target rate for sea lamprey marking on lake trout in Lake Superior is 5 fresh (AI-A3) wounds per 100 fish. ✧

Other Breaking News Items:

(Click on title or URL to read full article)

Guns needed to stop Chicago murders
The Washington Times reports if Chicago were serious about bringing its violent crime problem under control, it would recognize the constitutional right of residents to use firearms to protect themselves

New testing for Asian carp in Great Lakes waterway
Illinois and federal officials announced plans Wednesday to again dump fish poison into a Chicago-area waterway to help them determine whether the invasive Asian carp has come any closer to the Great Lakes.

Michigan congressional lawmakers seek anti-carp bill support
Michigan's congressional delegation is reaching across party lines to drum up support for the CARP ACT, a bill authored earlier this year aimed at keeping the invasive Asian carp out of the Great Lakes.

American eels once a prized Great Lakes inhabitant
The American eel is a fish rarely seen in the St. Catharines area, but even with dwindling numbers, this endangered species can still make its presence felt. What is so special about the American eel that it nearly scuttled the Shickluna hydro-power project?

Asian carp search may restrict boats in North Shore Channel
The Illinois Department of Natural Resources could soon restrict travel of kayaks and small boats in the North Shore Channel and neighboring waterways as officials use fishing nets and electric shock to track the elusive Asian carp.

Captains say they'll bolt if Lift Bridge changes are approved
Under the terms of a new policy proposed to take effect this shipping season, the Aerial Lift Bridge would be raised every half-hour between 6 a.m. and 9 p.m., instead of lifting on demand as it does now.

Michigan state officials see signs of another solid perch season on Lake Michigan
Lake Michigan perch fishing is expected to be good again this summer, state officials reported last week, saying the ports of St. Joseph, South Haven and Grand Haven should be the most productive based on trawl data and angler surveys.

End