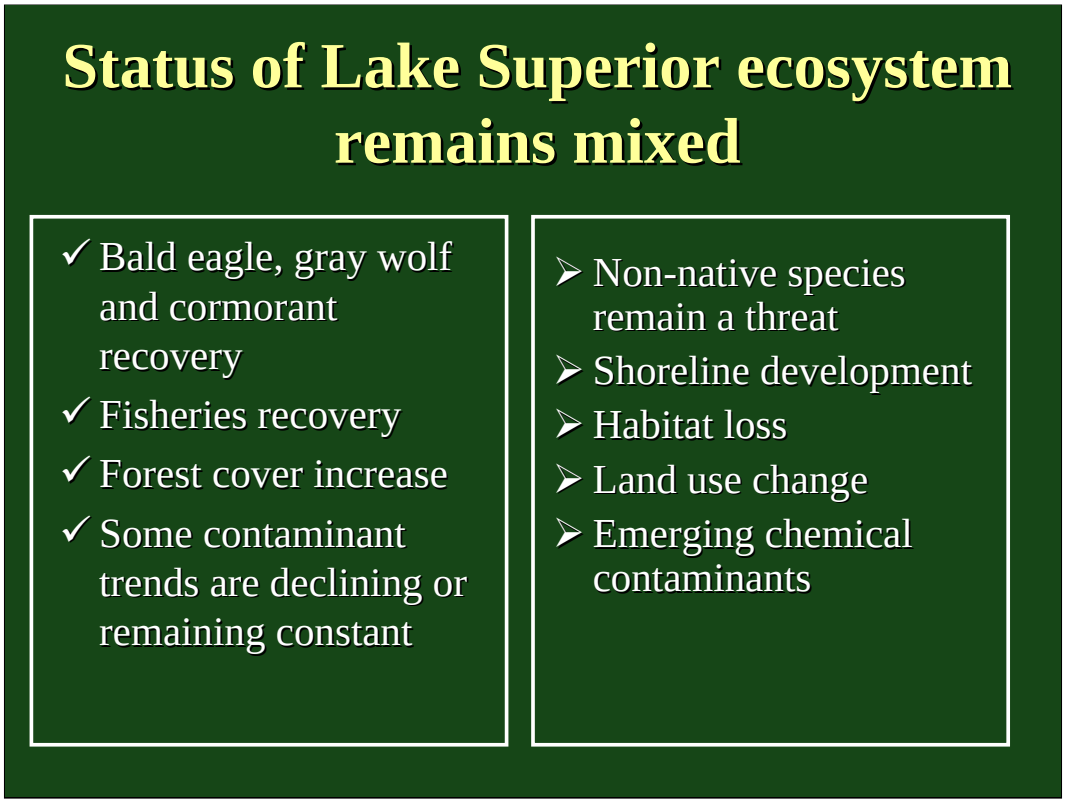
Good Morning!

I am pleased, today, to present the State of Lake Superior 2004.

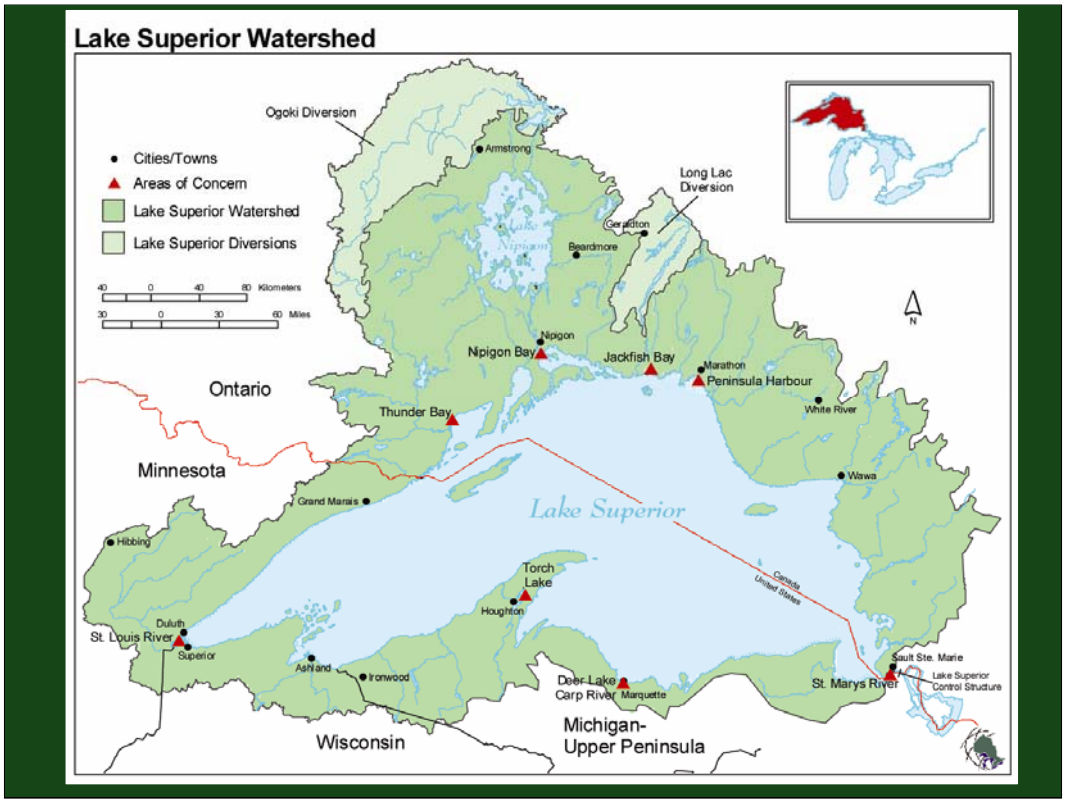


The state of the Lake Superior ecosystem remains mixed

Bald eagles, gray wolf and cormorants have recovered and forest cover has increased. Fisheries recovery indicators are also good. Some trends in contaminant loadings are showing declines while others remain constant.

Invasive species continue to be a problem and remain a threat to the recovering fish population. Stresses on the system include shoreline development, habitat loss, land use change and emerging chemical contaminants.

These topics will be discussed in more depth during this report.



The watershed contains many globally rare vegetation types, including arctic alpine communities, sand dunes, and pine barrens. The three principal industries are forestry, mining and tourism.

The retention time for Lake Superior is 173 years; what goes into the Lake affects the lake for several generations. Lake Superior has eight areas of concern as shown on the map above.

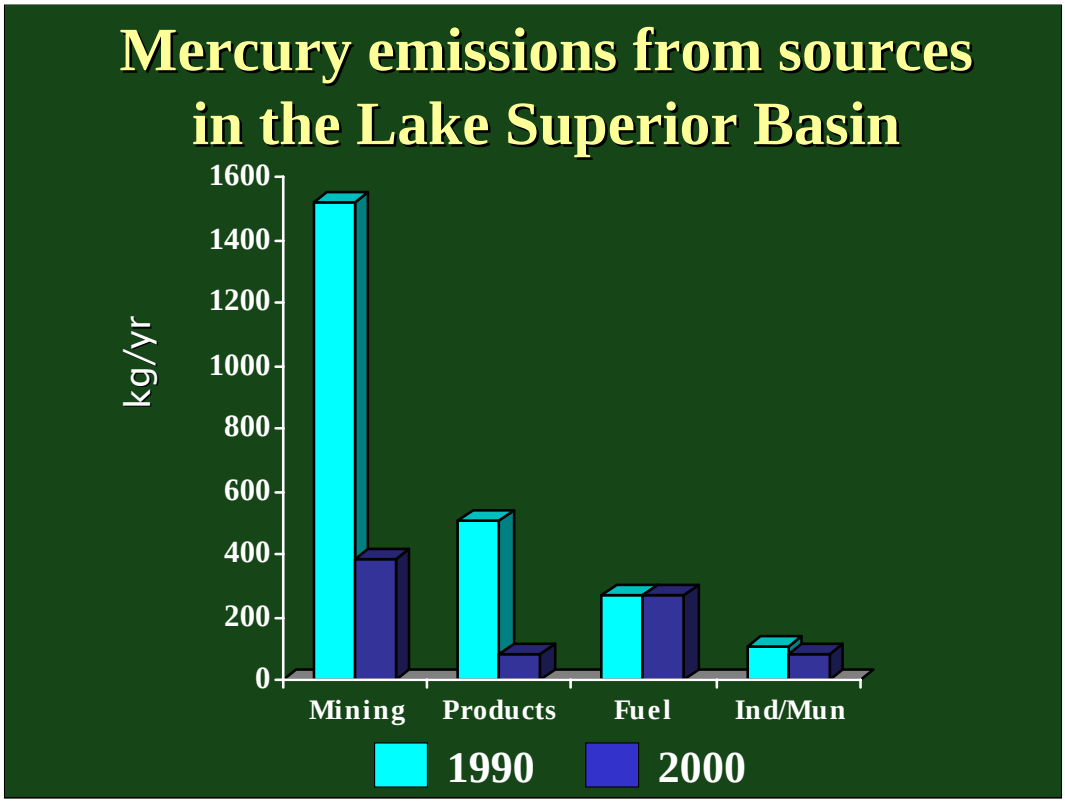
Lake Superior load reduction schedule (percentage reductions)

Chemical	2000	2005	2010	2015	2020
Mercury	60	--	80	--	100
PCBs	33	60	95	--	100
Dioxin, HCB, OCS	--	80	--	90	100
Pesticides: Aldrin/Dieldrin Chlordane DDT/DDE Toxaphene	100	--	--	--	--

Note: Baseline 1990

Lake Superior is a Zero Discharge Demonstration (ZDD) program. It is unique in scheduling load reductions to achieve zero discharge of the nine critical pollutants by the year 2020.

Overall, concentrations of a suite of toxic organic contaminants in water including the Lake Superior critical and lakewide remediation pollutants declined more than 50 percent between 1986 and 1997.

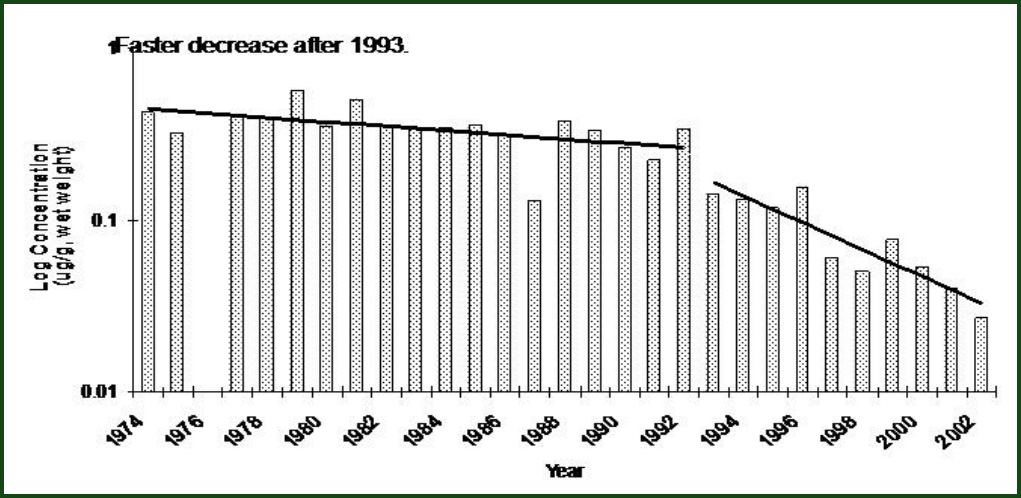


Progress for mercury emission reduction has occurred between 1990 and 2000.

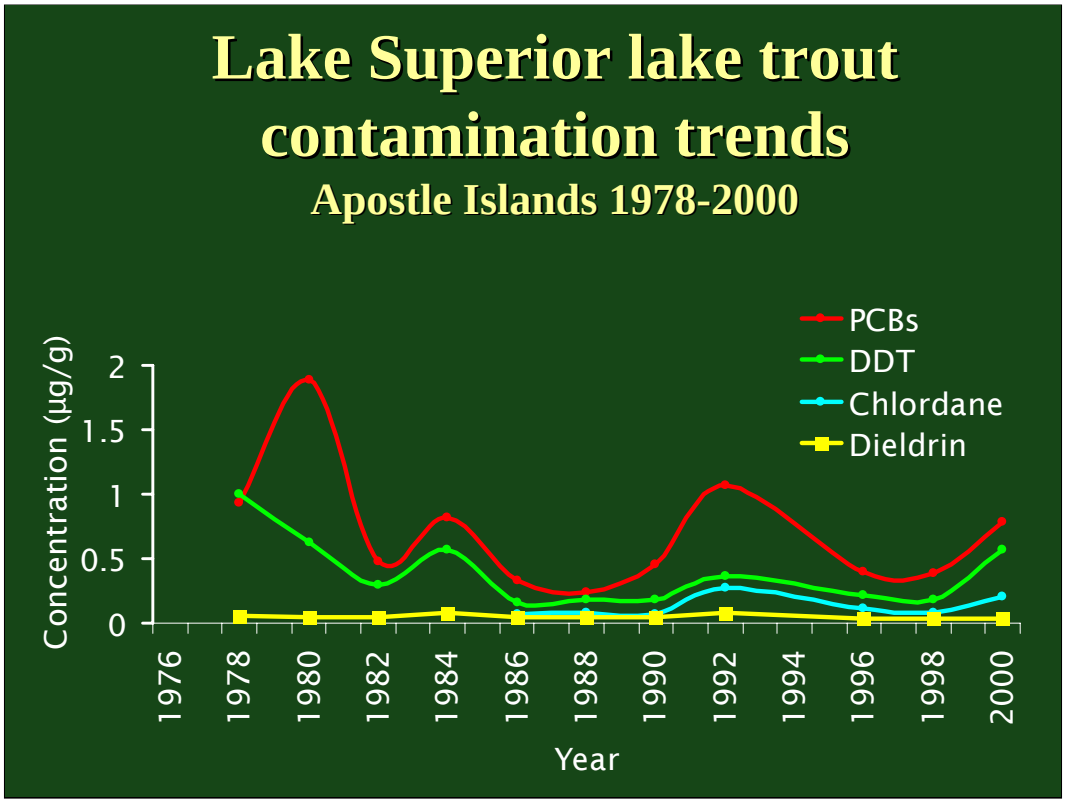
While significant reductions have occurred in products and mining, emissions from fuel combustion are virtually unchanged.

Herring Gull eggs have been collected and analyzed annually from the same two Lake Superior sites, Granite Island and Agawa Rocks, since 1974 for selected contaminants. 64% of contaminant-colony comparisons are declining as fast or faster than they were earlier in the study, while 29% have declined more slowly in recent years.

Dieldrin in herring gull eggs,
Agawa Rocks, 1974-2002



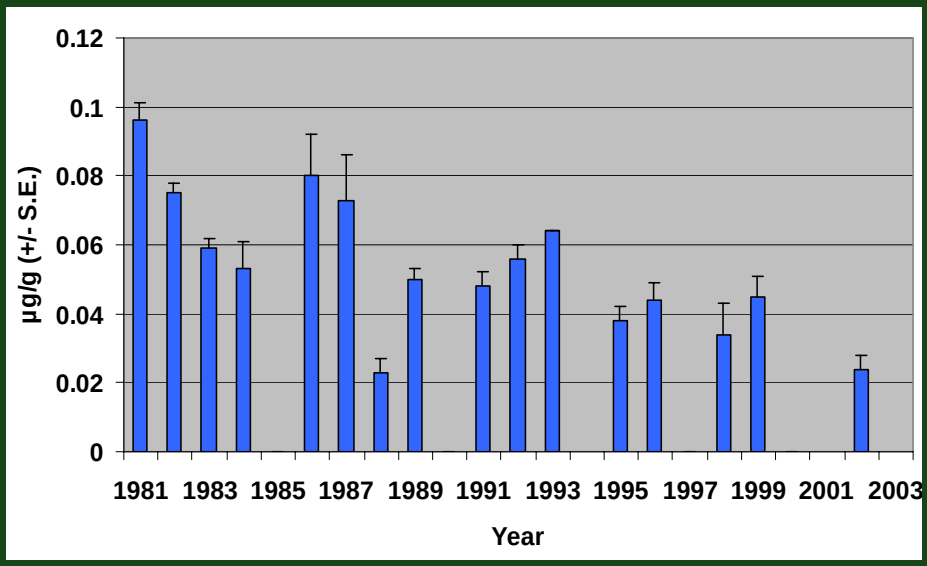
Data from 1974 to 2002 illustrates the decline in dieldrin in herring gull eggs at agawa rocks monitoring site. For dieldrin and heptachlor epoxide, Granite Island and Agawa Rocks ranked the third and fourth most contaminated, respectively, of the fifteen sites studied on the Great Lakes.



Lake trout contaminant data in the Apostle Islands show decreases for four of the Lake Superior critical chemicals. PCBs are fluctuating, although levels have dropped since 1980. The DFO lake trout data show very little recent change in mean PCB concentrations. Lake trout concentrations remain above the GLWQA criteria. Although DDT levels appear to be increasing slightly, it is likely that this increase is due to a change in the sampling location rather than to an actual increase in contaminant concentration. Chlordane and dieldrin appear to be leveling off.

Concentrations of toxaphene have declined dramatically in lake trout across all Great Lakes except for Lake Superior. Lower productivity, colder temperatures and large surface area are likely responsible for higher Superior levels. 70-80% of Ontario's sport fish consumption advisories are due to toxaphene.

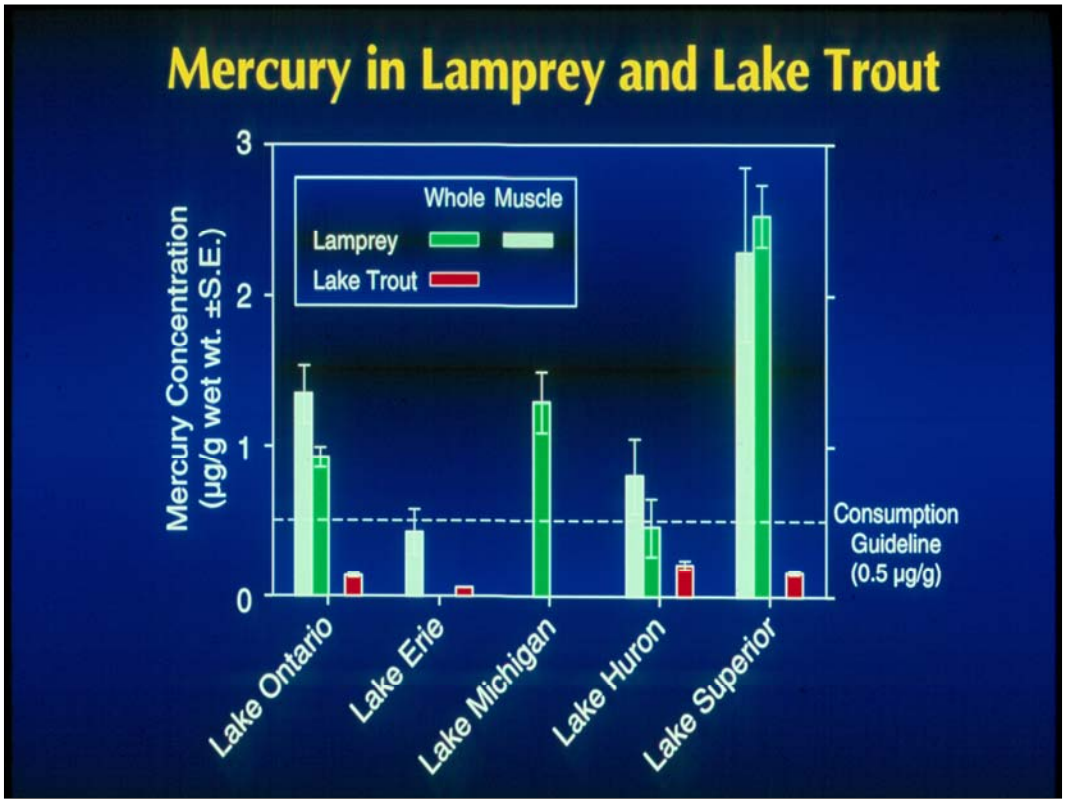
Total mercury levels in Lake Superior rainbow smelt



(µg/g +/- S.E. wet weight, whole fish)

Here is a typical temporal/spatial trend for mercury in a major Great Lakes forage fish species (smelt). Overall there has been a steady decline in Hg levels from the late 1970's and early 80's. While mercury levels are below GLWQA criteria, the trend data show continuing improvement in Mercury levels for this fish. As we shall see, this is not the case for sea lamprey and other Lake Superior biota.

(where is 00/01 data for Superior?- it is not collected every year).



This is a comparison of total mercury levels in lake trout and lamprey across the Great Lakes. At every site monitored, Hg levels in lamprey were significantly greater than those detected in their primary prey. These data also demonstrate the significantly elevated Hg levels in lamprey from the Lake Superior system compared to other Great Lakes.

Need to add “why?”

(note: Lamprey diet on older, more mercury-laden fish. Underlies the importance of lamprey controls.

(in response to the comment about including a year on this slide, Mike Whittle, DFO, stated that the data is 2002-2003. Is this specific enough to include in slide? In response to comment about consumption guideline, .5 is Canadian Federal Govt standard for sport/angler and .2 is for subsistence)

“Recycling” of PCBs in Superior

PCB behavior in Lake Superior is unique with little storage in the sediments. Also there is little organic matter in the ecosystem to affect PCB levels. PCBs deposited into the lake are recycled into the food web via the plankton and also volatilized back into the atmosphere. Only 2-5% accumulate in bottom sediments.

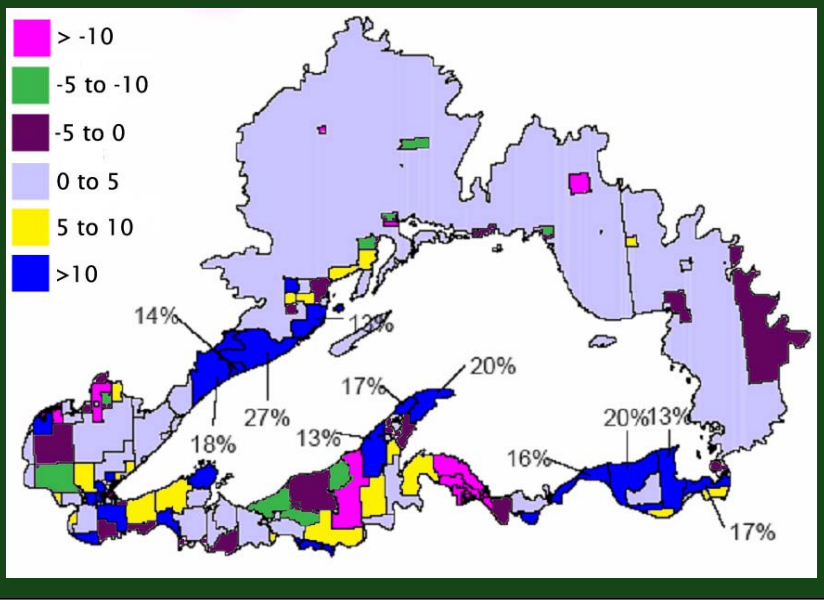
Over many years net volatilization of PCBs has released 26,000 kilograms to the atmosphere. Lake Superior was considered a PCB source but is now is at equilibrium with the atmosphere.

Note: (First note: Derek Muir, Baker/Eisenreich 1998) papers

Second note: About 60% in 1991. Since low organic material in Lake Superior (Jeremiason et al 1998).

Note: PCB behavior reference IAGLR 2004)

Human population change (%) between 1991 and 1996



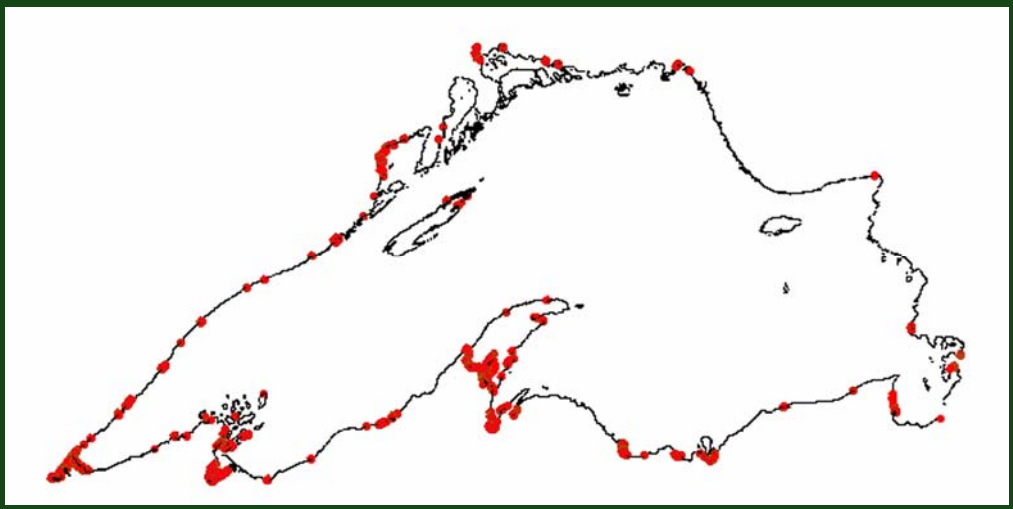
Moving on to the broader ecosystem…

Human population growth is greatest in the areas shown in blue including the Duluth/Superior areas, Grand Marais and the Bayfield Peninsula. In Ontario, this trend is greatest along the shorelines east and west of Thunder Bay and north of Sault Ste. Marie.

The Keweenaw Peninsula on Michigan's Upper Peninsula has seen unprecedented growth in the past 20 years, mainly as recreational homes; over 50 percent of the homes in Keweenaw County are now classified as second homes.

However, it should be noted that there are areas of population decrease. The biggest change is occurring in the southern part of the basin on the United States side.

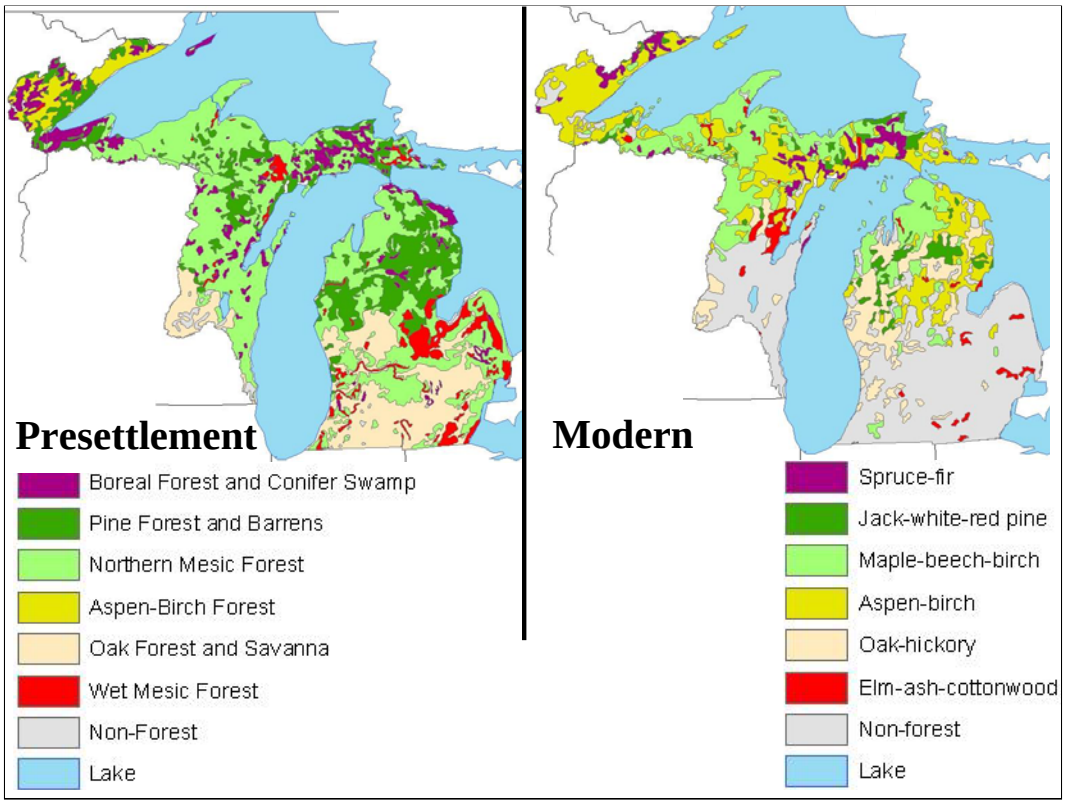
Shoreline hardening



Shoreline hardening, which consists of sheet piling, rip rap or other anthropogenic changes, is an increasing problem for Lake Superior. Although Lake Superior has the lowest percentage of shoreline hardening, the trend is increasing due to rapid growth of population in areas like Keweenaw County, the Duluth/Superior areas and the Bayfield Peninsula.

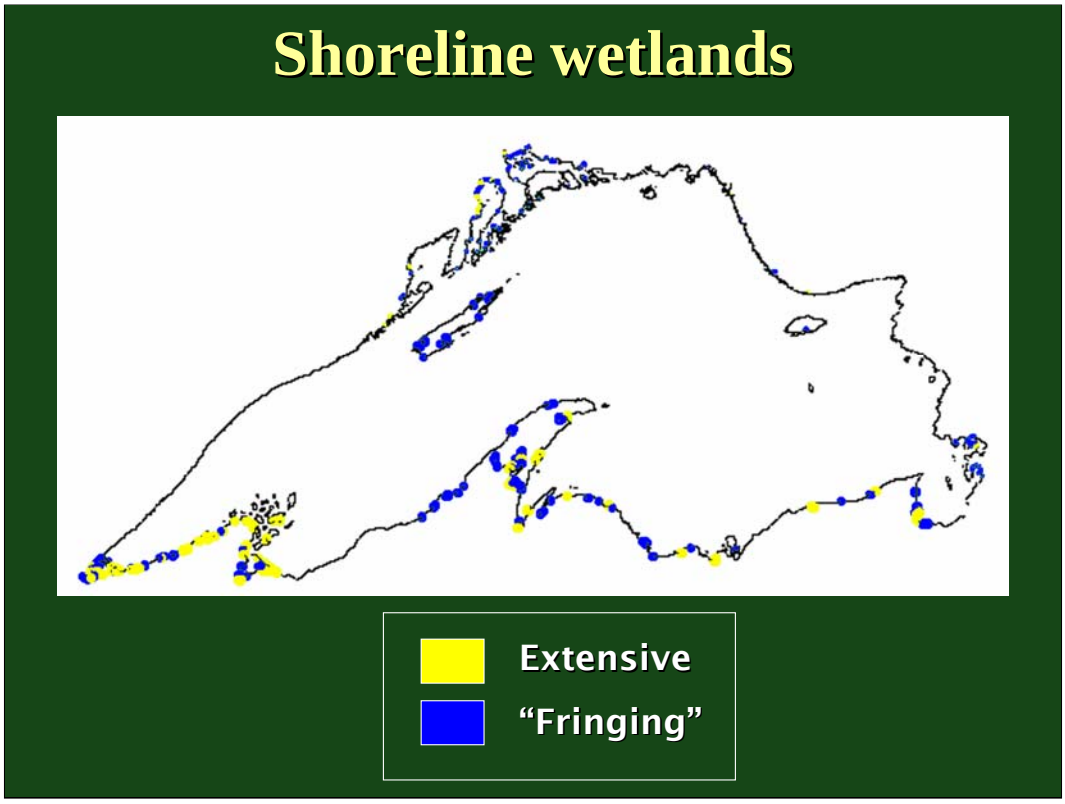
In Ontario, this trend is greatest along the shorelines east and west of Thunder Bay and north of Sault Ste. Marie; following population trends

Shoreline development is one of the most pressing issues facing the Lake Superior Basin today.



Forest fragmentation and changes in forest composition, as shown here, are two of the seminal changes to the Lake Sup basin since settlement times. Beginning in the 1880s U.S. forests were almost entirely clear-cut. Forest fragmentation of hardwoods will continue to increase due to development, including road construction. Although the legends of the two eras are made differently, the colors associated with the forest types are comparable.

Aspen-birch, fir and poplar have increased since that logging, while spruce and pines have been severely reduced. As large aspen areas are reaching maturity and die, that component will be reduced as more mesic forest types return. The amount of total forest cover is anticipated to remain the same or increase slightly in the future. The Great Lakes Forestry Alliance reported in 1995 that timber growth in MI, MN, and WI exceeded harvest by 90% and timber volume increased from about 25 billion cubic feet in 1952 to more than 50 billion cubic feet in 1992.



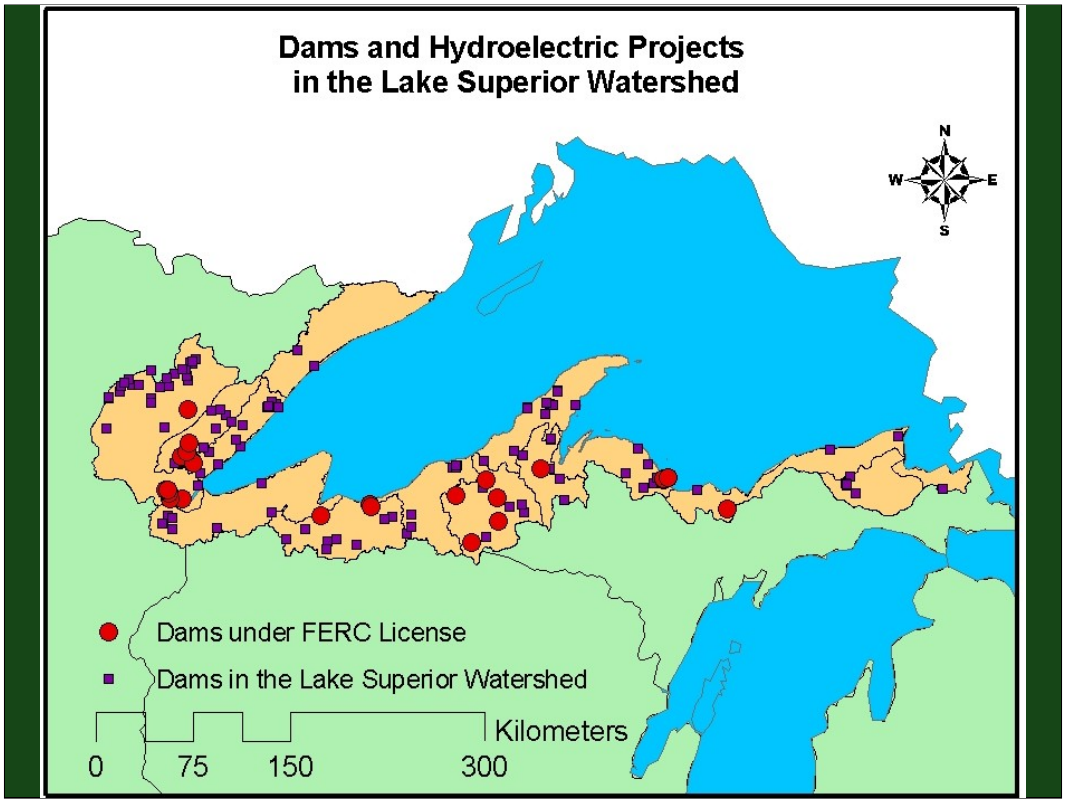
About 15% of the US basin and 6-25% of the Canadian basin are wetlands. The greatest threats to Lake Superior’s wetlands are wetland draining and filling, toxic contamination, water level regulation and site-specific stresses such as shoreline development. Other threats include invasive species and diminished water quality. Although there have been many wetland restoration success stories, it is not possible to determine if there has been a net loss or gain because of limitations on, and lack of coordination among, current monitoring efforts.

Loss of wetland habitat has been small in some counties but most of the St. Louis River estuary wetlands at Duluth have been lost since the early 1900’s.

Kakagon Sloughs

The wetlands of the Apostle Islands, Bad River and Kakagon Slough are largely intact. Wetland loss in Ontario is low (0 – 25 percent) for most of the basin, but locally, wetland losses have been reported in the AOCs, Thunder Bay and St. Mary's due to shoreline modification and urban encroachment. Wetland area around the city of Thunder Bay has declined by over 30 percent since European settlement.

Lake Superior shoreline wetlands are a particular concern in Ontario, given their scarcity and proximity to developed areas. The potential for further development at Cloud Bay, Sturgeon Bay and Pine Bay threatens wetlands.



All the offshore and most of the nearshore habitat remain healthy and productive. As a result, all forms of lake trout are abundant. The majority of impairments to aquatic habitat and water quality are found in embayments and tributaries. These tributaries remain significantly degraded by such stressors as agriculture, mining, hydroelectric dams, industrial effluents and waste, wetland dredging and filling, nonpoint source pollution, shoreline development and use practices that lead to increased runoff and erosion.

Note the numerous dams and Federal Energy Regulatory Commission sites within the US side of the basin. Recent multi-agency/tribal efforts during the Federal Energy Regulatory Commission re-licensing process for some sites has resulted in greatly improved stream flows and habitat for affected streams.

Habitat changes on the landscape, as well as harvest and management of select species, have created some dramatic changes in wildlife communities over the past 150 years. Ungulates, wolves and furbearers were hunted to near extinction but are now rebounding.

Successful reintroduction of peregrine falcons is also underway within the basin. Cormorants and herring gulls are recovering after being decimated by toxic contaminants in the 70's.

Woodland caribou

Photo credit: Gerry Racey

Caribou in Canada and Canada lynx in the US are still scarce although recovery planning is underway for these and a number of other species at risk in the basin, i.e. piping plover and wood turtle.

Endangered species in the Lake Superior Watershed

Mink frog

Eighteen animal species found in the Lake Superior watershed, including mammals, birds, insects and herptiles, are listed by Canada and/or the U.S. as endangered. In addition, there are 400 species in the basin listed by provincial or state jurisdictions as endangered, threatened, or of special concern. Of the 400 species, nearly 300 are plants. The preparation of recovery plans or conservation strategies is underway for 26 species.

Status of amphibian species found in the Lake Superior Basin in Minnesota and Wisconsin

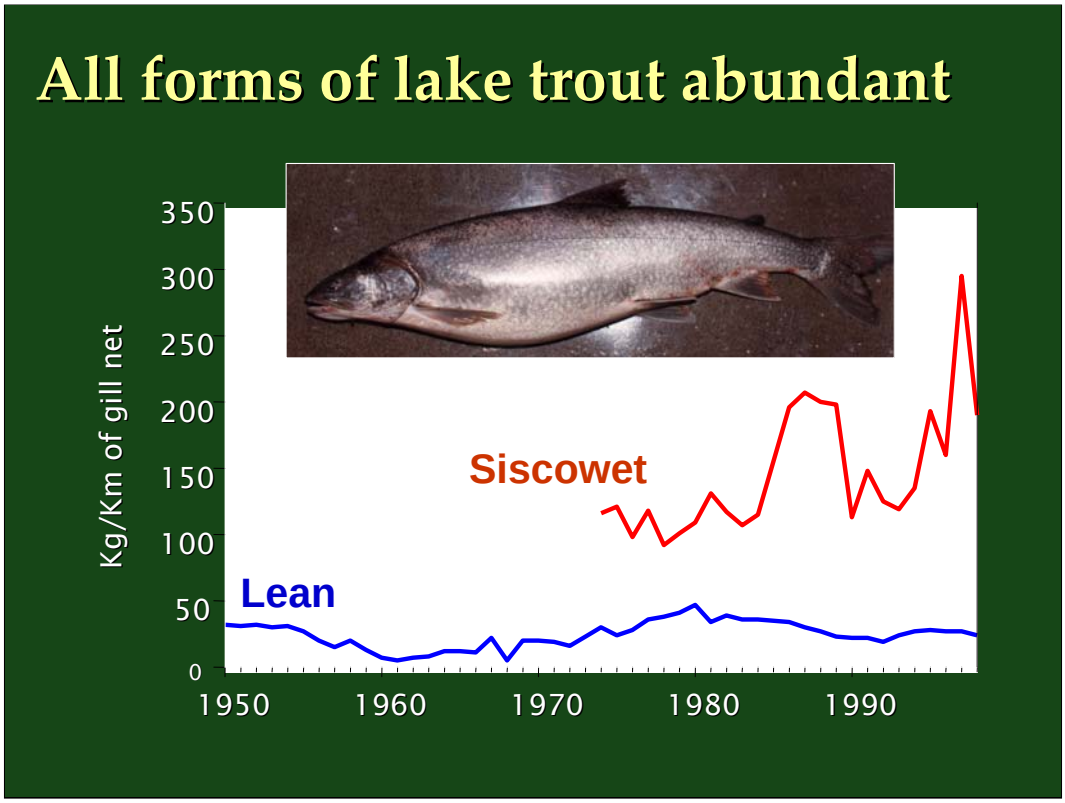
Species	Relatively Stable	Increasing	Decreasing	State Endangered	Special Concern	No Trend Data Available
Wood frog	●	■				
Northern leopard frog	●		● ■			
Pickerel frog			■			
Mink frog						● ■
Green frog	● ■					
Chorus frog	■					
Northern spring peeper	●		■			
Eastern gray treefrog	● ■					
Cope's gray treefrog			■			
Blanchard's cricket frog				■	●	
American toad	● ■					
Blue-spotted salamander	● ■					
Eastern tiger salamander			●			
Spotted salamander	■					
Four-toed salamander					■	
Redback salamander	●					
Mudpuppy						● ■

■ Wisconsin ● Minnesota

Little work has been done to monitor and classify the status of amphibians and reptiles in comparison to other vertebrates, although the planning of a basin-wide monitoring program for herptiles is underway. Thirty-seven species of reptiles and amphibians have been documented – 7 salamander, 12 frog, 6 turtle, 2 lizard and 1 snake.

As with many vertebrates, the widespread changes in habitat cover across the landscape have had a dramatic effect on the community composition of amphibians and reptiles. However, local population declines of many amphibians are becoming a concern worldwide. Many possible reasons exist for these declines; monitoring programs are being initiated to document trends.

The aquatics system is in reasonably good shape. Nearshore and open water habitat is very good, leading to abundance of trout, and good stocks of whitefish and herring. The problem is mostly in the tributaries and embayments, especially in the Areas of Concern.



There are three main points about lake trout: 1) All forms of trout are very abundant; 2) they are naturally reproducing; and 3) although the siscowet shows high levels of toxic contaminants, this has not interfered with reproduction.

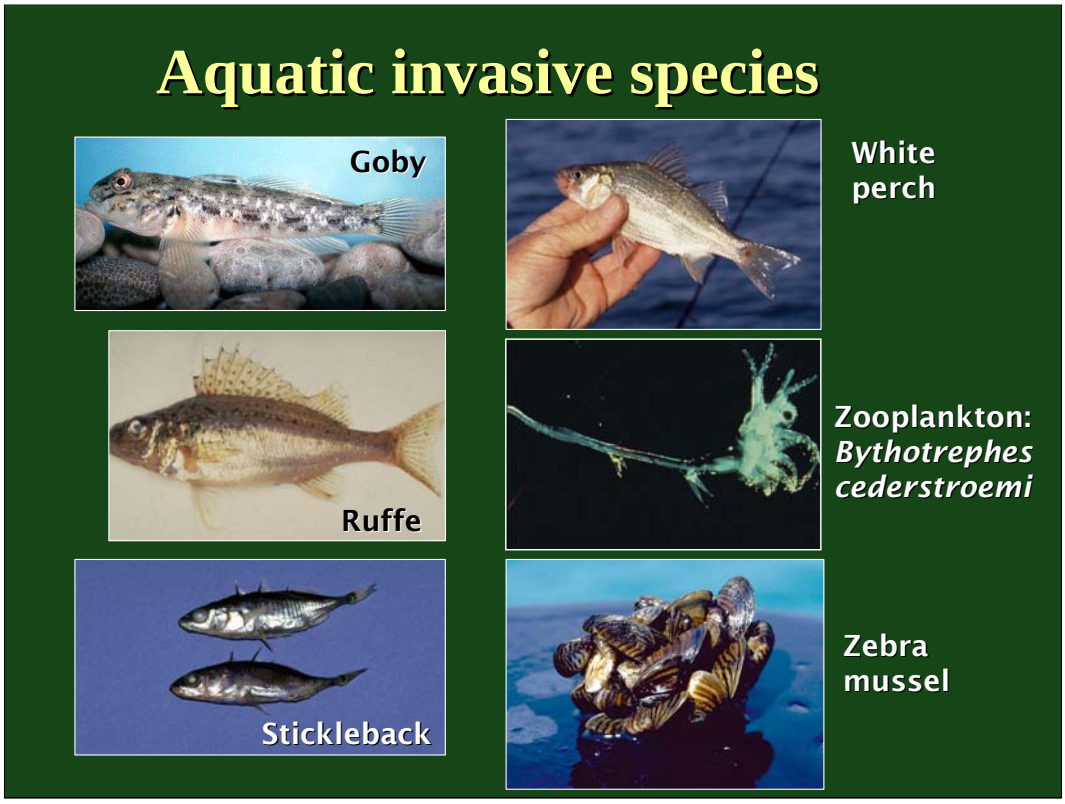
Both lean and siscowet populations are close to historic levels. There are more naturally reproducing lake trout in Lake Superior than there are in all the other Great Lakes combined. These trout are reproducing on their own with very little management needed.

Walleye, sturgeon and brook trout

>Increasing in abundance

>Sturgeon and walleye widespread

All three of these species used to be abundant but were affected because of habitat degradation in tributaries. All three fish are dependent upon tributaries for part of their life – they spawn in streams and their young inhabit the stream for some length of time. Lake Superior tributaries have borne the brunt of most of the habitat destruction and loss. Now, we have naturally reproducing sturgeon, walleye and brook trout. Populations are not near historic levels because of habitat destruction but the habitat is sufficient to help them increase in abundance. All three species have active rehabilitation programs and resource management activities.



Except for sea lamprey, the non-native species in Lake Superior have been manageable up to this point. Lake Superior, however, has the highest rate of non-native species to native species of all the Great Lakes. Lake Superior represents the dead-end for shipping for many invasive species as we are at the end of the lakes. There is nothing to make us think that Lake Superior won't have its own singular invasive species problem (i.e., such as zebra mussels in the lower lakes)

Unless we do something fairly proactive, fairly soon, we could have a significant problem on our hands.

NOTES:

Lake Superior Aquatic Non-Native Species – 32:

17 fish (53%)

5 aquatic invertebrates (16%)

4 diseases and parasites* (12%)

6 aquatic plants (19%)

61% arrived since 1960

Invasive species

- Gypsy moth
- Asian longhorned beetle
- Rusty crayfish
- Exotic buckthorns

Emerald ash borer

Numerous invasive insect, animal and plant species have been introduced to the Lake Superior basin. A few examples of species likely to have significant impacts include:

Gypsy Moth , Asian Longhorned Beetle, Rusty Crayfish and Exotic Buckthorns.

{click} One of the most potentially devastating invasives is the **Emerald Ash Borer**. Now located in Lower Michigan and Ontario, it remains outside the Lake Superior Basin for now. There is no known natural control or treatment at this time, so it could potentially devastate inland and coastal wetland ecosystems which may contain large areas of ash trees.

In summary

Lake Superior has many existing pressures on its system – continued degradation of tributary and embayment aquatic habitat, shoreline and other habitat development, continued introduction and impacts of non-native species, and continued release and deposition of critical pollutants. Emerging chemicals such as pharmaceuticals and personal health products are also of concern.

On the positive side, the governments recently reaffirmed their commitment to the Zero Discharge Demonstration Program, the Lake Superior cooperative monitoring program has been working to develop priorities for the Lake Superior monitoring year in 2005-6, many habitat inventory, assessment and monitoring programs are being implemented, rehabilitation of critical aquatics habitat is underway, and several wildlife and fish species have been restored.

Global warming, climate change, increasing water temperature, large-scale water export and proposed new mines are other critical issues needing to be explored.

We would like to acknowledge the people who helped make this presentation possible. Thank you.