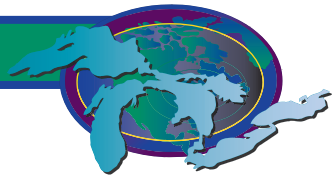

Lake Trout

Indicator #93

Overall Assessment

Status:	**Mixed**
Trend:	**Unchanging**
Rationale:	**Factors used to determine status were the levels of natural reproduction observed, the survival of hatchery-reared fish after stocking, the level of mortality on adults from sea-lamprey and fishing, and the over all population trajectory. This limits harvest objectives in most lakes.**

Lake by Lake Assessment

Lake Superior

Status:	Good
Trend:	Improving
Rationale:	Natural reproduction is widespread and supports all populations. Most stocking has been discontinued and fisheries are well managed. Sea lamprey mortality has been increasing.

Lake Michigan

Status:	Poor
Trend:	Declining
Rationale:	Survival of adult fish is declining from increased sea lamprey mortality and no evidence of significant natural reproduction. Fishing mortality is low.

Lake Huron

Status:	Mixed
Trend:	Improving
Rationale:	Some natural reproduction is occurring but at low levels. Fishing and sea lamprey mortality has declined since 2001. Parental stocks are increasing.

Lake Erie

Status:	Mixed
Trend:	Unchanging
Rationale:	Sea lamprey mortality is high. A shift to a deepwater Lake Superior strain for stocking has appeared to improved post-release survival.

Lake Ontario

Status:	Mixed
Trend:	Declining
Rationale:	Post-release survival of stocked fish is declining and the level of natural reproduction is decreasing.

Purpose

- To track the status and trends in lake trout populations
- To infer the basic structure of the cold water predator community and the general health of the ecosystem

Ecosystem Objective

Self-sustaining, naturally reproducing populations that support target yields to fisheries are the goal of the lake trout restoration program. Target yields approximate historical levels of lake trout harvest or levels adjusted to accommodate stocked non-native predators such as Pacific salmon. These targets are 1.8 million kg (4 million pounds) from Lake Superior, 1.1 million kg (2.5 million pounds) from Lake Michigan, 0.9 million kg (2.0 million pounds) from Lake Huron and 50 thousand kg (0.1 million pounds) from Lake Erie. Lake Ontario has no specific yield objective but has a population objective of 0.5 to 1.0 million adult fish that produce 100,000 yearling recruits annually through natural reproduction.

State of the Ecosystem

Background

Lake trout were historically the principal salmonine predator in the coldwater communities of the Great Lakes. By the late 1950s, lake trout were extirpated throughout most of the Great Lakes, mostly from the combined effects of sea lamprey predation and over fishing. Restoration efforts began in the early 1960s with chemical control of sea lamprey, controls on exploitation, and stocking of hatchery-reared fish to rebuild populations. Full restoration will not be achieved until natural reproduction is established and maintained to sustain lakewide populations. To date, only Lake Superior has that distinction.

Status of Lake Trout

Trends in the relative or absolute annual abundance of lake trout in each of the Great Lakes are displayed in Figure 1. Lake trout abundance dramatically increased in all the Great Lakes after initiation of sea lamprey control, stocking, and harvest control. Natural reproduction, from large parental stocks of wild fish, is occurring throughout Lake Superior, it supports both onshore and offshore populations, and it may be approaching historical levels. Stocking there has been discontinued. Sustained natural reproduction, albeit at low levels, has also been occurring in Lake Ontario since the early 1990s, and in some areas of Lake Huron, but it has been largely absent elsewhere in the Great Lakes. In Lake Huron, substantial and widespread natural reproduction was seen starting in 2004 following near collapse of the alewife population. Abundance of hatchery-reared adults was relatively high in Lake Ontario from 1986 to 1998, but declined by more than 30% in 1999 due to reduced stocking and poor survival of stocked yearlings since the early 1990s. Adult abundance again declined by 54% in 2006 likely due to ongoing poor recruitment and mortality from sea lamprey predation. Parental stock sizes of hatchery-reared fish were relatively high in some areas of Lake

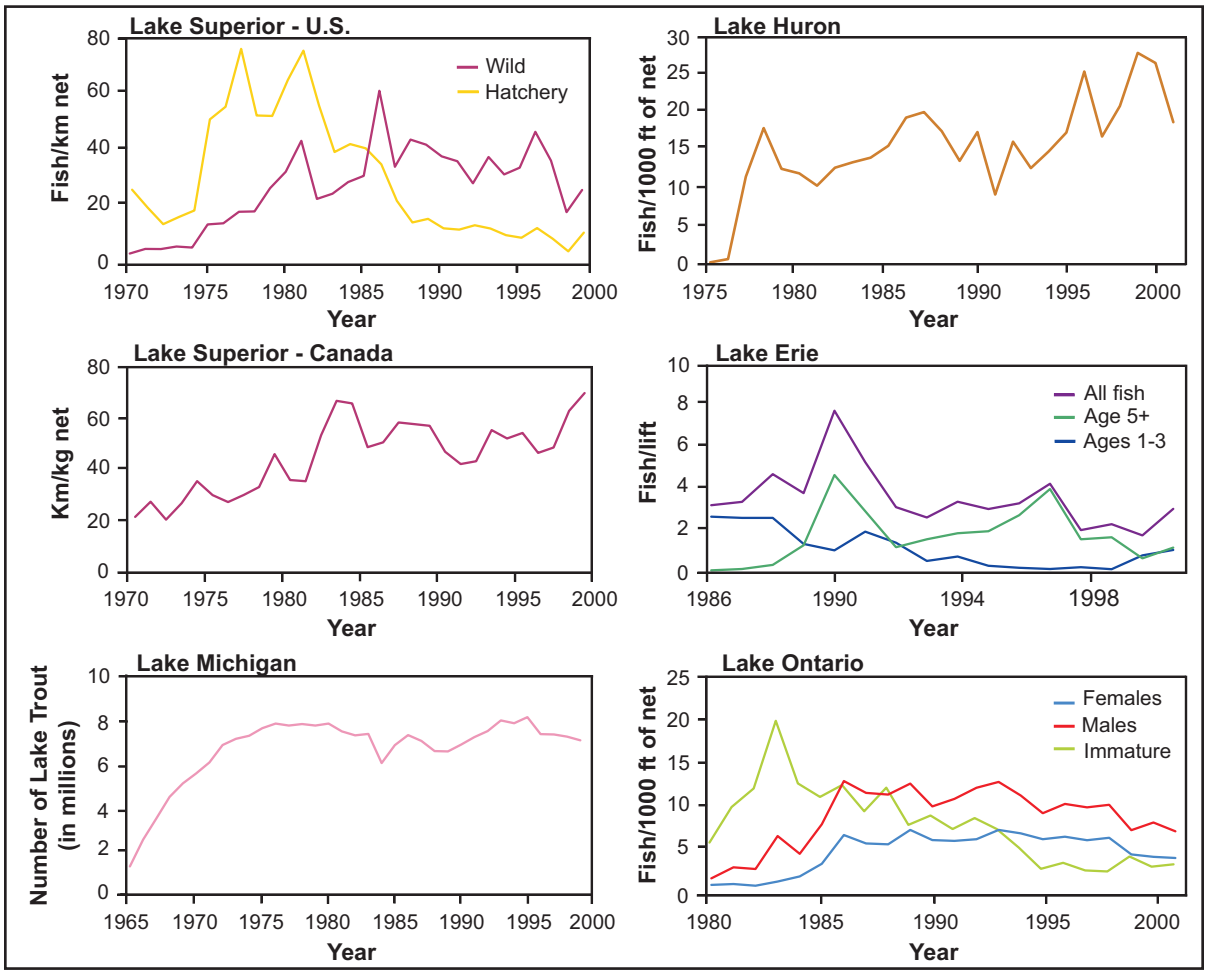

Figure 1: Relative or absolute abundance of lake trout in the Great Lakes.

The measurement reported varies from lake to lake, as shown on the vertical scale, and comparisons between lakes may be misleading. Overall trends over time provide information on relative abundances.

Source: U.S. Fish and Wildlife Service

Huron and Lake Michigan, but sea lamprey predation, fishery extractions, and low stocking densities have limited population expansion elsewhere.

Pressures

The numbers of sea lamprey continue to limit population recovery, particularly in Lake Michigan and Lake Superior, and parasitic adults are increasing basin-wide. Fishing pressures also continue to limit recovery. More stringent controls on fisheries are required to increase survival of stocked fish. In northern Lake Michigan, parental stock sizes are low and young in age due to low stocking densities, and substantial sea lamprey mortality. Hence, egg deposition is low in most historically important spawning areas. Fishing mortality has been reduced in recent years, but it has been replaced by sea lamprey mortality. High biomass of alewives and other predators on lake trout spawning reefs are thought to inhibit restoration through egg and fry predation, although the magnitude of this pressure is unclear. Recent trends in Lake Huron suggest that alewife may need to reach very low abundances to allow substantial natural reproduction of lake trout. A diet dominated by alewives may be limiting fry survival (early mortality syndrome) through thiamine deficiencies. The loss of *Diporeia* and dramatic reductions in the abundance of slimy sculpins is reducing prey for young lake trout and may be affecting survival. Current strains of lake trout stocked may not be appropriate for offshore habitats, therefore limiting colonization potential.

Management Implications

Continued and enhanced sea lamprey control is required basin-wide to increase survival of lake trout to adulthood. New sea lamprey control options, which include pheromone systems that increase trapping efficiency and disrupt reproduction, are being researched and hold promise for improved control. Continued and enhanced control on exploitation is being improved through population modeling in the upper Great Lakes but needs to be applied throughout the basin. Stocking densities need to be increased in some areas, especially in Lake Michigan. The use of alternate strains of lake trout from Lake Superior could be candidates for deep, offshore areas not colonized by traditional strains used for restoration. Introduction of such strains has been initiated in Lake Erie and holds promise. Direct stocking of eggs, fry, and yearling on or near traditional spawning sites should be used where possible to enhance colonization.

Comments from the author(s)

Reporting frequency should be every 5 years. Monitoring systems are in place, but in most lakes measures do not directly relate to stated harvest objectives. Population objectives may need to be redefined as endpoints in units measured by the monitoring activities.

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