Walleye

Indicator #9

Overall Assessment

Status: **Mixed**

Trend: **Variable**

Rationale: **A strong 2003 hatch has bolstered walleye abundance in nearly all of the Great Lakes and should keep them at moderate levels for the next several years. Variable reproductive success since 2003 will permit population and harvest to increase in select areas. Fisheries harvests have improved in recent years but remain near or below targets in nearly all areas.**

Lake-by-Lake Assessment

Lake Superior

Status: Fair

Trend: Undetermined

Rationale: Recent recreational harvest estimates showed steady harvest levels in the sport fishery following a peak in 2002 and 2003. Walleye abundance levels in all areas of Lake Superior, with the possible exception of the St. Louis River, are still below historical levels. Rehabilitation efforts of the walleye population in Black Bay, Ontario, are ongoing; however, competing fish community objectives for walleye and sea lamprey (*Petromyzon marinus*) control in the Black Sturgeon River, a Black Bay tributary, will complicate rehabilitation plans.

Lake Michigan

Status: Mixed

Trend: Undetermined

Rationale: Recreational harvest increased to above historical levels in 2007 with the availability of the strong 2003 year class. Tribal fishery yields were not available but were well above average in the four most recent years where data exist (2000-2003). Green Bay stocks appear to be improving, with strong spawning runs in the Fox, Peshtigo, Oconto, and Menominee rivers. Above average reproduction was observed in 2007 in southern Green Bay. Fishery yields in 2007 approached the annual target of 100-200 metric tonnes, but it is difficult to report on the trends and overall achievement of targets without all the components of the harvest.

Lake Huron

Status: Good

Trend: Improving

Rationale: Fishery yields are improving, but are still below the annual harvest target of 700 metric tonnes. Commercial harvest trends continue to decline while recreational harvest trends are improving. This is partly because the greatest gains in harvest have been seen in Saginaw Bay which is closed to commercial fishing. Reproductive success has greatly improved since 2003 in Saginaw Bay and perhaps other parts of the lake, and has been attributed to the decline of the alewife population.

Huron-Erie Corridor (St. Clair River-Lake St. Clair-Detroit River)

Status: Fair

Trend: Unchanging

Rationale: Walleye harvest in this area is down for the early 2000s time period compared to the 1980s. Catch rates for walleye anglers in the corridor remains good. It has not declined as much as harvest, which may be related to a decline in angler effort to other water areas (i.e., Lake Erie and Saginaw Bay), toward other Corridor species (i.e., muskie and smallmouth bass), or a change in tactics that are not evaluated (i.e., more evening and night fishing). This fishery has been evaluated on an inconsistent basis, but recent harvest estimates may be as high as 300,000 fish. No continuous fishery data is available to incorporate estimates into our metric ton yield figure, but at an average of about 1 kg/fish, the harvest in this corridor at a few hundred metric tonnes may be as great as that seen in the upper Great Lakes combined. As there exists the potential for sizable harvest, this Corridor cannot be overlooked in the scale of Great Lakes walleye fisheries and production, and should be included in the indicator description.

Lake Erie

Status: Mixed

Trend: Unchanging

Rationale: The fisheries objective of sustainable harvests lakewide has not been realized since the late 1990s but harvest has been fairly steady for the last several years. Commercial harvest increased substantially in 2005-2007, while recreational fisheries recovered in 2006 and 2007 on the successful recruitment of the 2003 hatch. Harvest by both fisheries is expected to decrease in 2008 and 2009. "Boom and bust" variable hatches have made long-term attainment of harvest targets difficult, but implementation of a specific harvest policy and a lakewide Walleye Management Plan has assisted managers and stakeholders alike to maintain robust fisheries and adequate fish populations.

Lake Ontario

Status: Fair

Trend: Unchanging

Rationale: After a decade long decline, walleye populations appear to have stabilized. Fishery yields are currently low relative to 1980s and 1990s levels. Recent hatches should keep the population at current or somewhat improved levels of abundance for the next several years.

Purpose

- To show status and trends in walleye populations in various Great Lakes habitats
- To infer changes in walleye health
- To infer ecosystem health, particularly in moderately productive (mesotrophic) areas of the Great Lakes

Ecosystem Objective

Protection, enhancement, and restoration of historically important, mesotrophic habitats that support natural stocks of walleye as the top fish predator are necessary for stable, balanced, and productive elements of the Great Lakes ecosystem.

State of the Ecosystem

Reductions in phosphorus loadings during the 1970s substantially improved spawning and nursery habitat for many fish species in the Great Lakes. Improved mesotrophic habitats (i.e., western and central Lake Erie, Bay of Quinte,

Saginaw Bay and Green Bay) in the 1980s, along with interagency fishery management programs that increased adult survival, led to a dramatic recovery of walleye populations in many areas of the Great Lakes, especially in Lake Erie. High water levels also may have played a role in the recovery in some lakes, estuaries or bays.

Trends in annual assessments of fishery harvests generally track walleye population recovery in these areas, with peak harvests occurring in the late 1980s to middle 1990s, followed by some declines into the early 2000s, and then increases in most areas after 2002 (Figure 1). Total yields by lake were highest in Lake Erie (annual average of about 4,500 metric tonnes, recorded from 1975 to 2007 data available), intermediate in Lakes Huron (224 metric tonnes), the Huron-Erie Corridor (tonnage unavailable, but up to a half million fish) and Ontario (average of 87 metric tonnes, and lowest in Lakes Michigan (average of 16 metric tonnes) and Superior (average of 2 metric tonnes). Declines after the mid-1990s were possibly related to shifts in environmental states (i.e., from mesotrophic, moderately productive conditions to less favorable oligotrophic, low productivity conditions), variable reproductive success, influences from invasive species, and changing fisheries.

Recent improvements in abundance are due to a strong 2003 hatch across the Great Lakes Basin, presumably due to ideal regional spring weather conditions. However, in Lake Huron and particularly Saginaw Bay, the production of very strong year classes has continued in four of the last five years beginning in 2003. Recent research has demonstrated that this is a result of the collapse of alewives in Lake Huron. Alewives there are documented to be formidable predators and competitors on newly-hatched walleye fry. In the absence of alewives, it appears that naturally-reproduced walleye fry are experiencing greatly improved survival. Saginaw Bay's walleye population (the largest source of walleye in Lake Huron) is approaching recovery criteria established by the Michigan Department of Natural Resources. This new paradigm may continue as along as alewives remain scarce. It may also give insight into the recovery potential and determining factors limiting walleye recovery in other locations. Lake Ontario has seen similar improvement in walleye recruitment; the 2003-2007 year-classes are on average stronger than the previous five years (1998-2002). Lake Erie hatches have been highly variable; moderate year classes were produced in 1999 (16 million age 2s) and 2001 (12 million age 2s), and 2003 produced a very strong year class at over 50 million age-2 fish, but around those years, very weak year classes were produced in 2000, 2002, 2004 and 2006 (all less than 2 million age 2s). Walleye spawner biomass was constant to increasing during this time period, so adequate egg production was not a controlling factor in the Lake Erie walleye hatch variability.

In general, walleye yields peak or improve dramatically under ideal environmental conditions and fewer or no nuisance species, and decline under less favorable (i.e., non-mesotrophic, less healthy) conditions. Overall, environmental conditions remain improved relative to the 1960s and early 1970s but concerns about food web disruption, pathogens (e.g., botulism, viruses), noxious algae, and poor watershed management practices persist.

Pressures

Natural, self-sustaining walleye populations require adequate spawning and nursery habitats. In the Great Lakes, these habitats exist in tributary streams, and in nearshore reefs, wetlands, and embayments. They have been used by native walleye stocks for thousands of years. Degradation or loss of these habitats is the primary concern for the health of walleye populations and can result from both human causes, as well as from natural environmental variability. Increased human degradation of nearshore and watershed environments continues to alter the natural hydrologic regime, affecting water quality (i.e., sediment and nutrient loads) and rate of flow.

Environmental factors that affect precipitation patterns ultimately alter water levels, water temperature, water clarity and flow. Thus, global warming and its subsequent effects on temperature and precipitation in the Great Lakes basin may become increasingly important determinants of walleye health.

Non-native invasive species, like zebra and quagga mussels, ruffe, and round gobies continue to disrupt the efficiency of energy transfer through the food web, potentially affecting growth and survival of walleye and other fishes through a reduced or changed supply of food or timing of food availability. In many of the Great Lakes food web and environmental changes following zebra and quagga (Dreissenid) mussel invasion likely led to the current lower abundance of walleye. Round goby expansion and predation on Dreissenids has brought some of that energy back into the food web as walleyes have begun to prey on round gobies in many Great Lakes. Recent experience in Lake Huron has elevated the concern over the predatory and competitive effects of the non-native alewife population on walleye. Alterations in the food web can also affect environmental characteristics (like water clarity), which can in turn affect fish behavior and fishery yields. Pathogens, like viral hemorrhagic septicemia and botulism, could also potentially affect walleye populations or their food webs in some areas of the Great Lakes.

Management Implications

To improve the health of Great Lakes walleye populations, managers must enhance walleye reproduction, growth and survival rates. Most walleye populations are dependent on natural reproduction, which is largely driven by uncontrollable environmental events (i.e., winter and spring weather patterns, water clarity, and alewife abundance). However, a lack of suitable spawning and nursery habitat is limiting walleye reproduction in some areas due to human activities and can be remedied through such actions as dam removal, substrate enhancement or improvements to watersheds to reduce siltation and restore natural flow conditions.

Growth rates are dependent on weather (i.e., water temperatures), quality of the prey base, and walleye density - most of which are not directly manageable. Survival rates can be altered through fishery harvest strategies, which are generally conservative across all of the Great Lakes. Continued interactions between land managers and fisheries managers to protect and restore natural habitat conditions in mesotrophic areas of the Great Lakes and in spawning and juvenile walleye habitats are essential for the long term health of walleye populations. Elimination of additional introductions of new non-native invasive species and control of existing non-native nuisance species, where possible, is also critical to future health of the walleye population and other native species.

Fisheries management and public expectations will need to respond to continuing ecosystem changes. Minnesota Department of Natural Resources personnel have developed a Fisheries Management Plan for their waters of Lake Superior. They have identified key areas in the St. Louis River estuary and the Pigeon River system that are important or Lake Superior watershed walleye populations. Most, if not all, agencies have developed or are revising strategic plans for the long-term health of the walleye populations. The Lake Erie Committee has drawn up a Walleye Management Plan that delineates desired fishery objectives and a specific harvest policy with thresholds and a sliding fishing harvest rate based on population abundance. Improving long-term data collection and management scenarios will be important to allow managers to understand changes to the walleye populations and fisheries in the Great Lakes.

Comments from the author(s)

Fishery yields are appropriate indicators of walleye health but only in a general sense. Yield assessments are lacking for some fisheries (recreational, commercial, or tribal) in some years for all of the studied areas. Moreover, measurement units are not standardized among fishery types (i.e., commercial fisheries are measured in pounds while recreational fisheries are typically measured in numbers), which means additional conversions are necessary which reduce accuracy. Also, “zero” values need to be differentiated from “missing” data in any figures. Therefore, trends in yields across time (blocks of years) are probably better indicators than absolute values within any year, assuming that any introduced bias is relatively constant over time. Given the above, a 10-year reporting cycle on

this indicator is recommended. Many agencies have developed, or are developing, population estimates for many Great Lakes fishes. Walleye population estimates for selected areas (i.e., Lake Erie's western and central basins, Saginaw Bay, Green Bay, and Bay of Quinte) would probably be a better assessment of walleye population health in the Great Lakes than harvest estimates across all lakes, and switching to them as they become available in all areas is recommended.

Assessing Data Quality

Rather than using the prescribed method (inserting an "x" under the statement that best corresponds with each data characteristic), each parameter is ranked by lake since there were significant differences and variability between the data characteristic assessments across the lakes. *Key*: LS=Lake Superior, LM=Lake Michigan, LH=Lake Huron, HEC=Huron-Erie Corridor, LE=Lake Erie, and LO=Lake Ontario.

Data Characteristics	Strongly Agree	Agree	Neutral or Unknown	Disagree	Strongly Disagree	Not Applicable
1. Data are documented, validated, or quality-assured by a recognized agency or organization		LE, LH, LM, LO, HEC	LS			
2. Data are traceable to original sources	LE	LH, LM, LO, HEC	LS			
3. The source of the data is a known, reliable and respected generator of data	LE	LM, LO, HEC	LH, LS			
4. Geographic coverage and scale of data are appropriate to the Great Lakes basin		LE, LM, LO	LH, LS, HEC			
5. Data obtained from sources within the U.S. are comparable to those from Canada		LE, LM, HEC	LO, LS	LH		
6. Uncertainty and variability in the data are documented and within acceptable limits for this indicator report	LE	LM, LO	LH, LS, HEC			
Clarifying Notes: There is room for improvement. Much of our data is not in yield form (pounds or kilos) and had to be converted. All elements of the harvest are not evaluated on a consistent basis. Knowledge of the population status is based on regular assessment surveys which may be more reliable or are associated with a greater degree of confidence by biologists and managers.						

Acknowledgments

Author:
Kevin Kayle, Ohio Department of Natural Resources (ODNR) (2008)

Sources

Fishery harvest data and management information were obtained from the following sources:

Lake Superior: Ken Cullis, Ontario Ministry of Natural Resources (OMNR), ken.cullis@ontario.ca
Lake Superior/Michigan/Huron: Karen Wright, Chippewa Ottawa Resource Authority, kwright@sault.com
Lake Michigan: David Rowe, Wisconsin Department of Natural Resources, david.rowe@wisconsin.gov
Lake Huron: Lloyd Mohr, OMNR, lloyd.mohr@ontario.ca
Lake Huron: David Fielder, Michigan Department of Natural Resources (MDNR), fielderd@michigan.gov

Huron-Erie Corridor: Megan Belore, OMNR, megan.belore@ontario.ca
Huron-Erie Corridor: Michael Thomas, MDNR, thomasmv@michigan.gov
Lake Erie: Kevin Kayle, ODNR, kevin.kayle@dnr.state.oh.us
Lake Ontario: Jim Hoyle, OMNR, jim.hoyle@ontario.ca
Lake Ontario: Jana Lantry, New York Department of Environmental Conservation, jrlantry@gw.dec.state.ny.us

Various annual fisheries reports from the Ontario Ministry of Natural Resources, Ohio Department of Natural Resources, Minnesota Department of Natural Resources, and the Great Lakes Fishery Commission commercial fishery database were used as data and information sources.

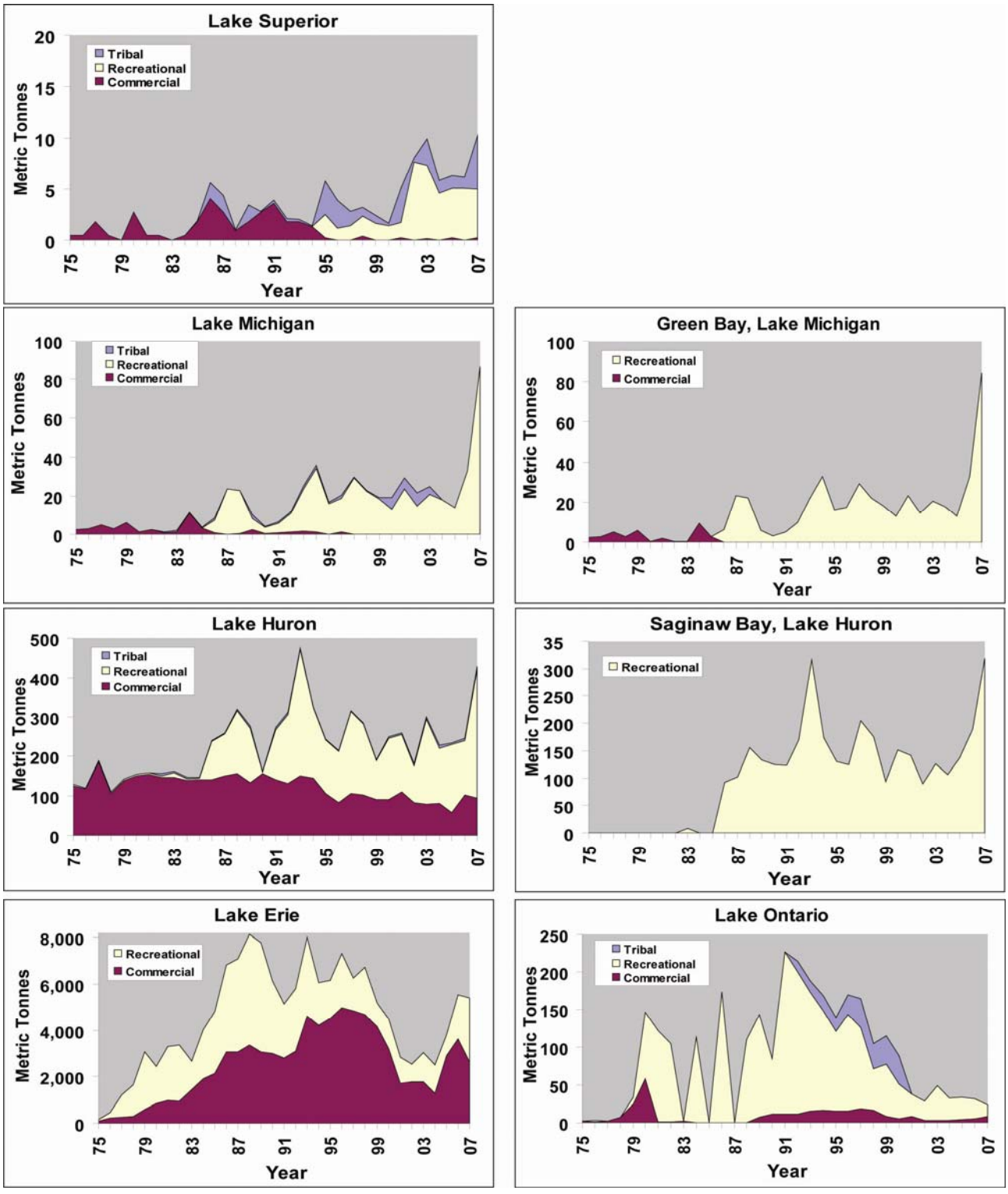
Fishery data should not be used for purposes outside of this document without first contacting the agencies that collected them.

List of Figures

Figure 1. Tribal, recreational and commercial harvest of walleye reported from the Great Lakes, 1975-2007.
Fish Community Goals and Objectives are: Lake Michigan, 100-200 metric tonnes; Lake Huron, 700 metric tonnes; Lake Erie, sustainable harvest in all basins; Lake Ontario, maintain early 1990s populations and expand populations into favorable habitats.
Sources: Chippewa Ottawa Resource Authority, Michigan Department of Natural Resources, Minnesota Department of Natural Resources, New York State Department of Environmental Conservation, Ontario Ministry of Natural Resources, Ohio Department of Natural Resources, Pennsylvania Fish and Boat Commission, Wisconsin Department of Natural Resources

Last Updated

State of the Lakes Ecosystem Conference (SOLEC) 2008



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