



Lake Michigan Committee

Representing the Fishery Management Agencies of Lake Michigan

Lake Michigan Yellow Perch Summit

UIC Forum, Chicago

March 22, 2014

Summary Report



Prepared by:

Victor J. Santucci, Jr.

Illinois Department of Natural Resources

Bradley T. Eggold

Wisconsin Department of Natural Resources

Todd G. Kalish

Michigan Department of Natural Resources

Jeremy Price

Indiana Department of Natural Resources

Thomas K. Gorenflo

Chippewa-Ottawa Resource Authority

June 2014



Acknowledgements

The Lake Michigan Committee (LMC) would like to acknowledge all of the individuals and agencies that made the Lake Michigan Yellow Perch Summit a success, and those individuals that contributed to this summary report. The summit was organized by the LMC, B. Breidert and J. Dettmers. M. Gaden and other members of the Great Lakes Fishery Commission (GLFC) Secretariat, including N. Ebinger, J. McAulay, T. Lawrence and J. Wingfield prepared press releases, announcement literature, web postings, on-line registration and the summit agenda document. D. O'Keefe of Michigan Sea Grant and Michigan State University Extension organized the webinar and provided IT support at the meeting. T. Marsee of University of Michigan provided webinar assistance. P. Charlebois and D. Hilbrich of Illinois-Indiana Sea Grant assisted with locating a suitable venue for the event. Many thanks to invited speakers M. Evans and D. Bunnell from USGS Great Lakes Science Center, J. Janssen and F. Binkowski from University of Wisconsin – Milwaukee, D. Clapp from Michigan Department of Natural Resources, B. Eggold from Wisconsin Department of Natural Resources, C. Roswell from Illinois Natural History Survey Prairie Research Institute, J. Dettmers from GLFC and M. Ryan from Indiana for volunteering their time, data and expert knowledge. B. Breidert, S. Robillard, D. Makauskas and P. Hirethota helped facilitate the structured breakouts and P. Bevell, K. Patterson and W. Stacy recorded detailed notes during the session. P. Bevell and K. Patterson kept on-site registration running smoothly. The Illinois Department of Natural Resources and GLFC hosted and provided financial support for the event. The summary report was prepared by members of the LMC with assistance from R. Knight and J. Dettmers. Finally, we thank Lake Michigan yellow perch anglers and other stakeholders for participating in the summit and providing valuable input to fishery managers.

Lake Michigan Yellow Perch Summit Summary Report

Introduction

The Lake Michigan Committee (LMC) of the Great Lakes Fishery Commission (GLFC) convened a multijurisdictional yellow perch summit at the University of Illinois Chicago on March 22, 2014. This informational meeting was hosted by the Illinois Department of Natural Resources (ILDNR) and the GLFC. Michigan Sea Grant hosted a live-streaming webinar for stakeholders unable to travel to Chicago in person. The purpose of the meeting was to update anglers and stakeholders about changing Lake Michigan ecology and the current status of yellow perch populations, fishing and management. The program included nine presentations by invited experts and a breakout session where smaller groups of constituents could comment and provide input to Lake Michigan fishery managers. The presentations and breakout session wrap-up are archived online at:

http://www.glfc.org/lakecom/lmc/yellow_perch_videos.html

The summit was initiated by ILDNR Director, Marc Miller, in August 2013 when he wrote to other natural resource agency executives requesting support for a reconsideration of management efforts on Lake Michigan yellow perch. Several factors led to the request, including: 1) recent declines in yellow perch abundance and sport fish harvest; 2) inconsistent yellow perch regulations across state jurisdictions creating confusion among perch anglers about the status of the fishery; 3) restrictive harvest regulations (unpopular in some jurisdictions) that have been in place for over a decade; and 4) reports by some anglers indicating a lack of opportunity to provide input on Lake Michigan yellow perch management. All parties agreed that the LMC was the appropriate lead to move forward management of the multijurisdictional yellow perch fishery. Holding a summit to foster the sharing of information and ideas among agency managers, researchers and stakeholders was considered an important initial step to direct future cooperative management initiatives.

The LMC met on several occasions during summer and fall 2013 to discuss the merits of a yellow perch summit and how to proceed. The committee selected a location, date and venue and developed a work plan to keep planning on track. Several additional meetings and conference calls were held as the group settled on a meeting format and developed topics for the informational program and structured breakout session. The informational program included presentations on changes to Lake Michigan productivity and food web, impacts of aquatic invasive species (AIS), yellow perch early life history survival bottlenecks and population status, status of yellow perch fishing, yellow perch aquaculture, stocking, management regulations and the difficult task of managing multijurisdictional fisheries in a system as large and complex as Lake Michigan. Structured breakouts facilitated discussion among managers and stakeholders and elicited constituent feedback in four topic areas: 1) ecosystem capacity; 2) population assessments; 3) stocking; and 4) sport fishing regulations. Time also was provided for general questions from the audience. In all, the cooperative effort resulted in a successful summit having 65 attendees at University of Illinois Chicago and 25-30 webinar participants. Having archived recordings of the summit on the GLFC website will allow for additional participation by interested stakeholders into the future.

Objective

The LMC set the following objective for the yellow perch summit:

To foster a well-informed and engaged base of Lake Michigan yellow perch anglers and stakeholders to support ongoing management efforts.

Background

Yellow perch (*Perca flavescens*) play an important role in the near-shore ecology of Lake Michigan and are extremely popular with commercial and recreational fishers around the lake. During a recent period of high abundance (1985-1993), yellow perch commercial and sport fishing harvest exceeded 2.0 million pounds annually (Clapp and Dettmers 2004), and perch comprised about 85% of the sport fish catch (Francis et al. 1996). Examining historic commercial fishing statistics from 1890-1991 (see Eshenroder et al. 1995), one might conclude that Lake Michigan yellow perch populations regularly experienced large fluctuations in abundance. However, analysis based on fishery dependent data may provide erroneous estimates of abundance because commercial landings may be influenced by factors other than fish density (Francis et al. 1996), such as changing market values, size of the fishing fleet, gear efficiency and regulations. Since the late 1970s, fisheries independent assessment techniques (e.g., trap nets, graded- and micro-mesh gill nets, beach seines and bottom trawls) have been used by management agencies to monitor yellow perch population trends. These assessments support the idea that perch densities may vary substantially across years, and combined with aging data show that fluctuations in abundance can be largely attributed to variations in year-class strength and recruitment of individuals to the spawning stock.

The most recent peaks in yellow perch abundance discussed above occurred after populations produced several consecutive strong year classes. However, the strong recruitment observed in the 1980s did not persist. Several years of reproductive failure combined with high commercial and sport fish harvests resulted in a rapid, lakewide decline in yellow perch abundance during the early 1990s (Marsden and Robillard 2004; Wilberg et al. 2005). Management authorities convened a yellow perch conference in Kenosha, Wisconsin on December 10, 1994 to alert constituents about declining perch abundance around the lake. Soon afterwards, the LMC created a Yellow Perch Task Group and charged the group with developing and implementing a multi-agency research initiative to explore the causes of yellow perch recruitment failure in Lake Michigan. The task group consisted of representatives from 14 management and research institutions that cooperatively developed a research plan to examine five hypotheses or factors (temperature, spawning stock, mass water movement, zooplankton and predation) likely to cause recruitment failure at various yellow perch early life stages (Clapp and Dettmers 2004). The group also sought and received over \$3.0 million in funding from 20 State, federal and private agencies and organizations to complete the proposed work. The research initiative and cooperative agency assessments supported by the Federal Aid in Sport Fish Restoration program provided critical information to managers about the ecology and status of Lake Michigan yellow perch. These efforts resulted in numerous reports and scientific publications, including the identification of mechanisms affecting survival and transport of larvae, prey selection, habitat preference, stock structure and adult movement patterns (Clapp et al. 2012).

Following is a brief narrative summarizing results from selected studies in the task group research initiative. Yellow perch were found to prefer rocky over sandy substrate for spawning along the western shoreline of Lake Michigan (Robillard and Marsden 2001) and researchers identified and mapped suitable spawning substrate in the nearshore waters of Illinois (Creque et al. 2010). Upon hatching, larval perch are transported offshore by lake currents (Dettmers et al. 2005; Beletsky et al. 2007) where they must inflate their airbladders and find adequate densities of appropriately-sized zooplankton prey to survive (Dettmers et al. 2003; Czesny et al. 2005; Fulford et al. 2006; Graeb et al. 2006). After feeding in the pelagic zone for several weeks, age-0 perch become demersal and return to nearshore areas sometime during late summer where they feed on invertebrates, typically preferring rocky substrate to sandy bottom when it is available (Janssen and Luebke 2004). Declines in abundance of southern Lake Michigan yellow perch are due to the development of weak and/or inconsistent year classes necessary to replace losses of adults from natural causes and fishing harvest. Suggested causes of poor recruitment and year class formation include air bladder non-inflation soon after hatching (Czesny et al. 2005), low zooplankton densities during the time of first feeding (Dettmers et al. 2003), losses of larvae to predation by alewife (Shroyer and McComish 2000), demographics of the spawning population (e.g., skewed sex ratios and low spawner abundance, size and condition; Heyer et al. 2001; Marsden and Robillard 2004;

Lauer et al. 2005), and alteration of the food web by zebra mussels (Marsden and Robillard 2004; Janssen and Luebke 2004). A genetic assessment of Lake Michigan yellow perch identified three differentiated stocks or populations within the lake (Miller 2003). These populations were based in Green Bay, southern Lake Michigan and northern Lake Michigan. A large scale mark-recapture study in southern Lake Michigan and Green Bay supported the assignment of a single genetic stock of yellow perch within the southern basin. Marked fish from the southern basin were never recovered in Green Bay or the northern basin and perch marked in Green Bay were never captured in the southern basin (Glover et al. 2008). The study also showed spawning site fidelity by tagged yellow perch (35-80% of recaptured individuals returned to their marking site, although straying to nearby sites was evident) and general movement of perch south along the western lake shore (WI to IL and IL to IN), west along the southern shoreline (IN to IL) and north along the eastern shoreline (IN-MI).

The LMC disbanded the Yellow Perch Task Group in spring 2013 after the task group met its charge. Research coordinated by the group has informed yellow perch management for nearly two decades and comprised much of the information presented at the yellow perch summit and summarized in a subsequent section of this report.

In addition to supporting research, Lake Michigan management authorities sought to reduce exploitation of declining yellow perch populations to protect the remaining spawning stock. Commercial perch harvest was reduced in the mid-1990s and closed lakewide by 1997 (except for Green Bay where the current harvest quota is 100,000 pounds). The States also implemented restrictive sport fishing regulations (e.g., bag limits, closed seasons and a keeper slot limit) to reduce potential harvest from recreational angling. In 1995, Wisconsin and Illinois set bag limits to 25 fish/day and closed fishing during the month of June. Both jurisdictions later reduced bag limits (15 fish/day in Illinois and 5 fish/day in Wisconsin) and changed fishing closure dates (May 1-June 15 in Wisconsin and July in Illinois). Illinois also enforced an 8- to 10-inch keeper slot limit between 1997 and 2001 to balance a biased sex ratio that was skewed in favor of smaller male perch. Indiana and Michigan set perch bag limits at 25 and 35 fish/day, respectively in 1996. One year later, Indiana lowered their daily bag limit to 15 fish. Neither state elected to implement a closure on yellow perch sport fishing. Although differing among jurisdictions, all harvest restrictions were intended to ensure that adequate numbers of mature perch remained for future spawning seasons when favorable conditions returned to the lake. While the cooperative actions by Lake Michigan management agencies prevented a complete collapse of the perch fishery, abundance has remained low relative to earlier peaks and populations show no immediate signs of recovery despite continued enforcement of harvest restrictions.

The most recent efforts to evaluate yellow perch regulations utilized statistical catch-at-age models developed during the early 2000s (Wilberg et al. 2005) and decision analysis (DA) tools developed by researchers from the Qualitative Fisheries Center at Michigan State University (Irwin et al. 2008, Wilberg et al. 2008). Results of these analyses were presented to Lake Michigan managers at a DA workshop in 2008 (Clapp et al. 2012). Preliminary recommendations from the workshop based on modeling estimates of yellow perch population demographics were to adaptively relax harvest restrictions around the lake. The LMC made a consensus decision not to relax regulations because of recent data showing declining catches in assessment surveys that were not included in model estimates and the lack of consistent recruitment and recovery of yellow perch populations following implementation of harvest restrictions in place since 1995.

Stocking has often been suggested as a means to enhance yellow perch populations and improve fishing. A stocking workshop including scientists, managers and public stakeholders was convened by the University of Wisconsin Sea Grant Institute in April 1998. The workshop was designed to summarize available information on the feasibility and desirability of implementing a yellow perch stocking program in southern Lake Michigan, but purposefully did not include recommendations on stocking (Kraft 1998). At the time, some constituents were advocating for implementation of a yellow perch stocking program

even though Lake Michigan management authorities had publically stated opposition to stocking perch in the lake. Workshop organizers developed eight questions related to various aspects of yellow perch stocking and invited scientists responded to these questions in a series of short presentations and discussions. The questions addressed potential goals of stocking, evaluating stocking success, risks of stocking, effects of stocking on management, past experiences with stocking yellow perch, costs of stocking and design of an experimental stocking program. Stakeholders and managers also were allowed to participate in the discussions and ask questions. Partially in response to information provided at the workshop, fishery advisors to the GLFC proposed and adopted a resolution at their 2004 annual meeting to oppose stocking yellow perch in Lake Michigan for reasons related to genetics, fish health and costs.

Past efforts to stock yellow perch in Lake Michigan have been limited in geographic location, duration and scale. Records in the GLFC stocking database show that Wisconsin introduced perch in southern Lake Michigan (Milwaukee and Kenosha counties) during 3 years from 1978-1984 and Michigan stocked Little Bay de Noc during 4 years from 1989-2002. In 1978, Wisconsin stocked about 179,000 fingerling, yearling and adult perch taken from inland lakes, followed by a single stocking of 200,000 fry from Green Bay egg skeins in 1981 and another of 6,000 juveniles in 1984. Michigan stocked about 25,000 adults and 129,000 fingerlings between 1989 and 1995, and another 5,700 adults in 2002. Though efforts to mark and assess the success of stocked fish have been limited, there is no indication to date that the introductions by Wisconsin and Michigan have had an effect on Lake Michigan yellow perch populations or the sport fish catch. Despite agency policy and the lack of success from past introductions, some user-group representatives continue to advocate for implementation of a yellow perch stocking program for Lake Michigan.

Summary of Informational Presentations

The summit began with ILDNR Director, Mark Miller and Assistant Fish Chief, Dan Stephenson providing welcome and introductory remarks. The morning session was moderated by LMC Chair, Brad Eggold and included nine presentations from invited experts. Below we provide highlights of each presentation in the order that they were presented at the summit.

Phytoplankton: food for the food for the perch (by Dr. Mary Anne Evans, USGS, Great Lakes Science Center)

“Phytoplankton” (plant plankton) is a technical term for a variety of small, free-floating, aquatic plants commonly known as “algae”. Phytoplankton use nutrients (especially phosphorus) and sunlight to grow and reproduce, providing food to “zooplankton” (animal plankton) that feed the prey fishes that, in turn, feed the predator fishes that support fisheries. Therefore, changes to phytoplankton communities indirectly affect fish populations and fisheries through the food chain.

The phytoplankton community has declined in Lake Michigan and several other Great Lakes since the 1980s, most rapidly during the 2000s. Low phytoplankton densities in offshore waters are now comparable to Lake Superior, which should not be the case given Lake Michigan’s bathymetry, watershed characteristics, and southerly location. The decline was caused by:

- planned reductions in phosphorus through point source pollution control under the binational 1973 Great Lakes Water Quality Agreement,
- unexpected predation and nutrient recycling by invasive “Dreissenid” (zebra and quagga) mussels, and
- changing weather patterns that affected nutrient inputs and their seasonal distribution in the lake.

The changing Lake Michigan zooplankton community and potential implications for young yellow perch (by Dr. David Bunnell, USGS, Great Lakes Science Center)

“Zooplankton” (animal plankton) is a technical term for a variety of small, free-swimming, aquatic animals that feed on phytoplankton and provide essential food to fish fry, thereby enhancing their growth and survival. Zooplankton species are of various sizes, some being too large for fry to eat. Therefore, the availability of edible-size zooplankton is considered to be a “bottleneck” for many fish populations with documented effects on “recruitment” (hatch strength). In Lake Michigan, yellow perch recruitment tracks well with zooplankton densities in June.

Zooplankton abundance has declined in the offshore waters of Lake Michigan since the late 1990s. The causes and implications of this decline to fisheries are:

- low abundance of phytoplankton may limit the availability (numbers and sizes) of edible zooplankton to fishes in offshore areas,
- reductions in prey fish abundance are evident in offshore areas,
- variable, but generally low, recruitment is apparent for yellow perch, and
- a return to the yellow perch hatch pattern of the 1980s appears unlikely given current trends in Lake Michigan zooplankton availability.

Yellow perch baby bottlenecks (by Dr. John Janssen, University of Wisconsin-Milwaukee)

Successful recruitment of yellow perch in Lake Michigan consists of spawning in near shore rocky areas, transportation of newly-hatched fry to offshore areas in water masses with sufficient food (zooplankton), and return movements of juvenile perch to food-rich, near shore bottom habitats. Invasive species have compromised this cycle by reducing food availability to yellow perch fry and juveniles in both near shore and offshore areas:

- invasive Dreissenid mussels have reduced the offshore availability of zooplankton for yellow perch fry by lowering their food supply (phytoplankton),
- invasive Dreissenid mussels have reduced the abundance of “mud scuds” (*Diporeia*) as food for juvenile yellow perch in near shore and offshore bottom habitats, and
- invasive round gobies have reduced the availability of various prey to juvenile yellow perch in near shore rocky areas, through predation on the prey and aggressive behavior toward perch.

Yellow perch recruitment might improve if juveniles switch to alternative food sources in near shore areas, such as native midges, invasive bloody red shrimp (*Hemimysis* sp.), and round goby fry.

Status of Lake Michigan and Great Lakes yellow perch populations (by Mr. Dave Clapp, Michigan Department of Natural Resources)

Trends in Lake Michigan yellow perch populations were compared over time and against other Great Lakes to provide a perspective on establishing appropriate benchmarks. From the 1980s to present, yellow perch have supported important near shore fisheries throughout the Great Lakes, with harvests ranging from <10,000 pounds annually in Lake Superior, 100,000 to 6 million pounds in Lake Huron, 800,000 to 8 million pounds in Lake Michigan, and 15 million to 30 million pounds in Lake Erie. Major points were:

- ranges in fishery harvests reflect differences in ideal yellow perch habitat among these lakes,
- yellow perch population assessments from long-term netting surveys at various sites in the lakes show that adult perch abundance was generally high during the 1980s in Lakes Huron, Michigan and Erie, but declined during the 1990s in all lakes, with recovery occurring only in Lakes Huron and Erie during the 2000s,

- older (up to 17 years) yellow perch are being sampled in Lake Michigan, suggesting that adult mortality is not excessive and that the major cause of low abundance in Lake Michigan is poor recruitment, and
- research indicates that successive strong hatches were only observed in Lake Michigan during a few years (mid-1980s) over a 40-year period (1963-2003), which may help frame realistic expectations for future improvement in recruitment.

Status and trends of yellow perch fishing and harvest in Lake Michigan (by Mr. Charles Roswell, Illinois Natural History Survey, University of Illinois)

State sport fisheries were examined to provide lakewide fishery trends over the past decades for Lake Michigan yellow perch. Commercial fisheries on yellow perch were closed in all states after 1997, excluding Green Bay where commercial fishing still accounts for about 12% (by weight) of the annual total harvest lakewide. Summary points were:

- yellow perch constitute about 17% of the total lakewide angling effort in Lake Michigan, trailing only salmon/trout in popularity,
- sport fishery success (annual harvest, annual angling hours, and average harvest per angling hour) was 2 to 6 times higher in the peak period (1986-1993) than in recent years (2004-2013) but the rate of decline has slowed over the recent decade,
- harvested yellow perch in the peak period were 14% (on average) shorter in length than in recent years, with no trend over the recent decade,
- all states have declining trends in yellow perch sport fishery effort over the past decade on the main lake (no trend in Green Bay), and
- major changes in sport fishery trends are not foreseeable.

Can cultured perch become wild? (by Mr. Frederick P. Binkowski, University of Wisconsin-Milwaukee)

Aquaculture techniques are currently available to raise yellow perch to fingerling sizes utilizing Intensive Aquaculture Technology, a process where fish are spawned and reared through egg, larval and fingerling stages in a controlled, indoor facility with a recirculating water system. Past problems with egg incubation, swim bladder inflation and first feeding of newly hatched larvae, and weaning of larger fry and fingerlings to artificial feeds have largely been worked out. A proportion of larvae may develop spinal abnormalities 3-5 weeks post hatch and cannibalism may occur in tanks with larvae of different sizes. Resources necessary for yellow perch fingerling production are:

- experienced team to collect wild broodstock,
- capital investment for broodstock holding (in photo-thermal controlled room), egg incubation, hatching and rearing equipment,
- New facilities necessary if existing hatchery space is unavailable,
- Fish food and feeding equipment,
- Emergency equipment (notification alarms, supplemental oxygen, etc.), and
- Utilities and labor.

The total costs to produce yellow perch fingerlings will equal the sum of capital and production costs. Perch fingerlings can be purchased from suppliers on the discount market at between 8-10 cents/inch. These fingerlings are typically 1.5 to 2.0 inches long and come from pond production systems.

To stock or not stock, that is the question (by Mr. Mike Ryan, Indiana Sport Fishery Advisor to the GLFC)

In 2004, the GLFC Advisors passed a resolution to advocate against stocking cultured yellow perch into Lake Michigan. Their rationale consisted of:

- stocking was not supported by fishery management agencies,
- insufficient information for extant population genetics in the lake,
- unacceptable risk from stocking given uncertainty about population genetics, and
- the potential transmission of parasites and diseases to resident fish populations.

Recommendations from a 1998 Wisconsin Sea Grant workshop on this topic should also be considered:

- formal specification of a stocking goal and how it will be evaluated,
- full assessment of risks associated with a stocking program,
- incorporation of knowledge from effective fish stocking programs, especially involving yellow perch,
- consideration of potential impacts on existing sport fishery regulations, and
- consideration of stocking program cost in light of the goal.

Lake Michigan yellow perch regulations: past and present (by Mr. Brad Eggold, Wisconsin Department of Natural Resources)

Current sport fishery regulations for the main waters of Lake Michigan by state:

State	Daily Bag (Year Enacted)	Closed Season to Angling (Year Enacted)
Illinois	15 fish (2001)	July (2001)*
Indiana	15 fish (1997)	none
Michigan	35 fish south of the 45 th parallel (1996)	none
Wisconsin	5 fish (1996)	May 1 –June 15 (2002)

* modified in 2006 to allow 10 fish daily for fishers under age 16

Rationale in support of varying bag limits among states:

- yellow perch population levels differ among states,
- habitats differ among states,
- governance systems differ among states, and
- the common goal among the states has been to encourage recruitment by reducing adult mortality through appropriate constraints on harvest, instead of standardizing bag limits.

Future management considerations:

- analysis of regulation effectiveness,
- simplification/unification of regulations,
- protect against increasing mortality on adult yellow perch, and
- regional approach to regulate fisheries.

Yellow perch in a complex and changing Lake Michigan: insights and synthesis (by Dr. John Dettmers, Great Lakes Fishery Commission)

Inter-jurisdictional fisheries management of shared fish stocks is complex, requiring understanding of the resource, having sufficient science for management decisions, and sustaining effective communication among managers and stakeholders. Great Lakes states have committed to work together under a formal fisheries management plan, which emphasizes accountability, information sharing, and consensus-based decisions, such as maintaining low adult mortality on Lake Michigan yellow perch.

Key points from today’s presentations and decades of fishery management and research:

- the capacity of Lake Michigan to produce yellow perch has decreased in recent years,
- first-year recruitment is not showing up in adult assessments or in fisheries,
- first-year yellow perch are now smaller than they were in the 1980s-1990s,
- food web shifts affect first-year survival of yellow perch fry and juveniles,
- stocking is possible but may not be appropriate, and
- the LMC is aware, concerned, and emphasizes the importance of conserving perch spawner abundance.

Fishery managers are facing a dilemma. All states recognize the importance of yellow perch fisheries and want to harvest fish. Regulations have conserved spawner biomass, but invasive species have compromised recruitment. Best management intentions have been confounded by ecosystem changes that may be unmanageable. The LMC is considering next steps.

Summary of Structured Breakouts

Stakeholder and agency participants were directed to three pre-assigned breakout rooms for small group discussions. Each breakout was facilitated by a member of the LMC and an assisting Lake Michigan biologist from a different jurisdiction. A flip chart was available for recording session highlights and detailed notes were taken by a second assistant. Webinar participants did not participate in the breakout session; however, the LMC created an email address (yposummit45@gmail.com) so webinar participants and other stakeholders could weigh in with questions or comments about Lake Michigan yellow perch populations and management. Breakouts lasted for 90 minutes, after which all participants returned to the large-group meeting room for a wrap up that also is included in the recordings archived on the GLFC website (see link above). The following summary was prepared after reviewing archived recordings of the breakout session wrap up and notes from flip charts and note takers.

Breakouts were structured around four topic areas addressed during the morning informational session. The topic areas were: 1) the changing Lake Michigan ecosystem and capacity to support yellow perch populations; 2) agency population assessments as predictors of yellow perch abundance; 3) stocking to enhance yellow perch populations; and 4) sport fishing regulations. Facilitators were equipped with questions designed to either stimulate discussion by the group or elicit feedback from participants on a specific topic. Responses to questions generally were similar among breakout rooms so responses from each room have been combined for each of the four topic areas.

Below we provide a general overview of the breakout discussions and responses to feedback questions for each of the above mentioned topic areas and any additional issues brought up by constituents. Questions from the summit gmail account are presented along with answers from the LMC in Appendix A of this report.

Focus Area 1: Ecosystem capacity and yellow perch

Stakeholders generally agreed that the Lake Michigan ecosystem has undergone dramatic changes since the last peak in yellow perch abundance during the late 1980s and early 1990s. Stakeholders clearly understood the effects of nutrient reduction and Dreissenid mussels (zebra and quagga) on lake productivity and how less phytoplankton means fewer zooplankton and less food for young yellow perch. Participants also understood the connection between survival of larval and juvenile perch (or year class strength) and the number of adults recruiting to the fishery.

When asked if the lake could now support the number of perch seen in the 1980s and early 1990s, respondents indicated that it was unlikely to happen in today's lake and several commented that what we are seeing now in terms of fish abundance and fishing success may be a "new normal."

When asked what could be done to restore perch densities to levels seen in the 1980s and early 1990s, some stakeholders expressed concern that the fishery would never recover, whereas others indicated the need for additional research or suggested ways to fertilize the lake to increase productivity.

In response to stakeholder concerns about the causes of ecosystem changes and their effects on fishing in the future, managers and scientists informed constituents that different user groups have differing goals for the lake that are not always compatible and observed changes to the lake have resulted from deliberate actions (e.g., Clean Water Act) and unintentional ones (e.g., zebra and quagga mussel invasions) that are beyond control of fisheries managers. Managers and scientists were optimistic that lake conditions and fishing will improve at some point in the future. They cited evidence that mussel densities in other lakes have declined after reaching peak densities and mussels may be reaching peak densities in Lake Michigan (suggested by recent scientific monitoring data and anecdotal reports from wreck divers). In addition, lake conditions in some years are more favorable than in others and still may support successful reproduction and recruitment of yellow perch (e.g., relatively strong year classes were produced in 2005 and 2010).

Additional comments:

- There was some discussion about increased water clarity and how it is affecting fishing. In the past when visibility was lower, perch staged close to shore for longer periods of time. Now the fishery in many areas of the lake is largely a boat fishery.
- Two of the breakouts discussed the effects of water level changes on nutrients, fish populations and fishing. Water levels have increased recently and are predicted to be stable or increase slightly going into the future, as the Great Lakes region is predicted to be wetter and warmer than average.
- It was noted that some species, such as freshwater drum (sheepshead), smallmouth bass, northern pike and crappie seem to be doing well under current conditions, whereas abundance is down for others, including alewife, yellow perch, and rainbow smelt.
- Several people would have liked a presentation on effects of predation on yellow perch. Perch are generally not consumed by the typical top predators in Lake Michigan (e.g., salmon and trout), although anglers cited instances where they have caught steelhead or walleye with stomachs full of young perch.
- One individual expressed the belief that alewife are the only reason why yellow perch are not doing well, despite the fact that alewife abundance is currently at near record lows in Lake Michigan. This individual suggested managers should stock walleye instead of Chinook salmon to control alewife populations or overstock salmon to crash the alewife population.
- One individual asked if there has been any research documenting round goby/yellow perch competition. Research shows that young gobies compete with young yellow perch, larger gobies feed more on Dreissenid mussels, and gobies can be nest predators on centrarchids (bass and sunfishes) and sculpins, but probably do not eat perch eggs because the perch egg skeins likely contain compounds that repel predators.

Focus Area 2: Population assessments and yellow perch abundance

After seeing data from all jurisdictions showing similar trends, stakeholders agreed that assessments are probably accurately reflecting yellow perch population levels in the lake. There was some concern over specific methods used for sampling (e.g., seining for juveniles when the water is so clear) and sampling at the same place during the same time year after year. Managers responded that seining by ILDNR detected the strong year class of yellow perch in 2010 when water clarity was high. Managers also stressed the importance of standardized sampling and the practice of supplementing standard samples with samples from different gears taken throughout the sample season. It was also noted that standard

sampling methods catching no or few fish are not necessarily wrong and most likely reflect low fish abundance, especially if high catches occurred in these samples in the past.

Stakeholders generally agreed that perch abundance is much lower now than it was during the late 1980s and early 1990s. However, one individual agreed that abundance is down, but suggested it is not as low as managers think it is.

Additional comments:

- There were questions about how far back assessment data goes and historic population densities. Natural resource agencies began standardized population assessments in the 1970s. Prior to that time, fisheries managers used commercial landing statistics to track population changes in species sought by commercial fishers.
- There was some discussion about larvae spawned in Illinois being carried by currents to Michigan and Indiana. The fate of perch larvae spawned in Michigan and Indiana is unknown at this time. Old data showed higher growth of age-0 perch on the eastern lake shore, but faster growth of yearlings on the western shore. New information is needed on regional growth of young yellow perch.
- One breakout group emphasized the need for lakewide bottom mapping to characterize substrates so that important rocky spawning habitat can be identified and protected.

Focus Area 3: Stocking to enhance perch populations

Discussions focused on the size and number of yellow perch that would need to be stocked to produce a measurable return to the creel and the cost required to produce such a large number of fingerlings. All agreed that a 3-inch or larger fingerling would be necessary to overcome survival bottlenecks experienced by smaller perch in the lake. However, some stakeholders expressed concern that growth and survival of stocked fingerlings would be low given current food limitations and slow growth of wild fish. There were also concerns about broodstock sources and introducing bad genes to the wild populations. In discussing numbers, it was explained that yellow perch are lower on the food web and typically occur at higher densities than the top predators that are usually stocked to create or enhance fisheries (e.g., bass, walleye, salmon and trout). A clarification in the cost of yellow perch fingerlings was made in one breakout. The cost of 8-10 cents/inch for perch fingerlings mentioned in the morning session referred to the average price that industry sellers and buyers agree to for pond reared fingerlings that usually are between 1.5 and 2.0 inches long. The price of high quality 3.5- to 4.0-inch perch fingerlings, those suggested for a Lake Michigan stocking program, typically sell for 0.75 cents to \$1.00 per fingerling. High quality fingerlings are typically raised intensively under controlled conditions.

A yellow perch stocking program in a lake the size of Lake Michigan would require very large numbers of fish to have a chance of success. A target of 100 million fingerlings was not considered excessive. After some discussion, there was agreement by participants that the high cost of fingerlings and limited outlook for success make stocking yellow perch impractical at this time.

Despite the general lack of support for stocking, there were some individuals that continued to support stocking as a method to recover yellow perch populations. There was one suggestion to create a perch stamp to fund perch hatcheries and another to let anglers with boats help stock the fish. One stakeholder called for more research on the cost-benefit feasibility of stocking yellow perch to enhance populations in Lake Michigan.

Focus Area 4: Sport fishing regulations

There was a strong appeal by Illinois anglers to open July to perch fishing for everyone and close fishing during the spawning season. Reasons given were that the July closure is causing a loss of perch anglers in Illinois and having a negative effect on bait shops in the Chicago region. In addition, Lake Michigan

perch are important to Illinois anglers because they have no other place to go in the State to catch perch. People in Wisconsin are fishing inland lakes because perch fishing is poor in Lake Michigan. It was explained that July was closed because that was the month with the highest perch harvest so it provided the greatest reduction in potential harvest. Yellow perch not harvested in July would be able to spawn the following spring. Stakeholders seemed to understand the rationale for closing July, but suggested it should be opened again because the fishery has changed. The impact of fishing is less now than when the regulation was first implemented because access to the lakeshore in Chicago is reduced due to the high cost of parking. In addition, overall fishing effort for yellow perch is down in Illinois and the other states and the fish do not stage along the shoreline for as long as they used to in the past.

When asked if regulations should be relaxed most stakeholders indicated that regulations should strike a balance between protecting fish populations (particularly mature spawners) and retaining a sport fishery. The 5 fish per day bag limit in Wisconsin protects the population by reducing harvest, but it also makes it less appealing for someone to launch a boat for a day of perch fishing. Limits can be too strict causing a loss in anglers. Angler retention was a factor in Indiana's choice of perch regulations (15 fish/day and no closures). Michigan's regulation is based on the belief that spawner abundance is good and other biological bottlenecks are the cause of inconsistent recruitment and declining perch abundance.

There were mixed results when stakeholders were asked about a regional approach to regulations. Some were in favor of a regional approach and standardization of regulations among states, whereas others were opposed fearing the possibility of stricter harvest restrictions. There was a suggestion that Illinois and Wisconsin have the same regulations because anglers often cross state lines to fish depending on the bite. In general, a regional approach to regulations was less important than other regulation issues (e.g., lifting the July closure in Illinois).

Unlike regional regulations, stakeholders indicated strong preferences for or against various types of regulations. Slot and length limits for yellow perch were favored the least by stakeholders and bag limits were the most highly favored regulation. Daily bag limit of 15 or more fish were favored by constituents from all states. One Wisconsin resident suggested raising the limit from 5 to 15 fish/day and an Illinois angler suggested a 12 fish/day bag limit would be acceptable if perch fishing was allowed in July. Closed seasons were acceptable only if they included the spawning season (May and early June).

Additional comments:

- There was concern by one individual that Green Bay had different regulations than the main lake and disbelief that Green Bay yellow perch did not regularly enter the main lake. Research has shown that Green Bay has a different genetic population of yellow perch than the main lake so it is managed as a separate water body.
- One stakeholder expressed concern that culling perch caught in deep waters was harmful because released fish have high mortality from barometric trauma. Educating anglers about ways to reduce baro-trauma and enforcing catch and keep regulations could help to alleviate this problem.
- A stakeholder expressed concern about the effect of cormorants on yellow perch in Indiana. Cormorant numbers are increasing in Indiana and they are known to eat perch.

Summit Take Home Message

The summit met the goal of updating anglers and stakeholders about changing Lake Michigan ecology and yellow perch populations, fishing and management. It also succeeded in providing a public forum for discussion and sharing of ideas among stakeholders, scientists and fishery managers. Some major points drawn from the summit are highlighted below.

- Lake phytoplankton productivity is down and the lower trophic level food web has been altered by aquatic invasive species (e.g., Dreissenid mussels, spiny water fleas and round gobies) that have displaced native benthic prey organisms.
- Lower productivity has led to a reduced lake carrying capacity that appears to be affecting many fish species, including yellow perch, alewife, rainbow smelt, sculpins, and bloater chub.
- The changing lake ecosystem has resulted in inconsistent recruitment, survival bottlenecks at multiple juvenile life stages and low abundance of adult yellow perch in recent years.
- Changing lake conditions (e.g., water clarity and levels) also appear to be influencing adult perch movement and nearshore staging patterns (e.g., less time spent nearshore in summer).
- Assessment results indicating low abundance are consistent across sampling techniques and in all jurisdictions suggesting the observed decline in yellow perch populations is real and not an anomaly of sampling protocols.
- Changing lake conditions and population abundance are influencing yellow perch fishing (e.g., recent effort, harvest and CPE are down compared to previous years).
- Strict harvest regulations in place for the past 15 years have not resulted in a recovery of yellow perch populations to previous levels, but likely prevented further reductions in abundance or a complete collapse of the fishery.
- Illinois anglers and stakeholders indicated a strong desire to be able to fish for yellow perch during the month of July, which is currently closed to adult anglers, and instead suggested closing fishing during spring to protect spawners.
- Yellow perch population levels are currently driven primarily by recruitment, which is generally poor in the changed Lake Michigan ecosystem. Options for recovery may be limited due to current lake conditions (see above).
- Stocking as a recovery tool for yellow perch populations may be technologically possible, but probably not practical given the need to stock large fingerlings (3- to 4-inch minimum) to bypass juvenile growth and survival bottlenecks and the cost to produce large numbers of fingerling perch.

Guiding Management Principles

The LMC recommends the following guiding principles for management of Lake Michigan yellow perch:

- At present, yellow perch population size is driven more by ecological factors than fishing. The changing lake ecosystem means that opportunities for large year classes of yellow perch are less common now than they were in the past.
- Prudent management of Lake Michigan yellow perch should ensure that spawning stock abundance/biomass is sufficient to take advantage of favorable ecosystem conditions in years when they occur, while maintaining reasonable levels of yellow perch sport harvest in the lake.
- Stocking yellow perch in an attempt to bring about lakewide population recovery is not recommended at this time given recent changes in the lake ecosystem, the fact that natural yellow perch recruitment is occurring, numbers of stocked perch necessary to enhance year classes will be substantial and costly, success of stocking is unknown and the risk of introducing harmful disease or detrimental genetics may be high. Stocking may be considered in the future as a rehabilitation tool should perch stocks show additional declines, or on a limited basis for experimental purposes or to enhance local, targeted fisheries.

The LMC desires regulations and other management strategies that are broadly consistent with the principles above, and remains committed to inter-jurisdictional coordination among management agencies to achieve common objectives through cooperative management, continued standard population assessments and new research efforts.

Action Items

Focus Area 1 – Reduced Lake Carrying Capacity and Food Web Changes

- Support US Coast Guard, USEPA and State agency efforts to prevent further introductions of exotic species from ballast water transfers and movement of existing populations of AIS around the Great Lakes.
- Support research to control Dreissenid mussels or hasten population declines to less impactful levels in the open waters of Lake Michigan.

Focus Area 2 – Inconsistent Perch Recruitment, Juvenile Bottlenecks and Low Adult Abundance

- Support research that monitors phytoplankton, zooplankton and macro-invertebrates in the near shore and examines predator:prey interactions between yellow perch and round goby to gain a better understanding of lower trophic level dynamics in the nearshore zone and effects of round gobies on yellow perch populations.
- Work to increase/enhance vegetated habitats in connected wetlands and nearshore areas to provide nursery habitat for juvenile perch and increase invertebrate food production.

Focus Area 3 – Assessments

- Continue coordinated and cooperative assessments of young-of-year, juvenile and adult yellow perch populations in all jurisdictions to monitor population changes over time.

Focus Area 4 – Regulations

- Protect yellow perch spawning stock biomass to enhance the probability of successful year class formation when favorable conditions for recruitment occur in the lake.
- Work toward more consistent regulations among jurisdictions while recognizing that angler access, perch abundance and suitable habitat vary around the basin.

Focus Area 5 – Stocking to Enhance Population Recovery

- Support research to assess the feasibility and cost/benefit of stocking yellow perch to enhance local population abundances.
- Only support yellow perch stocking projects that use Lake Michigan brood stock, evaluate the contribution of stocked fish to local fisheries and follow the guiding management principles presented in the previous section of this report.

Literature Cited

- Beletsky, D., Mason, D. M., Schwab, D. J., Rutherford, E. S., Janssen, J. Clapp, D. F., and Dettmers, J. M. 2007. Biophysical model of yellow perch advection and settlement in Lake Michigan. *J. Great Lakes Res.* 33:842-866.
- Clapp, D. F., and Dettmers, J. M. 2004. Yellow perch research and management in Lake Michigan: evaluating progress in a cooperative effort, 1997-2001. *Fisheries* 29(11):11-19.
- Clapp, D. F., Elliott, R. F., Lenart, S. J., and Claramunt, R. M. 2012. Inshore and benthivore fish communities. *In* The state of Lake Michigan in 2011. *Edited by* D. B. Bunnell. Great Lakes Fish. Comm. Spec. Pub. 12-01.
- Creque, S. M., Stainbrook, K. M., Glover, D. C., Czesny, S. J., and Dettmers, J. M. 2010. Mapping bottom substrate in Illinois waters of Lake Michigan: linking substrate and biology. *J. Great Lakes Res.* 36:780–789.

- Czesny, S. J., Graeb, B. D. S., and Dettmers, J. M. 2005. Ecological consequences of swim bladder noninflation for larval yellow perch. *Trans. Am. Fish. Soc.* 134:1011-1020.
- Dettmers, J. M., Reffenberg, M. J., and Weis, A. K. 2003. Exploring changes in southern Lake Michigan: implications for yellow perch recruitment. *J. Great Lakes Res.* 29:355-364.
- Dettmers, J. M., Janssen, J., Pientka, B., Fulford R. S., and Jude, D. J. 2005. Evidence across multiple scales for offshore transport of yellow perch (*Perca flavescens*) larvae in Lake Michigan. *Can. J. Fish. Aquat. Sci.* 62:2683-2693.
- Eshenroder, R. L., Holey, M. E., Gorenflo, T. K., and Clark, Jr., R. D. 1995. Fish-community objectives for Lake Michigan. *Great Lakes Fish. Comm. Spec. Pub.* 95-3.
- Francis, J. T., Robillard, S. R., and Marsden, J. E. 1996. Yellow perch management in Lake Michigan: a multijurisdictional challenge. *Fisheries* 21(2):18-20.
- Fulford, R. S., Rice, J.A., Miller, T. J., Binkowski, F. P., Dettmers, J. M., and Belonger, B. 2006. Foraging selectivity by larval yellow perch (*Perca flavescens*): implications for understanding recruitment in small and large Lakes. *Can. J. Fish. Aquat. Sci.* 63:28-42.
- Glover, D. C., Dettmers, J. M., Wahl, D. H., and Clapp, D. F. 2008. Yellow perch stock structure in Lake Michigan: an analysis using mark-recapture data. *Ca. J. Fish. Aquat. Sci.* 65:1919-1930.
- Graeb, B. D. S., Mangan, M. T., Jolley, J. C., Wahl, D. H. and Dettmers, J. M. 2006. Ontogenetic changes in prey preferences and foraging ability of yellow perch: insights based on relative energetic return of prey. *Trans. Am. Fish. Soc.* 135:1493-1498.
- Heyer, C. J., Miller, T. J., Binkowski, F. P., Calderone, E. M., and Rice, J. A. 2001. Maternal effects as a recruitment mechanism in Lake Michigan yellow perch (*Perca flavescens*). *Can. J. Fish. Aquat. Sci.* 58:1477-1487
- Irwin, B. J., Wilberg, J. M., Bence, J. R., and Jones, M. L. 2008. Evaluating alternative harvest policies for yellow perch in southern Lake Michigan. *Fish. Res.* 94:267-281.
- Janssen, J., and Luebke, M. A. 2004. Preference for rocky habitat by age-0 yellow perch and alewives. *J. Great Lakes Res.* 30:93-99.
- Kraft, C. 1998. Issues related to stocking yellow perch in southern Lake Michigan: a workshop summary. University of Wisconsin Sea Grant Institute, Workshop Summary Report, Green Bay, WI.
- Lauer, T. E., Shroyer, S. M., Kilpatrick, J. M., McComish, T. S., and Allen, P. J. 2005. Yellow perch length-fecundity and length-egg size relationships in Indiana waters of Lake Michigan. *N. Am. Fish. Manage.* 25:791-796.
- Marsden, J. E., and Robillard, S. R. 2004. Decline of yellow perch in southwestern Lake Michigan, 1987-1997. *N. Am. J. Fish. Manage.* 24:952-966.
- Miller, L. M. 2003. Microsatellite DNA loci reveal genetic structure of yellow perch in Lake Michigan. *Trans. Am. Fish. Soc.* 132:503-513.

- Robillard, S. R. and Marsden, J. E. 2001. Spawning substrate preferences of yellow perch along sand-cobble shoreline in southwestern Lake Michigan. *N. Am. J. Fish. Manage.* 21:208-215.
- Shroyer, S. and McComish, T. S. 2000. Relationship between alewife abundance and yellow perch recruitment in southern Lake Michigan. *N. Am. J. Fish. Manage.* 20:220-225.
- Wilberg, M. J., Bence, J. R., Eggold, B. T., Makauskas, D., and Clapp, D. F. 2005. Yellow perch dynamics in southwestern Lake Michigan during 1986-2002. *N. Am. J. Fish. Manage.* 25:1130-1152.
- Wilberg, M. J., Irwin, B. J., Jones, M. L., and Bence, J. R.. 2008. Effects of source-sink dynamics on harvest policy performance for yellow perch in southern Lake Michigan. *Fish. Res.* 94:282-289.

Appendix A. Questions and comments submitted to ypsummit45@gmail.com by webinar participants and other stakeholders between 22 March and 30 April 2014. Answers to questions are provided by the Lake Michigan Committee (LMC) or authors of informational presentations, where appropriate.

Lake Michigan Ecology

Yellow perch are doing better in Green Bay than the main lake basins. Does Green Bay offer any clues to increase the number of young Lake Michigan perch?

Although a good suggestion, it is difficult to make comparisons between Green Bay and the main lake because data indicate that Green Bay is physically and ecologically different than the main lake. In general, Green Bay is shallower, warmer and has higher fertility than the main lake. The bay also has numerous tributaries that provide seasonal nutrient input and more coastal wetlands than the main basin. These natural conditions make Green Bay more productive than the main lake and its yellow perch and other fish populations have been impacted less than populations in the main lake, even though the bay contains the same invasive species as the main lake.

Do phosphates affect phytoplankton production?

Yes, increases in phosphates in the water column cause increases in phytoplankton or algae in lake ecosystems. The increase occurs because phosphates contain phosphorus, a necessary and often limiting nutrient in the growth and production of photosynthesizing plants.

During the 1980s the water level in Lake Michigan was at a high level. Does any of the research look at the relationship between water levels and yellow perch populations or water levels and production of plankton?

Yellow perch population abundance and Lake Michigan water levels have varied considerably during the past 100-150 years. However, we are not aware of any studies relating population abundance to varying lake levels. Similarly, we are not aware of any studies showing a positive relationship between Lake Michigan water levels and phytoplankton or zooplankton abundance.

Does plankton production run in cycles of 10, 50, 100 or even 1,000 years just like the weather and everything else?

Plankton abundance fluctuates considerably throughout the year, and it may even vary among years as changing weather patterns cause variation in runoff and the nutrients that it brings to the lake. However, we are not aware of any studies showing long term cycles in plankton production, and consider these trends unlikely given the short life span and rapid regeneration rate of most plankton species and their ability to show quick population level responses to changing environmental conditions.

Why don't you stock food for the perch?

Stocking invertebrate food organisms is considered impractical due to the large amount of organisms that would have to be produced and stocked to feed even a small population of predator fishes. In addition, any stocked food organisms require food, as well. So, where does it stop? Though not proven in large lakes, a better approach may be to expand or enhance habitats known to produce more invertebrate food organisms (e.g., connected wetlands, protected areas with aquatic vegetation, and rocky substrates).

How do you explain that lake whitefish numbers have gone up in Lake Michigan during the same time yellow perch numbers have been declining? Only perch sac fry can't find food, while whitefish can?

While data indicate that lake whitefish numbers have increased in recent years, these data also show that whitefish are growing slower and are in poor condition (a measure of a fish's plumpness) compared to years before zebra and quagga mussels invaded the lake. Comparing whitefish and perch population trends is not really valid because, except for Green Bay, the two species typically occupy different regions of the lake – lake whitefish in the northern portions and yellow perch in the southern basin. Hatch size and timing of larval hatch may benefit lake whitefish because they hatch at a larger size and months before yellow perch, which allows whitefish to get a jump on the perch when it comes to utilizing limited available zooplankton resources.

We need to control zebra and quagga mussels. Is there anything that can be done?

It is very difficult, if not impossible to eliminate an aquatic invasive species once populations become established, especially in a large system like Lake Michigan. It is always better to prevent an introduction from happening. Research is currently being done to assess the efficacy of a biocide (Zequanox) for controlling Dreissenid mussels in confined areas. In addition, a freshwater parasite of Dreissenid mussels that might be suitable to larger scale applications has been identified and is being studied. Treatments with these biological control agents are years away and probably will not be effective in the main part of Lake Michigan due to the large area requiring treatment. The LMC would like to see effective control of zebra and quagga mussels and has included in this report an action item to support ongoing research.

I have read that lake whitefish eat zebra and quagga mussels. Why not stop commercial fishing for whitefish so they can eat more mussels and improve conditions in the lake?

There is no reason to believe that ending lake whitefish fishing would result in substantial increases in whitefish abundance or the control of zebra and quagga mussels in Lake Michigan. It is true that lake whitefish are now eating more zebra and quagga mussels than they have in the past and that predation by whitefish and other species (e.g., freshwater drum, common carp and round goby) may help reduce mussel abundance over the long term (decades). However, the mussels do not appear to be as beneficial a food resource as traditional invertebrates (Diporeia or “mud scuds”) were because whitefish growth rates and body condition have declined in recent years. Reduced fitness will in time lead to lower population fecundity (egg production) and lower population abundance. Like recreational angling, commercial fishing is a traditional use of fishery resources in the Great Lakes that provides substantial benefits to society (e.g., a source of high protein food and contributions to the economy). Based on past results and with continued management, both commercial and recreational fishing for lake whitefish can be maintained in Lake Michigan without causing declines in self-sustaining populations.

Why aren't the DNRs stocking more fish like bass, freshwater drum and other species that will eat zebra and quagga mussels?

Zebra and quagga mussels are native to the Caspian Sea region of Europe and have only recently been introduced to the Great Lakes. Most of our native fish species are not accustomed to eating these mussels so stocking them would have very little effect. We are finding more mussels in the diets of bottom feeding fish, such as carp, drum and whitefish indicating that they may be utilizing mussels in the absence of other more suitable prey. Probably the best mussel predator in the lakes at this time is the round goby, another invasive species that comes from the Caspian region that has evolved with and developed into a natural predator of the mussels.

Population Assessments and Yellow Perch Abundance

What were Mr. Clapp's yellow perch harvest numbers for each lake based on and are they current?

Mr. Clapp indicated that the harvest numbers for lakes Superior, Huron, Michigan and Erie were "ballpark" numbers rounded to the nearest 10,000 or 100,000 fish, and intended to show the range of harvest over the past 20-25 years. The sources of information were harvest databases and consultations with creel and perch biologists for each lake.

My take away from the Perch Summit is that environmental cleanup of the lakes has and is going to be the main driving force in the perch situation because it will reduce plankton blooms, and thus reduce food for young-of-year, fingerlings and advanced fingerlings. Is the "new normal" for Lake Michigan a similar perch fishery as Lake Superior?

While water quality changes have been great for the lake, the effect on fish production may reduce the numbers of sport fish available to anglers. In the case of yellow perch, warmer water temperature and suitable habitats (e.g., coastal wetlands and drowned river mouth lakes) should keep the Lake Michigan perch harvest above that reported for Lake Superior. The main driving force behind changes in fish populations in Lake Michigan is the number and types of aquatic invasive species in the lake, especially the zebra and quagga mussels. The mussels are responsible for the benthification of Lake Michigan, which means they are removing food and energy from the water column and concentrating it on the bottom. This is drastically different than what has occurred in Lake Michigan over the last 10,000 years.

What numbers of yellow perch are currently estimated to be in the lake?

Estimates of yellow perch population abundance are not available for Lake Michigan. Most agencies use trends in catches from standardized sampling gears (e.g., catch-per-effort in gill nets, trap nets, seines or bottom trawls) to track relative changes in population abundance over time. These assessment data from around the main lake all show that perch abundance currently is low compared to the peaks of the late 1980s and early 1990s and that a large drop in lakewide abundance occurred around 1992. While abundance generally appears to be stable at these lower population densities, continuing gradual declines are evident in Wisconsin and Illinois waters.

Yellow perch are skewing female in Wisconsin waters (last report 80% female). Is this a lakewide phenomenon?

Recent assessment data from 2000-2011 show that the percentage of female yellow perch in annual samples varied between approximately 10% and 80% in Illinois, 60% and 70% in Indiana, 30% and 70% in Michigan and 40 and 80% in Wisconsin. Differences in the percentage of females caught among states and years within states may be related more to variations in sampling protocols (e.g., sampling gears used, seasons and time of sampling relative to perch spawning) than actual differences in population sex ratios.

We are catching a lot of yellow perch in the harbors in winter and you are not sampling them. Why don't you sample where people are catching fish? You are missing them.

Sampling the harbor fishery in winter is difficult due to weather and ice conditions and may not be representative of actual population abundance because yellow perch appear to concentrate in these protected areas during fall and winter. All the agencies conduct an extensive open water creel survey along their respective shorelines. These creel surveys are very expensive and current budgets do not allow for extending them into winter months. However, the Illinois Natural History Survey is planning a

fall/winter creel survey in the Illinois waters of Lake Michigan that targets shoreline perch anglers to determine the extent of angler harvest in this winter fishery.

We catch a lot of yellow perch at times you don't sample and we think there are a lot more perch out there than the agencies know about. Why can't regulations be relaxed?

Research has revealed that accurate estimates of fish population abundance are best made with fishery-independent sampling procedures that are standardized so that comparisons can be made across areas and over time. It is difficult to get an accurate estimate of fish abundance from catch data provided by individual anglers because anglers often target fish when they are concentrated. Targeting concentrated fish can result in the perception that abundance is high, even when it is not. Standardized assessments of perch stocks from all jurisdictions in Lake Michigan, as well as data from angler creel surveys, all show a rapid decline in perch abundance back in the early 1990s and little signs of recovery over the past 20 years. For this reason, relaxing harvest regulations is not recommended at this time.

Could Dr. Wilberg (2005) be correct that there are not enough adult yellow perch remaining to repopulate Lake Michigan?

In their 2005 paper, Wilberg and others used agency assessment data and catch-at-age models to examine changes in the spawning stock biomass of yellow perch in Illinois and Wisconsin from 1986 through 2002. The study showed that spawning stock biomass was low during the mid-1990s when commercial and recreational harvest was high. Regulations implemented by management agencies successfully reduced losses to fishing mortality and spawning stock biomass was at its highest level since the early 1990s in the last year of the study (2002). High catches of young-of-year perch in some recent years suggest that sufficient numbers of spawners remain in the lake to repopulate the population. A problem affecting perch populations today is the lack of recruitment of juveniles to catchable-sized adults, one of the baby perch bottlenecks discussed by Dr. Janssen during his morning presentation at the summit.

Since the commercial fishing harvest quota was increased to 100,000 pounds in Green Bay in 2007, the older year classes of yellow perch have been disappearing. This was substantiated by Mr. Roswell's recreational harvest data showing smaller perch being caught by sport anglers in Green Bay compared to other regions of the lake. How much impact does commercial fishing have on the average size of fish remaining for sport anglers?

In Wisconsin and in the Green Bay fishery, commercial fishers have a 7.5-inch minimum, which in itself drives the fact that the sport harvest is going to be comprised of smaller-sized fish than commercial harvest. The commercial fishers simply can't keep those smaller fish, whereas many sport anglers keep a 6-inch perch. Even with the size minimum in place for commercial fishers, the average size in the 2013 commercial harvest was 8.7 inches, while the 2013 open water sport harvest average was 8.5 inches. Not a drastic difference.

Stocking Yellow Perch and Population Recovery

Why don't you stock yellow perch?

The number of stocked yellow perch needed to enhance the population in a lake as big as Lake Michigan is huge. The current bottlenecks in survival of young yellow perch, likely related to limited food resources, suggest larger fingerlings would need to be stocked to have a positive effect on the population. Producing large fingerling perch is possible with today's technology, but sources of brood fish, facilities for rearing young, and costs of rearing to fingerling sizes (e.g., costs of feed, electricity, manpower, etc.) makes perch stocking an unlikely remedy for population recovery. Maintaining the unique genetic

signature of wild perch and preventing the spread of disease are other reasons why stocking perch remains unpopular among Lake Michigan biologists, managers and policy makers.

Stocking yellow perch in Wisconsin was very successful in the 1980s. Why don't you replicate those stocking efforts?

Yellow perch were stocked three different times in Wisconsin's waters of Lake Michigan. In 1978, about 178,740 yellow perch ranging from young-of-year to adults were transferred from a northern Wisconsin lake to Milwaukee for stocking. In 1981, 200,000 fry were stocked from the UW-Milwaukee WATER Institute into Lake Michigan near Milwaukee and in 1984, 6,000 yearling yellow perch were also stocked in Milwaukee. We believe that the stockings from these events contributed very little to the yellow perch population in the lake. In fact, the transferred yellow perch were easily identified from native perch in that 1) they were a much greener color, 2) most of them had black spot, and 3) they were given an anal fin clip. These fish were rarely observed in the yellow perch harvest.

In addition, Wisconsin DNR has carefully discussed the possibility of stocking yellow perch into Lake Michigan and concluded that:

- a. Aquatic invasive species, most notably quagga mussels, have completely changed the Lake Michigan ecosystem over the last decade. Sustainable yellow perch populations at the levels previously recorded may be difficult if not impossible to reach again;
- b. Stocking age-1 or older yellow perch would be extremely expensive, and unlikely to make a difference given the numbers that we could stock;
- c. Stocking of hatchery-reared yellow perch could lead to stock domestication and loss of the native population's ability to survive on its own;
- d. Lake Michigan's yellow perch have historically shown the ability to reproduce and provide a substantial fishery on their own;
- e. The U.S Committee of Advisors to the Great Lakes Fishery Commission and the Indiana Wildlife Federation are on record opposing the stocking of yellow perch into Lake Michigan;
- f. All of WDNR hatcheries are at capacity producing other priority fish for Wisconsin fisheries.

Can we have a yellow perch stamp with proceeds to fund construction/operation of hatcheries to raise perch?

A yellow perch stamp is one method of generating dollars that could be targeted for perch rearing and stocking. However, as indicated earlier, the high costs associated with raising meaningful numbers of yellow perch fingerlings to supplement wild populations and the potential to do more harm than good (e.g., altering genetics and spreading disease) make construction/expansion of hatcheries for perch production unlikely at this time.

Why don't you stop stocking salmon and stock yellow perch instead?

Salmon were originally stocked to create a sport fishery, control an overabundant alewife population and expand and diversify the lake's top predator base after overfishing and sea lampreys decimated lake trout and burbot population, the native pelagic predators in the lake. Ease of rearing, rapid growth, and natal homing make Pacific salmon desirable and cost effective sport fishes for stocking in the clear, cold waters of Lake Michigan. Raising extensive numbers of yellow perch and stocking them in large lakes is uncharted territory for aquaculture and fishery management. To date, we are aware of no large scale aquaculture operations capable of raising the number of advanced yellow perch fingerlings required to enhance populations in a lake the size of Lake Michigan (potentially 100 million advanced perch fingerlings annually). Perfecting culture techniques to raise enough yellow perch to enhance populations will require years of research and a substantial amount of money, all without any guarantee of success.

How many and what sizes of yellow perch will be needed to get a favorable response in the population and how much will it cost?

As indicated above and in the summary report, the LMC does not consider perch stocking as a viable management tool to enhance population recovery at this time. However, stocking may prove necessary in the future should natural recruitment and population abundance continue to decline lakewide. A cost/benefit analysis of yellow perch stocking to enhance populations in Lake Michigan was not included in the information presented at the summit. Discussions during the breakout section indicated that stocking as many as 100 million perch fingerlings would be necessary to have an effect on populations in a lake the size of Lake Michigan and that 3-inch or larger fingerlings would probably be needed to overcome young perch survival bottlenecks. Using these estimates, stocking 100 million 2-inch fingerlings would cost approximately \$20,000,000 at the rate of 20 cents per fish (or 10 cents/inch). The cost of high quality 3-inch perch fingerlings reared intensively would be about \$75 to \$100 million at a rate of 75 to 100 cents per fish. A more detailed cost analysis has been suggested as an action item in this report.

How does the cost of raising yellow perch to fingerling size compare to the cost of raising walleye fingerlings?

The LMC is not aware of a study comparing the cost of fingerling walleye and yellow perch so we contacted a fish supplier that sells both walleye and yellow perch fingerlings. The dealer sells 3- to 4-inch walleye fingerlings for \$1.00-\$1.50 per fish and similar-sized yellow perch for \$0.75-\$1.00 per fish. This pricing suggests that the cost of rearing walleye and yellow perch fingerlings is generally similar. Higher prices for walleye fingerlings may be related more to higher demand than increased rearing costs. Regardless of cost, the larger point is that walleye are a higher trophic level species, so fewer stocked fingerlings are required to see a response in the fishery. Yellow perch on the other hand are lower on the trophic scale so many, many more would have to be stocked to see a response.

What is the economic benefit of yellow perch sport fishing in Lake Michigan? How does it compare to salmon fishing? It seems that this information is necessary to do a cost/benefit analysis of yellow perch stocking.

The LMC is not aware of a current study that determines the cost/benefit of yellow perch stocking in Lake Michigan, nor are we aware of a lakewide evaluation of yellow perch economic benefits. It is likely that the economic impact of yellow perch angling is much smaller than the economic impact of salmon angling, given the extensive use of big boats, expensive tackle and gear, and mooring of boats for salmon fishing. However, the societal impact of yellow perch fishing may be greater than that of salmon fishing. A more detailed cost:benefit analysis has been suggested as an action item in this report.

Why hasn't the USFWS been asked to assist with yellow perch stocking in Lake Michigan?

The LMC does not consider yellow perch stocking to be a viable option to enhance populations at this time, and therefore has not made any requests to State, federal, tribal or private hatcheries regarding perch fingerling production.

The University of Wisconsin WATER Institute had 150 L of Lake Michigan strain yellow perch eggs in house during 2001 and 2002. What happened to the fry produced from those eggs? What is the hatching success of eggs taken from the wild?

Mr. Binkowski emailed that no yellow perch of any life stage were stocked in Lake Michigan in 2001 and 2002. Survival of perch eggs to sac fry can vary depending on the broodstock, the handling of the eggs, the environmental conditions for incubating the eggs and husbandry practices. Survival of sac fry to pre-

fingerling stage yellow perch again depends on the genetics of the progeny and all the husbandry practices applied to rearing yellow perch sac fry to pre-fingerling perch. Survival of pre-fingerling perch to fingerlings improves significantly; however, again, it is based on the knowledge, skill and expertise of the husbandry practitioner.

A reason given for not stocking yellow perch is that stocked fish might spread disease. Doesn't the same chance for spread of disease occur with other stocked species?

There is always a chance that stocked fish from hatcheries or those translocated from wild populations may spread disease to existing fish populations in receiving water bodies. Current hatchery practices include extensive testing and other measures (e.g., prophylactic chemical treatments and disinfection of source water) to ensure that disease is not spread to waters receiving stocked fish. The Great Lakes Fish Health Committee of the Great Lakes Fishery Commission coordinates regional efforts in the Great Lakes basin to prevent introduction and dissemination of communicable fish diseases. Use the following link for more information: <http://www.glfsc.org/boardcomm/fhealth/fhealth.php#online>. The spread of disease and parasites may be higher when fish are captured from wild populations for stocking. The practice of transferring wild perch from inland lakes to Lake Michigan is a specific concern of the LMC because of the potential high risk of spreading disease among water bodies and perch populations.

Why doesn't the Wisconsin DNR isolate an area of Lake Michigan to raise young yellow perch fry?

Isolating an area in Lake Michigan to raise fish is not practical because the same problem with food availability and survival bottlenecks that occur in the lake would be effecting survival and growth of fry in the designated area. Other natural factors that cause mortality of fish in the wild (e.g., predators and diseases) likely would be present in any designated rearing area in the lake or adjoining water bodies.

Why hasn't the Wisconsin DNR allowed a fund raising effort, assigned a specific manager/citizen task force or spearheaded a signature drive by all anglers with a fishing license demanding that State and federal government agencies assign resources to immediately fix this disastrous problem of the yellow perch in Lake Michigan?

Wisconsin, like other agencies, would have to evaluate any citizen petition or effort by stakeholders for a fund raising effort. As described throughout this report, an immediate fix to the problem is not easy and would take a substantial and long-term commitment by the agencies.

Regulations

Why are there different regulations for the states or why aren't the regulations the same in all the states?

This is a complex question. Variation in yellow perch regulations among states can occur for a number of reasons, even with LMC-coordinated strategic management of the perch fishery. First, each state jurisdiction has the authority to develop and implement regulations that allow it to achieve its own management objectives, as long as that management does not have a negative effect on the shared resource in other jurisdictions. Second, ecological conditions and habitats that influence localized fish population abundances may vary among state jurisdictions. For example, Michigan has drowned river mouth habitat not found elsewhere in the basin. Drowned river mouths may provide localized benefits to yellow perch populations not realized in other jurisdictions. Third, the nature of the sport fishery (e.g., boat vs. shoreline or urban vs. rural) can influence the type of regulation implemented by a state. A more liberal regulation may be appropriate in Indiana, where shore access is limited and fishing pressure is reduced because only a boat fishery exists. In contrast, extensive shoreline access in Chicago and the

largest concentrated human population in the Great Lakes basin may require more restrictive regulations to achieve a desired level of protection (reduced fishing mortality) for the yellow perch population.

What are the chances of Wisconsin implementing a tighter bag limit for Lake Michigan waters outside of Green Bay? Maybe something with a protected 1 over type slot to help protect the best breeders in the event that good spawning conditions are in place in any given year?

Wisconsin already has a 5 fish daily bag limit for yellow perch, which is the most restrictive harvest limit of any jurisdiction on Lake Michigan. Population modeling and creel data indicate that yellow perch are not being overharvested under the current level of harvest in Wisconsin waters. Going to a more restrictive bag limit or slot limit would not have a substantial impact on the population.

Will Wisconsin close sport fishing for yellow perch now that catches in population assessments have dropped to single digits?

Wisconsin has no immediate plans to close yellow perch sport fishing in Lake Michigan. Sport fishing harvest in Wisconsin and elsewhere in the lake does not appear to be the cause of poor recruitment and low yellow perch abundance seen in recent years. The main driving force seems to be aquatic invasive species, especially zebra and quagga mussels. The mussels are responsible for the benthification of Lake Michigan, which means they are removing food from the water column and concentrating it on the bottom. This change in the food web is drastically different than what occurred in Lake Michigan over past millennia.

Is Indiana going to implement a closure during the perch spawning season? Many fishermen have the spawning grounds locations dialed in and harvest numerous big females right before the spawn.

Indiana has no immediate plans to implement a seasonal closure to protect spawning yellow perch. The level of angling mortality under the current bag limit is deemed reasonable to maintain an adequate spawning stock in spite of pre-spawn harvest.

Why has the commercial harvest quota for yellow perch in Green Bay increased to 100,000 pounds in recent years?

The Green Bay yellow perch population has been shown to be genetically and biologically different from perch in the main basins of Lake Michigan. Evidence from a marking study also indicates that Green Bay yellow perch do not move into the main lake and those in the main lake do not move into Green Bay. For these reasons, Wisconsin DNR manages Green Bay yellow perch separately from perch populations in the main lake. Recent population assessment data has shown that yellow perch recruitment and abundance is higher in the more fertile waters of Green Bay. Based on these data, Wisconsin managers determined perch populations in Green Bay were able to sustain the increase in commercial harvest quota that you reference.

What is the future of commercial fishing for yellow perch in Lake Michigan? When is commercial fishing coming back?

Individual states have the authority to regulate commercial fishing in Lake Michigan. The decision when to allow a return of commercial fishing for yellow perch is a complicated one that will likely be based on assessment data collected within each jurisdiction. We do not foresee natural resource agencies increasing the zero harvest quotas for commercial yellow perch fishing in the main lake anytime in the near future because perch population abundance remains low and recruitment is too inconsistent for a sustainable commercial fishery. It is possible that commercial fishing might start up again in states where it is permitted, if and when a yellow perch population recovery is realized.

Additional Comments

- A Michigan angler commented that cormorants are a big problem with yellow perch recruitment in Ludington and elsewhere in Michigan. His observations indicate that nest counts substantially underestimate numbers of cormorants at a rookery site. More should be done to reduce cormorant abundance.
- Native yellow perch need to be stocked. They are not surviving spawn attempts and need to be stocked to get them past the "stage one bottle neck." Native perch are an important species in our lakes and need some help to restore our native fisheries. Not all our efforts should be centered on non-native species like salmon. Most people do not fish for salmon, but fish inland lakes.
- What I got out of the yellow perch summit is that if we can get perch past the stage one bottle neck they will do fine. They have a lake full of invasive food, which includes quagga mussels. We can collect yellow perch eggs at low cost (gas for our boats actually) and move them to a less hostile environment to get past the stage one bottlenecks, low food abundance and invasive predators in the lake. I oppose any actions to increase alewives, a well-documented predator of larval yellow perch. Thank you for your time.
- It has been my pleasure to watch all the presenters on this morning's yellow perch webinar. Thank you for this opportunity and thanks again to all the presenters.
- I just finished the presentations; having public access to them is a great thing, lots of good information. Based on my knowledge of yellow perch, and the facts from the presentations my takeaway is that environmental cleanup has and is going to be the main driving force in the yellow perch situation since it will reduce plankton blooms, and thus reduce food for YOY, fingerlings, and extended fingerlings. It looks like the new normal for Lake Michigan is going to be a yellow perch fishery similar to Lake Superior. I am really not a fan of the stocking idea that is constantly kicked around online and etc. I think it would be absolutely regressive to natural reproduction and simply create another put-and-take fishery.
- Thank you so much for putting together the yellow perch summit and webinar. I want to see the July closure in Illinois opened and encourage the states to work toward more similar regulations around the lake. When you see the differences by State in terms of daily bag limits (i.e., 5, 15, and 35 fish), it is hard to see how the states are even on the same page in terms of overall management goals for the lake as a whole. I could get behind any regulation (even the July closure in Illinois), if all of the surrounding Lake Michigan states were on the same page. However, when you can go a couple of hours around the lake to Michigan and catch well over double the daily bag limit (without the July closure mind you), it's no wonder so many tax dollars are being lost in Illinois and fishermen are towing their boats elsewhere.
- Wisconsin regulations are quite restrictive with a significant seasonal closure and a 5 fish daily limit. While conceptually most of us understand the value of protecting breeding stock, the management result of highly restrictive rules that have been ongoing for multiple years, shows no evidence whatsoever that it is working. The "new normal" scenario of a far less productive ecosystem wide food chain, due to fundamental and large scale ecosystem changes is the bottom line and virtually no restrictive regulation is going to change that. The food bottleneck at the sensitive fry stage is the major bottleneck and no restrictive harvest scenario will affect that in any way. At low catchable populations, the "law" of diminishing returns or effort for fish caught gets so low that people just quit fishing or cannot harvest fish. Restrictive harvest rules irritate people and since they have not resulted in population benefits anglers wonder about the veracity of the science and those who implement it. We spend millions of dollars on salmonid management and all this effort on yellow perch does nothing (and far less money is spent). Maybe it is time to consider the heresy of stocking as a means around the food bottleneck or other less popular efforts by managers. Thanks for reviewing my comments.