

**Lake Michigan
Integrated Fisheries Management Plan
2015-2024**

Public Discussion Draft

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Lake Michigan Fisheries Team
Bureau of Fisheries Management and Habitat Protection
Wisconsin Department of Natural Resources

**Lake Michigan Integrated Fisheries Management Plan
2015-2024**

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OVERVIEW

Introduction

Fisheries management programs, along with state and Federal pollution prevention and habitat protection initiatives, have made huge strides in protecting and restoring fish populations in Lake Michigan. World class fisheries now exist where once pollution, habitat degradation, exotic species and unrestricted harvest of native species lead to the collapse of fish populations and ecosystem devastation. Even today, new exotic species continue to be introduced, habitat impacted, and much of what has been degraded in the past remains unrestored—all of which limit Lake Michigan from reaching its full sport and commercial fishing potential.

Our work is not completed and must carry on; thus we present this draft Lake Michigan Integrated Fisheries Management Plan (Plan) to guide our management of sport and commercial fisheries in Wisconsin waters of Lake Michigan for the next ten years (2015 -2024). The Plan presents an ambitious agenda of work that will test our energies and resources over the next five biennial budgeting and planning cycles.

This draft plan was developed engaging fisheries and law enforcement personnel working on Lake Michigan, the interested public, Department of Natural Resources (Department) staff in all related programs, and our external partners. There was a public review of the accomplishments over the past ten years which included a request for comments regarding the future direction of Lake Michigan fisheries management. See the Appendix 1 for details of the Plan development process and Appendix 2 for a review of all comments received during the initial public comment period. This plan recognizes the roles of the other state, federal, tribal, and private agencies and organizations in interjurisdictional management of Lake Michigan fisheries. However, we do not attempt to include all activities and programs related to Lake Michigan that are conducted by other Department programs or by our partners in Great Lakes fisheries management.

The Visions of the new Plan are similar to those of the previous plan:

- I. A balanced, healthy ecosystem;
- II. A multi-species sport fishery;
- III. A sustainable and viable commercial fishery;
- IV. Employing principles of science-based management; and
- V. Effective internal and external communication.

A balanced, healthy ecosystem. The tactics within this Vision pertain to habitat protection, native species restoration and management, and nuisance species prevention and control. Control of sea lamprey remains one of the most important management activities that supports today's sport and commercial fisheries. Sea lamprey control is carried out on Lake Michigan by the Great Lakes Fishery Commission through its agent, the U.S. Fish and Wildlife Service. In this plan, we propose to continue to work with partners to support these efforts. This plan addresses habitat protection and restoration for native species (e.g., walleye, smallmouth bass, muskellunge, and northern pike) and for desirable non-native trout and salmon species. We emphasize the effects of land use practices and in-water activities on aquatic habitats. We intend to continue to work on lake trout, Great Lakes spotted musky, and lake sturgeon population restoration and to also work with our partner agencies, especially the USFWS, to attempt to restore lake herring in Green Bay. This plan continues to have a focus on maintaining and improving yellow perch, lake whitefish, walleye, northern pike, smallmouth bass and other gamefish populations. Our tactics for management of nuisance species includes two native wildlife species, the cormorant and white pelican, as well as several non-native fish and wildlife species. Inter-jurisdictional cooperation is essential to slowing the flow of exotic species into the Great Lakes.

A multi-species sport fishery. This Vision focuses on sustaining and improving the world class salmon and trout, and nearshore coolwater fisheries of Lake Michigan. Stocking salmon and trout remains one of our most

important management activities. The salmon and trout fishery is diverse, with steelhead, lake trout, brown trout, chinook salmon and coho salmon helping to sustain fishing . After a troubling bout with bacterial kidney disease in the late 1980s, the chinook salmon fishery stabilized during the 1990's and harvests were exceptional throughout the 2000's into the early 2010's. Alteration of lakewide primary productivity caused by invasive Dreissinid mussels, record low forage abundance, large increases in Chinook salmon natural reproduction, and recent increases in lake trout natural reproduction are all issues needing to be addressed over the next ten years with a focus on balancing overall predator and prey populations to maintain Lake Michigan's great fishing. Our information needs are emphasized in discussions of the importance of sustaining creel surveys, sustaining fish health monitoring, further developing the inter-jurisdictional Lakewide Assessment Plan for key predators (lake trout, burbot, and chinook salmon), and improving lakewide forage assessments. Poor and erratic runs of coho salmon and steelhead continue to impact the fishery, so we propose to initiate a systematic approach to identifying controllable factors that influence returns of stocked fish to spawning weirs. The salmon and trout fishery in Lake Michigan depends on an aging statewide hatchery system, so we emphasize the need for substantial renovations, especially at the Kettle Moraine Springs and Les Voigt Hatcheries. Excellent coolwater nearshore fishing for walleye, lake whitefish, Great Lake spotted musky, and smallmouth bass can be found in Green Bay. The Milwaukee River and other river mouths and bays along the Lake Michigan shoreline also produced nearshore coolwater fishing opportunities. Maintaining and enhancing these nearshore coolwater fisheries are addressed in Goal 1.

A sustainable and viable commercial fishery. Over the past 25 years Wisconsin has moved toward a smaller and better regulated commercial fishery targeting four species – lake whitefish, yellow perch, rainbow smelt, and bloater chubs. Today only the lake whitefish fishery is strong, as populations of yellow perch, rainbow smelt, and bloater chubs have declined markedly over the past twenty years. Wisconsin commercial fishing management is built on three principles – annual harvest limits, limited entry, and individual transferable quotas. Harvest regulation is our primary day-to-day tool for protecting and enhancing commercial fish populations. In this Plan we emphasize improving population assessments and models and exploring the possibility of automating the setting of harvest limits by linking them explicitly to objective measures of population abundance. We also propose to continue to address some of the conflicts between sports and commercial fishers including harvest allocation, commercial bycatch, and physical gear conflicts.

Employing principles of science-based management. Science-based management is a crucial principle of all the other Visions in this plan. This focuses on maintaining professional credentials of staff, maintaining appropriate research technology, using science to fill information gaps, and incorporating scientific findings in management. Tactics include supporting continuing education for field biologists, hatchery personnel, and wardens; utilizing external funding opportunities; investing in equipment and technology, working with our counterparts in Michigan, Indiana, and Illinois; developing partnerships with other agencies and with sport and commercial fishing groups; communicating findings and policies to the public; and encouraging research by others that would help achieve our management goals.

Effective internal and external communication. Effective communication is essential to achieving all of the visions in this plan. Past plans have included elements related to communication, but this time we are placing them in one place for emphasis and clarity. We understand the need to foster open two-way dialogue with the interested public, legislators, and sister agencies.

Authority and Guidance

The Department manages fisheries under authority of Sections 23.09 and 29.041 of the Wisconsin Statutes:

23.09: Conservation. (1) PURPOSES. The purpose of this section is to provide an adequate and flexible system for the protection, development, and use of forests, fish and game, lakes, streams, plant life, flowers, and other outdoor resources in this state. (2) DEPARTMENTAL RULES; SURVEYS; SERVICES; POWERS; LONG-RANGE PLANNING. The department may promulgate such rules, inaugurate such studies, investigations and surveys, and establish such services as it deems

necessary to carry out the provisions and purposes of this section. The department shall establish long-range plans, projects, and priorities for conservation. . .

29.041 Department to regulate hunting and fishing in interstate waters. The department may regulate hunting and fishing on and in all interstate boundary waters, and outlying waters.

The Department also receives instruction from the Natural Resources Board through Chapter NR 1 of the Wisconsin Administrative Code:

NR 1.01 Management of fisheries and aquatic resources. (1) To meet its responsibilities established by statute, department programs shall be based on scientific management principles which emphasize the protection, perpetuation, development, and use of all desirable aquatic species. (2) The goal of fish management is to provide opportunities for the optimum use and enjoyment of Wisconsin's aquatic resources, both sport and commercial. A healthy and diverse environment is essential to meet this goal and shall be promoted through management programs. (3) Aquatic resources include both non-game and game species of fish, other aquatic animals and their habitats. Endangered and threatened species form a special group that will be managed according to ch. NR 27 and s. 29.604, Stats. (4) To assure its effectiveness, the management program shall be based upon a close working relationship among all functions of the department, other governmental agencies, federally recognized Indian tribes, and the public. The department will keep interested parties informed of policies, plans and management. To anticipate change and meet future demand, the department shall engage in long-range planning of management programs. (5) Financing the department's fish and aquatic resource management program through, in large part, user fees, particularly license fees and excise taxes on selected equipment purchased by sport and commercial fishers, is an established principle. Although user fees collected for a specific purpose are targeted at that purpose, they provide significant indirect benefits for a wide range of wildlife and users. When beneficiaries are a broader or different segment of the public, other funding sources will be sought. (6) Wisconsin law enunciates a trust doctrine which secures the right of all Wisconsin citizens to quality, non-polluted waters and holds that waters are the common property of all citizens. Fish management programs will vigorously uphold the doctrine that citizens have a right to use in common the waters of the state and these waters shall be maintained free of pollution. (7) With access to Wisconsin's lakes and streams a prerequisite for their use by the public, the acquisition and development of public access to waters should be accelerated, particularly in the more populous areas of the state. (8) Wild and wilderness lakes and streams are a special and limited resource providing unique settings for enjoyment of fishing and other outdoor activities. Additional efforts are required to designate lakes and streams for this status. Special management methods that increase fishing quality shall be encouraged on these waters. Such methods may include trophy fishing, regulated harvest, special seasons, and controlled entry. (9) Sport fishing shall be managed in such a way that all have an equal opportunity to safely enjoy the aquatic resources, regulated to the extent that: (a) Fish and other aquatic resources are protected and enhanced; (b) Fishing effort does not exceed the capabilities of the resource to sustain desirable, quality fish populations; (c) The social, biological and economic values associated with all sport fishing, competitive and non-competitive, are recognized; (d) A sense of responsibility for the resource is inherent in all who participate and enjoy fishing; (e) User conflicts are minimized; and (f) Aesthetic and cultural values associated with fishing are held in trust for future generations.

NR 1.04 Great Lakes fisheries management. The board endorses a flexible management system for the protection, development, and utilization of the waters and fish populations of the Great Lakes for the maximum public benefit. (1) Management of the Great Lakes is of intrastate, interstate, federal and international interest; therefore, cooperation with management agencies shall be sought in developing management objectives and measures for fish stocks of common concern. (2) The Great Lakes fisheries are to be considered part of a diverse community. The department shall promote efforts to maintain and enhance the quality of this community and its environment. (3) Management of the fishery resources shall be based on a sound understanding of the dynamics of interacting fish stocks. The department shall conduct research and resource base inventories and collect harvest and utilization statistics on which to base sound management decisions. (4) The fishery resources of the Great Lakes,

though renewable, experience dynamic changes and are limited. The resources will be managed in accordance with sound management principles to attain optimum sustainable utilization. Management measures may include but are not limited to seasons, bag and harvest limits, limitations on the type and amount of fishing gear, limitation as to participation in the fisheries and allocation of allowable harvest among various users and the establishment of restricted areas.

The Department has made additional commitments through the *Joint Strategic Plan for Management of Great Lakes Fisheries* (SGLFMP)¹. This basin-wide management agreement was developed with assistance from the Great Lakes Fishery Commission. Wisconsin is a signatory to SGLFMP along with the seven other Great Lakes states, the Chippewa-Ottawa Treaty Fishery Management Authority², the Great Lakes Indian Fish and Wildlife Commission, the U.S. Fish and Wildlife Service, the U.S. Geological Survey, the Ontario Ministry of Natural Resources, and the Canada Department of Fisheries and Oceans. As a signatory, Wisconsin has agreed to a set of procedures for coordinating activities and resolving conflicts. Through SGLFMP, the Department accepts the following common goal for Great Lakes fishery agencies:

To secure fish communities, based on foundations of stable self-sustaining stocks supplemented by judicious plantings of hatchery-reared fish, and provide from these communities an optimum contribution of fish, fishing opportunities and associated benefits to meet needs identified by society for wholesome food, recreation, employment and income, and a healthy human environment.

Pursuant to the Joint Strategic Plan, the Department works with the Michigan DNR, the Indiana DNR, the Illinois DNR, and the Chippewa-Ottawa Resource Authority to address issues of common concern on Lake Michigan. Lakewide fisheries management policies are developed by those five agencies through the Lake Michigan Committee. The LMC has adopted a set of Fish Community Objectives³ to guide all five agencies in the management of Lake Michigan fisheries.

Finally, planning for work on Lake Michigan is conducted within the framework of *A Fisheries, Wildlife, and Habitat Management Plan for Wisconsin*⁴, which describes how the Department will implement its mission and its strategic plan in the programs that work with fish, wildlife, and their habitats.

External Partners

Although the Department retains management authority within Wisconsin waters of the Great Lakes, fisheries management is conducted in partnership with others, as reflected in SGLFMP. We also rely on the advice, cooperation, and assistance of the citizens of Wisconsin. In addition, our partners include the three other states bordering Lake Michigan, the Chippewa-Ottawa Resource Authority, the U.S. Fish and Wildlife Service (Green Bay Fisheries Resources Office), the US Geological Survey (Great Lakes Science Center), and the Great Lakes Fishery Commission. Among the international agreements and federal statutes that define the roles of other governments and agencies are the following:

The Convention on Great Lakes Fisheries, between the United States and Canada, established the Great Lakes Fishery Commission in 1954 with two major responsibilities: 1) To develop coordinated programs of research in the Great Lakes and, on the basis of the findings, recommend measures which will permit the maximum sustained productivity of stocks of fish of common concern and 2) To formulate and implement a program to eradicate or minimize sea lamprey populations in the Great Lakes.

¹ Great Lakes Fishery Commission. 1997. *A Joint Strategic Plan for Management of Great Lakes Fisheries*.

² COTFMA has been re-constituted as CORA, the Chippewa-Ottawa Resource Authority, which is expected to become a signatory to the Joint Strategic Plan.

³ Eshenroder, R.L., M.E. Holey, T.K. Gorenflo, and R.D. Clark, Jr. 1995. *Fish Community Objectives for Lake Michigan*. Great Lakes Fish. Comm. Spec. Pub 95-3. 56 pp.

⁴ <http://www.dnr.state.wi.us/org/water/fhp/fish/management/fwhplan.htm>

The Great Lakes Water Quality Agreement of 1972, amended in 1987 and 2012, between the United States and Canada sets out objectives, programs, powers and responsibilities to restore and maintain the chemical, biological, and physical integrity of the Great Lakes ecosystem. Programs currently being developed under authority of this agreement include Lakewide Management Plans (LaMPs) and Remedial Action Plans (RAPs), including surveillance and monitoring activities and development of ecosystem health indicators for the Great Lakes.

The Great Lakes Fish and Wildlife Restoration Act of 1990 enhances the role of the U.S. Fish and Wildlife Service in the Great Lakes by establishing offices on the Great Lakes. We now have two Fish and Wildlife Conservation Offices in Wisconsin (Ashland and Green Bay) "to provide assistance to the Great Lakes Fishery Commission, the States, Indian Tribes, and other interested entities . . ." and by requiring a "comprehensive study of the status, and the assessment, management, and restoration needs, of the fishery resources of the Great Lakes Basin."

We cultivate partnerships with the public. Department biologists and technicians interact with the general public, fishing clubs, and commercial fishing groups. Fishing clubs and individual commercial fishers have actively supported Department activities in a variety of ways. Three statutorily defined groups, the Wisconsin Conservation Congress, the Lake Michigan Commercial Fishing Board, and the Lake Superior Commercial Fishing Board, provide advice to the Department regarding Lake Michigan Fisheries. Finally, we have established the Lake Michigan Fisheries Forum, composed of sport fishers, commercial fishers, scientists, Wisconsin Conservation Congress members and others to promote public discussion and feedback on Lake Michigan fisheries management issues.

Base Program

Most of the fisheries work conducted on Lake Michigan is recurring work to maintain essential data bases, monitor trends in fish populations and in harvests, and propagate salmon and trout. Here the base program is summarized in terms of permanent staffing, fish propagation costs (including facility maintenance, rearing, and stocking), and base field work. That program consumes most of the available resources. Additional work will only be accomplished through external grants or by partners.

Permanent staff supporting the Lake Michigan fisheries program. Asterisks (*) denote individuals who whose time is only partly devoted to Lake Michigan fisheries work.

<u>Location</u>	<u>Staff</u>
Central Office (Madison)	Great Lakes Fisheries Specialist/Coordinator, Eastern District Fisheries Supervisor*, Fish Health Specialist*, Fish Contaminant and Toxicology Program Coordinator*
Green Bay work unit (Green Bay and Peshtigo)	one supervisor*, two biologists*, three technicians*
Northern Lake Michigan work unit (Sturgeon Bay)	one supervisor, two biologists, a commercial fishing specialist, three technicians, and a boat captain.
Southern Lake Michigan work unit (Milwaukee)	one supervisor, two biologists, three technicians
Production facilities	
Besadny Anadromous Fisheries Facility	one technician
Wild Rose SFH	two supervisors*, seven technicians*
Kettle Moraine SFH	one supervisor, three technicians
Les Voigt SFH	one supervisor*, two technicians
Lake Mills SFH	one supervisor*, two technicians*
Brule River SFH	two technicians*
Thunder River SFH	one supervisor, one technician

Staffing. The base program includes activities of permanent field biologists and hatchery personnel described in the table above. Funding for permanent salaries comes mostly from license revenues, with a smaller amount from salmon stamp revenues. Permanent staff conduct specific funded projects, but also have other responsibilities, including meeting with sport and commercial fishing groups, responding to questions and concerns raised by the public, and providing assistance to research scientists conducting studies related to our program. The work of the staff listed here is complemented and supported by Department staff from a variety of programs including Law Enforcement, Watershed Management, and Legal Services.

Base fisheries management work. Every two years, biennial work plans are developed for field projects and related activities. Specific defined projects are selected for funding by fishing license revenues, Salmon Stamp revenues, or (occasionally) federal grants. The following table summarizes the recurring activities that form the core of our program.

Base fisheries management work. These projects form the core work of the Lake Michigan fisheries program for the term of the Plan. Other projects may be pursued, as funding allows, to address changing management needs.

Maintain two research vessels, the Gaylord Nelson and the Coregonus.

Manage feral broodstocks.

Assess spawning runs of steelhead, brown trout, chinook salmon, and coho salmon at Besadny Anadromous Fisheries Facility (Kewaunee River) and Root River Steelhead Facility. Assess spawning run of chinook salmon at Strawberry Creek Egg Collection Facility.

Propagate feral steelhead, coho salmon, and chinook salmon at the three egg collection facilities to meet stocking needs.

Propagate brown trout from feral parents to meet stocking needs.

Rear offspring of feral steelhead, coho salmon, chinook salmon, and brown trout broodstocks, and stock them as fingerlings or yearlings.

Propagate Great Lakes spotted muskellunge from feral parents from Wisconsin waters of the Great Lakes and elsewhere.

Manage populations of wild commercial and recreational species.

Assess Green Bay and Lake Michigan yellow perch populations.

Assess Green Bay walleye population.

Assess Green Bay northern pike and muskellunge populations.

Collect and maintain a data base of commercial catch data.

Collect fish for contaminant monitoring and advisory updates per biennial collection schedule.

Collect and maintain a data base of charter boat effort and harvest data.

Review and adjust commercial harvest limits.

Conduct dock-side checks on commercial harvests to determine the age and size structure of the harvests.

Assess commercial and sport fish species including lake whitefish, bloater chub, rainbow smelt, lake trout and yellow perch.

Conduct creel and moored boat surveys in Lake Michigan and Green Bay.

Estimate salmon and trout harvests from all sportfishing surveys (creel, moored boat and charter)

Initiate a lake herring restoration effort with our partners with an emphasis on Green Bay.

Continue rehabilitation projects for lake sturgeon in the Menominee, Peshtigo, Oconto, Fox, Kewaunee and Milwaukee Rivers

Base fisheries management work. These projects form the core work of the Lake Michigan fisheries program for the term of the Plan. Other projects may be pursued, as funding allows, to address changing management needs.

Conduct baseline fisheries surveys in tributaries and estuaries to Lake Michigan and Green Bay

Prepare annual reports on all projects.

Prepare a biennial Salmon Stamp expenditure report.

Short term projects. In addition to the base program described above, a few additional short-term projects may be conducted with budgeted Department funds and/or contributions from external partners. This plan includes many ideas for such projects. In the recent past short term projects have included efforts to restore a near-shore rainbow trout fishery in Lake Michigan, improve habitat in the Peshtigo River and Duck Creek (Brown County), and compare the survival of coho salmon stocked as yearlings and fingerlings.

Vision I. A diverse, balanced, healthy ecosystem

We seek to support an ecosystem that sustains sport and commercial fisheries, that contains as much of the natural variety of species and strains as possible, and that is resistant to dramatic changes in species abundance. This section of the Plan focuses on enhancing fish habitat, protecting and restoring self-sustaining native fish species, and dealing with invasive species.

Goal A. Protect, maintain, and enhance habitat for game and non-game fish species.

Although manipulation of fish populations is possible by a variety of techniques (e.g. fish stocking, regulation of harvest), ultimately an abundant, diverse, and stable fish community depends on the availability of suitable habitat for the desired species. By the broadest definition, suitable habitat includes those physical, chemical, and biological factors that are needed to satisfy the essential requirements of a species, allowing it to survive in an aquatic environment. We seek to protect undisturbed habitat, maintain functioning habitat, and, if possible, improve or create habitat beneficial to both game and non-game species.

Objective 1. Identify, evaluate, restore and/or enhance spawning and nursery habitats for game and non-game fish species focusing on walleye, sturgeon, northern pike, Great Lakes spotted muskellunge, lake whitefish, and smallmouth bass.

Critical shoreline and shallow water habitat needed by native fish species have been lost as the Lake Michigan shoreline and lower reaches of major tributary streams have been urbanized and industrialized. The development of these areas have resulted in the alteration of shorelines, filling of wetlands and near shore areas, construction of dams and sedimentation that have destroyed habitat areas that are needed by fish for spawning, nursery areas and as juvenile fish habitat. This habitat loss has contributed to the decline of many native species such as walleye, northern pike, lake sturgeon, muskellunge and smallmouth bass.

Small streams have also been impacted by development as wetlands are drained, water is diverted and streams are channelized and blocked by impassable barriers resulting in the loss of fish habitat. Fish that utilize small streams and their associated wetlands include northern pike, walleye, white sucker, long nose sucker, rainbow trout (steelhead), brown trout, brook trout, Chinook salmon, coho salmon and native minnow species.

Past work to mitigate these losses includes installing rock/ rubble to repair shorelines and rebuild reefs. These efforts have benefited walleye and lake sturgeon in some locations, but additional work needs to be done to restore these species as rock alone does not fulfill all the habitat needs of these species. Restoration of wetlands and removal of river and stream barriers have begun to benefit fish species that migrate up streams to spawn but many streams are still degraded. The benefits of removing barriers to fish migration must be weighed against the risk of providing upstream access to undesirable aquatic invasive species (AIS). Progress toward restoring fish populations has been slow because habitat issues still exist in many areas. To effectively protect existing habitat or restore degraded habitat, assessment of the present condition of the habitat is necessary to develop appropriate management strategies.

Tactic a. Inventory northern pike and Great Lake spotted muskellunge spawning habitat in Green Bay.

Tactic b. Determine habitat factors limiting walleye reproduction and develop strategies to improve reproduction in Green Bay west shore tributaries, the Sturgeon Bay area, and the Milwaukee River.

Tactic c. Enhance northern pike habitat along the west shore of Green Bay and other areas of Lake Michigan.

Tactic d. Evaluate, restore or enhance lake sturgeon spawning and nursery habitat in the Milwaukee, Kewaunee, Fox, Oconto, Peshtigo, and Menominee rivers.

Tactic e. Evaluate and/or enhance habitat in tributaries for natural reproduction of rainbow trout, brown trout, Chinook salmon, and coho salmon.

Objective 2. Minimize impacts to fish, wildlife, and other aquatic habitat from construction and maintenance of in-water structures, lake-bed/stream-bed modifications (e.g., dredging, filling), and filling behind bulkhead lines, and restore habitat previously degraded from these activities.

A variety of man-made structures have been constructed on the bed, banks and shorelines of the Great Lakes, including embayments, estuaries, connecting channels and tributaries, which have had both negative and positive impacts on fish habitat. A partial list of the more common structural modifications includes sheet pile, rip rap, breakwater, groin fields, and solid permanent piers. While these structures were constructed to protect shoreline developments (e.g., harbors, marinas, lakefront properties) from erosion, they often exacerbated erosion and habitat loss.

Historically, one of the most destructive and common practices was the construction along bulkhead lines using heavy rip rap and especially steel sheet pile located at or extending beyond the natural shoreline and wetlands to create more developable land. Fill, often consisting of dredge spoils, industrial and municipal wastes, was added behind the sheet pile destroying the original aquatic habitat and creating degraded habitat adjacent to the bulkhead. All of Wisconsin's larger rivers and estuaries have been modified extensively by dredging and filling behind bulkheads lines. As one example, the Milwaukee Estuary once included over 6,000 acres of emergent and submergent wetlands. Modifications and filling for development has eliminated all but 0.5 acres of wetland in the Milwaukee area.

Additionally, lake-bed modifications from dredging activities, particularly in the Door County waters of Lake Michigan and Green Bay, have in many cases degraded habitat for multiple life stages of fish. Historic low water levels in Lake Michigan have compounded this problem in recent years as the rate of requests to dredge and maintain previously dredged and new sites has increased. As an example, in each of 2012 and 2013, DNR Water Regulation and Zoning Specialists issued 47 individual permits for dredging in Door County, while in 2010 and 2011 they issued only 11 and 29 permits, respectively.

Inversely, fish and wildlife habitat restoration/enhancement projects often require engineered modifications to the bed and banks of Lake Michigan, Green Bay, its tributaries and wetlands. Constructed projects included island and wetland construction from dredge spoils, spawning reefs, and submerged groins, bluff re-sloping and bioengineered systems that utilize a combination of live and dead plant material with or without hardened material to stabilize mass wasting of bluff lines while restoring littoral drift for beach nourishment.

Tactic a. Evaluate and inventory habitat potential behind existing bulkhead lines.

Tactic b. Work with regulators, engineers and scientists to evaluate the individual and cumulative impacts of construction activities to fish, wildlife, and other aquatic habitat, and to identify alternative systems or practices that minimize negative ecological impacts.

Tactic c. Continue habitat rehabilitation efforts using engineered and bioengineered practices, where appropriate.

Objective 3. Minimize non-point source pollution impacts to fish in our tributaries and estuaries.

Developed land uses can lead to non-point sources of pollution that affect fish and fish habitat in our lakes, tributaries and estuaries. Non-point sources of pollution are responsible for the majority of water quality and

habitat loss problems throughout the Great Lakes. Most reported fish kills and chronic toxicity are a result of non-point sources of pollution. Unabated runoff from agricultural land uses can contribute excessive nutrients, potentially toxic pesticides and ammonia, bacteria, and oxygen demanding pollutants to surface waters. Runoff from urban land use contributes potentially toxic heavy metals, carcinogenic hydrocarbons (poly-nuclear hydrocarbons or PAHs), and bacteria. Increased runoff volumes and soil erosion from crop land and construction sites, and runoff from impervious surfaces has resulted in stream bed and bank erosion (degradation), sedimentation (aggradation), and loss of habitat. Approximately 50% of the original wetlands in Wisconsin that provided fish and wildlife habitats have been lost through ditching and tiling to develop more agricultural lands and to a lesser extent, more urban development.

As required by the federal Clean Water Act (CWA), the DNR addresses waters impaired by nonpoint source pollution by establishing a Total Maximum Daily Load (TMDL⁵) for each impaired waterbody. The sum of all pollution sources that the waterbody can assimilate is allocated among the individual sources so as not to exceed water quality standards. TMDLs are in preparation for the lower Fox River Watershed, Upper Fox and Wolf River Watersheds, the Milwaukee River Basin and including the lower reaches of Cedar Creek due to PCB contaminated sediments from historical discharges of PCBs.

- Tactic a.** Educate the public about effects of land use practices on fisheries.
 - Tactic b.** Develop specific land acquisition and protection goals, related to fisheries habitat needs, for implementation by the Department's Stewardship Program.
 - Tactic c.** Provide fish and fish habitat information and identify factors responsible for limiting the biological uses of surface waters to external agencies and to the Department's Runoff Management Programs to support programs that protect water quality and provide a diversity of habitats for fish.
 - Tactic d.** Encourage use of buffer strips by educating riparian landowners using programs like USDA Conservation Reserve Program (CRP) and Conservation Reserve Enhancement Program (CREP).
 - Tactic e.** Support the Department's Law Enforcement and environmental regulatory staffs in enforcement actions for violation of laws relating to fish kills, water pollution, storm water runoff and water and shoreline protection.
 - Tactic f.** Communicate best management practices (BMP's) to state and local highway departments and others to reduce sediment runoff resulting from roadside ditch maintenance.
- Objective 4.** Achieve the most protective possible classifications of Lake Michigan tributaries with potential for trout and salmon natural reproduction.

Wisconsin streams are classified based on the aquatic community that current stream conditions can support, and in-turn these classifications are used to guide management decisions that affect fish and water resources. For example, the DNR regulates the discharge of pollutants into waters of the state (e.g., discharge of heated water or organic material) by issuing permits (i.e., Wisconsin Pollutant Discharge Elimination System or WPDES permits) and stream classifications are used to guide these permitting decisions. Stream classifications have been established through administrative codes NR 102 and NR 104 and classifications include: Cold Water Sport Fishery (CWSF), Warm Water Sport Fishery (WWSF), Warm Water Forage Fishery (WWFF), Limited Forage Fishery (LFF), and Limited Aquatic Life (LAL). Although this classification system can be an effective and useful management tool, it can also limit DNR's ability to enhance and protect streams because some classifications have been assigned inappropriately and/or were made based on degraded conditions. The most

⁵ Total Maximum Daily Loads Overview <http://dnr.wi.gov/topic/tmdls/overview.html>

protective classification is ‘Cold Water Sport Fishery’ and this classification only applies to streams that support trout populations. Most Lake Michigan tributaries are currently not designated as CWSF, but many Lake Michigan tributaries do seasonally support trout and salmon. Additionally, naturally produced trout and salmon smolts have recently been identified in many Lake Michigan tributaries and this production could be enhanced if proper in-stream habitat and watershed management practices are implemented. DNR Fisheries staff has worked with Watershed Management staff to survey Lake Michigan tributaries and develop stream classification recommendations, but not all recommendations have been adopted.

Tactic a. Work with Department staff in the Watershed Bureau and with the interested public to achieve the most protective possible classifications of Lake Michigan tributaries.

Objective 5. Minimize impacts of aquatic plant control to fish populations.

Aquatic plant communities provide essential habitat for fish, but when found in high abundance aquatic plant communities composed of rooted macrophytes and algae are viewed as nuisances by some lake shore property owners. Under these circumstances individuals or property owner associations will attempt to reduce aquatic plant abundance along their shorelines using a variety of control techniques. Control methods can be classified into three categories; physical, chemical and biological. The impacts that aquatic plant control has on fish communities vary with the type of fish community present and the type and extent of the control measures. Chemicals may directly affect fish, and plant control measures will affect fish habitat and food production. Sufficient vegetation is critical for successful breeding, rearing, and growth of fish throughout their life. However, needed habitat and plant densities vary among fish species. Also, particular native species of plants afford better habitat than do other non-native species. Physical, chemical and biological control measures can be targeted to eliminate or significantly reduce existing populations of non-native species.

In Wisconsin physical controls (hand-pulling, bottom covers, dredging, raking, mechanical harvesting) and chemical controls (herbicides) are allowed with certain restrictions (e.g., for controlling non-native plants). Under new rules, only limited plant removal by hand may be conducted without a permit. Permits for chemical treatment and physical removal of aquatic plants are handled by the Department's Aquatic Plant Management Program^{6,7}. Through the Department's Sensitive Areas Designation Program, certain aquatic plant communities are afforded special protection.

Tactic a. Support protection of aquatic plant habitats important for fish including working with the Aquatic Plant Management Program to evaluate sites for inclusion in the Sensitive Areas Designation Program.

Tactic b. Review aquatic plant management permits and plans and work with applicants to limit ecosystem impacts of aquatic plant management.

Tactic c. Partner on research identifying potential impacts of aquatic plant management activities to Lake Michigan aquatic ecosystems and develop BMP's.

Tactic d. Partner with other Department programs to identify, inventory and report on aquatic plants, both native and non-native species, when conducting fish and habitat surveys.

Objective 6. Minimize impacts of dams and other waterway alterations that limit the movement of fish in rivers and degrade habitat and restore habitat and/or connections previously degraded from these alterations.

Most major Lake Michigan tributaries have been dammed. These dams restrict both upstream and downstream movement of fish. The dams can benefit fisheries by preventing sea lamprey from reaching suitable spawning habitat and limiting upstream migrations of other detrimental species, but they can have major negative effects.

⁶ Aquatic Plant Management in Wisconsin. <http://www4.uwsp.edu/cnr/uwexlakes/ecology/APMguide.asp>

⁷ See Administrative Code sections NR 107 and NR 109.

They can restrict access of many fish species to large areas of spawning and nursery habitat and divide populations into genetically isolated sub-populations. The species affected can include smallmouth bass, walleye, muskellunge, northern pike, lake whitefish, lake sturgeon, rainbow trout, coho salmon, Chinook salmon, and brown trout. Blockage of the upstream migration of fish also limits stream fishing opportunities. Hydroelectric dams are operated under licenses granted by the Federal Energy Regulatory Commission (FERC). When a license expires, FERC has the opportunity to deny re-licensing or to require the construction of fish ladders or other structures to allow safe passage of fish. Department biologists provide expert advice to FERC during the re-licensing process. Alterations of waterways for other purposes are regulated by the Department through the Bureau of Water Regulation and Zoning. Some old dams do not stop the upstream passage of fish, but angling for those fish is regulated by inland rules that include a closed winter season. In addition, during the FERC licensing process, the licensee is required to obtain a Wisconsin Water Quality Certificate. That WQC can address fish passage. Fisheries staff will continue to provide input to Bureau staff as it relates to improvements to fisheries populations. The Department is developing a fish passage guidance policy and will complete administrative rulemaking regarding fish passage as required in Wis. Stats. 31.02(4). This guidance should allow staff to evaluate fish passage and dam removal at each dam on a case by case basis.

Inventories of public and private roads, highway bridges, and culverts have identified a large number of structures that are a significant impediment to fishes for purposes of accessing spawning and rearing habitats⁸. Improperly designed and installed structures can also affect water quality and physical habitat by causing channel enlargement and sedimentation. Public and private culverts, bridges and other infrastructure capable of limiting fish movement are routinely replaced and often require state, federal and local regulatory review for purposes of structural integrity and hydraulic conveyance, but not always for purposes of providing fish movement. A variety of methods exist that qualitatively or quantitatively assess existing structures fish passage efficiency, as well as design standards for new structures. Other agencies and groups have successfully completed watershed-scale inventories of potential fish movement barriers⁹.

- Tactic a.** Continue to advise FERC during re-licensing of dams.
- Tactic b.** Provide input on State Water Quality Certificates during the FERC licensing process to protect and improve fisheries related to each dam.
- Tactic c.** Work with other Department programs on developing a Department fish passage policy.
- Tactic d.** Encourage the removal of obsolete and other selected dams and other barriers (culverts, bridge pilings, etc.) that are not important barriers to aquatic invasive species and those for which the benefits of removal outweigh risks of invasive species expansion.
- Tactic e.** Work with partners to address fish connectivity needs on barriers identified on Green Bay watersheds.
- Tactic f.** Explore methods for passing sturgeon and other migratory species around dams.
- Tactic g.** Assist other groups and agencies to complete inventories of potential fish passage barriers.
- Tactic h.** Evaluate dam related habitat limitations for lake whitefish in the Menominee River and possibly other tributaries along the west shore of Green Bay.

⁸ Stephanie R Januchowski-Hartley, Peter B McIntyre, Matthew Diebel, Patrick J Doran, Dana M Infante⁴, Christine Joseph, and J David Allan. 2013. Restoring aquatic ecosystem connectivity requires expanding inventories of both dams and road crossings Ecological Society of America.

⁹ Milwaukee Riverkeeper. 2013. Menomonee River Fish Passage: Identifying Stream Passage Impediments and Opportunities to Address Aquatic Habitat Fragmentation in the Menomonee River Watershed Final Report

Objective 7. Assist in studies and projects that will result in evaluation of impacts, remediation, restoration and removal of contaminated sediments in the nearshore waters and tributaries which have degraded fish habitat, and threaten human health and the environment.

Historic discharges of stormwater, municipal and industrial wastes has contaminated sediments in major rivers and estuaries including the Menominee (arsenic, lead, cyanide, mercury and PAHs), lower Green Bay and Fox River (PCBs), Sheboygan River (PCBs) and Milwaukee Rivers (PCBs, PAHs and heavy metals). In addition, there are smaller and more localized contaminated sediment deposits located within these rivers and estuaries (e.g., former coal gas and die cast facilities) and further upstream in their watersheds (e.g., PCBs discharged to a tributary of the Manitowoc River; PCBs discharged to Cedar Creek a tributary to the Milwaukee River). Remediation of PCBs and other pollutants has been a long-term, major effort at great expense in several of Wisconsin's tributaries to Lake Michigan to reduce the amount of contaminants entering the Lake. Remediation efforts are expected to continue until defined sediment and fish contaminant target goals are reached.

In some instances where the source(s) of contamination are fully known and the damages to the public resources are significant, federal law allows trustees to recover damages under Natural Resource Damages (NRD) laws. In these instances trustees (federal, state and tribes) are able to use financial forfeitures for projects that restore/rehabilitate the impacted environment.

- Tactic a.** Work with partners to identify contaminated sediment sites and assist with monitoring and other studies that will result in remediation, restoration, and removal of contaminated sediment.
- Tactic b.** Work with fish contaminant and advisory program to collect and submit fish samples per collection schedule and to review updates to Wisconsin's fish consumption advisories for Lake Michigan.
- Tactic c.** Work with remediation programs and partners to reduce PCBs in tributaries entering Lake Michigan and restore habitat to improve overall ecosystem health.
- Tactic d.** Work with partners to identify projects, prepare plans and implement projects for the restoration of the environment using forfeitures received under NRD laws (e.g., real estate acquisition, wetland restoration and other habitat projects that benefit fish), or other sources.

Goal B. Protect and restore native species.

Human activities in the Lake Michigan basin, through water quality degradation, habitat modification, intentional and unintentional introduction of non-indigenous species, and sport and commercial fishing, have had profound effects on native fish populations. The Lake Michigan system as a whole has been sufficiently altered so extensively that it is not possible to completely restore the pre-settlement native fish community. However, rehabilitation of populations of some native species will promote diversity and stability within the ecosystem and provide additional sport or commercial fishing opportunities.

Objective 1. Restore self-sustaining lake trout populations to a level that supports sport fisheries.

The long-term goal of restoring lake trout populations has eluded us for almost 40 years of intense lake trout restoration efforts among Wisconsin, neighboring states, and Federal partners. However, in recent years we have observed evidence of successful natural lake trout reproduction and recruitment into spawning age classes. While still not self-sustaining, it is possible that the lake trout populations will become self-sustaining in the near future.

Through a joint state and federal program, tens of millions of juvenile lake trout stocked over the years have demonstrated good survival and growth and have provided a sport fishery. However, for decades no naturally

reproduced lake trout were observed in older age classes. Several year classes of sexually mature lake trout have been consistently found during spawning surveys and Dr. John Janssen (UW Milwaukee) has documented eggs deposited as early as 2001 as well as young of the year lake trout (late sac-fry) starting in 2013¹⁰. Factors that might limit successful natural reproduction include contaminants, predation by alewives and other fish, genetic strains used for stocking, and thiamine deficiencies¹¹.

The recent evidence of natural reproduction and recruitment into older age classes include non-marked fish in fall and spring surveys in Wisconsin¹², Indiana, and Illinois waters and non-marked juvenile lake trout captured during winter surveys by the FWS in 2011 and 2012¹³. How extensive this natural reproduction and recruitment is, whether it will last, and why it is just now happening are all questions that remain unanswered.

Tactic a. Implement the Lake Trout Implementation Strategy for Lake Michigan¹⁴

Tactic b. Cooperate with UW-Milwaukee and other investigators conducting life history studies addressing factors limiting natural reproduction and recruitment.

Tactic c. Work with other agencies to evaluate recent observations of successful natural lake trout reproduction and seek to understand the factors and mechanisms causing this success.

Objective 2. Restore self-sustaining walleye populations in Green Bay and Milwaukee Harbor to support sport fisheries.

Walleye populations in the Wisconsin waters of Lake Michigan and Green Bay were decimated by poor water quality and habitat loss by 1970. Following the implementation of the Clean Water Act, water quality improved dramatically in these waters.

To quickly respond to improving water quality in Green Bay, the Department established an intensive walleye stocking program. Survival was good and within a few years, high-density populations were achieved. Walleye stocking was discontinued in 1984 to evaluate the reproductive success of the program. Since 1984, with the exception of stocking in the Sturgeon Bay area that resumed in 1994, the Green Bay walleye population has been maintained by natural reproduction.

Since the large studies that were conducted in the 1980's to evaluate the reproductive success of initial stockings, walleye reproduction across Green Bay has not been systematically evaluated. Some walleye populations have been studied intensively in the past, including those found in the Fox River and Sturgeon Bay. Populations that utilize the Oconto and Peshtigo Rivers have had little evaluation. Large annual spring spawning migrations of walleye have been documented by Department staff in most major Green Bay tributaries. These rivers along with several other spawning locations scattered around Green Bay likely sustain the large walleye population found in Green Bay but little is known about which rivers or locations contribute to the overall Green Bay population. In addition, walleyes naturally reproduced in Sturgeon Bay in the early stages of the restoration program; but because of habitat destruction only limited natural reproduction is now occurring in this area.

¹⁰ Janssen, J. et al. 2006. Evidence of lake trout reproduction at Lake Michigan's Mid-lake Reef complex. *J. Great Lake Res.* 32:749-763.

¹¹ Bronte, C. et al. 2003. Possible impediments to lake trout restoration in Lake Michigan. Great Lake Fishery Commission.

¹² During fall 2012 at Mid-Lake Reef complex not marked fish composed 13% of the catch. During spring 2013 surveys at Mid-Lake Reef complex the unmarked rate was 8.2%.

¹³ Hanson, S. D., et al. 2013. Evidence of wild juvenile lake trout recruitment in western Lake Michigan. *North American Journal of Fisheries Management.* 33:186-191.

¹⁴ Dexter, J.L. et al. 2001. A Fisheries Management Implementation Strategy for the Rehabilitation of Lake Trout in Lake Michigan. Great Lakes Fishery Commission

In an effort to improve the near-shore fishery in the Lower Milwaukee River including the Milwaukee Estuary Area of Concern (AOC), fry and fingerlings of native species including walleye, northern pike and smallmouth bass were stocked since the mid-1980s. Fry stocking yielded only marginal results. In the mid-1990s, when the yellow perch population in Lake Michigan declined dramatically, the interest in improving populations of alternate near-shore species grew much stronger in the local fishing community. In 1995, the Department, with the support of many local fishing clubs, embarked on a pilot project to raise and stock 10,000 extended growth walleye annually in the lower Milwaukee River. However, the initial stocking occurred prior to significant improvements in water quality and access to suitable spawning habitat did not begin until 1997 with the initial completion of the Combined Sewer Overflow (CSO) pollution abatement program and the removal of the North Avenue Dam. Since 1997, the remainder of the CSO pollution abatement program has been completed along with three additional dam removals over 32-miles of river and the construction of an engineered fish passage facility at another dam. Along with the stocking of walleye, a detailed plan for the restoration of walleye in the lower Milwaukee River and harbor was developed. The main objective of the program, as in Green Bay, was to re-establish self-sustaining populations.

- Tactic a.** Assess natural reproduction of walleye in Green Bay, Fox River, Oconto, Peshtigo, Menominee, Milwaukee rivers, and the Sturgeon Bay area.
- Tactic b.** Evaluate characteristics of the walleye population in the Sturgeon Bay area and work toward re-establishing a self-sustaining population using stocking and/or habitat improvement.
- Tactic c.** Update the Milwaukee River Walleye Management Plan.
- Tactic d.** Develop a coolwater isolation facility that will allow us to propagate the Lake Michigan strain of walleye.

Objective 3. Restore self-sustaining populations of lake sturgeon populations in suitable Lake Michigan and Green Bay tributaries.

The Lake sturgeon is the largest and oldest fish species inhabiting the Great Lakes and historically was one of the most abundant fish species in Lake Michigan. Sturgeon were particularly abundant in the relatively shallow and productive waters of Green Bay and utilized the many large tributaries of the bay for spawning, including the Fox, Oconto, Peshtigo, and Menominee rivers in Wisconsin, and the Cedar, Ford, Escanaba, Whitefish, and Sturgeon rivers in Michigan. Through the last century their abundance has drastically declined. However, as water quality and quantity improves in Wisconsin streams, our lake sturgeon population has gradually increased. Population increases have been noted in the Oconto, Peshtigo and Menominee rivers in particular.

Overall, lake sturgeon are currently considered depleted throughout most of their native range. They are presently a species of special concern in Wisconsin, are listed as threatened in Michigan, and are considered a Federal species of concern by Region 3 of the U.S. Fish and Wildlife Service.

The largest concentration of lake sturgeon in Lake Michigan is in Green Bay. Of the four tributaries to Green Bay that are known to support lake sturgeon, the Menominee River supports the largest population. In addition to the Menominee River, the Peshtigo, Oconto, and Fox rivers also support lake sturgeon populations below the first dam, and these fish have free access to Green Bay. While the number of lake sturgeon using these once highly-polluted rivers has increased with the improved water quality of recent years, numbers are still relatively low. In spite of limited spawning habitat in these rivers there is some natural reproduction. Two Lake Michigan tributaries, the Kewaunee and Milwaukee Rivers do not now support remnant sturgeon populations, but offer suitable habitat for sturgeon reproduction. The stocking of early life stages of sturgeon was initiated in the Milwaukee River in 2003 and the Kewaunee River in 2009 through the use of streamside rearing facilities.

Our goals for lake sturgeon management in Green Bay and Lake Michigan are to 1) enhance existing naturally reproducing populations, 2) re-establish self-sustaining naturally reproducing lake sturgeon populations throughout their historic range and, 3) develop harvestable surpluses through natural reproduction to provide opportunities for sport harvest. These goals are consistent with and derived from sturgeon management plans developed in Wisconsin and elsewhere^{15,16,17}.

Tactic a. Implement Wisconsin's Lake Sturgeon Management Plan

Tactic b. Continue lake sturgeon rehabilitation efforts in suitable Lake Michigan and Green Bay tributaries, including habitat enhancement and stream-side rearing at Kewaunee, Milwaukee, and other suitable rivers.

Objective 4. Restore self-sustaining populations of Great Lakes spotted muskellunge to Green Bay to support a sport fishery.

The Wisconsin Department of Natural Resources in cooperation with several local muskellunge clubs and the Musky Clubs Alliance of Wisconsin initiated a Great Lakes strain muskellunge reintroduction program in 1989 in the Green Bay waters of Lake Michigan. Muskellunge in southern Green Bay were decimated during the early to mid-1900s by habitat destruction, pollution, and over-exploitation. The need to re-establish a native inshore predator fish species was identified in several planning efforts including the Lake Michigan Integrated Fisheries Management Plan and the Lower Green Bay Remedial Action Plan. A three-phase plan was drafted by Department biologists to re-establish a self-sustaining population of muskellunge in Green Bay. The phases of this plan included: (1) identification of an appropriate egg source, to obtain eggs, and successfully hatch, rear and stock fish, (2) establishment of an inland lake broodstock population, and (3) development of a self-sustaining population in Green Bay.

The stocking of Great Lakes muskellunge into the Fox River and various locations around Green Bay began in 1989 and has continued since. In 2008 two unmarked (naturally reproduced) young-of-year muskellunge were collected from the Lower Menominee River and in 2009 young-of-year muskellunge were captured from the Lower Menominee River and Sturgeon Bay. However, to date there has been no significant documented natural reproduction of muskellunge in Green Bay or the Lower Fox River.

In 2010 public meetings were held with anglers to develop goals for the Great Lakes spotted muskellunge program and to develop a new management plan. This process was completed in 2012 when the new Great Lakes Spotted Muskellunge Plan was finalized (margins of Randy's comments were deleted so not sure what changes he wanted). Management objectives of this plan included continuing stocking until substantial natural reproduction occurs, maintaining protective bag and size limits, working with other management agencies to enact protective seasons and expand our knowledge of the fishery, and protecting, enhancing, and creating muskellunge habitat in the Fox River, Green Bay and tributary streams.

Tactic a. Implement the Green Bay Great Lakes Spotted Muskellunge Plan, including importing eggs or fish to establish populations in broodstock lakes and evaluating whether natural reproduction is occurring in Green Bay.

¹⁵ Thuemler, T.F., E.A. Baker, and R.F. Elliott. 1999. Draft lake sturgeon plan for the Green Bay basin. Wisconsin DNR, Michigan DNR, and USFWS.

¹⁶ Wisconsin Department of Natural Resources. 2000. Wisconsin's Lake Sturgeon Management Plan. Bureau of Fisheries Management and Habitat Protection. Madison, WI. 12 pp.

¹⁷ Great Lakes Fishery Commission, 2010. Genetic Guidelines for the Stocking of Lake Sturgeon (*Acipenser fulvescens*) in the Great Lakes Basin, publication 2010-01. Ann Arbor, MI.

- Tactic b.** Continue to collect eggs from the Fox River, broodstock lakes, and outside Wisconsin (through cooperating agencies), for rearing and stocking into Green Bay.
- Tactic c.** Create, enhance and protect critical muskellunge habitat in the Fox River, Menominee River, Green Bay, and other tributary streams.
- Tactic d.** Develop a coolwater isolation facility that will allow us to meet the stocking quotas for Great Lakes strain of muskellunge, especially since viral hemorrhagic septicemia (VHS) prevents us from using our present muskellunge rearing stations.

Objective 5. Investigate yellow perch survival after the first year of life in Green Bay

Adult yellow perch abundance declined 90% between 1988 and 2000 primarily as a result of poor recruitment. However, several years of excellent recruitment over the last decade have helped to bolster the adult perch population. Peak year classes occurred in 2003, 2005, and 2010, with several moderate year classes in between. A statistical catch-at-age model was used to document and quantify population growth and we were able to increase the sport bag limit from 10 to 15/day in 2005 and to increase the total allowable commercial harvest of yellow perch from 20,000 to 60,000 pounds in 2005 and from 60,000 to 100,000 pounds in 2007. Despite excellent recruitment occurring in Green Bay, commercial and sport harvest has leveled off over the last four years and has not exhibited significant increases as expected. The lack of increase in harvest may be because relatively few yellow perch are surviving beyond the first year of life.

We recognize that Green Bay has changed dramatically since the 1980s, with the introduction of many exotic species and increases in many native bird and fish species. Their effect on food web dynamics and specifically on yellow perch is unclear. Also, we do not fully understand the degree to which predation by walleye, northern pike, muskellunge, cormorants, or pelicans might affect recruitment to age-one and beyond.

- Tactic a.** Continue assessments of young-of-year and adult abundance.
- Tactic b.** Continue to collect data to support the Green Bay and Lake Michigan yellow perch statistical catch-at-age population model development.
- Tactic c.** Study the effects of fish and bird predation on yellow perch populations.

Objective 6. Investigate yellow perch populations in Lake Michigan and develop criteria for changing sport fishing harvest limits, in cooperation with Michigan, Indiana, and Illinois Departments of Natural Resources.

The yellow perch population in Lake Michigan has dramatically declined since the early 1990's. Recruitment has been very poor with very few moderate year-classes developed since 1989. These moderate year-classes were produced in 1998 and 2005 which supported a decent sport fishery. However, harvest rates have continually declined throughout the last decade because of a decreased number of yellow perch in Lake Michigan. Results from our statistical catch-at-age model indicate very low adult yellow perch biomass in Wisconsin's waters of Lake Michigan. Sport harvest of yellow perch in Lake Michigan has dropped from 51,000 fish in 2010 to about 9,000 in 2012. Stringent harvest regulations are in effect in Wisconsin with the commercial yellow perch fishery closed, the sport fishing daily bag limit down to 5 perch per day, and the season closed from May 1 to June 15. The impact of colonization of invasive dreissenid mussels on the survival of early life stages of yellow perch is unclear. In addition, the productivity of the lake, especially that of nearshore waters, has tremendously changed¹⁸.

- Tactic a.** Continue assessments of young-of-year and adult abundance.

¹⁸ Turschak, Benjamin, "Changes in the Lake Michigan Trophic Structure: As Revealed by Stable C and N Isotopes" (2013). *Theses and Dissertations*. Paper 170.

Tactic b. Develop criteria for changing sport fishing harvest limits, in cooperation with Michigan, Indiana, and Illinois Departments of Natural Resources.

Tactic c. Continue to collect data to support the southern Lake Michigan yellow perch population model.

Tactic d. Work with researchers to continue to investigate causes of poor recruitment.

Objective 7. Restore cisco (*Coregonus artedii*) populations in Lake Michigan with focus on Green Bay.

The cisco (lake herring) population, which supported large-scale commercial fisheries and other ecological functions and values in the Great Lakes during the first half of the 20th century, collapsed in all the lakes by 1970 because of overfishing, habitat destruction, and invasive species. A remnant population of ciscos persists in some parts of Lake Michigan¹⁹. Cisco populations in Lake Superior and Lake Huron are coming back. The non-native rainbow smelt may have prevented a cisco recovery in Lake Michigan. There is a concerted effort by state and federal agencies to restore cisco populations in Lake Michigan and other Great Lakes.

Tactic a. Cooperate with partner agencies in restoring lake herring, especially in Green Bay

Tactic b. Explore the possibility of cooperating with Federal agencies by rearing lake herring at Department propagation facilities.

Objective 8. Investigate population characteristics of northern pike and smallmouth bass in Green Bay and Lake Michigan.

While northern pike and smallmouth bass provide ample fishing opportunities and are found throughout much of the Wisconsin waters of Green Bay and Lake Michigan, there are still many unknowns regarding their discrete population characteristics. Population dynamics of northern pike in Green Bay, in particular, are poorly understood making judgment of the efficacy of current or future regulations difficult. Furthermore, recent low water conditions and habitat degradation have likely reduced the contribution of certain populations of tributary spawning northern pike to the overall population. However, the scale of these reductions cannot be determined with the data we currently collect. While some smallmouth bass populations, particularly in Door County waters, have been surveyed on a regular basis over time, some of the more remote populations have received little attention. Given that smallmouth bass generally move only a short distance from their natal area, having a good understanding of the underlying population characteristics of each population (including genetic differences) is very important to making sound management decisions.

Tactic a. Identify spawning populations including specific contributions to the overall populations.

Tactic b. Determine population characteristics (e.g., age, growth, length, weight, abundance) and track through time.

Objective 9. Investigate lake whitefish spawning populations in the Menominee and other Green Bay tributaries.

The recent re-establishment of a spawning lake whitefish population in the Menominee River has been a boon for Green Bay fisheries. Given that more than a century had passed since the last viable population of spawning lake whitefish occupied this tributary, there remains a great deal to be learned about this situation and how their characteristics may differ from lake spawning populations.

¹⁹ J. D. Stockwell and 12 others. 2009. A synthesis of cisco recovery in Lake Superior: Implications for native fish rehabilitation in the Laurentian Great Lakes. *North American Journal of Fisheries Management*, 29:626-652.

Historically, there were multiple tributary spawning populations of lake whitefish in Wisconsin waters of Green Bay and early evidence suggests that lake whitefish may be in the early stages of re-colonizing other tributaries besides the Menominee. An understanding of the dynamics of the various life history stages of the Menominee River spawning fish as well the riverine habitat conditions that lead to their success is not only essential in order to guide management strategies, but may also help us to enhance populations in other tributaries that historically hosted populations.

Given the high level of both sport and commercial harvest of lake whitefish in Wisconsin, it is critical that the tributary population-level characteristics are understood to help set safe harvest levels that protect the current and potential future tributary spawning populations.

Tactic a. Identify spawning populations and assess contributions to the overall populations.

Tactic b. Determine population characteristics (e.g., age, growth, length, weight, abundance) and track through time.

Tactic c. Evaluate habitat and hydrological conditions in lake whitefish spawning rivers to determine riverine characteristics that are important to successful recruitment.

Goal C. Develop, evaluate, and implement strategies to control, manage, or cope with invasive species, as well as certain nuisance native species.

Lake Michigan currently contains many invasive species and new invasions continue. Most are non-indigenous species that were introduced as the unintended result of human activities. Some of these non-indigenous species, such as sea lamprey, alewives, and dreissenid mussels are highly invasive and have had undesirable impacts on the ecosystem. Prevention of further invasions is the best protection for the lake ecosystem. Although invasive species can sometimes be managed and controlled (e.g., sea lamprey have been reduced by the Great Lakes Fishery Commission's control program and alewives have been reduced by coordinated state stocking of salmon and trout), most often effective control is not possible once invasive species are established. Even some native species, such as cormorants, have reached historical high levels and are affecting the aquatic ecosystems. For such native species, control and management is needed to protect the Lake Michigan ecosystem.

Objective 1. Monitor populations, investigate impacts to fisheries, and develop management plans for invasive and nuisance native species that are currently present in Lake Michigan and causing ecological impacts.

Control actions can be effective in some cases. For example, sea lamprey have been drastically reduced through Federal control efforts but these efforts are expensive and must be done on an annual basis in perpetuity, and sea lamprey will never be eliminated through these efforts. When control is feasible we should develop, implement, and/or support control efforts.

Studies in Green Bay and elsewhere have shown that cormorants can reduce fish populations^{20,21}. The USFWS is the responsible agency under the Migratory Bird Treaty Act. Under terms of Federal Depredation Permits issued by the USFWS, we have cooperated with USDA Wildlife Services for several years in an ongoing program of oiling cormorant eggs and culling adult birds on selected Green Bay islands, with the effect of sharply reducing the size of the nesting populations on those islands. Initially, the oiling program was funded by the Department, but more recently funding through the Great Lakes Restoration Initiative (GLRI) has been used

²⁰ Meadows, S. R. 2006. Double-crested cormorants in southern Green Bay: ecology and food habits with emphasis on the yellow perch fishery, dietary overlap with sympatric American white pelicans, and seasonal contaminant intake. Master's thesis. University of Wisconsin, Madison.

²¹ Bacheler, N.M., T.J. Paoli, and G.M. Schacht. 2011. Controls on abundance and distribution of yellow perch: predator, water quality, and density-dependent effects. *Transactions of the American Fisheries Society* 140:989-1000.

by Wildlife Services. In recent years, white pelicans have proliferated in southern Green Bay, raising concerns that they too may be negatively impacting fish populations.

Control actions in most other cases are not effective once the species become established. For example, there are currently no effective means to control zebra and quagga mussels. When control is not feasible, we should continue to support research on potential control methods and support monitoring.

- Tactic a.** Continue to support sea lamprey control efforts by providing survey data and advocating continued federal support.
- Tactic b.** Closely evaluate barrier or dam removal efforts for the potential impacts to expanding the sea lamprey. Work with partners to install sea lamprey barriers as needed and feasible.
- Tactic c.** Continue to support Federal and other partners in monitoring of established invasive species populations.
- Tactic d.** Continue working with Federal partners to manage cormorant populations.
- Tactic e.** Continue to support monitoring of pelican populations and work with Wildlife Division and Federal partners to establish population goals.

Objective 2. Minimize introduction of new invasive species into Lake Michigan.

These two vectors of introduction of non-native species have been well studied and the Department is actively involved in addressing the problems. The Bureau of Water Quality leads Department work in the regulation of ballast discharge, and has developed a general WPDES Ballast Water Discharge Permit²². Department participation in inter-jurisdictional discussions of controlling the movement of invasive species through the Chicago Sanitary and Ship Canal is centered in the Lakes and Rivers Section of the Bureau of Water Quality. The ability of the Lake Michigan Fisheries Program to influence either of these issues is limited, but we can provide some leadership in detecting new invasive species and in planning and guiding appropriate Department responses to new arrivals. Because public concern about Asian carp is acute, because all Great Lakes jurisdictions are concerned about the arrival of Asian carp in any jurisdiction, and because our tools for controlling their spread once they arrive are very limited, it is particularly important to be prepared with supportable response strategy that has been reviewed and accepted at all levels of the Department and discussed with the interested public.

- Tactic a.** Support the creation of a single bi-national (U.S. and Canada) legal authority to establish ballast water discharge standards that are enforceable.
- Tactic b.** Support efforts to block the passage of exotic species into Lake Michigan via the Chicago Sanitary and Ship Canal.
- Tactic c.** Work with partners on AIS surveillance
- Tactic d.** Develop and implement an Asian carp response strategy including an outreach program to inform the public about limitations of potential management responses to new AIS and interpreting early detection results (e.g., environmental DNA).

Objective 3. Minimize introduction of invasive species from the Great Lakes to inland waters.

Exotic species in the Great Lakes can spread into inland waters with deleterious effects on inland ecosystems and game fish populations. Recreational boats are an important vector for invasive species. The Department

²² <http://dnr.wi.gov/topic/wastewater/generalpermits.html>

has adopted rules prohibiting the transport of invasive species attached to or in boats, and requiring boaters to drain all water from boats trailers, and containers before transporting a boat from one body of water to another.

Tactic a. Continue to support Department and Sea Grant AIS outreach programs to educate boaters and fishers using the waters of Lake Michigan, Bay of Green Bay and tributary streams on proper cleaning /disinfecting of boats, trailers and live wells to prevent transfer of exotics to inland waters.

Objective 4. Manage nonnative alewife populations to minimize impacts to native species. .

Non-native alewife can negatively impact native fishes and this is especially true when alewife abundance is too high. Competition for food and predation are two primary ways that alewives may negatively impact native fishes, especially during early life stages when young fishes are highly vulnerable to starvation and predation. Alewives may also contribute to Early Mortality Syndrome (EMS) because they contain the enzyme thiaminase. EMS affects both native and non-native salmon and trout (e.g., lake trout and Chinook salmon) and occurs because of a thiamine deficiency in newly-hatched fish whose female parent has consumed a diet rich in alewives.

Generally, alewife populations in Lake Michigan have been successfully controlled by stocking Pacific salmon. Chinook salmon are especially effective at controlling alewives because chinooks are large, aggressive predators and in Lake Michigan a chinook's diet consists almost exclusively of alewives. In turn, an important recreational fishery for Pacific salmon has developed in Lake Michigan. So despite the many negative impacts that alewives have on native fishes, alewives also provide a forage base which is critically important to support Lake Michigan's salmon fishery. Alewife abundance in Lake Michigan has recently been low because of high levels of predation by Chinook salmon and reduced fitness, generally attributed to decreased lakewide zooplankton populations caused by filter-feeding zebra and quagga mussels.

The Department would like to sustain an abundance of alewives sufficient to support salmon and trout populations, but low enough to allow rehabilitation and enhancement of native species. Maintaining this balance will be challenging, because Lake Michigan is a large, complex and dynamic system.

Tactic a. Manage alewife populations through judicious stocking of salmon and trout.

Tactic b. Continue to participate with other agencies in lake wide forage assessments.

Vision II. A diverse multi-species sport fishery within the productive capacity of the lake

This vision expresses our desire for varied sport fishing opportunities in Lake Michigan and also acknowledges the limitations of the sport fishery due to the limited productive capacity of the ecosystem. The diverse sport fishery will include, brown, rainbow and lake trout, coho and chinook salmon, walleye, smallmouth bass, northern pike, Great Lakes spotted muskellunge, lake sturgeon, lake whitefish, and yellow perch. It will include fishing opportunities in tributaries, from shore and piers, nearshore and on the open lake.

Goal A. Sustain a salmon and trout species mix within ecosystem capacity that supports sport harvests within target ranges.

Sport harvest targets are listed below for the five salmon and trout species currently stocked in Lake Michigan. Harvests of salmon and trout during the last ten years were within previous targeted ranges for chinook and coho salmon but not for other species. The Chinook salmon fishery has recovered from the low levels experienced during the early 1990s and anglers have harvested tremendous numbers of Chinook salmon in the past 10 years. In the last 10 years, anglers have achieved the top three (2005, 2006, 2007) harvests of all-time and six out of the top 10 (2003, 2004, 2005, 2006, 2007, 2012). The average coho salmon harvest was within the desired range but was near the low end of the target range. Rainbow trout, brown trout, and lake trout harvest were below the previous target ranges.

The stocking program that supports these fisheries has been and will continue to be adjusted in response to ecosystem changes. Beginning in the summer of 2011 and continuing through a Lake Michigan Fisheries Forum (LMFF) meeting in December 2012, WDNR along with sister agencies on Lake Michigan, engaged interested stakeholders in discussions of the correct number of Chinook salmon to stock into Lake Michigan. After this intensive process, state agencies agreed that stocking 50% fewer Chinook salmon in 2013, 2014 and 2015 was the next adjustment necessary to balance predator and prey populations. Because much of the increasing salmon natural reproduction is occurring in their waters, Michigan reduced their stocking by the largest amount. Wisconsin agreed to reduce Chinook salmon stocking by 37.8% or reduce a combination of Chinook salmon and other trout and salmon species to a level that would be equivalent to a 37.8% reduction of Chinook salmon (equivalency based on fish prey consumption ability). Starting in 2014, the distribution of stocked chinook salmon among counties along the shoreline will be guided by a new strategy that allocates 75% of the stocked chinook salmon equally among most counties and 25% differentially among most counties based on 3 measures of September and October fishing: number of charter boat trips, total hours of directed angler effort for chinook salmon, and chinook salmon harvest rate.

For the next ten years we propose the following harvest target ranges for trout and salmon.

Average estimated annual sport harvest of salmon and trout from Wisconsin waters of Lake Michigan during 2003 through 2012 and target harvest ranges for the next ten years.			
	annual harvest average (2003-2012)	target range (2014-2023)	
		Low	High
brown trout	21,163	25,000	65,000
rainbow trout	52,186	70,000	125,000
chinook salmon	327,442	150,000	300,000
coho salmon	67,898	75,000	140,000
lake trout	17,422	10,000	40,000

Brown and rainbow trout: The desired harvest range for brown and rainbow trout would remain the same as the past ten years. Though Wisconsin did not harvest the desired amounts over the past ten years, anglers and others still desire these harvest amounts. The target range for brown trout may be within the ecosystem capacity of Lake Michigan and maybe achievable by changes in stocking practices. The target range for rainbow trout is likely within the ecosystem capacity and is likely achievable if stocking goals can be more consistently achieved.

Chinook salmon: The desired harvest range for Chinook salmon would increase from 85,000-190,000 to 150,000 to 300,000. Lake Michigan has recovered from the low populations of the 1990's that drove the past ten years lower target range. We think that with judicious stocking and monitoring of natural reproduction, the Lake Michigan ecosystem can support this range of harvest in Wisconsin waters.

Coho salmon: The desired range of coho salmon would increase from 50,000 -140,000 to 75,000-140,000. Though average harvest was within the past range, the public would like increased opportunities for coho salmon. We think that if coho salmon stocking goals can be more consistently achieved the Lake Michigan ecosystem can support this new target harvest range.

Lake trout: The desired harvest range for lake trout would decrease from 30,000-82,000 to 10,000-40,000. Public input has led us to propose this decrease harvest target range for lake trout. Wisconsin sport harvest of lake trout is in part driven by near shore stocking of lake trout. We received strong public feedback that less lake trout should be stocked to compensate for higher Chinook salmon stocking.

Objective 1. Manage the predator population to match the available prey fish populations in Lake Michigan.

Maintaining an appropriate predator-prey balance has been an important and challenging component of Lake Michigan fisheries management both historically and presently. Historically, native lake trout and burbot were the dominant top predators in Lake Michigan's ecosystem; but lake trout were extirpated during the 1950s by sea lamprey predation and overfishing. Without an abundant top predator in Lake Michigan's ecosystem, invasive alewives proliferated and became problematic by the 1950-60s. To correct this predator-prey imbalance, fisheries managers began to stock large numbers of both native (lake trout) and non-native (Pacific salmon) predators into Lake Michigan during the 1960's. Chinook salmon and alewives are an especially good predator-prey match because 1) chinooks are large, aggressive predators, 2) chinooks eat almost exclusively fish, and 3) chinooks and alewives are pelagic or mid-water fishes, compared to lake trout which are more benthic or bottom dwelling.

The numbers of trout and salmon stocked into Lake Michigan have been adjusted occasionally in an effort to balance the number of predators with the available prey. The total number of Chinook salmon stocked into Lake Michigan increased during the 1970's and peaked during the 1980's. In 1992, the number of Chinook salmon stocked into Wisconsin waters was reduced by approximately 25%. In 1998, lakewide stocking of Chinook salmon was cut by all four Lake Michigan states by 27% (from 6,000,000 to 4,400,000 fish). In 2006, chinook stocking levels were reduced by 25% lakewide. Most recently, in 2013, a 50% lakewide chinook stocking reduction was implemented. Natural reproduction of chinook salmon in Michigan streams played a large role in the need for these reductions in 2006 and 2013 because approximately 50% of Chinook salmon are now from natural reproduction.^{23,24}

Past stocking reductions have been strongly supported by biological data, and a simple principle that limited forage can only support a limited predator population. Despite high chinook stocking levels during the 1980's,

²³ Williams, M.C. 2012. Spatial, temporal, and cohort-related patterns in the contribution of wild chinook salmon (*Oncorhynchus tshawytscha*) to total chinook harvest in Lake Michigan. A thesis submitted to Michigan State University.

²⁴ Claramunt, R.M., C.P. Madenjian, and D.F. Clapp. 2013. Pacific salmonines in the Great Lakes basin. In Great Lakes Fisheries Policy and Management: A Binational Perspective, 2nd Edition. Michigan State University Press, Pages 609-650.

catch rates and population abundance for Chinook salmon plummeted during the late 80's and early 90's. Bacterial kidney disease (BKD) caused large die-offs of Chinook salmon during the 80's and 90's and this was likely associated with an unbalanced ecosystem with too many predators and not enough forage (i.e., fish that are stressed due to hunger, spawning, etc., are more susceptible to disease). Alewife abundance declined during the 1980s and then stabilized but remained low during the 1990s. Additionally, bloater chubs (a native forage species) flourished during the 1980's, but then declined drastically during the 1990's. In 1991, the commercial harvest of alewife was prohibited. More recently, alewife abundance has reached record lows and chinook salmon growth rates have been slow^{25, 25, 26}. Both top-down (predation) and bottom-up (productivity) mechanics have likely contributed to low forage abundance in Lake Michigan including high levels of predation pressure on alewives by naturally produced and stocked chinook salmon and decreased lakewide productivity caused by filter feeding zebra and quagga mussels.

- Tactic a.** Maintain appropriate salmon and trout stocking levels and species mix, guided by harvest targets, the growth rates of adult salmon, lake wide estimates of forage abundance, and modeling of forage consumption.
- Tactic b.** Support continued efforts to improve models of forage consumption by trout and salmon.
- Tactic c.** Continue to support the USGS in lakewide forage surveys, including joining them in expanded monitoring, if appropriate.
- Tactic d.** Quantify and work to continue to minimize incidental loss of forage species (e.g., alewives in water intakes; bloater chubs and alewife in commercial trawls).
- Tactic e.** Continue to favor allocation of the available surplus production of alewives to salmonine predators, rather than to commercial harvests.

Objective 2. Continue to complete annual sport harvest estimates that are critical for management of the fishery.

Our knowledge of sport harvests is based on creel surveys (funded largely from the sale of Great Lakes Salmon and Trout Stamps), moored boat mail surveys, and reports submitted by charter captains. Creel surveys provide needed information about angler effort, numbers of fish harvested, movements of marked fish, growth and fitness of harvested fish, and extent of natural reproduction. They can also be used to collect data related to special studies or management questions. Recognizing that states differ in creel survey methods, the Creel Task Group of the Lake Michigan Technical Committee compared creel surveys in the four states and issued recommendations in 1995. The Wisconsin creel survey was considered well designed. All recommendations to improve Wisconsin's survey have been implemented. The Creel Task Group recommended that all states annually provide a standardized set of data to a lakewide creel survey data base. Wisconsin has consistently submitted data to the GLFC for this purpose.

Results from the sport fishing surveys conducted on Lake Michigan and Green Bay have been used on a variety of issues over the last twenty years including coho salmon stocking assessment, yellow perch management, nearshore rainbow trout stocking assessment, OTC / CWT chinook salmon studies and much more. However, funding for the program has remained relatively flat over the past 10 years and other studies to assist in the management of the salmon and trout program have not been completed. If completed, these studies would greatly expand our knowledge of the fishery and allow for better management of these important species. In addition, changes to the existing sport fishing surveys and additions of others will provide more accurate and

²⁵ Warner, D.M., T.P. O'Brien, S.A. Farha, R.M. Claramunt, and D. Hanson. 2013. Status of pelagic prey fishes in Lake Michigan, 2012. Presented at: Great Lakes Fishery Commission, Lake Michigan Committee Meeting, Duluth, MN, March 19, 2013.

²⁶ Leger, N.D., R. Claramunt, B. Breidert, D. Clapp, R. Elliott, C. Madenjian, S. Hansen, S. Robillard, D. Warner, G. Wright, and C. Bronte. 2013. Salmonid Working Group Update. Presented at: Great Lakes Fishery Commission, Lake Michigan Committee Meeting, Duluth, MN, March 19, 2013.

precise estimates. Recently, a new strategy for chinook salmon stocking locations was developed that incorporates two creel survey parameters, a charter boat parameter and results from our chinook salmon coded wire tag study. The use of these parameters underscores the need to have the best design, implementation, and analyses of these surveys in the future.

Tactic a. Continue conducting lake wide sport fishing surveys.

Tactic b. Expand the creel survey to assess late fall and winter brown trout, muskellunge, and lake whitefish harvest and effort.

Tactic c. Encourage synthesis of lake wide creel results.

Tactic d. Design and implement methods to determine charter boat reporting accuracy and implement changes if needed.

Tactic e. Implement a guide harvest reporting program for Green Bay and Lake Michigan.

Objective 3. Work with other Lake Michigan agencies to understand the population dynamics of salmon and trout.

Knowledge of salmon and trout population dynamics has improved greatly during the past decade, as many studies have been completed and others are currently underway. Additional studies will provide helpful guidance for future fisheries management decisions and will especially be important for guiding future stocking decisions.

A Lake-wide Assessment Plan (LWAP) for lake trout and burbot has been implemented annually during the past 10 years. The LWAP involves standardized spring gillnet surveys and all data are entered into a shared Lake Michigan database. LWAP data have been used to evaluate early life history, growth, diet, mortality, health, and movements of lake trout and burbot. The original intent of the LWAP involved an evaluation of chinooks too, but this has been difficult to implement because of limited sampling capacity.

Other studies by various agencies and universities have gathered information about natural reproduction, energetics and forage demand of many Lake Michigan fishes including Chinook salmon. For example, Michigan DNR and Michigan State University collaborated with other Lake Michigan fisheries agencies on a chinook salmon natural reproduction study that used oxy-tetracycline (OTC), coded wire tags (CWT), and fin-clips to mark stocked chinook salmon. Ratios of marked (hatchery) to unmarked (wild) chinooks in creel and assessment surveys were used to estimate natural reproduction, and results suggest that over 50% of age-1 chinook salmon in Lake Michigan are wild. Additionally, the Department participates in an annual evaluation of salmonine and planktivore populations within Lake Michigan conducted by a group called the Salmonid Working Group (SWG). The SWG is comprised of fisheries personnel from state, federal and tribal agencies around Lake Michigan and SWG evaluations specifically focus on chinook abundance, chinook recruitment, chinook growth rates, and prey fish biomass.

Since 2011, an adipose clip and CWT has been used to mark almost every Chinook salmon and lake trout stocked into the Great Lakes. This large scale marking initiative, called the Great Lakes Mass Marking Program, is a collaborative effort between federal (USFWS), state and tribal agencies to mark and recover chinook salmon and lake trout. Objectives of the Mass Marking Program are to evaluate: 1) estimate levels of natural reproduction, 2) determine among- and within-lake movements, 3) measure growth & age at capture, and 4) evaluate hatchery and stocking practices. Preliminary CWT results suggest that over 50% of age-1 chinook salmon in Lake Michigan are wild, and that chinooks are highly mobile (i.e., anglers fishing Wisconsin waters of Lake Michigan are catching stocked chinooks from the states of Michigan, Indiana, Illinois, Wisconsin and from Lake Huron).

The Department also operates three spawning weirs on Lake Michigan and collects important biological information from spawning trout and salmon at these three locations. Our weirs are the Strawberry Creek Chinook Facility in Sturgeon Bay, the Besadny Anadromous Fisheries Facility (BAFF) on the Kewaunee River, and the Root River Steelhead Facility (RRSF) in Racine. Strawberry Creek is exclusively a chinook salmon facility and has been in operation since 1972. BAFF (since 1989-90) and the Root River Weir (since 1994) are used primarily for spawning steelhead, coho salmon and brown trout and also serve as a backup egg collection facility for chinook. Data collected from trout and salmon at these weirs are important for tracking size-at-age, maturity, return rates, and fish health.

Although much is already known about population dynamics of trout and salmon in Lake Michigan, continued efforts to learn more will enhance this understanding and provide new information to guide future management decisions. Especially given recent concerns about predator-prey balance, it will be important to further study and quantify natural reproduction and growth rates by trout and salmon to better understand overall forage demands and appropriate stocking levels.

- Tactic a.** Continue lake wide assessments of lake trout pursuant to LWAP.
- Tactic b.** Participate with other states in lake wide estimates of natural reproduction of salmon and trout (e.g., Great Lakes Mass Marking Program) including measuring biological parameters of naturally reproduced fish (e.g., age, growth, length, weight).
- Tactic c.** Evaluate movements, survival, and return to creel using results from Great Lakes Mass Marking Program.
- Tactic d.** Maintain weir data sets for Strawberry Creek, the Kewaunee River, and the Root River.
- Tactic e.** Identify and quantify natural reproduction in Wisconsin tributaries and evaluate habitat and other factors that may be limiting natural reproduction.

Objective 4. Support programs and testing of pathogens and early mortality syndrome that continue to threaten salmon and trout fisheries.

In the late 1980's, Chinook salmon experienced large scale die-offs in Lake Michigan. Although no one factor was responsible for the disease outbreaks, several were implicated; *Renibacterium salmoninarum*, the causative agent of Bacterial Kidney Disease (BKD); *Echinorhynchus salmonis*, a parasite that caused serious intestinal hemorrhaging and anemia; bacterial gill disease; and the absence of visceral body fat. The lack of visceral fat indicated a nutritional stress was present (insufficient forage), which was thought to be the underlying stressor responsible for the conditions mentioned above. Since that time, hatchery biologists have worked to reduce the prevalence of BKD in fish reared at state hatcheries and fisheries biologists have worked to adjust stocking quotas to reflect the amount of available forage. These efforts have reduced the prevalence of *Renibacterium salmoninarum* to levels that are below detection using bacterial culture from the kidney on selective agar in spawning chinook compared to 66% in 1988 when a direct fluorescent antibody technique (DFAT) was used. The DFAT technique is a less sensitive technique than bacterial culture. *R.s.* is still detectable in adult coho salmon and seeforellen brown trout, but the prevalence is very low, ranging from 0 to 6%, depending on the year. No signs of bacterial kidney disease have been observed in any trout or salmon raised in Wisconsin state hatcheries since coho production was moved to the new Wild Rose hatchery in 2007/2008.

In the early 1990's, an early life stage mortality syndrome (EMS) was identified as the cause of seriously high mortality (up to 90% at some hatcheries) in fry of coho salmon, and to a lesser extent in the fry of chinook salmon, steelhead and Seeforellen brown trout. Research studies showed that EMS resulted from a thiamine (vitamin B₁) deficiency in the eggs. There is evidence that this deficiency occurs when adult fish consume diets comprised exclusively of alewife. The alewife contain an enzyme, thiaminase, that breaks down thiamine. Based on these studies, hatchery staff now treat newly fertilized eggs in a thiamine solution which greatly

improves fry survival and overall fry health.

Since its first appearance in 2007, Viral Hemorrhagic Septicemia virus (VHSV) has been isolated from smallmouth bass in multiple years in the Sturgeon Bay area and yellow perch and round goby in nearshore waters near Milwaukee during spring assessments or fish kill events. The virus has not been isolated from chinook or coho salmon, seeforellen brown trout, or steelhead that spawn at Wisconsin weirs. Two new methods developed by Michigan State University and the University of Wisconsin Veterinary School are available to screen fish serum for antibodies to VHSV. Presence of serum antibodies to VHSV indicate that a fish was previously exposed to the virus, but survived. Using these methods, in conjunction with standard virus isolation methods when conducting VHS surveillance, will provide a more complete picture of the geographic distribution of the virus and its prevalence.

- Tactic a.** Continue to rigorously test returning feral broodstocks and their progeny reared in the state hatcheries for fish pathogens including *Renibacterium salmoninarum*, *Aeromonas salmonicida*, *Yersinia ruckeri*, *Echinorhynchus salmonis*, *Myxobolus cerebralis*, Infectious Pancreatic Necrosis virus, Infectious Hemorrhagic Necrosis Virus, Viral Hemorrhagic Septicemia virus.
- Tactic b.** Continue to treat salmon and trout eggs with thiamine.
- Tactic c.** Support efforts to identify ecological factors that cause stress in feral and hatchery populations and develop ways to ameliorate the stresses so that disease/mortality events do not occur.
- Tactic d.** Continue to monitor the health of non-spawning salmon and trout in open water according to the lake wide fish assessment protocol.

Objective 5. Investigate the spawning runs of trout and salmon and determine causes for their erratic returns.

River spawning runs for Great Lakes trout and salmon can sometimes be erratic or inconsistent due to a complexity of factors. These factors include fisheries management actions which can be adjusted (e.g., stocking locations, size of fish at stocking, genetic strains, etc.) but also include uncontrollable or natural events (e.g., weather, precipitation, stream flow, etc.). Spawning runs of Lake Michigan trout and salmon have been monitored and/or researched quite extensively, especially at DNR's three Lake Michigan spawning weirs, and various management techniques have been implemented to improve spawning runs. A select list of management techniques include: 1) stocking three strains of steelhead (Skamania, Chambers Creek and Ganaraska) which each have a slightly different run time and collectively provide up to ten months of stream fishing opportunities, 2) stocking coho as yearlings because studies show that return rates of adults are higher for coho stocked as yearlings compared to fingerlings, and 3) stocking chinook salmon in rivers vs. harbors or vs. directly into Lake Michigan, because river stocked chinooks return better as mature adults likely due to improved imprinting.

- Tactic a.** Update the Lake Michigan Steelhead Fisheries Management Plan (WDNR, 1999. Lake Michigan Steelhead Fisheries Management Plan. Administrative Report No. 44 reference it) and implement the recommendations.
- Tactic b.** Build in the capacity to produce Skamania strain steelhead during the re-designed of the Kettle Moraine Fish Hatchery.
- Tactic c.** Continue to closely monitor the fish return to weirs and selected tributaries.
- Tactic d.** Operate weirs to comply with the Department's feral broodstock protocol.
- Tactic e.** Maximize the numbers of coho salmon stocked as yearlings.

Objective 6. Evaluate and improve, if possible, feral brood stock management practices.

Chinook salmon, coho salmon, rainbow trout and brown trout stocked into Lake Michigan are the result of a feral broodstock management program that includes all steps from the spawning of one generation of fish collected from the wild to the recovery of returning adults from that generation to spawn for the next generation. It includes both assessment and production activities at the weirs, in the hatcheries, on the stocking site, and on the lake. Methods and protocols for this program have been developed over time through experience and research. However, much is still unknown on the effectiveness of certain practices and if there are better techniques. A concerted effort in evaluating the effectiveness of current and potentially new methods could improve the Lake Michigan stocking program and make the program more effective.

Tactic a. Thoroughly evaluate gamete collection and other propagation practices to determine the most effective and successful strategies and methods.

Tactic b. Compare the contributions of offshore versus nearshore stocked brown trout to the fishery.

Tactic c. Evaluate stocking locations and strategies including implementing targeted studies and supporting mass-marking efforts for all stocked trout and salmon.

Tactic d. Evaluate origin of harvested trout and salmon to determine which stocking strategies contribute most to the Wisconsin fishery and use information to improve efficiency of stocking programs.

Goal B. Improve and enhance the statewide fish production system for Lake Michigan.

The current salmon and trout sport fishery in Lake Michigan, and particularly in Wisconsin's waters, is largely dependent on fish propagation and stocking. The new Wild Rose State Fish Hatchery was recently added to the State's coldwater production system, but additional work is needed at other Great Lakes hatcheries to meet production goals.

Objective 1. Work with Fisheries propagation staff to insure long-term production capacity for the salmon and trout stocking program

In 2012 HDR Engineering, Inc., completed a comprehensive study of Wisconsin's fish propagation system²⁷. The report will guide future improvements to the system. Key conclusions from this study are that we currently cannot meet production needs for Lake Michigan and to do so would require substantial renovation and improvement in our hatchery system. One especially important and needed hatchery renovation is to develop captive and feral broodstock rearing facilities for fishes including near-shore rainbow trout, Skamania steelhead, seeforellen brown trout, Great Lakes spotted muskellunge, and Great Lakes strain walleyes.

Implementing recommendations of the HDR study is currently in progress. Full implementation of these recommendations will require substantial funds beyond that which are available through the Salmon Stamp Fund. We have permission and funding to move forward with the groundwater studies at Kettle Moraine Springs (KMS) hatchery and Les Voigt hatchery. The last budget also designated \$7 million dollars for each of the next 2 years (FY2014 & FY2015) for the renovation of the KMS hatchery. This allocation is an important step and will have large benefits for Great Lakes fish production but will not bring the propagation system up to full production of all Great Lakes species.

Tactic a. Implement the recommendations from the HDR Engineering Study.

Tactic b. Develop a facility for near-shore captive broodstock (e.g., rainbow trout).

²⁷ <http://dnr.wi.gov/topic/fishing/documents/hatcheries/volume1execsumm.pdf>

Tactic c. Design and build a feral broodstock quarantine facility (e.g., Skamania steelhead, Seeforellen brown trout, G.L. spotted muskellunge, walleye).

Objective 2. Investigate and develop additional rearing ponds for the production of Great Lakes spotted Musky and walleye.

Natural reproduction of Great Lakes Spotted Musky has been extremely limited to date. To maintain a viable muskellunge population in Green Bay, continuation of the stocking program is required. Musky gametes used in Wisconsin's Great Lakes Spotted Musky program have been collected from multiple sources including Lake Huron, Lake Michigan, Lake St Clair and from an inland brood lake. The inland brood stock program was created to develop a VHS-free source of eggs. However, the original inland brood lake is no longer providing eggs and new brood lakes are years away from producing reliable numbers of eggs. Restrictions on bringing muskellunge eggs from VHS positive waters such as the Great Lakes into the hatchery have made it difficult to maintain the stocking program.

Although there is available hatchery space at the Wild Rose Hatchery to raise additional Great Lakes Musky, there is not an approved disinfectant for muskellunge eggs that would kill the VHS virus allowing those eggs to be safely raised at the hatchery. Since 2010 we have collected gametes from the Fox River and used an isolated pond at the Besadny Anadromous Fisheries Facility near Kewaunee to rear 3000 to 5000 fall fingerling that get stocked back into the Fox River and Green Bay. This represents only about 10% of the fingerling muskellunge needed for Great Lakes stocking. Additional pond space is needed to raise additional muskellunge.

Sources of Lake Michigan basin strain walleye are also very limited. The best sources of this genetic strain of walleye are Green Bay and Lake Winnebago but since these waters are VHS positive, eggs from these fish cannot be brought into a hatchery unless an approved egg disinfectant is used. Currently there is not an approved walleye egg disinfectant for VHS. To raise walleye fingerling needed for Lake Michigan stocking, obtaining isolated ponds will be necessary.

Tactic a. Identify ponds within the Lake Michigan watershed that are suitable for raising Great Lakes Spotted Musky and walleye.

Tactic b. Work with partners to obtain funding to lease or repair and to operate the additional ponds used to rear walleye or muskellunge.

Tactic c. Develop VHS disinfectant protocols for muskellunge, walleye, and other cool water species.

Goal C. Enhance tributary, shore, and near-shore fishing opportunities.

There is a strong public demand for shore and near-shore fishing opportunities on Lake Michigan. These shore and near-shore opportunities are often most important to younger anglers, families, and new anglers. The lack of shore fishing opportunities has implications of angler recruitment and the future of fishing. Currently a variety of opportunities exist, but often these are available only seasonally, are limited by poor public access, or have been affected by changes in fish distributions. With reduced yellow perch abundance and salmon and trout moving farther offshore, anglers have requested the Department to evaluate and enhance the shore and near-shore fishery of Lake Michigan and Green Bay.

Objective 1. Seek to improve both quality and quantity of access to shore, near-shore, and tributary fishing opportunities

Small boats cannot safely make long runs on Lake Michigan to reach productive areas and are therefore, confined to fishing near shore. In the last decade, several safe harbors in Little Sturgeon Bay (Carmody Park), Egg Harbor, and Rowley's Bay were completed. These and existing locations provide access and poor weather

protection for small boat anglers and other water users.

Those anglers without a boat are restricted to fishing areas of Lake Michigan and tributary rivers that are accessible by foot and where parking is available. Public access areas are often crowded lessening the quality of the fishing experience. Through acquisition of land and access rights, the Department or others can expand access for fishing opportunities.

Fisheries has supported the purchase of lands along the Lake Michigan shoreline and tributary streams that have provided access or were needed to protect critical habitat areas. Examples include land along Heins Creek (Door County) and shoreline just north of Kewaunee. In 2008, the Department purchased 11 acres of river frontage on the lower Suamico River in Brown County. This property includes 1,300 feet of river frontage and is maintained by the department for public access, including fishing. These and previous land purchases and easements provide access to many miles of streams, but additional access will be required as the human population continues to expand.

- Tactic a.** Work with the private sector and municipalities for agreements to open additional public fishing areas for pedestrians and small boats.
- Tactic b.** Support Department efforts to acquire lands and easements along Lake Michigan and tributary streams for public access.
- Tactic c.** Improve public knowledge of existing access by maintaining and improving maps of tributary access locations on DNR web pages and other media.

Objective 2. Continue to stock fish species that utilize nearshore waters of Lake Michigan.

Over the past decade or so, fish populations have moved further offshore likely due to increased water clarity. This change has corresponded to decreased catch rates for shore and near-shore anglers. Shore and nearshore opportunities are extremely important to those without large boats which often include new anglers and families. One of the goals of the Department is to ensure opportunity for shore and small boat anglers on Lake Michigan. Specifically, the Department has the objective to increase catch rates for nearshore and shore anglers.

- Tactic a.** Continue nearshore rainbow trout stocking program.

Objective 3. Increase habitat for cool and warm-water fisheries and create management objectives in those areas.

In the lower reaches of some tributary streams, the amount of available cool and warm-water habitat has increased because of improvements in water quality and the removal of dams. However, the lower reaches of most Lake Michigan tributaries provide limited habitat for cool and warm-water species, so only small increases in fishing opportunities for warm-water species can be expected.

Moreover, the Department is concerned about the impact of smallmouth bass, walleye, and northern pike on salmon and trout. Currently, many of Wisconsin's Lake Michigan tributary streams are managed for those anadromous coldwater species. Those rivers not only are host to returning adult fish, but also are the sites of stocking of thousands of fingerlings and yearlings.

- Tactic a.** Develop management objectives for major tributaries based on fishery goals and potential of available habitat.
- Tactic b.** Assess impacts of enhancing populations (e.g., stocking or improving habitat) on other species including impacts of warmwater predators on trout and salmon.

Goal D. Discourage fish waste and unethical fishing practices.

Anglers are generally a very responsible cross-section of society and care deeply about protecting and sharing their natural resources. However, over the years certain unethical behaviors have persisted amongst some anglers including using illegal fishing methods, trespassing, littering, and wasting fish. This unethical behavior causes non-anglers to reflect poorly on anglers as a whole and also degrades the experiences for law-abiding, ethical anglers. The Department should take actions necessary and pursue efforts to discourage these unethical behaviors.

Objective 1. Minimize snagging and keeping of foul-hooked fish

Snagging and the use of snag hooks was completely banned on Lake Michigan, Green Bay, and the tributary streams by 1987. Concentrations of spawning walleye, northern pike, trout, and salmon in Lake Michigan and Green Bay tributaries attract anglers. Many anglers are still intentionally snagging these vulnerable fish or retaining foul-hooked fish. We want to give anglers the clear message that unethical angling practices are unacceptable. This will require restrictions on gear, closed seasons, and fish refuges. Some additional restrictions are necessary to maintain legitimate fishing opportunities and clean up the unacceptable practices. The Law Enforcement program has addressed this issue during the past 10 years by 1) developing a warden recruit fall fish run training class and enforcement effort, 2) implementing a River Watch Program with UW Stevens Point Students, and 3) publishing fishing regulations in both Hmong and Spanish.

Tactic a. Enforce existing regulations.

Tactic b. Seek to repeal or modify current laws authorizing the sale of eggs from lawfully caught trout and salmon.

Objective 2. Reduce the discarding of fish at some catch, release, and hold tournaments

Fish are subjected to conditions during catch-hold-release fishing tournaments that cause physiological stress and in some cases may ultimately lead to direct and latent mortality²⁸. This is particularly true when fish are caught during warm water periods, moved over long distances during rough lake conditions and/or are generally handled improperly during transport or weigh-ins^{29, 30}. Fish that are not able to ultimately recover from such stressors are sometimes released after tournament weigh-ins and consequently die resulting in resource waste issues.

Tactic a. Discourage waste by including fish-handling guidelines in tournament permits.

Tactic b. Monitor tournaments to determine the extent of the problem.

Tactic c. Encourage tournament organizers to donate dead fish to non-profit groups

²⁸ Wilde, G. R. 1998. Tournament-associated mortality in black bass. *Fisheries*. 23:12-22.

²⁹ Maynard, G. A. et al. 2013. Use of external indicators to evaluate stress of largemouth (*Micropterus salmoides*) and smallmouth (M. dolomieu) bass at tournaments. *Open Fish Science Journal*. 6:78-86

³⁰ Schramm, H. L. Jr. et al. 2010. Factors associated with mortality of walleyes and saugers caught in live-release tournaments. *NAJFM*. 30:238-253.

Vision III. A sustainable and viable commercial fishery

We desire the Lake Michigan fisheries resource to be utilized to its potential but recognize that fish populations are limited by the productivity of the ecosystem and that the Lake Michigan ecosystem is constantly changing. Therefore, harvest must be regulated and in some cases commercial fisheries will even need to be closed while fish populations recover. Over the past 25 years Wisconsin has moved toward a smaller and better regulated commercial fishery targeting five species – lake whitefish, yellow perch, round whitefish, rainbow smelt, and bloater chubs. Today only the lake whitefish fishery is strong, as populations of yellow perch, rainbow smelt, and bloater chubs have declined markedly over the past twenty years.

Wisconsin commercial fishing management is built on three principles – annual harvest limits, limited entry, and individual transferable quotas. *Harvest limits.* The harvest of each species is constrained by harvest limits established by the Department. In setting harvest limits we attempt to follow the “precautionary approach” recommended by the National Research Council’s Committee on Ecosystem Management for Sustainable Marine Fisheries. Attempting to maximize long-term harvests often leads to over exploitation, so our goal is to seek moderate harvest limits. *Limited entry.* There are now approximately 80 commercial fishing licenses on Lake Michigan, and the number cannot increase. This limited entry system helps stabilize the fishery by protecting the participants from unrestrained competition. *Individual transferable quotas.* The harvest limit for each species is divided among license holders on a percentage basis. That is, each fisher is allotted a percentage of the harvest limit. When that percentage is multiplied by the harvest limit it yields the individual’s quota expressed in pounds. An individual license holder’s share may be transferred to another fisher either temporarily (for one fishing year) or permanently. This system assures each license holder that a portion of the total harvest is reserved for him or her, and eliminates the need for fishers to race to harvest the largest possible portion of the total allowable harvest. It also allows ambitious fishers to build more profitable businesses by accumulating larger shares of the total harvest. The exceptions are for portions of the bloater chub and smelt harvest limits that are allocated to racehorse fisheries for which participants can fish until that overall racehorse fishery harvest amount is reached and the fishery closes.

Within this goal we address the challenges of adequately funding our commercial fishing management program, managing harvest numbers, minimizing mortality of non-target species, improving the catch reporting system, minimizing conflicts between commercial and sport fisheries, and streamlining administrative procedures.

Goal A. Adequately fund commercial fisheries management.

The Department spends about \$750,000 annually (based on FY2012) to manage commercial fisheries yet only takes in about \$75,000 in commercial license fees.

Objective 1. Pursue alternative sources of funding for commercial fisheries management to reduce the dependence on sport license and fee funds.

The bulk of the commercial fisheries management is paid for by sport license and fee funds. While sport anglers benefit from well managed commercial fisheries, commercial fishers and the public who consume the commercial fish are the primary beneficiaries of sound commercial fisheries management. We have received public comments and other feedback asking us to find alternative means to fund commercial fisheries management.

Tactic a. Work with Fisheries Management and other DNR staff to investigate alternative funding sources.

Goal B. Sustain populations of commercial species.

For each of the important commercial species in Lake Michigan, the table below shows the range of annual harvests for the past ten years, the current commercial harvest limit, and the reported commercial harvest from Wisconsin waters of Lake Michigan during 2012. However, the ecology of Lake Michigan has changed and continues to be dynamic so past harvests amounts may not be attainable in the future.

Over the past two decades total annual harvest limits have been established for each of the important Lake Michigan commercial fish species. Annual harvest quotas are set by the Natural Resources Board based on recommendations from the Fisheries Bureau. The recommendations are based on the best information available to the Department with the intent of supporting a healthy and viable fish population and a sustained commercial harvest within the ecological capacity of Lake Michigan. The best information available to the Department comes from a variety of sources. In some cases (i.e. lake whitefish and yellow perch) the Department maintains a time series data base and conducts specific biological surveys targeting these species. In other situations, (i.e. smelt and round whitefish) the Department does not conduct specific biological surveys for those species but uses other available information (e.g. USGS surveys, commercial catch rates) to develop recommendations. Often commercial catch falls below the allowable quota demonstrating that factors besides harvest regulation affect commercial harvest. Possible factors include fish abundance and distribution, weather and other environmental conditions, market prices, fuel costs and business practices.

Annual commercial harvest ranges (2003-2012), current annual harvest limits, and reported harvests from Wisconsin waters of Lake Michigan during 2012.

	harvest range (pounds)	harvest limit (pounds)	2012 harvest (pounds)
lake whitefish	1,344,753 to 1,525,305	2,890,000	1,525,305
bloater chubs	15,216 to 1,186,186	3,600,000	15,216
yellow perch			
Green Bay	17,506 to 90,473	100,000	57,845
Lake Michigan	0	Closed	0
round whitefish	not significant	75,000	162
rainbow smelt	23,912 to 625,503	1,000,000	32,417

Objective 1. Adjust harvest limits based on the current status of fish populations.

Lake Michigan commercial fish populations fluctuate over time. Currently the bloater chub population is at historical lows while the lake whitefish population has increased in the last 15 or so years. Harvest quotas are adjusted up or down depending upon population status. Harvest quotas have been increased recently for lake whitefish and Green Bay yellow perch. Quotas are based on the best available information including Department and other agency surveys and commercial catch reporting. This vital information is expensive and time consuming to collect, analyze, and synthesize for making quota recommendations.

- Tactic a.** Evaluate and improve or maintain population and harvest assessments for commercial fish species.
- Tactic b.** Evaluate and improve or maintain current population models used to estimate commercial fish abundance.
- Tactic c.** Continue commercial reporting program and monitoring commercial catches.
- Tactic d.** Adjust commercial quotas to reflect current harvestable population estimates.

Tactic e. Continue to refine techniques to assess juvenile whitefish abundance and distribution.

Objective 2. Create a method to periodical adjust harvest limits more efficiently.

The adjustment of a commercial harvest limit to protect a declining fish population or allow increased harvest of a growing population requires an amendment to the Administrative Code. The rule-making process can be lengthy, requiring up to two full years. When stocks are in decline, needed harvest limitations can be highly controversial and the protracted rule-making process can lead to over-harvesting. When stocks are expanding, the delay can deny fishing opportunities to commercial fishers. One alternative is to automate harvest limit adjustments. This can be accomplished by amending Administrative Code to set the harvest limit for a commercial species to be a function of an objective index, model, or other measure of population abundance. There are also other alternatives that have been used in other states that are also timelier and less controversy and in addition add more certainty and structure into the quota modification process. One example is Stock Status Evaluation Protocol which uses a matrix of parameters that indicate changes in a particular fish population and potential actions based on those parameters.³¹

Tactic a. Explore alternative means of adjusting harvest levels (e.g., automate, streamline, or simplify harvest limit adjustments or otherwise improve the current code)

Objective 3. Continue to cooperate with four states, the USFWS, and the Chippewa Ottawa Resource Authority (CORA) share management responsibilities for the fishery resources of Lake Michigan. (Lake Michigan Committee)

The Lake Michigan Committee of the Great Lakes Fishery Commission is the primary forum for discussing and resolving inter-jurisdictional management problems. The states each have different management strategies with differing harvest regulations for commercial fisheries. Movements of commercial fish species over state borders are known to occur but are not well understood. Thus allocation of shared stocks has been a problem for the different management agencies and commercial fishers including the North/Moonlight Bay stock of lake whitefish, which spawns in Wisconsin waters of Lake Michigan.

The U.S. Federal Government, several Tribes, and the State of Michigan reached agreement in a Consent Decree³² regarding the allocation, management, and regulation of fishing in 1836 Treaty waters, which include most of the northern part of Lake Michigan, but do not include Wisconsin waters. The Consent Decree has implications for Wisconsin because it supports tribal harvest of whitefish and lake trout, allows a limited commercial harvest of salmon, and calls for increased stocking of lake trout in Michigan waters of Lake Michigan. The Consent Decree recognizes the role of the Lake Michigan Committee in setting lakewide stocking goals and policies.

The yellow perch population of southern Lake Michigan moves among three jurisdictions – Michigan, Illinois, and Wisconsin. Although yellow perch may move little among jurisdictions after the first year of life³³, studies indicate that young-of-year yellow perch drift from near-shore spawning areas into the open lake³⁴ where winds and currents distribute them unpredictably among the jurisdictions. Agencies have worked to develop shared strategies to manage the shared population³⁵.

³¹ Mohr, Lloyd C. and M. P. Ebener. 2005. Evaluation of two harvest polices for managing lake whitefish (*Coregonus clupeaformis*) populations in Laurentian Great Lake, Lake Huron. *Advanc. Limnol.* 60, p. 771-483.

³² Enslin, Hon. R.A. 2000. 1836 Great Lakes Treaty Waters Consent Decree. 121 pp.

³³ Horns, W.H. 2001. Spatial and temporal variation in length at age and condition of yellow perch in southern Lake Michigan during 1986-1988. *North American Journal of Fisheries Management* 21:580-591.

³⁴ Beletsky, D., D. Mason, D. Schwab, E. Rutherford, J. Janssen, D. Clapp, and J.M. Dettmers. 2007. Biophysical model of larval yellow perch advection and settlement in Lake Michigan. *J. Great Lakes Research.* 33(4): 842-866.

³⁵ Clapp, D.F. and J.M. Dettmers. 2004. Yellow perch research and management in Lake Michigan: evaluating progress in a cooperative effort. *Fisheries.* 29(11): 11-19.

Tactic a. Support Great Lakes Joint Strategic Plan³⁶

Tactic b. Encourage and participate in studies of whitefish and yellow perch to refine stock identification and understanding of stock mixing as it pertains to shared fisheries.

Tactic c. Work through the Lake Michigan Committee and Technical Committee on interjurisdictional management of commercial species.

Objective 4. Yellow perch and lake whitefish are shared between commercial and sport fishers, requiring allocation.

The Department is responsible for managing the Lake Michigan fishery for both sport and commercial fishing. Historically, yellow perch have been allocated to both user groups. However, it is not possible to ensure that equal numbers of perch will be harvested each year. The sport and commercial fisheries are radically different in number of participants, effectiveness of gear, harvest response to varying fish population levels, and the effect of weather on harvest. As a result, they have to be regulated differently within the dual goals of protecting the yellow perch resource and equitably allocating the long term harvest. The Department has maintained, in principle, a 50/50 split, by numbers, when allocating sport and commercial harvest limits for yellow perch in Green Bay. This is not fully achieved every year, but over the long term we have done reasonably well. For example, the average ratio of estimated sport to commercial harvest in Green Bay from 1996 through 2011, by number, was 54% sport and 46% commercial harvest.

In Lake Michigan, the commercial season for yellow perch was closed in 1996, the sport bag was reduced to 5 fish per day in 1996 and a closed season in June (1996), later revised to May 1 to June 15 was in-acted in 2002. Since these regulations have been put in place, Lake Michigan has undergone drastic changes in its ecosystem primarily due to zebra and now quagga mussel colonization. This has changed the lower food web which consists of phytoplankton and zooplankton to such an extent that a recovery of yellow perch to population numbers observed in the 1980s is not feasible. In addition, the current state of the ecosystem probably precludes commercial fishing into the future. There does not seem to be enough yellow perch to support a very limited sport fishery and commercial fishing in southern Lake Michigan. In fact, anglers only harvested 8,830 yellow perch in 2013.

Prior to 2008, sport harvest of lake whitefish in Green Bay was negligible. However, in recent years a substantial winter whitefish sport fishery has developed with annual harvests ranging from 54,000 to 190,000 fish. The sport harvest is substantially below the commercial harvest for Commercial Harvest Zones 1 & 2 (Green Bay and a portion of northern Lake Michigan waters) and commercial fishers have not been harvesting the full commercial quota. If sport harvest continues to increase or commercial fishers begin harvesting more of the commercial quota, formal harvest allocation may be needed.

Tactic a. Seek to achieve a formal 50/50 allocation split, by numbers for yellow perch in Green Bay over the long term to be approved by the Natural Resources Board.

Tactic b. Continue monitoring sport harvest of lake whitefish in Green Bay and include these data in Wisconsin's statistical catch at age lake whitefish model to determine if formal harvest allocation between both user groups is warranted.

Tactic c. Develop a new Lake Michigan yellow perch sport/commercial allocation to be approved by Natural Resources Board.

Objective 5. Establish an Electronic Fish Harvest Reporting System (EFHRS) for commercial fishers.

³⁶ Great Lakes Fishery Commission. 1997. A Joint Strategic Plan for Management of Great Lakes Fisheries

The EFHRS will replace the current biweekly reporting system, reducing paperwork and improving the timeliness and accuracy of reports. It will also form the basis for a database about fish populations that will assist with efficient management of the Great Lakes resource. Establishment of this system is an unresolved recommendation accepted by Natural Resources Board in 2000, and included in rule changes, as described in NRB Order FH-13-08 (<http://dnr.wi.gov/about/nrb/2008/october/10-08-3b3b.pdf>).

Sufficient Department funding was not allocated for development and implementation of the EFHRS. Subsequently staff attempted to create stand-alone computer system utilizing DNR surplus and obsolete computers, equipment and dial-up technology. Implementation was discontinued in September of 2012 after beta testing with members of the industry proved it was unacceptable to the commercial fishers due to problems with dial-up connections, slow data-transfer speed, and antiquated equipment for which parts could not be obtained. Pending completion; the Bureau of Law Enforcement is in the process of securing an USFWS grant to contract development of a web-based system as recently recommended by the commercial fishers. Sufficient funds are required to establish the electronic Fish Harvest Reporting System and provide continued support for wardens to implement it. Fee increases, borne by commercial fishers, and/or supplemental GPR funding, would cover most costs of the system.

Tactic a. Establish an electronic Fish Harvest Reporting System (FHRS) in order to record and report all elements of the commercial catch.

Goal C. Minimize mortality of non-target species

The incidental catch and kill of non-target species is a problem common to most commercial fisheries worldwide. The Department and Wisconsin commercial fishers have cooperatively made important progress in the past to reduce non-target catch problems. Examples of progress include: increased use of entrapment gear, elimination of large-mesh gill nets in certain areas, use of low profile small-mesh gill nets, depth and seasonal restrictions, and use of diverters in trawls. Fluctuating fisheries populations and industry practices make the problem of non-target species ever changing

Objective 1. Monitor current incidental catch and mortality.

The incidental catch and kill of non-target fish species continues to occur. For example, significant incidental catches of bloater chub, lake trout, whitefish, and alewife occur in the commercial trawl fishery; and lake trout, walleye, and others species are killed in gill nets set for whitefish, perch, and bloater chub. In addition, undersized fish of the target species are often incidentally caught. Unfortunately, much of the available information on incidental catch in Wisconsin commercial fisheries is at least 20 years dated and fisheries and fish populations have changed over the past 20 years. Updated information on incidental catch rates and mortality rates is needed to make management decisions. Non-target fish mortality negatively impacts the sport and commercial fisheries by removing otherwise useable fish from the various fish stocks. Although most of the commercial fishing gear currently in use by the Wisconsin Lake Michigan commercial fishery is somewhat selective, improvements should be encouraged where feasible. In addition, trawls disturb the benthic invertebrate community, but the impacts of commercial trawling on Lake Michigan benthic communities have not been assessed.

Tactic a. Monitor current incidental catch and mortality rates of current commercial gear types and fisheries in Wisconsin waters.

Tactic b. Encourage investigations of and modifications in gear and fishing practices that reduce non-target mortality. (e.g., conversion of whitefish gill net fishery to trap or pound nets, determine impacts of trawls on non-target species and benthic communities).

Goal D. Enhance the viability and stability of the commercial fishing industry.

We take direction from Administrative Code section NR1.01, “The goal of fish management is to provide opportunities for the optimum use and enjoyment of Wisconsin’s aquatic resources, both sport and commercial.” However, for reasons outside our control, opportunities for commercial harvest have been reduced over the past two decades as populations of yellow perch, bloater chubs, and rainbow smelt have declined. Although we recognize the need to revise harvest limits in response to fish population changes, we do not believe that these declines were caused by excess commercial harvest. Instead, ecological changes in the lake are responsible, and our tools for restoring the diminished populations are limited.

Objective 1. Clarify and communicate to the commercial industry, the procedure commercial fisheries must follow to initiate and implement a change in rules and/or fishing practices (e.g. larger or smaller gill net sizes, change in seasons).

Commercial fishers have suggested a variety of changes to make commercial fishing easier or more productive, but often the implications of the changes for incidental mortality of non-target species or for conflict with sport fishers are not known. Studies would be helpful, but resources are limited.

Tactic a. Clarify the procedure that outlines the steps commercial fishers must follow to initiate and implement a change in rules and/or fishing practices (e.g. larger or smaller gill net sizes, change in seasons).

Tactic b. Prioritize requests and implement request as appropriate or develop studies as funding and staffing allows.

Tactic c. Encourage and cooperate with externally funded high priority studies of current fishing practices and potential new fishing practices.

Objective 2. Minimize physical conflict between sport and commercial fishing gear.

At times commercial fishing gear can be in direct conflict with sport anglers attempting to fish Lake Michigan. Some of the conflict is the result of an inadequate understanding, by sport fishers, of the gear commercial fishers use. Another contributing problem is that some commercial fishermen do not clearly mark their gear, especially when it is in high use areas of the lake where the potential for conflict is great. Trap and gill nets and their markings are illustrated in the Wisconsin fishing regulations pamphlet. After a fatal boating accident in 2010, NRB Order FH-50-10 a) re-defined the boundaries of the July-August trap netting inclusion areas, b) added reflective tape on flag staffs to the net marking requirements, and c) extended all net marking requirements in effect on Lake Michigan to Lake Superior.

Tactic a. Continue to educate boaters and sport fishers about commercial fishing gear and how to avoid it through literature and presentations to fishing clubs.

Tactic b. Continue to encourage dialogue between sport and commercial fishing groups.

Vision IV. Science-based management

Guidance to the Department in Administrative Code emphasizes science-based management. Section NR 1.01 states, “To meet its responsibilities established by statute, department [DNR] programs shall be based on scientific management principles . . .” Section NR 1.04 states, “The department shall conduct research and resource base inventories and collect harvest and utilization statistics on which to base sound management decisions.” Science-based management requires attention to methods of data collection, communication of results, and cooperation with public and private partners.

Goal A. Employ the best available information, methods, and technologies in the management of the fisheries of Lake Michigan.

Effective fisheries management requires well trained staff, adequate funding, inter-jurisdictional cooperation, public involvement, timely communication of information, and the involvement of trained scientists.

Objective 1. Continue to train staff on the latest technologies and principle of fisheries management.

The Lake Michigan ecosystem is constantly changing with the introduction of new species. At the same time, fisheries science is rapidly evolving with the development of new tools. These include hydro-acoustic equipment, fish population models, and genetic analysis tools. Great Lakes fisheries managers must keep up with knowledge about ecosystem changes and with new methodologies.

Tactic a. Support continuing education for fisheries, hatchery, and law enforcement staffs including out-of-state travel to inter-jurisdictional meetings.

Objective 2. Insure that our large vessel fleet is adequately maintained.

The Department owns and operates two research vessels. The Research Vessel Coregonus is 60 feet with a 16-foot beam (width) and weighs approximately 45 tons fully loaded and was built in 2010. The RV Coregonus was designed to meet all of our research and monitoring needs including gillnetting, trawling, serving as a dive platform, and deploying water sampling equipment. It also has the capability of conducting hydroacoustic surveys. The Research Vessel Gaylord Nelson is 45 feet long and has a beam of 15 feet, a draft of 5 feet, an aluminum hull, and a displacement of 12 tons and was built in 1992. The RV Gaylord Nelson can meet many of our sampling needs but is limited in space and does not have an enclosed lab and gillnet lifting area. Currently, the RV Gaylord Nelson is used by the USFWS under a cooperative agreement to conduct various Lake Michigan fisheries surveys and research. We would like to partner with other agencies on additional projects involving vessel sharing to accomplish more and also fund vessel maintenance. Under recent statutory amendments, the Fisheries program can recover costs for operation, maintenance, and depreciation of vessels used by partners.

Tactic a. Adopt, fund, and implement maintenance schedules for both vessels.

Tactic b. Update MOU’s and fee recovery schedules to support research vessel maintenance to reflect recent statutory changes in 2013-2015 State Budget allowing for obtain certain reimbursements for research vessel use.

Objective 3. Work with the United States Fish and Wildlife Service’s Fish and Wildlife Conservation Office (FWCO) in Green Bay, the University of Wisconsin- Milwaukee’s School of Freshwater Sciences (SFS) in Milwaukee and, possibly, others to share manpower and vessels.

The three agencies pursue parallel and complementary research and assessment objectives. Although there are

many examples of cooperation, we might all be more efficient and productive by sharing manpower and vessels. In 2013 two significant steps were taken to allow the use of Department vessels by external partners. These two developments expand our ability to share our vessels with partners for mutual benefit. 1) A memorandum of agreement between the Department and the USFWS allowed use of the Gaylord Nelson by FWCO staff in return for assistance in yellow perch population modeling and vessel maintenance costs. This involved developing appropriate language to allay concerns on all sides about liability and insurance. For the first time, one of our large vessels was put in the hands of an external partner with no Department captain on board. Now it is clear that we can make either of our vessels available to the FWCO or, presumably, the SFS in return for negotiated payment in kind. 2) The 2013-2015 State Budget included a provision allowing the Bureau of Fisheries Management to obtain reimbursement for any staff salaries, supplies, depreciation, and capitol expenses associated with use of one of our vessels by an external partner. This will allow us to use either boat, with our captain on board, to conduct research or assessment work for the FWCO or the SFS, with sufficient compensation to cover all costs. Previously we were only able to recover the cost of supplies and services (gas, LTE time, etc.).

Tactic a. Develop a DNR/USFWS/SFS strategy to maximize effectiveness of all available resources.

Objective 4. Maintain and invest in fisheries management equipment and technology..

The Department replaced the 70+ year old RV Barney Devine with a more sophisticated RV Coregonus that has an overall length of 60 feet with a 16-foot beam (width). It was designed to meet fisheries needs including gill netting, trawling and hydro acoustic work, SCUBA diving surveys, and deploy equipment like underwater cameras, remotely operated vehicles (ROVs), and various water sampling equipment. While the RV Coregonus was recently built, it still needs routine maintenance, upgrades and safety inspection.

In addition, there are several electroshocking boats, heavy equipment, stocking trucks, hatchery infrastructures, database software, fish ageing equipment, fish tracking gear, netting and so on. All of these require ongoing maintenance and upgrades. Sufficient funding support is required to accomplish these in a timely manner.

Tactic a. Develop and implement replacement schedules for fisheries gear (e.g., fyke nets, gill nets, trawl gear, electroshocking equipment, and electronics).

Tactic b. Invest in more modern fisheries management technology where appropriate.

Objective 5. Increase research devoted to Lake Michigan.

Lake Michigan is a dynamic environment. Changes in nutrient loading and colonization of invasive species have tremendously altered the water quality and productivity of the lake which has impacted the fish community and biomass of various sport and commercial fish species. In order to increase our understanding of the changing situation and respond in a timely manner, we need to evaluate and develop appropriate research questions. The LMFT recently have developed and prioritized research needs for Lake Michigan and Green Bay fisheries management³⁷. The list has been communicated to various institutions including the Department's Bureau of Science Services.

Tactic a. Annually review and revise, if necessary these research priorities.

Tactic b. Communicate research priorities to others.

Tactic c. Expand internal and external partnerships to address research priorities.

Goal B. Obtain more external funding for the program.

³⁷ <http://dnr.wi.gov/topic/fishing/documents/lakemichigan/lakemichigan-greenbayresearchpriorities.pdf>

A number of external funding sources are available to directly or indirectly support fisheries in the Great Lakes. These include the Great Lakes Fishery Trust, the Great Lakes Fish and Wildlife Fish and Restoration Act, the Great Lakes Protection Fund, the Fisheries Research Program of the Great Lakes Fishery Commission, Coordination Activities Funding by the Great Lakes Fishery Commission, USEPA-GLNPO, the Wisconsin Coastal Management Program, and the Water Resources Development Act.

Objective 1. Work with and encourage the Department to pursue external funding. .

Despite the potential value of external funding, we have not devoted the staff time necessary to understand and pursue the funding opportunities. The Department should provide staff with necessary time and tools to facilitate better access to external funding. In addition, we should seek partnerships to better utilize these external funding sources.

Tactic a. Cooperate with Office of Great Lakes on streamlining external funding processes including identifying and tracking funding opportunities, coordinating applications, and improving administrative procedures.

Tactic b. Cooperate with University, Federal agencies, and others on obtaining external funding for priority projects.

Tactic c. Develop further internal capacity in grant writing and obtaining external funding to address research priorities.

Goal C. Share information and maintain contacts with other Great Lakes fisheries management agencies.

Lake Michigan shares management authority and responsibility with other jurisdictions. Under A Joint Strategic Plan for Management of Great Lakes Fisheries, the Department, along with sister state, tribal, and federal fisheries agencies is committed to a set of “Strategic Procedures”, which include several under the heading “Information Sharing”³⁶. Data Standards – The Great Lakes Fishery Commission (GLFC) will coordinate development of standards for recording and maintaining fishery management and assessment data, to ensure compatibility among the Parties and other agencies. Models – The GLFC and the Parties will coordinate development and implementation of models for common use by the Parties and other agencies. Information Access – The Parties are encouraged to maintain databases on the Internet. The GLFC will maintain Internet links to Party and others’ databases to facilitate access, including a catalog of Great Lakes fishery assessment and research programs which are planned or in progress. Data Sharing – The agencies are encouraged to provide their data to other agencies upon request if the collecting agency has had reasonable time to verify and interpret the data . . . and to collectively develop shared information services under the umbrella of the GLFC. The Lake Michigan Committee and Lake Michigan Technical Committee provide the appropriate forums for information sharing and resolution of issues of common concern.

Objective 1. Encourage participation in efforts that promote integrated management of Lake Michigan’s fishery resources.

Over the last 20 years, integrated fisheries management on Lake Michigan has increased dramatically. Prior to the 1990’s, agencies around Lake Michigan had the tendency to change management policies on the lake with limited input from the other states. Since that time, agencies have made the committed effort to work with each other to solve complicated problems, create consistent management policies and work together on all issues related to the Lake Michigan ecosystem. The consequence of these deliberate actions is that a lot more committees and workshops have been developed to aid in these efforts. Many DNR staff are assigned to these lakewide committees, working groups, task groups and adhoc groups to solve these complicated issues. However, travel and participation in these groups is sometimes difficult due to time, money, out of state travel restrictions and priority.

Tactic a. Make participation in lake wide committees, workshops, and task groups a funding priority.

Tactic b. Continue to prepare annual report summaries to share with the Lake Michigan Committee.

Goal D. Continue and expand partnerships with sport and commercial fishers, Universities, other Agencies, and others.

The Lake Michigan Fisheries program has established important working relationships with the University of Wisconsin-Milwaukee's School of Freshwater Sciences (SFS), University of Wisconsin Sea Grant, the Lake Michigan Fisheries Forum, and others. Private interests have made major contributions to the program through support for weir construction, funding for stocking, contributions of commercial boat time for assessment work, contribution of labor for fin-clipping and other activities.

Objective 1. Utilize the UW-Milwaukee/DNR Senior Fisheries Scientist position to address research and assessment needs of our Lake Michigan fisheries program.

A Memorandum of Agreement between the UW-Milwaukee (UWM) and the DNR was adopted in 1999 and amended in 2002. It provides that the two agencies will jointly support a full time Senior Fisheries Scientist at the School of Freshwater Sciences (formerly the WATER Institute) of the UWM, with the explicit purpose of conducting research of value and interest to both parties. This position has been and is expected to continue to be of great value to our Lake Michigan fisheries program by addressing important questions related to fisheries management.

Tactic a. Identify and communicate Department fisheries research priorities for this position.

Tactic b. Continue to provide funding and in-kind support.

Tactic c. Encourage the position to work with external partners.

Tactic d. Highlight and disseminate research results from the position.

Objective 2. Work with private partners to help the Department accomplish its objectives.

Sport fishers, commercial fishers, and other interest groups have contributed to the Lake Michigan fisheries program in various capacities. Private cooperators can bring beneficial skills and support that can help to advance common goals and interests.

Tactic a. Continue to interact with sport and commercial fishing organizations individuals and groups to identify, develop, and implement cooperative work, and identify new partnerships opportunities.

Objective 3. Continue to fund the Michigan State University Quantitative Fisheries Center (QFC)

The QFC is integral to several of Wisconsin's Lake Michigan fisheries management projects. Staff at this institution are considered authorities on fisheries stock assessment modeling used to evaluate fish populations and set harvest quotas. They have developed and assisted with models used to assess the yellow perch and lake whitefish stocks in Wisconsin waters of Green Bay and Lake Michigan. QFC staff has also been integral to the analysis of stocking levels for salmon and trout species in Lake Michigan as well as evaluating statistically robust sampling designs for these species as part of the Coded Wire Tag program, particularly with Chinook salmon. Departmental support (including financial) is necessary to maintain this unique level of expert assistance especially given the complex research and management issues we face in Lake Michigan.

Tactic a. Continue to provide funding and in-kind support for the QFC to work on priority projects.

Tactic b. Highlight and disseminate research results from the QFC.

Objective 4. Maximize our integration with the Wisconsin Cooperative Fishery Research Unit to accomplish our objectives.

Wisconsin Cooperative Fishery Research Unit is located within the University of Wisconsin- Stevens Point. The Research Unit will have a vital role in successfully investigating the Lake Michigan fishery research priorities identified by DNR staff.

Tactic a. Continue to provide funding and in-kind support for the Wisconsin Cooperative Fishery Research Unit to work on priority projects.

Tactic b. Highlight and disseminate research results from the Wisconsin Cooperative Fishery Research Unit.

Goal E. Expand Lake Michigan research by the Department's Bureau of Science Services.

Science Services supports a wide variety of services, including fisheries research across the state. The work conducted by Science Services helps ensure sound decisions for both resource management and environmental quality programs, and ultimately, for human health and the environment

Objective 1. Expand partnerships with Science Services to address Lake Michigan research priorities.

The Lake Michigan Fisheries Team has developed a set of research priorities³⁸ that should be considered by Science Services or other investigators.

Tactic a. Communicate Lake Michigan fisheries research priorities at annual Bureau of Integrated Science Services meetings.

Tactic b. Continue to encourage Science Services involvement with Lake Michigan Projects (e.g., engage during work planning).

³⁸ <http://dnr.wi.gov/topic/fishing/Documents/LakeMichigan/LakeMichigan-GreenBayResearchPriorities.pdf>

Vision V. Effective internal and external communication

Good communication is essential for effective fisheries management. Like all Wisconsin fisheries, Lake Michigan fisheries are managed for the benefit of the public. In order for this system to work well, 1) the public should be informed about fisheries management issues and the capacity and limitations of Lake Michigan, 2) fisheries managers should be informed about public desires and experiences, and 3) elected officials should be informed about our management program. In addition, Lake Michigan fish resources are shared with three other states so communication with those states and the Federal government is crucial. Lake Michigan is a complex, changing ecosystem that is threatened with many impacts ranging from habitat destruction to invasive species and more. To meet these challenges we will need the most current knowledge of the Lake's ecosystem as well as the most thought-out, science-based management techniques. Therefore, it is essential for Department biologist to communicate with other professionals to advance the knowledge and state of the science of Lake Michigan.

Goal A. Maintain full and open exchange of information and ideas with the public.

Communication with other agencies and with science professionals is included in other goals and objectives in this plan. Here we highlight the need for good two-way communication with the interested public.

Objective 1. Continually improve our methods to communicate information to our stakeholders.

Staff working on Lake Michigan fisheries issues has always tried to maintain good communication with external stakeholders. We routinely provide information on complex management issues to user groups, sport fishing clubs, the Natural Resources Board, the Commercial Fishing Board, the Federation of Great Lakes Sport Anglers and others. UW Sea Grant has provided invaluable assistance by facilitating the Lake Michigan Fisheries Forum and by developing and disseminating information about our fisheries to the interested public. Most of these issues are very complex and require multiple meetings to resolve them. We must be more proactive with our communication so that stakeholders can fully understand these complex management issues.

In 2012, the Department revised the existing Lake Michigan Fisheries Forum by changing their charge from advising to information-sharing and adding more members. This will allow more information to be disseminated to this group and the groups the members represent. We used this group extensively to gather input and comments on our chinook salmon stocking strategy and it will assist us in the future on other important issues.

In addition, we have started to use new technologies like our GOV delivery email system to contact interested stakeholders that subscribe to our Lake Michigan web pages. This allows us to quickly and efficiently contact over 5,000 stakeholders providing them with important information and upcoming meetings and events. In addition, technologies like Facebook and Twitter have allowed us to get short messages to a large number of people with the intent of increasing awareness of and interest in Lake Michigan fisheries management.

Tactic a. Work with Sea Grant and the Lake Michigan Fisheries Forum to disseminate information.

Tactic b. Continue to disseminate Lake Michigan fisheries information via GovDelivery, email, and/or direct mail.

Tactic c. Routinely update information on the Department's web page.

Tactic d. Provide media releases, news articles, and other public publications on important management issues, survey findings, and fisheries projects.

Tactic e. Provide information to media outlets and devote staff time to conduct interviews and other medial activities on important management issues, survey findings, and fisheries projects.

- Tactic f.** Continue to highlight Lake Michigan fisheries management at special outreach events including tours and open house events at egg take facilities and hatcheries and, where applicable, outreach kiosks and exhibits.
- Tactic g.** Continue to provide updated fishing information to the public based on creel reports, staff experiences, and other fishing reports from anglers.
- Tactic h.** Provide timely responses to legislative inquiries and other questions from elected officials.
- Tactic i.** Continue annual Great Lakes commercial fishing reports to Natural Resource Board.
- Tactic j.** Utilize existing or emerging technology to effectively communicate to all Lake Michigan stakeholders

Objective 2. Cooperate with our stakeholders to determine their fishery preferences, desires, perceptions, and experiences.

Knowledge about our customer’s preferences, desires, perceptions, and experiences is critical for effective fisheries management. However, obtaining this information in an unbiased and representative manner is difficult. Furthermore, once obtained, including such information in management plans and actions can be difficult due to conflicting desires and contradicting perceptions and experiences. Not all ideas can or should be incorporated into management strategies and not all desires can be met given the limitations of our natural resources. Historically and in recent years the Department has done a good job in obtaining such information using a wide variety of venues and has been receiving input from stakeholders with a variety of interests and backgrounds. This public input has been considered in management decisions and planning such as in this 10-year planning document. Public knowledge and desires change and it will be important for the Department to maintain and improve upon efforts to obtain information from the public to guide the future of Lake Michigan fisheries management.

- Tactic a.** Update this plan (LMIFMP) every ten years including soliciting public input and a formal review and comment process of the final draft document.
- Tactic b.** Include public participation in management planning processes (Steelhead management plan, Great Lakes Spotted Musky management plan, etc.) and allow for public review of planning documents.
- Tactic c.** Work with Sea Grant, the Lake Michigan Fisheries Forum, and hold other public meetings to solicit feedback on important management issues.
- Tactic d.** Use formal survey methods as needed to obtain public feedback on important management issues (e.g., additional questions on creel surveys, online surveys, mail surveys).
- Tactic e.** Continue to work with formal groups and processes such as the Lake Michigan Commercial Fishing Board and the Conservation Congress.
- Tactic f.** Continue routine attendance and participation in meetings of local and regional sport clubs, conservation groups, Wisconsin Federation of Great Lakes Sport Fishing Clubs, and other relevant groups.

Objective 3. Communicate our survey results and management project results with the public and scientific community.

Fisheries staff work on a variety of projects including surveys, long-term monitoring projects, routine assessments, research, fish habitat enhancements, regulatory changes, population restoration and stocking

evaluations. Some of the projects are collaborative efforts of the Department, the public, and other agencies. Planning, field effort and data gathering often take up the majority of time invested on the project leaving behind limited amount of time for summarizing and proactively disseminating the findings through various means such as presenting in scientific conferences, public meetings, preparing agency reports and publications.

Tactic a. Require standard reporting on priority topics identified by the LMFT and encourage publishing in peer-reviewed journals and include these as priorities in work planning.

Tactic b. Provide formal reports and publications to the public via website or other venues.

Tactic c. Present relevant findings and project results at professional scientific conferences, Lake Michigan Fisheries Forum Meetings, and other relevant venues.

APPENDIX 1 – THE PLANNING PROCESS

Statement of Scope and Process for the Lake Michigan Integrated Fisheries Management Plan, 2015-2024

SCOPE

The *Lake Michigan Integrated Fisheries Management Plan – 2015-2024* (Plan) will define management and policy direction pertaining to sport and commercial fisheries in Lake Michigan for the coming decade. It succeeds the *Lake Michigan Integrated Fisheries Management Plan – 2003-2013*. The Plan will be developed under the following four broad Lake Michigan fishery goals carried forward from the expiring Plan: 1) A diverse, balanced, and healthy ecosystem. 2) A diverse multi-species sport fishery within the productive capacity of the lake. 3) A stable commercial fishery within the productive capacity of the lake. 4) Science-based management.

The planning effort will be carried forward by the Lake Michigan Fisheries Team. Integration of the Plan with other DNR programs and plans will be achieved by the involvement from the outset of all relevant Department programs. Integration of the revised Plan with the thinking and planning of state and federal agencies will be achieved by the involvement of representatives of those agencies. Public participation will involve the active participation of the interested public.

PROCESS

The process of Plan development is summarized by specification of who will be involved and when specified steps in the process will occur.

Participants in the planning process

- **Lake Michigan Fisheries Team.** The LMFT will conduct the planning effort.
- **Policy Support Group.** This will include the Administrator of the Division of Water, the Water Leader for the East Unit, and Director of the Bureau of Fisheries Management. This group will endorse the planning process and ratify the completed document, but need not play any other active role, except as interest may dictate or as requested by the LMFT.
- **FM Board.** Reviews drafts of the Plan.
- **Great Lakes Fisheries Team.** Reviews drafts of the Plan.
- **Internal Partners.** Other DNR programs will be asked to help. This participation will be coordinated through the Office of the Great Lakes (OGL).
 - **Office of Great Lakes**
 - **Bureau of Watershed**
 - **Science Services**
 - **Bureau of Wildlife**
 - **Bureau of Law Enforcement**

○ **Bureau of Water Quality including Robert Wakeman**

- **External Partners.** External partners (including but not necessarily limited to EPA, GLFC, USFWS, USGS, Michigan DNR, Indiana DNR, Illinois DNR, and CORA) will be asked to comment on drafts of the new Plan. This assures that the Plan takes appropriate consideration of external concerns.
- **Public.** The public at large will be involved through open meetings of the Lake Michigan Fisheries Forum (LMFF) and other public forums as needed.

Planning Timetable

- January 2013 – Statement of Scope and Process approved by the Policy Support Group.
- January 2013 – A written review of the old Plan is completed by the LMFT.
- January-March 2013 – Issues and concerns solicited from the interested public, internal partners, and external partners via the LMFF and other mechanisms.
- April 2013 - March 2014 – The LMFT outlines the new Plan, noting any potentially controversial objectives or tactics that may raise concerns with the public, with internal partners, or with external partners. FM Board and GLFT review draft and provide comments approval for review.
- April 2014 – Discuss overall goals of plan and options for public review with LMFF.
- March-June 2014 – Internal partners and Policy Support Group reviews the draft and advises LMFT regarding the need for additional conflict-resolution steps regarding the potentially controversial objectives and tactics.
- July 2014 – Conflict resolution, if needed.
- July - August 2014 – Public review process; specific approach to be determined in discussion with LMFF members at April 5, 2014 meeting.
- November 2014 – Final draft of the Plan review by FM Board
- December 2014 – Review and approval by Policy Support Group, WMT and DNR Secretary.
- January 2015 – Presentation to Natural Resources Board and posting on the Department’s policy webpage, as appropriate.

Approvals:

Mike Staggs	date
Director, Bureau of Fisheries Management and Habitat Protection	

Beth Olson	date
Water Leader, Eastern Unit	

Ken Johnson	date
Water Division Administrator	

APPENDIX 2 – REVIEW OF COMMENTS

[Insert a review of comments received from the public, other agencies, and other Department programs after review processes are completed. Will be included in final version.]