Administrative Report No. XX

REVIEW

of the

Lake Michigan Integrated Fisheries Management Plan 2003-2013

Note to the reader:

The LMIFMP has a hierarchical structure. Several objectives are listed under each of four major goals. Within each objective, problems are identified and specific tactics to address the problems are presented.

In this review we have reproduced the entire Plan and inserted brief comments summarizing work accomplished toward each of the specific tactics. Look for text preceded by the bold-faced phrase, "**§Review comment**", throughout this document.

More information about results of surveys and assessments mentioned in these reviews can be found at the Lake Michigan web page (http://dnr.wi.gov/topic/Fishing/lakemichigan/index.html).

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Bureau of Fisheries Management and Habitat Protection
Wisconsin Department of Natural Resources

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OVERVIEW

§§Review comment: Review and revision of the "Overview" section will be taken up at a later date. The purpose of the present review is to examine progress toward the specific "Tactics" listed in the plan.

Introduction

This Lake Michigan Integrated Fisheries Management Plan (Plan) will guide the management of sport and commercial fisheries in Wisconsin waters of Lake Michigan during the years 2003 through 2013. It was developed through a process designed to engage fisheries and law enforcement personnel working on Lake Michigan, the interested public, Department of Natural Resources (Department) staff in all related programs, and external partners. See the Appendix 1 for details of the Plan development process and Appendix 2 for a review of all comments received on an intermediate "Public Discussion Draft" of the Plan. The term "Integrated" in the title indicates our intention to develop a fisheries management program that complements and utilizes other Department programs and that recognizes the roles of the other state, federal, tribal, and private agencies and organizations -- our partners in the management of the Great Lakes and their fisheries. However, we do not attempt here to present a plan that encompasses 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 Plan presents an ambitious agenda of work that will test our energies and resources over the next five biennial budgeting and planning cycles, and we realize that we may not achieve all of the proposed objectives or employ all of the proposed tactics. We considered presenting a streamlined Plan, but to do so would understate the challenges and needs of fisheries management on Lake Michigan. We realize that our scope for action may be limited by budgets and priorities established outside the Fisheries Management Program. The order of presentation of goals and objectives is not intended to reflect agency priorities.

Fisheries management programs on Lake Michigan, along with state and federal pollution prevention and habitat protection initiatives, have fashioned a silk purse of fishing opportunity from a sow's ear of ecosystem degradation. The Lake Michigan ecosystem was transformed in the 19th and 20th centuries by pollution, habitat degradation, the introduction of exotic species, and the unrestricted harvest of native species. Even today the presence of dozens of exotic species, together with irreversible losses of some near-shore wetland and tributary habitats, precludes the full restoration of the fish community that was present at the time of European settlement. But, strides have been made. With chemical and organic pollution limited and habitat degradation slowed, state, federal, and tribal fisheries agencies have been able to develop a successful inter-jurisdictional fisheries management program that provides exceptional opportunities for both sport and commercial fishers.

Today's sport and commercial fisheries on Lake Michigan rely on two ongoing management activities, the control of sea lamprey and the stocking of salmon and trout. Together, these activities have transformed an ecosystem devastated by the proliferation of sea lamprey and alewives, and created remarkable sport and commercial fishing opportunities. 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. The program still relies primarily on the use of the chemical lampricide, TFM, but also involves barrier dams, the trapping of migrating adults, and the release of sterile males. An active research program funded by the Commission has identified pheromones that may lead to dramatic improvements in control methods. Without the sea lamprey control program, commercial and sport fisheries would not exist as we know them, and lake trout restoration would not be considered a realistic possibility. The stocking of 13,000,000 chinook salmon, coho salmon, rainbow trout, and brown trout annually is conducted by the Departments of Natural Resources of Wisconsin, Illinois, Indiana, and Michigan. In addition the U.S. Fish and Wildlife Service stocks over 2,000,000 lake trout annually in a restoration program designed by the four states together with the Chippewa-Ottawa Resource Authority.

Most of the Department's investment in Lake Michigan fisheries is directly related to the propagation and stocking of trout and salmon. These programs have stabilized the Lake Michigan fish community, and provided a context in which significant local initiatives, described below, are taking place related to yellow perch, lake sturgeon, Great Lakes spotted musky, smallmouth bass, walleye, and northern pike.

We are generally pleased with the condition of sport and commercial fishing in Lake Michigan. Sport fishing. After a troubling bout with bacterial kidney disease in the late 1980s, the chinook salmon fishery stabilized during the 1990's and harvests in the last two years have been exceptional. Today anglers and agency biologists understand the need to balance stocking of those predators against available forage abundance. The salmon and trout fishery is diverse, with steelhead, lake trout, brown trout, and coho salmon helping to sustain fishing on the open lake from early spring through late fall. We maintain a steelhead stocking program involving three strains that can provide stream fishing opportunities nine months of the year, although returns in recent years have been disappointing, probably mostly because of low flow rates in our tributaries. Yellow perch are temporarily in decline both in Lake Michigan and Green Bay, but we have made strides in assessing and predicting population fluctuations in order to guide the regulation of commercial and sport harvests. Excellent fishing for other cool water species, especially walleye and smallmouth bass, can be found in Green Bay, the Milwaukee River, and other river mouths and bays along the Lake Michigan shoreline. The Great Lakes spotted musky restoration program in Green Bay has been a success in its early stages. Commercial fishing. On the commercial fishing side, we have over the past 25 years moved toward a smaller and better regulated commercial fishery targeting five species – lake whitefish, yellow perch, round whitefish, rainbow smelt, and bloater chubs. 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[1]. Attempting to maximize long-term harvests often leads to over exploitation, so our policy 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 (except for portions of the bloater chub and smelt harvest limits that are open to so-called racehorse fisheries) 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.

Despite these successes, the future of fishing on Lake Michigan is uncertain because the ecosystem is constantly changing. The steady flow of new exotic species, most of which are introduced through the discharge of ballast by ocean-going vessels, complicates our work and places all predictions in doubt.

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. . .*

[1] National Research Council. 1999. Sustaining Marine Fisheries. National Academy Press, Washington, D.C.

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)[2]. This basin-wide management agreement was developed with assistance from the

[2] Great Lakes Fishery Commission. 1997. A Joint Strategic Plan for Management of Great Lakes Fisheries.

Great Lakes Fishery Commission. Wisconsin is a signatory to SGLFMP along with the seven other Great Lakes states, the Chippewa-Ottawa Treaty Fishery Management Authority[3], 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 Objectives[4] 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*[5], which describes how the Department will implement its mission and its strategic plan in the programs that work with fish, wildlife, and their habitants.

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.

The Great Lakes Water Quality Agreement of 1972, amended in 1987, 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 Fishery Resource Offices "to provide assistance to the Great Lakes

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

[4] 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.

[5] http://www.dnr.state.wi.us/org/water/fhp/fish/management/fwhplan.htm

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, and others to attempt to develop consensus recommendations reflecting the interests of all interested parties.

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 can only be accomplished with limited available Department funding, through external grants, or by partners.

Staffing. The base program includes activities of permanent field biologists and hatchery personnel described in the following table. 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

Permanent staff involved in the Lake Michigan fisheries program. Some positions are vacant, and one position may be eliminated as part of statewide staffing reductions. Asterisks denote individuals who whose time is only partly devoted to Lake Michigan fisheries work.

Region	Location	Staff
Central Office	Madison	Great Lakes Fisheries Specialist
	Madison	Fish Health Specialist*
	Madison	Fish Contaminant and Toxicology Program Coordinator*
Northeast Region	Peshtigo	Green Bay Fisheries Supervisor*, two biologists*, two technicians*.
	Green Bay	NER Fisheries Expert*, one biologist*, one technician*
	Sturgeon Bay	Lake Michigan NER Fisheries Supervisor*, one biologist, five technicians (one of which is to be filled as a boat captain and may be moved to SER as a boat captain), one commercial fisheries program assistant
	Mishicot	one biologist*, one technician*
	Wild Rose SFH	one supervisor*, three technicians*
	other NER hatcheries	one supervisor*, one technician*
	Besadny Anadromous Fisheries Facility	one technician
Southeast Region	Plymouth	one biologist
	Milwaukee	Lake Michigan SER Fisheries Supervisor, SER Fisheries Expert*, one biologist, three technicians
	Kettle Moraine SFH	one supervisor, four technicians
Northern Region	Bayfield SFH	one supervisor*, three technicians*
Southern Region	Lake Mills SFH	one supervisor*
	Nevin SFH	one supervisor*, one technician*

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 fish production costs. Most of the cost of fisheries management in Lake Michigan is directly related to maintenance of fish production facilities and the propagation and stocking of salmon and trout. Each year approximately $1.2 million dollars is spent on this work. That cost is split roughly equally between license revenues and Salmon Stamp revenues. Further detail is provided in the biennial Salmon Stamp report[6].

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.

Base fisheries management projects. These projects form the core work of the Lake Michigan fisheries program for the term of the Plan. Funding will be withheld only if a) unavailable or b) needed for urgent short-term projects.

Project	Base-level annual funding, by source		
	Fish and Wildlife Account[7]	Salmon Stamp	other
Maintain two assessment boats, the Perca and the Barney Devine	$10,000	$10,000	
Steelhead broodstock management at Besadny Anadromous Fisheries Facility (BAFF)	0	$10,000	0
Coho and chinook broodstock management at Strawberry Creek and BAFF	0	$20,000	0
Assess Green Bay yellow perch population	$23,000	0	0
Assess Green Bay walleye fishery	$5,000	0	0
Lake trout restoration and management	0	$20,000	0
Green Bay creel survey data collection	$32,000	0	0
Spotted muskellunge restoration in Green Bay	$7,000	0	0
Collection and analysis of commercial catch statistics	0	0	$13,000[8]
Determination of commercial harvest limits	$6,000	0	0
Yellow perch commercial catch monitoring	$9,000	0	0
Lake Michigan and Green Bay creel survey data analysis	0	$16,000	0
Salmon and trout brood stock management at the Root River Steelhead Facility	0	$25,000	0
Assess yellow perch population in Lake Michigan	$14,000	0	0
Cool-water fishes restoration in the Milwaukee River	$8,000	0	0
Lake Michigan creel survey data collection	0	$106,000	0
Assess yellow perch recruitment in Lake Michigan	$8,000	0	0
Salmon Stamp expenditure report and stamp printing	0	$6,000	0
TOTAL	$122,000	$213,000	$13,000

[6] Wisconsin Department of Natural Resources. 2002. Expenditures of Great Lakes Salmon and Trout Stamp Revenues, 2000-2003. Administrative Report No. 51. Bureau of Fisheries Management and Habitat Protection.

[7] The Fish and Wildlife Account receives income from a variety of fees, including sport fishing license fees and commercial license fees.

[8] Federal funds available through the Inter-jurisdictional Fisheries Act

During the term of this Plan, most fisheries work not directly related to propagating salmon and trout will fall within the base projects listed here. These are the needed recurring activities that form the core of our program. Annual funding shown for these projects will cover limited-term employees and supplies needed for each project, but not salaries and office/travel/administrative costs that support the permanent staff.

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 an effort to restore a near-shore rainbow trout fishery in Lake Michigan, habitat improvements in the Oconto River, and a comparison of coho salmon stocked as yearlings and fingerlings.

Summary

The Plan is presented in outline format, moving from broad goals to specific tactics. Within each of four goals, objectives are listed. For each objective, one or more problems are identified, and for each problem, one or more tactics are suggested. The tactics are too numerous to summarize here, but the following paragraphs capture the main features of the Plan.

Ecosystem. The first goal is a diverse, balanced, healthy ecosystem. The tactics pertain to habitat protection, native species restoration, and nuisance species prevention and control. Habitat issues for walleye, smallmouth bass, and northern pike are highlighted. We emphasize the effects of land use practices on aquatic habitats. Native species of concern to us include *Diporeia*, lake trout, northern pike, bloater chubs, lake sturgeon, Great Lakes spotted musky, and yellow perch. Several recommendations of the Lake Michigan Fisheries Forum pertaining to yellow perch restoration in Green Bay are adopted here. Our discussion of nuisance species includes one native species, the cormorant, as well as several non-native species. Inter-jurisdictional cooperation is essential to slowing the flow of exotic species into the Great Lakes.

Sport Fishing. The second goal is a diverse multi-species sport fishery. We highlight the importance of sustaining a salmon and trout stocking program (matched to the abundance of forage species) and of taking steps to enhance near-shore and tributary fishing opportunities. 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 trouble us, 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 a crumbling statewide hatchery system, so we emphasize the need for substantial renovations, especially at the Wild Rose State Fish Hatchery.

Commercial Fishing. The third goal is a stable commercial fishery. Because the regulation of harvests is our primary tool for protecting and enhancing the five commercial species (yellow perch, bloater chubs, lake whitefish, rainbow smelt, and round whitefish) the Plan emphasizes improving population assessments and models. It also calls for automating the setting of harvest limits by linking them explicitly to objective measures of population abundance. A major objective of the new plan is to implement the recommendations of the Commercial Fishing Task Force.

Science-based Management. The final goal is science-based management of Lake Michigan fisheries. This goal addresses a number of issues related to our ability to implement this Plan. The tactics include supporting continuing education for field biologists, hatchery personnel, and wardens; exploiting external funding opportunities; working with 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.

GOAL I. A diverse, balanced, healthy ecosystem

This means an ecosystem that sustains desired sport and commercial fishing activity, but also contains as much of the natural variety of species and strains as possible and that is resistant to dramatic changes in species abundance. The ecosystem management tools available to fisheries management are limited, so we focus in this section of the Plan on enhancing fish habitat, protecting and restoring native fish species, and dealing with non-indigenous species.

Objective 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.

Human activity has altered fish habitats by filling or dredging wetlands and littoral areas, constructing solid piers, diverting and increasing runoff, decreasing base flow and changing drainage patterns in watersheds, blocking fish migration routes, releasing contaminants into the air and water, increasing nutrient loading, and releasing chemical pollutants. We must seek to protect undisturbed habitat, maintain functioning habitat, and, if possible, improve or create habitat beneficial to both game and non-game species.

Problem 1. Walleye, smallmouth bass, and northern pike spawning habitats are degraded or destroyed.

Urbanization and industrialization of the lower reaches of many major Lake Michigan tributaries have resulted in extensive filling of wetlands. Also, fills behind established bulkhead lines (bulkhead lines are legally established shorelines, see Problem 6, below) reduce shallow water habitat. Mitigating these losses with rock rip-rap appears to be one method of increasing walleye natural reproduction.

Ditches on the west shore of Green Bay are very important northern pike spawning and nursery areas and are used increasingly by adult walleyes with unknown success. These ditches vary substantially in their quality as spawning and nursery habitat. We can improve this habitat. Major west-shore tributaries also have substantial walleye spawning runs but appear to have limited reproductive success, for reasons that are poorly understood. Possible causes are interference by large sucker runs and/or de-watering of spawning areas because of hydro-electric operations or base-flow fluctuations. In addressing this problem we will work with Department programs for Law Enforcement and Water Regulations and Zoning.

Tactic a) Continue evaluating enhanced walleye spawning habitat in the Fox River.

§Review comment: Although, because of staff time and budgetary considerations, staff did not do any specific work to evaluate recently constructed walleye spawning habitat. Young of year surveys are conducted annually on the Fox River and lower Green Bay to determine the relative strength of walleye production. Data are summarized in the annual Lake Michigan Management Reports[9].

[9] http://dnr.wi.gov/topic/fishing/lakemichigan/ManagementReports.html

Tactic b) Restore/enhance walleye spawning habitat in other areas of the Fox River and lower Green Bay.

§Review comment: No new walleye habitat was created in the Fox River or lower Green Bay during this period.

Tactic c) Evaluate the feasibility of enhancing walleye and northern pike spawning habitat in the Menomonee and Milwaukee Rivers.

§Review comment: A 0.6-acre spawning shoal for walleye and other lithophilic spawning fish was constructed in the upper limits of the Milwaukee River Estuary below the abandoned Milwaukee River North Ave. Dam in 2006 at river mile 3 (RM 3)[10]. Habitat enhancement efforts for walleye and northern pike (and lake sturgeon) have also concentrated on removal or modification of barriers to fish passage to enable fish to access remaining spawning and nursery habitats. Approximately 0.2-mile of concrete channel and fish passage barrier were removed from the Menomonee River in 2001 and an additional 1000-foot reach is planned and funded for removal in 2013. An engineered fishway was constructed around the Milwaukee River Thiensville Dam at RM 19 in 2010[11].

Dams were removed from Pigeon Creek a tributary to the Milwaukee River at RM 18 in 2008, the Milwaukee River Lime Kiln Dam at RM 30 in 2010, and the Milwaukee River Chair Factory Dam at RM 31 in 2001. The Ozaukee County Fish Passage Program removed or modified at least 8 man-made culvert barriers on principal tributaries of the Milwaukee River during 2010-11. Two 6-acre wetland parcels are planned to be restored in the Milwaukee Estuary Inner harbor beginning in 2013. Additional fish and wildlife habitat projects are being proposed as part of the Milwaukee Estuary Area of Concern Stage 2 Remedial Action Plan emphasizing fish passage, wetland hydrological connectivity and duration, and restoration.

The Petrifying Springs Park dam and the Kenosha Country Club dam, two low-head dams and effective fish passage barriers, were removed from the Pike River in Kenosha County. As a result, the Pike River and its principal tributary the South Branch of the Pike River are free of fish-passage barriers for over 15-miles.

Tactic d) Determine factors limiting walleye reproduction in major Green Bay west-shore rivers, and develop strategies to improve reproduction.

§Review comment: Surveys have begun to evaluate the spawning population and young of year production in the Oconto, Peshtigo and Menominee Rivers. In 2006, WDNR and MDNR performed a spawning population estimate for walleye in the Menominee River. The estimated population was 58,382 (45,221 males and 13,161 females)[12].

Tactic e) Inventory northern pike spawning habitat in Green Bay.

§Review comment: WDNR deployed young-of-year northern pike traps in various tributaries of the west shore of Green Bay in 2003, 2004, and 2009. In 2011 and 2012, partners including Brown County Land Conservation Department, Oconto County Land Conservation Department, Oneida Tribe, UW-Madison, and The Nature Conservancy deployed northern pike traps as part of various grants that those entities received. Observations of adult northern pike in streams and roadside ditches were recorded in 2011 and 2012 by WDNR and partners. Data from young-of-year surveys from 1994 through 2012 was entered in a WDNR

[10] Wawrzyn, Will. 2007. Final Report to the National Fish and Wildlife Foundation - Milwaukee River Fish Spawning Habitat Rehabilitation Project (unpublished file report).
[11] http://www.co.ozaukee.wi.us/PlanningParks/PlanningParks_FP_OzaukeeFishway.asp
[12] Kapuscinski, K.L., T.G. Zorn, P.J. Schneeberger, R. P. O'Neal, and B. T. Eggold. 2010. Status of Lake Michigan Walleye Stocks. *In* Status of walleye in the Great Lakes: proceedings of the 2006 Symposium. Great Lakes Fish. Comm. Tech. Rep. 69. Pp15-70.

Excel and GIS databases and shared with interested parties. Data collected in 2011 and 2012 was also entered into the WDNR Surface Water Integrated Monitoring System (SWIMS) database.

Spawning habitat assessment and connectivity of channels that lead from Green Bay to northern pike spawning locations are being evaluated by the Department's Bureau of Science Services, the Nature Conservancy, the United States Fish and Wildlife Service, and Brown and Oconto County Land Conservation Departments, with GLRI funding. The final report will be completed in 2013. One of the outcomes of this work is a road/stream crossing inventory and prioritization model for the Duck Creek, Suamico, Little Suamico, and Pensaukee watersheds[13].

WDNR received a Wisconsin Coastal Management Program Grant (No. 82015-002.63) in 2004, titled "Northern Pike Habitat Protection by Low Order Stream Protection and Education". As part of this project, WDNR staff created a new map and Geographic Information Systems database to include low order streams not previously mapped within the Pensaukee River watershed. Low order streams are the smallest tributaries in a watershed, and are sometimes only intermittent, but they can play a vital role for spawning northern pike that migrate from Green Bay waters each spring to spawn. UW-Extension designed an educational brochure to educate the public about the importance of low order streams and northern pike management.

A planning-level spawning habitat assessment and inventory of effective and complete fish passage barriers was completed for the Milwaukee and Menomonee Rivers and estuary upstream to the first complete barrier to fish passage (SEWRPC 2009[14] and Wawrzyn, 2011[15]). A detailed structure-specific inventory complete with invert elevations was completed by Riverkeeper[16] for the Menomonee River watershed in 2012 with a grant from the Wisconsin Coastal Management Program.

Tactic f) Assess enhancement methods for northern pike spawning and nursery habitat.

§Review comment: Several habitat projects described in Tactic g, below, were surveyed for use by northern pike before and after work was completed. In general, constructed spawning areas have been some of the highest producers of northern pike young-of-year particularly in years with low spring precipitation. This is because many constructed wetlands are designed to hold water for longer periods than natural wetlands.

As an alternative to a highly engineered solution to drainage and flood control measures that included concrete channelization, the City of Mequon with funding assistance from Wisconsin Coastal Management constructed a dual purpose flood control and northern pike spawning marsh approximately 17 miles upstream of the Milwaukee Estuary in 2004. The project was expanded to create 10 acres of wetland and enhance the hydrology of 27 acres of wetlands, and re-meander 0.5 miles of previously channelized Trinity Creek. Two outlet weirs were lowered in 2011 by the Ozaukee County Fish Passage Program to improve fish passage, increase the acreage of vegetated spawning shelf, and manage water depths to increase probability for winterkill to remove over-wintering fish predators, nuisance Common carp and Gizzard shad.

Prior to European settlement there were over 6,000 acres of wetland in the Milwaukee Estuary. All of these wetlands have been filled. The City of Milwaukee with funding assistance from Wisconsin Coastal Management is preparing design and 30% construction plans for restoring a 6.5 acre wetland in the Milwaukee Estuary, and the Milwaukee Metropolitan Sewerage District (MMSD) has been authorized by its

[13] http://maps.tnc.org/DuckPenTool/
[14] Southeastern Regional Planning Commission. 2010. Stream habitat Conditions and Biological Assessment of the Kinnickinnic and Menomonee River Watersheds: 2000-2009. Memorandum Report No. 194.
[15] Wawrzyn, Will. 2011. A Management Plan for Restoring a Sustainable Population of Northern Pike in the Milwaukee Estuary Area of Concern (AOC). Unpublished report available from the Bureau of Fisheries Management, Southern Lake Michigan Work Unit, Milwaukee, 91 pp.
[16] http://www.mkeriverkeeper.org/projects/home.htm

Commission to design and construct a 7-acre wetland in the Milwaukee Estuary Burnham Canal. Both designs will account for the seiche dominated hydrology of the estuary.

Tactic g) Work with highway departments to enhance northern pike habitat in roadside ditches along the west shore of Green Bay.

§Review comment: Northern pike habitat enhancement projects have been completed in partnership with highway departments, as well as county and federal agencies, non-profit organizations, and on state lands. Some of the projects are adjacent to tributaries of Green Bay rather than roadside ditches.

With grant funding (Project #123) from the Lower Fox River and Green Bay Natural Resource Damage Assessment (NRDA) program, WDNR removed the remains of a concrete weir in order to enhance flow in a side channel on the Suamico River upstream from CTH J in the Village of Suamico, Brown County. This grant also funded work on the WPA ditch in the Town of Pensaukee, Oconto County. Fill material was removed from the north side of the channelized ditch to allow the adjacent coastal marsh to filter runoff and return to a more natural wetland complex. The existing ditch channel was retained to allow northern pike to access nearby ditches and wetlands during and after spawning. These projects were completed in 2008-09.

WDNR worked with Wisconsin Department of Transportation to design several mitigation sites that provide northern pike spawning habitat. One site is adjacent to Resort Road in the Village of Suamico, Brown County. The entire Resort Road mitigation site added 121 acres of total wetland, including 78 acres of shallow marsh and wet meadow that will provide spawning habitat for northern pike. The Resort Road mitigation site was completed in 2012, and northern pike currently have access to the north side of Resort Road. Through grant funding obtained by The Nature Conservancy, northern pike will have access to the south side of the Resort Road mitigation site once hydrologic connections are completed within the Sensiba Wildlife Unit. Work on that project is scheduled for completion in 2013.

A second WDOT mitigation site was completed in 2008 at the end of Sunrise Lane in the Township of Little River, Oconto County. This 38 acre site includes a shallow scrape sloping up from the sides of the established waterway. A third WDOT mitigation site was completed in 2008 adjacent to the newly created Highway 41 bypass in the City of Oconto, Oconto County. Meanders and 50:1 slopes were created on this 85 acre site.

As of January 2013, Oconto County Land Conservation Department has replaced four culverts, opening 6.3 miles and has removed nine smaller obstructions, opening 4.5 miles of stream. In addition, they have restored 4.3 acres of wetlands for use by northern pike, completed critical area shaping and seeding on 3.6 acres, and have installed 7.5 acres of buffers.

As of January 2013, Brown County Land Conservation Department has replaced seven culverts and removed one rock dam, opening 17 stream miles to migrating fish. Also, they have restored 28.5 acres of wetlands for use by northern pike, completed critical area shaping and seeding on 49.9 acres, and have installed 59.2 acres buffers.

In 2012, the Duck Creek/Pamperin Park dam in Brown County was removed by the Oneida Tribe and partners. Removal of the lower two dams and modification of the third dam to allow for northern pike passage while minimizing the risk of passage of invasive species such as sea lamprey and round goby has opened over twenty miles of stream that was previously blocked to pike movement.

In addition to the above habitat enhancement projects, numerous culverts have been replaced by highway departments, with a design and size that allows passage of aquatic organisms. Multiple road and stream crossing workshops were held in Suamico to highlight the importance of road crossings and fish passability. The road/stream crossing barrier inventory and prioritization model mentioned in Tactic e, above, also addresses this.

Fish Management staff routinely review local and state transportation agency bridge and culvert plans to insure fish passability and work with SEWRPC to include recommendations in water quality management and transportation plans that incorporate fish passage designs. Staff and volunteers from Milwaukee Riverkeeper, a licensed member of the Waterkeeper Alliance coalition, were instructed by Matt Diebel (DNR Science Services) and Stewart Cogswell (USFWS) in standardized fish passage barrier assessment protocols.

Problem 2. Structures and lake-bed modifications degrade fish habitat.

Construction of private solid piers, especially along the Green Bay shore of Door County, and the dredging often associated with these structures have degraded and/or destroyed spawning and nursery habitat for smallmouth bass, forage fish, and invertebrates. Requests for such private structures have increased in part because public mooring facilities are limited in some areas.

Tactic a) Work with shore property owners to find alternatives to solid piers and dredging and develop a program for removal of deteriorating solid piers.

§Review comment: Fisheries and LE staff provide support to Water Management Specialists in reviewing permit applications. We have not developed a program as described.

Tactic b) Encourage creation and expansion of facilities for public mooring of boats.

§Review comment: This tactic should refer to public dockages (which are inside protective marinas) rather than public moorings (which are in open water). Fisheries staff supported the development of several large marinas and boat dockages. Large projects were completed at the South Marina, Green Bay, Carmody Park, Little Sturgeon Bay, Egg Harbor, Port Washington and Sheboygan that improved public access to the water. These projects limited the scope of habitat destruction by localizing construction rather than allowing individual projects that additively cause more habitat loss.

Tactic c) Support enforcement action on violations resulting in fish habitat degradation.

§Review comment: Fisheries staff provides technical information as needed for enforcement actions. During 2003-2013 there were a number of enforcement actions in Lake Michigan, Green Bay, or tributaries below the first dam.

Problem 3. Land use practices can lead to non-point source pollution affecting fish in our tributaries and estuaries.

While most people are familiar with the dramatic effects of point source pollution (e.g., direct discharge of untreated waste water into a stream or lake and resultant fish mortality), non-point source pollution has been largely overlooked in the past because it is not as conspicuous in its effects. Non-point source pollution can be the result of industrial or manufacturing processes, but also develops from land use practices related to construction, road-ditch maintenance, agriculture, and other activities. Improper land use can result in increased sediment, nutrient, organic-chemical and heavy-metal loadings to streams, while creating abnormal flow rates. All have negative effects on aquatic communities by destroying habitat, increasing turbidity, lowering dissolved oxygen levels, disrupting food webs, decreasing diversity, raising stream temperatures, altering stream flow, and increasing the abundance of undesirable species.

The Department's Nonpoint Source Program Management Plan[17] addresses these issues. The application of watershed best management practices can help fish populations[18], but single guidance document describing watershed best management practices from a fisheries perspective is not now available.

Federal participation in non-point pollution control efforts includes assistance in implementing Remedial Action Plans and development of a Lake Michigan Lakewide Management Plan (LaMP). Additionally, the Environmental Protection Agency and the National Oceanic and Atmospheric Administration work with Wisconsin to develop a Coastal Non-point Pollution Control Program. The Conservation Reserve Program (CRP) and Conservation Reserve Enhancement Program (CREP) administered by DATCP, Stewardship Streambank Protection programs administered by the Department, and the riparian buffers program administered by county soil and water conservation departments are available to help reduce agricultural-related non-point pollution of tributaries.

§Review comment: Fisheries staff provide technical reviews and information on many of the programs outline above. Our main goal is to support these activities and provide fisheries input. However, these programs are either outside the Department and within other programs within the Department and therefore we do not take the lead on the tactics outlined below.

Tactic a) Support efforts to help educate the public about effects of land use practices on water quality.

§Review comment: Fisheries staff worked with local agencies, Friends of the Branch, Manitowoc and Twin Rivers, and Centerville CARES through public outreach meetings that provided information regarding tributary streams and Lake Michigan nearshore areas to the general public on how water quality, fish populations and land use are linked. Fisheries staff developed presentations that described the impacts of poor land management and stormwater management practices on fish and aquatic life, and their habitat. Audiences included professional engineer and technicians responsible for designing and constructing developments and stormwater drainage systems, county land conservation department staff responsible for developing rural nonpoint source management plans and site-specific agricultural stormwater facilities, fishing clubs, and recreational fishing-based conservation groups.

Tactic b) Develop specific land acquisition and protection goals related to fisheries habitat needs, for implementation by the Stewardship Program.

§Review comment: Fisheries staff provided justifications for the purchase of property along the Lake Michigan shoreline or tributary streams that either enhanced public access or protected habitat such as land purchases along Hines Creek, near Rowleys Bay and Mashek Creek. Fisheries staff worked with internal Lands and Real Estate program staff and external land conservancy trusts in the Milwaukee River Basin to identify lands adjoining high quality surface waters resources and fisheries, and provide the necessary documentation of their values needed to protect them through land acquisition or easements.

Tactic c) Provide information to external agencies and to the Department's Runoff Management Program to support programs that protect water quality and provide a diversity of habitats for fish.

§Review comment: Worked with County Land Conservation Departments to limit soil and manure runoff at public meetings by presenting talks on the impacts of these activities and by providing fisheries related input during ordinance development.

[17] Wisconsin's Nonpoint Source Program Management Plan FFY 2011-2015

[18] Wang, L., J. Lyons, P. Kanehl. 2002. Effects of watershed best management practices on habitat and fish in Wisconsin streams. Journal of the American Water Resources Association. 38(3): 663-680.

Tactic d) Encourage use of buffer strips by educating riparian landowners about programs like CRP and CREP.

§Review comment: Fisheries staff assisted County Land Conservation Departments in promoting programs that reduce runoff, stream water quality and protected fish habitat. A workshop and tour sponsored by WDNR, Natural Resources Conservation Service, Glacierland Resource Conservation and Development, Brown, Oconto, and Outagamie Land Conservation Departments, Great Lakes Commission, and Oneida Nation was held in May 2004 in Suamico, WI, to highlight the role that buffer strips play in improving water quality and fish spawning habitat.

Tactic e) Support Department Law Enforcement and environmental regulatory staff in enforcement actions for violation of laws relating to water pollution, storm water runoff and water and shoreline protection.

§Review comment: Fisheries staff assisted other DNR programs investigating runoff events that may lead to fish kills or by collecting field data to assist that are needed for enforcement actions. Staff collected information on fish kills in the Ahnapee River, Kewaunee River, Branch River, Manitowoc River, Calvin Creek, Silver Creek Point Creek and Fischer Creeks. In some cases fisheries reached settlement money for restocking of fish in Point and Fischer Creeks.

Tactic f) Encourage highway departments to take steps to reduce sediment runoff resulting from roadside ditch maintenance.

§Review comment: Staff has talked to County Highway Departments and local towns to request that they reduce the amount of ditch clearing that occurs in late fall after the end of the growing season by conducting this work during the growing season in low rainfall months.

Problem 4. Stream classifications may limit our ability to enhance natural reproduction by salmon and trout in tributary streams.

The Administrative Code classifies surface waters to reflect the aquatic communities they can support. Waters that have been classified through in state administrative codes NR102 or NR104 may have the following category: Cold, Warm Water Sport Fishery (WWSF), Warm Water Forage Fishery (WWFF), Limited Forage Fishery (LFF), Limited Aquatic Life (LAL). Those classifications in turn guide the Department in issuing WPDES permits for discharges of heated water and organic material. The most protective classification is “cold water”, a designation that can be applied only to streams that support trout populations. Most Lake Michigan tributaries do not have this designation, although salmon and trout use the streams seasonally. The classifications are under review. One proposal is to create a new “seasonal use” classification to reflect the seasonal use of our streams by anadromous trout and salmon species. Some Lake Michigan tributaries have been degraded by past industrial, forestry, or agricultural practices cannot be classified “cold water” based on their present fish communities, but if adequately protected might in time be capable of earning that classification. Others may support very limited reproduction by trout and/or salmon, which might expand if water quality is adequately protected.

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

§Review comment: Tributaries are formally classified and supportive water quality standards established perin Administrative Code chapters NR 102 and NR 104. Fisheries staff worked with the Watershed Management program biologists to complete surveys and develop individual stream classification and management recommendations. To date not all recommended classifications have not

been adopted. Some of the surveys have identified small tributary streams with reproducing populations of Lake Michigan-run trout and salmon including Pigeon Creek, a tributary of the Milwaukee River in Ozaukee County at Thiensville, Sauk, Sucker and Mineral Springs Creek with direct discharges to Lake Michigan in Ozaukee County at Port Washington, and Willow Creek, a tributary to the Sheboygan River in Sheboygan County and Sheboygan.

Problem 5. Aquatic plant control may affect 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. These 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 extent of the control measures. Chemicals may directly affect fish, and plant control measures will affect fish habitat. Optimal amounts of vegetation are critical for successful breeding, rearing, and growth of fish throughout their life. However, optimal habitat and plant densities vary between fish species. Also, particular species of plants afford better habitat than do others.

In Wisconsin physical controls (pulling, bottom covers, dredging, raking) and chemical controls (herbicides) are generally used. Under new rules, only limited plant removal 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[19,20]. Through the Department's Sensitive Areas Designation Program, certain aquatic plant communities are afforded special protection.

Tactic a) Work with the Aquatic Plant Management Program, municipalities, and others involved in aquatic plant control efforts to assure compatibility of control methods with fisheries needs.

§Review comment: The Department's Aquatic Plant Management Program routinely works with Fisheries Staff to insure that aquatic plant control efforts have minimal impacts to the fish community. We have assisted the Program in helping them setup correct timetables and locations for effective plant control that limits fishery impacts. Fisheries staff has provided input into plant harvesting plans for Little Sturgeon Bay and the Sturgeon Bay Ship Canal and for chemical treatments around docks and launch slip in many Door County locations including Sister Bay, Ephraim, Baileys Harbor and Jacksonport.

Tactic b) Provide information to support implementation of rules regarding aquatic plant control.

§Review comment: The Administrative Codes for harvesting plants (NR 109) and chemical treatments (NR 107) have not been updated since before this plan was written. Fisheries staff has made recommendations on the timing and locations of treatments for individual permits.

Tactic c) Provide information to support protection of important aquatic plant habitats through the Sensitive Areas designation program.

§Review comment: Fisheries staff assisted Water Management staff in this area whenever possible.

[19] WDNR. Wisconsin's Aquatic Plant Management and Protection Program. Publication WR-448-96.
[20] See Administrative Code sections NR 107 and NR 109.

Milwaukee Estuary Outer Harbor marinas at McKinley and South Shore have active management programs, as do some of the marinas in Sturgeon Bay[21]. This late summer, it was obvious that the Milwaukee marinas macrophyte coverage was a fraction of what many considered "nuisance" to navigation a decade ago by exotics M. spicatum and P. crispus, and native Elodea sp. It is worth pursuing more information as to cause and effect relative to over-zealous treatment of target and non-target species for the AOC BUI process.

Problem 6. Dams and other waterway alterations limit the movement of fish in rivers and can degrade habitat.

Most major Lake Michigan tributaries have been dammed (if the Besadny Fisheries Facility on the Kewaunee River is counted as a dam, all 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. They can restrict access of many native species to large areas of spawning and nursery habitat and divide populations into genetically isolated sub-populations. The native species affected can include smallmouth bass, walleye, musky, northern pike, lake whitefish, and lake sturgeon. Blockage of the upstream migration for anadromous fish also limits stream fishing opportunities. These issues are discussed in detail for the Menominee River in the Menominee River Fisheries Plan[22]. 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 anadromous fish, but angling for those fish is regulated by inland rules that include a closed winter season.

Tactic a) Continue to advise the Federal Energy Regulatory Commission during re-licensing of dams.

§Review comment: A FERC license for the DePere dam (first dam on the Fox River) was issued in 2005. In part, that license provides improved conditions for spawning and larval lake sturgeon. Department staff have been working with the Menominee Dam (Menominee River in Marinette) owner on fish passage and license renewal. The FERC license renewal process began in 2010 and will expire in 2015. The agencies and dam owner have secured funds to install upstream fish passage at this site by 2014 and plan to implement safe downstream passage at that facility by 2020.

Tactic b) Encourage the removal of obsolete and other selected dams and look for methods for passing sturgeon and other migratory species around other dams.

§Review comment: Following the removal of Bruemmerville Dam on Silver Creek a tributary to the Ahnapee River in 2012, a new stream channel was constructed through the former mill pond with large habitat features including runs, riffles and pools and small scale habitat features including large woody debris and large boulders. On Centerville Creek, a stream restoration project was completed in 2012 that stabilized an eroding stream bank and added fish habitat. Two additional dams were removed from Duck Creek in Howard (Brown Co.) to facilitate the upstream movement of migratory fish from Green Bay. Dams were removed from Pigeon Creek a tributary to the Milwaukee River at RM 18 in 2008, the Milwaukee River

[21] Milwaukee County Parks, Recreational and Culture Department. 2002. Aquatic Plant Management Plan for the McKinley Marina, South shore and Bender Parks.

[22] Wisconsin Department of Natural Resources and Michigan Department of Natural Resources. 1992. Menominee River Fisheries Plan. 48 pp.

Lime Kiln Dam at RM 30 in 2010, and the Milwaukee River Chair Factory Dam at RM 31 in 2001. The Milwaukee River North Avenue Dam at RM 3 was removed in 1997. Fisheries staff and the USFWS are working with Milwaukee County to develop fish passage and dam operational management alternatives for the county-owned Milwaukee River Estabrook Dam at RM 7 and Milwaukee River Kletzsch Dam at RM 10. Alternatives under consideration include dam removal and an engineered fish passage facility, and to identify potential funding sources for constructing the selected alternative. The Ozaukee County Fish Passage Program removed or modified at least 8 man-made culvert barriers on principal tributaries of the Milwaukee River during 2010-11. Two 6-acre wetland parcels are planned to be restored in the Milwaukee Estuary Inner harbor beginning in 2013. Additional fish and wildlife habitat projects are being proposed as part of the Milwaukee Estuary Area of Concern Stage 2 Remedial Action Plan emphasizing fish passage, wetland hydrological connectivity and duration, and restoration. The Petrifying Springs Park dam and the Kenosha Country Club dam, two low-head dams and effective fish passage barriers were removed from the Pike River in Kenosha County. As a result, the Pike River and its principal tributary the South Branch of the Pike River are free of fish-passage barriers for over 15-miles.

Tactic c) Continue to advise Water Regulations and Zoning staff and local zoning agencies about fishery impacts from waterway alterations.

§Review comment: Fisheries continues to review dam removal permits and, through that review process, limit fisheries impacts.

Tactic d) Restore instream habitat after dam removal.

§Review comment: See Tactic b). Fisheries continues to encourage habitat restoration following dam removal.

Problem 7. Filling behind bulkhead lines and related shoreline development sometimes destroys fish habitat.

Valuable fish habitats, including some of the last remaining wetlands on Lake Michigan, lie behind bulkhead lines. Bulkhead lines are established by municipalities (township, city, or village) with approval by the Department. Currently, bulkhead lines must conform as nearly as possible to the existing shoreline. However, past approvals established lines that were significant distances from the natural shoreline. The law allows property owners to build structures or place fill in the waterway out to a bulkhead line without further permits from the Department, although it does not remove the responsibility to obtain federal permits.

Most municipalities do not have long range land usage plans to regulate the activities that may occur along a shoreline. In practice this means that once a bulkhead line is established a riparian land owner can conduct projects behind the line that would not be allowed if the bulkhead line did not exist. While one property owner may choose not to develop the shoreline, when ownership changes, the next may choose to fill out to the bulkhead line and in the process destroy valuable habitat.

Even in shoreline areas, especially in Green Bay, where there are no bulkhead lines established, private riparian land owners are placing structures and fill on public lakebed for private use. In the process fish habitat is being degraded or completely buried.

Tactic a) Work with local municipalities to remove bulkhead lines by ordinance where appropriate.

§Review comment: No progress in this area.

Tactic b) Determine the value of habitats landward of bulkhead lines and, where appropriate recommend protection measures.

§Review comment: We have not determined the value of habitats landward of bulkhead lines.

Tactic c) Work closely with Water Regulation and Zoning staff and local zoning agencies to minimize any additional loss of near-shore habitat.

Tactic d) Support Department Law Enforcement and the Water Regulation and Zoning staff in enforcement actions for violations of water and shoreline protection laws.

§Review comment: Fisheries staff provide technical support for the enforcement of shoreline protection laws.

Objective 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 that it is not feasible to completely restore the pre-settlement native fish community. However, rehabilitation of populations of some native species could promote diversity and stability within the ecosystem, while also, in some cases, providing additional sport or commercial opportunities.

Problem 1. Declining abundance of *Diporeia* in some areas on Lake Michigan threatens whitefish fisheries.

Scientists with the Great Lakes Environmental Research Laboratory (GLERL) are monitoring trends in the benthic amphipod *Diporeia*, a species that is an important part of the diet of whitefish and lake trout. The data show that in *Diporeia* have declined dramatically in large areas of Lake Michigan and other lakes, raising concerns for the long-term health of whitefish populations.

Tactic a) Participate in Great Lakes-wide discussions about the problem and provide in-kind support for appropriate studies.

§Review comment: The Department actively participates in data collection and evaluation regarding declining trends in whitefish condition as related to limitations in food availability and/or density dependent factors. The Department also engages in discussions on the issue at the inter-jurisdictional level through participation in the Benthivore Working Group of the Lake Michigan Technical Committee (an advisory group to Lake Michigan management agencies). This issue continues to be an important research need and has been listed among the Benthivore Working Group Research Priorities. Interest in whitefish diet studies continue to be discussed by various research entities, though no formal large-scale study has been conducted in recent years. The Department continues its willingness to support such studies.

Problem 2. We have not succeeded in reestablishing self-sustaining stocks of lake trout.

Wisconsin and neighboring states began a lakewide program to restore native lake trout in Lake Michigan almost 30 years ago. Through a joint state and federal program, tens of millions of juvenile lake trout stocked over the years have demonstrated good survival and growth. Stocking and protective measures have focused in areas thought to be suitable for reproduction, including the Midlake Reef Refuge where several year classes of sexually mature lake trout can

be found during the spawning season, and where preliminary studies by Dr. John Janssen (University of Wisconsin – Milwaukee) have documented that eggs were deposited during the fall of 2001 and 2002. The Department has worked with commercial fishers and the U.S. Fish and Wildlife Service to stock millions of fertile lake trout eggs on Jacksonport Deep Reef. However, assessments so far have captured no confirmed survivors from that egg-stocking project. Aggregations of adult lake trout capable of producing viable eggs and sperm are also found inshore during the fall spawning season at locations along the coast from Door County south to the state border. Fertile eggs and fry have been collected from time to time in other parts of Lake Michigan. However, survival to adulthood of the offspring of stocked lake trout has not been documented in Wisconsin waters. Factors that might limit natural reproduction include contaminants, predation by alewives and other fish, and genetic adaptations.

Tactic a) Continue to assess the performance of different lake trout strains in the Midlake Reef Refuge.

§Review comment: Spring and fall (spawning) Lake trout surveys on the Midlake Reef Refuge have been conducted annually using gill nets. The strategy adopted by the Lake Michigan Committee, *A Fisheries Management Implementation Strategy for the Rehabilitation of Lake Trout in Lake Michigan*[23] used this information to determine the best strains to use for the next phase of Lake Trout rehabilitation. These strains include Seneca, Lewis Lake and Apostle Island.We have also continued to cooperate with Dr. Janssen (UW-Milwaukee School of Freshwater Sciences) in his attempts to describe the distribution and amount of lake trout spawning, and to identify spawning strains[24,25].

Tactic b) Cooperate with UW-Milwaukee investigators conducting early life history studies in the Midlake Reef Refuge addressing factors limiting natural reproduction.

§Review comment: The Department has established a Memorandum Of Understanding with UW-Milwaukee to partially fund Dr. John Janssen[26] to assist the Department on Great Lakes Fisheries issues. Dr. Janssen has worked on a variety of issues concerning Lake Trout on the MidLake Reef. These investigations include remotely operated vehicles (ROV) surveys to determine timing and numbers of lake trout egg deposition, ROV surveys to determine lake trout larval abundance, deep-water trawls to determine larval lake trout abundance[27].

Tactic c) Work with federal fisheries staff to implement a trawl assessment for fry and juvenile lake trout in the Midlake Refuge.

§Review comment: Wisconsin DNR has not pursued establishing a trawl assessment for fry and/or juvenile lake trout in the MidLake Refuge primarily because of costs and limited budgets within the Fisheries program, however Dr. John Janssen, in cooperation with the USFWS has conducted this work[28].

Tactic d) Work with other management agencies on Lake Michigan to complete revision of the Lake Michigan Lake Trout Management Plan.

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[23] http://dnr.wi.gov/topic/fishing/Documents/LakeMichigan/LakeTroutImplementationStrategyforLakeMichigan.pdf

[24] Janssen, J.J., D.J. Jude, T.A. Edsall, R.W. Paddock, N. Wattrus, M. Toneys, and P. McKee. 2006. Evidence of lake trout reproduction at Lake Michigan's mid-lake reef complex. J. Great Lakes Res. 32:749-763.

[25] DeKoning, J., K. Keatley, R. Phillips, J. Rhydderch, J. Janssen, and M. Noakes. 2006. Genetic analysis of wild lake trout embryos recovered from Lake Michigan. Transactions of the American Fisheries Society. 135:399-407.

[26] http://www.glwi.uwm.edu/people/jjanssen/

[27] Janssen, J., J.E. Marsden, C.R. Bronte, D.J. Jude, S.P. Sitar, and F.W. Goetz. 2007. Challenges to deep-water reproduction by lake trout: pertinence to restoration in Lake Michigan. J. Great Lakes Res. 33(Supplement 1):59-74.

[28] Riley, J.W., N.F. Thompson, J.E. Marsden, and J.Janssen. 2011. Development of two new sampling techniques for assessing lake trout reproduction in deep water. N. Am. J. Fish. Management. 30:1571-1581.

§Review comment: Wisconsin along with other agencies on Lake Michigan completed two Lake Trout plans to guide future rehabilitation efforts. The first document, *A Guide for the Rehabilitation of Lake Trout in Lake Michigan*[29], dealt with the technical issues surrounding successfully stocking Lake Trout so that self-sustaining populations could be developed. Specifically this guide was intended to provide technical direction for the ongoing effort to rehabilitate the lake trout population of Lake Michigan. By 2037, rehabilitated populations in specified deep- and shallow-water habitats should be phenotypically diverse, composed predominately (>75%) of wild fish for age groups <10 years old, and capable of sustaining fisheries. Stocking should be focused in priority areas of limited geographic extent that potentially have the best reproductive habitat and where exposure to mortality is lessened. In these defined areas, hatchery-reared fish should be concentrated to provide a density of adults sufficient for successful reproduction and to reestablish lake trout as a dominant local predator. Selected morphotypes introduced from Lake Superior are expected to augment the population in deep, offshore waters. Continued control of fishing and increased control of sea lamprey populations are needed to achieve the population densities required for sustainable natural reproduction. Progress toward achievement of rehabilitation should be reviewed annually and reported.

The second report titled "A Fisheries Management Implementation Strategy for the Rehabilitation of Lake Trout in Lake Michigan" primarily dealt with the plan to stock specific strains, areas and numbers to achieve a self-sustaining population of Lake Trout in Lake Michigan. Key components include concentrating on three strains of Lake Trout (Seneca, Lewis Lake and Apostle Island), stock yearling Lake Trout at about 2.74 million per year, concentrate stocking in refuge areas and develop specific monitoring goals to assess the program's success. These documents are located on our website and can be downloaded in their entirety.

Problem 3. Natural walleye recruitment does not sustain acceptable fisheries in some areas of Green Bay and in the Milwaukee River and Harbor.

Green Bay. The objective of walleye rehabilitation efforts in Green Bay and the Milwaukee River is to re-establish self-sustaining populations. We want to sustain walleye populations to provide one component of a diverse sport fish community that also includes northern pike, smallmouth bass, and yellow perch. To quickly establish high-density populations, intensive stocking of walleye was conducted in various areas of Green Bay in the early 1980s. Survival was good and within a few years high-density populations were achieved. During this period the fishing season for walleye remained open and, as abundance increased, exceptionally good catch rates created a nationally recognized sport fishery. Walleye stocking was discontinued in Green Bay in 1984. Natural reproduction has maintained the lower Green Bay population, but, because of insufficient natural reproduction, walleye abundance in other areas, including Sturgeon Bay declined. Stocking was resumed in Sturgeon Bay in 1994.

Tactic a) Conduct periodic investigations assessing natural reproduction.

§Review comment: Annual fall index surveys are conducted on the Fox River and lower Green Bay to assess young of year production and to collect relative abundance, length and age data on adult walleye. Electroshocking surveys have documented substantial year classes over the past five years[30]. Annual fall YOY index surveys have been conducted for walleye on Little Sturgeon and Sturgeon Bays for most years since 2008. Surveys were done during stocked and non-stocked years. YOY walleye have been collected in these areas during non-stocked years suggesting some natural reproduction is occurring. However, based on limited spring survey information, to date it appears naturally reproduced walleyes are not making a substantial contribution to the spawning population. Further studies in these areas are critical to fully

[29] http://dnr.wi.gov/topic/fishing/Documents/LakeMichigan/LakeTroutRehabilitationGuideforLakeMichigan.pdf
[30] http://dnr.wi.gov/topic/fishing/lakemichigan/ManagementReports.html

evaluate what, if any bottleneck to natural reproduction is occurring, so that management efforts can be made to encourage reproduction if possible.

Tactic b) Employ maintenance stocking in the Sturgeon Bay/Little Sturgeon Bay area and work with private groups, like the Green Bay Sports Fishing Club and Walleyes for Tomorrow, to supplement rearing capability.

§Review comment: Walleye stocking in the Sturgeon Bay area has occurred sporadically throughout the time period with limited success. Since 1994 walleye from various life history stages have been stocked in Little Sturgeon Bay and Sturgeon Bay for many, but not all, years. During this period, nearly 851,000 and walleye have been stocked in Sturgeon Bay. In Little Sturgeon, approximately 1.6 million walleye were stocked though nearly 1 million of those were at the fry stage[31]. Walleyes for Tomorrow and the Green Bay Area Great Lakes Sportfishing club contributed to stocking efforts for some of those years with walleye wagons and supported efforts in raising extended growth walleyes at ponds near the Besadny facility. Walleye have been stocked from several sources during this period including the state hatchery system and from portable hatcheries run by the local Walleye For Tomorrow club and the Green Bay Sportfishing Club with eggs obtained from local waters. VHS rules limited the use of walleye wagons in the area from 2007 through 2011.

Tactic c) Explore other areas of Green Bay for limited walleye fisheries.

§Review comment: Fall electrofishing surveys have been conducted in the Oconto, Peshtigo and Menominee river since 2006 to assess young of year production. Results from these surveys indicate low young of year production in the Oconto and Peshtigo Rivers and moderate production in the Menominee River. These results may be underestimating walleye production because surveys covered few river reaches. In the spring of 2012, spring run assessment was begun on the Oconto and Peshtigo Rivers. Spring electroshocking surveys captured 499 walleye in the Peshtigo River and 212 walleye in the Oconto River just below the first dams. It is unknown at this time if these walleyes were produced in these rivers or came from other known spawning locations in Green Bay.

Tactic d) Initiate a night creel survey.

§Review comment: A night creel has not been initiated because of budgetary constraints.

Milwaukee River. In an effort to improve the near-shore fishery in the Lower Milwaukee River, 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. With the initial financial support from the Lakeridge and Lakeshore sportfishing clubs, the Department in 1995 embarked on a pilot project of raising and stocking 10,000 extended growth walleye annually in the lower Milwaukee River. A detailed plan of walleye population restoration in the lower Milwaukee River and harbor was developed in 1998[32]. The main objective of the program, as in Green Bay, was to re-establish self-sustaining populations. The plan also included marking each fish in order to identify the year of stocking and evaluate their performance of each year class. In addition, a radiotelemetry study was incorporated to examine movement patterns of adult walleye. The growth rate of the stocked walleye has been

[31] http://dnr.wi.gov/topic/fishing/stocking/

[32] WDNR 1998. An assessment of the impact of stocked walleye on stocked salmon in the Milwaukee estuary. Unpublished report available from the Bureau of Fisheries Management and Habitat Protection. 17p.

well above average compared to other walleye populations in the state. Anglers are now targeting walleye, with good seasonal catches documented. Catch-and-release has played a big part of the success of the program. We are conducting annual spring assessments to document if there is any natural spawning in the area. The stocking goal is to continue to stock 10,000 extended growth walleye fingerlings through 2004 and then re-evaluate our 1998 plan for further action.

Tactic e) Continue implementation of the lower Milwaukee River and estuary walleye restoration plan through 2004.

§Review comment: This original plan was completed in 1998 and was implemented through 2004. A new plan was written that extended the plan from 2005 through 2009. The new plan can be viewed on our website[33].

Tactic f) Continue to evaluate and monitor the impact of stocked walleyes on stocked chinook salmon smolts in the Milwaukee River (see Goal 2, Objective C, Problem 3).

§Review comment: Diet studies were conducted to determine if walleye were eating recently stocked salmonids. Study results indicated a negligible impact of walleye on recently stocked trout and salmon[34]. In addition to the study, steps were taken to further reduce any potential predatory impacts of walleyes on smolts by using net pens and by spatially separating salmonid stocking locations from walleye feeding areas.

Tactic g) Assess natural reproduction and estimate population size in the Milwaukee River.

§Review comment: We have conducted yearly assessments of the walleye population to estimate the population size and determine if any natural reproduction is occurring in the Milwaukee River. These assessments have shown the walleye population have varied through the years, with no natural reproduction detected through 2012[35].

Tactic h) Use extended growth walleye fingerlings, when available, for stocking in the Milwaukee River, following the current plan.

§Review comment: The walleye management plan of 1998 guided work until 2004. A new plan was written in 2005[23]. Both these plans outlined using either small fingerlings or extended growth walleye fingerlings in the River. In most years, the Department stocked extended growth walleyes in an effort to build up the population of walleyes. Stocking continued through 2007 after which the stocking was discontinued because of a shortage of suitable Lake Michigan strain of walleye as outlined in the plan.

Tactic i) Continue to work with private groups to supplement rearing costs, deploy net pens, and meet other project needs.

§Review comment: WDNR received substantial financial support from Walleyes For Tomorrow towards the cost of raising extended growth walleye fingerlings for stocking in the lower Milwaukee River. In addition, the Milwaukee Great Lakes Sports Fisherman purchased, installed and operated net pens in the

[33] WDNR. 2005. Milwaukee River Estuary Walleye Management Plan. PUB FH-512-05. 31p. (http://dnr.wi.gov/topic/fishing/Documents/LakeMichigan/WalleyeRestorationPlan.pdf)
[34] WDNR 2004. An Evaluation of Walleye Population Restoration Efforts in the Lower Milwaukee River and Harbor, Wisconsin, 1995-2003. PUB FH-510-2004 (http://dnr.wi.gov/topic/fishing/Documents/LakeMichigan/WalleyeReport2004.pdf)
[35] http://dnr.wi.gov/topic/fishing/lakemichigan/ManagementReports.html

McKinley Marina for holding Chinook salmon fingerlings overnight to acclimate to the lake water and minimize potential predation by walleye.

Tactic j) Describe walleye movement patterns in the Milwaukee River using radio-telemetry technology.

§Review comment: As part of our walleye assessment program, the Department has radio tagged numerous walleyes in the Milwaukee Estuary and River. Telemetry has shown the walleye move into the rivers at appropriate times in the spring to spawn and move downstream afterwards[36].

Problem 4. Lake sturgeon populations are limited.

Lake sturgeon are the largest and oldest fish species inhabiting the Great Lakes and historically were one of the most abundant fish species in Lake Michigan. They 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, Menominee, Cedar, Ford, Escanaba, Whitefish and Sturgeon Rivers. However, through the last century their abundance has drastically declined.

Although commercial exploitation has been stopped and water quality has improved in many areas, we have not seen a strong rebound in the lake sturgeon population of Green Bay or elsewhere in the Great Lakes. 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. In 2003 the Lake Michigan Committee established a Lake Sturgeon Task Force to develop a lakewide lake sturgeon restoration plan.

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 small. In spite of limited spawning habitat in these rivers there is some natural reproduction. Two Lake Michigan tributaries, the Manitowoc 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 those rivers in May of 2003.

The goals of lake sturgeon management in Green Bay and Lake Michigan are to 1) enhance existing naturally reproducing populations, 2) reestablish self sustaining naturally reproducing lake sturgeon populations throughout their historic range and, 3) develop harvestable surpluses through natural reproduction and provide appropriate opportunities for sport harvest. These goals are consistent with and derived from sturgeon management plans developed in Wisconsin and elsewhere[37,38].

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[36] WDNR 2007. Movement of Walleye in the Lower Milwaukee River and Estuary. PUB FH-513-207 (http://dnr.wi.gov/topic/fishing/Documents/LakeMichigan/WalleyeTelemetryReport.pdf)

[37] 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.

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

Tactic a) Implement Green Bay, statewide, and lakewide sturgeon management plans.

§Review comment: WDNR has not developed a Green Bay sturgeon management plan, however the WDNR Sturgeon Team is re-writing the statewide sturgeon management plan and that document should be completed later in 2013.

Tactic b) Initiate lake sturgeon rehabilitation efforts in suitable Lake Michigan and Green Bay tributaries, including habitat enhancement and stocking.

§Review comment: WDNR has operated streamside rearing trailers on the Milwaukee River since 2007, a Manitowoc River tributary in 2008-09, and the Kewaunee River since 2010. These facilities have strived to stock 1,500 fingerling sturgeon annually. A new FERC license for DePere dam (first dam on the Fox river) has allowed consistent minimum flows in the spring over known spawning locations. FWS and WDNR have investigated spawning activity on the Oconto River and have documented natural recruitment although the known spawning population is likely less than 100 adults. FWS and WDNR have also investigated spawning activity and recruitment on the Peshtigo River. The spawning population there has increased since the early 2000's and is presently estimated at more than 500 adults. Successful natural recruitment has been documented by Purdue University researchers as well as FWS and WDNR on the Oconto and Peshtigo rivers. It is believed that fingerlings remain in this river until late summer and the Peshtigo river fingerling estimate at that time of the year ranged from 70 in 2006 to 950 in 2007. Variable recruitment is likely linked to hydroelectric dam operation. On the Peshtigo river, consistent spring flows have occurred since 2007. The Menominee river is known to have the largest lake sturgeon spawning population. The adult population in the lower river is over 1,500 fish and larval production in 2012 exceeded 10,000 fish. WDNR has secured funding through the USFWS Great Lakes Restoration Act ($118,276) to explore spawning fidelity related to the Fox, Oconto, Peshtigo, and Menominee rivers to determine the proper approach towards the management of the Green Bay sturgeon population. Preliminary results indicated that multiple sub-populations are represented in Green Bay including representation from the Manistee and Muskegon rivers in Michigan.

Tactic c) Coordinate sturgeon rehabilitation work with federal, state and university partners.

§Review comment: WDNR has coordinated with MDNR, FWS, Purdue, UWGB and Michigan State universities on studies related to the Lake Michigan and Green Bay sturgeon populations. These partners have secured multiple grants worth nearly one million dollars towards this work. WDNR staff have participated in Great Lakes sturgeon workshops and utilized this information to improve management of our populations.

Lake Sturgeon rehabilitation has received a lot of attention over the last 5 to 10 years. Numerous agencies and partners have worked together to formulate plans, apply for funding and execute projects.

The streamside rearing projects on the Milwaukee and Kewaunee River work with Michigan DNR, Little River Band of Ottawa Indians, University of Stevens Point and the US Fish and Wildlife Service to implement this project. We have received grants from the Anadromous Fish Conservation Act, Great Lakes Fishery Trust, US Fish and Wildlife and Great Lakes Fish and Wildlife Restoration Act.

Lake Sturgeon work in Green Bay on in the Oconto, Peshtigo and Menominee Rivers has been a collaborative effort among several agencies including the Department, US Fish and Wildlife Service and Michigan DNR. For this work we have also received grants from the sources listed above.

Problem 5. Great Lakes spotted musky are not fully restored in Green Bay.

Great Lakes strain spotted musky once inhabited Green Bay and Lake Michigan. Records indicate 3,000 pounds were harvested in 1884. There appear to have been remnant populations at least into the 1930s. Re-establishment of a musky population would complement other top predators, add stability to the fish community, and provide additional fishing opportunities. The restoration program involves establishing one or more brood lakes where artificially-propagated offspring from well-established populations (we have used the population in Lake St. Clair) can be stocked, grow to maturity, and provide offspring for rearing and stocking in Green Bay. Long Lake, Waushara County, has been used as the brood lake for the program so far, but one or more new brood lakes are needed.

Tactic a) Import eggs from Lake St. Clair broodstock, or elsewhere.

§Review comment: Various sources of eggs have been used to produce Great Lakes spotted musky for stocking in the Fox River and other locations around Green Bay. Outside sources of eggs have included: Indian Spread-northern Lake Huron, St Clair River-Lake Huron, Detroit River-Lake Huron and Georgian Bay-Lake Huron. We have also used eggs collected from broodstock held in Long Lake-Waushara County and from the Fox River-Brown County. Development of broodstock lakes have been hampered because of VHS and other diseases that has hampered our ability to import eggs from other states or provinces. To date WDNR has stocked 145,000 fingerling and 3,800 yearling musky into Green Bay. Although sufficient numbers of musky can be captured to produce all the necessary eggs from the Fox River, several issues continue to exist that require us to import eggs from other locations. First, the fish in the Fox River were produced from only a few females. To prevent a genetic bottleneck caused by spawning too many related fish together, an additional egg source is required. Secondly there is a fish health concern about bringing eggs back to the Wild Rose Hatchery before an acceptable treatment to kill the VHS virus is verified and approved for cool water fish eggs.

David Rowe and Mike Donofrio participated in a study funded by the USFWS under the Great Lakes Fish and Wildlife Restoration Act, entitled, "Great Lakes Spotted Muskellunge Restoration Natural Spawning Effort and Recruitment Evaluation". A draft Green Bay Great Lakes Spotted Musky Plan has been developed and circulated for comment[39].

Tactic b) Work with inland lake groups to establish brood lakes.

§Review comment: Long Lake has been dropped from being the broodstock lake for this project. Three new lakes have been selected, including Elkhart Lake in Sheboygan County and Archibald and Anderson Lakes in Oconto County. Stocking began in 2009.

Problem 6. Yellow perch recruitment has declined in Green Bay and Lake Michigan.

Green Bay. Yellow perch abundance in Green Bay declined 90% between 1988 and 2000. The estimated total biomass of yellow perch in Green Bay dropped from nearly 10,000,000 pounds in 1988 to less than 1,000,000 pounds in 2000. Estimated natural reproduction has been very low since 1991, except for 1998. In the summer of 2001 and 2002 the 1998 year class comprised most of the sport and commercial harvest. Because of the high level of concern over the diminishing yellow perch population in Green Bay the commercial harvest limit was lowered from 200,000 pounds to 20,000 pounds in 2001, and the daily sportfishing bag limit was lowered from 25 to 10. These regulation changes will stay in effect until 2004 when the rule will have to be reassessed.

[39] http://dnr.wi.gov/topic/fishing/lakemichigan/ManagementReports.html

Annual assessment of the perch population is critical in understanding the perch population in Green Bay and to run population models. These models require that data be collected in a standardized manner over many years to function properly. Several different sampling strategies are used to monitor the reproduction and recruitment of yellow perch in the Green Bay fishery and to collect data for the model. Fyke nets are used in April to capture spawning adult perch. A high speed Miller sampler is used to collect pelagic young-of-year perch from May through June. Long-term trends in perch populations are monitored with index station shoreline seining for YOY perch from June through July, and by index station trawling for YOY and adult perch in August.

In addition, a creel survey is conducted to estimate sport harvest of yellow perch from both Green Bay and Lake Michigan. The data collected are used in the calculations of harvest limits and seasons.

The Lake Michigan Fisheries Forum conducted three public workshops in 2002 to explore strategies to address the Green Bay yellow perch problem[40]. Among the questions raised and discussed in the workshops was whether predation by walleye, northern pike, and/or muskies might affect the yellow perch population. The following table summarizes the Forum's recommendations and the actions approved by the Lake Michigan Fisheries Team:

Topic	LMFF recommendation	Action
Yellow Perch	• Assessments – Update Perch Population Model. Evaluate sampling methods. Evaluate spatial coverage. • Data review -- Review and consolidate existing assessment data. Create summaries addressing hypotheses developed by the GB Fisheries Research Group (see below).	The LMFT will tackle these recommendations through a cooperative agreement with the Green Bay Fisheries Resources Office of the USFWS.
White Perch	• Allow increased commercial harvest of white perch • Evaluate effectiveness of lampara seine to harvest white perch.	The LMFT established a committee to explore these recommendations.
Research	• Determine the level of predation on yellow perch by white perch, cormorants, walleye, northern pike, and burbot (in priority order). • Measure the abundance of significant predators and determine their impact on perch. • Create multi-agency research group to develop hypotheses and research agenda to address yellow perch issues in Green Bay. • Develop an assessment plan to evaluate the success of management actions taken to benefit Green Bay yellow perch	The research proposed here is beyond the means of available funding, and should be guided by the recommendations of the proposed Green Bay Fisheries Research Group. The LMFT has taken steps to initiate the GB Fisheries Research Group.

Tactic a) Continue assessments and develop a better index of YOY abundance

[40] Moy, P.B., M.E. Holey, and T.P. Mickelson. 2002. "Green Bay yellow perch workshop results and recommendations: A completion report of the Lake Michigan Fisheries Forum". (available from Bureau of Fisheries Management and Habitat Protection, WDNR).

§Review comment: We continue to perform bottom trawl surveys in August that target YOY yellow perch in Green Bay. These surveys continue to be our most reliable long-term indicator of year class strength. Shoreline seining surveys at index sites continues, but at a reduced effort due to funding and time constraints. Instead of seining each of the 15 index sites three times each summer, we are able to seine each site only one or two times. Miller sampling for larval YOY was discontinued in 2011. Yellow perch recruitment has been steady for the last decade, with peak year classes occurring in 2003, 2005, and 2010. Even with excellent recruitment occurring in Green Bay, commercial and sport harvest has leveled off over the last four years and has not exhibited increases as expected. We believe that the lack of increase in harvest may be because fewer yellow perch are surviving to age-one and beyond.

Tactic b) Pursue Lake Michigan Fisheries Forum recommendations for Green Bay yellow perch management.

§Review comment: A statistical catch-at-age model was developed by USFWS Green Bay staff. Outputs from this model were utilized to increase the sport bag limit from 10 to 15/day in 2005, 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.

Tactic c) Continue to support cooperative research through the Yellow Perch Task Group of the Lake Michigan Technical Committee.

§Review comment: Department biologists have been active participants in the Yellow Perch Task Group (YPTG)[41] and have cooperated with and assisted several investigators and graduate students[42]. Annual reports of the YPTG are prepared for the Lake Michigan Committee. Along with DNR fish health staff, we are involved with research work by UW-Milwaukee researchers on fish health, changes in sex ratios, and decline in male numbers in recent years (specifically hormonal imbalance due to pharmaceutical wastes).

Tactic d) Encourage research into the effects on yellow perch of stocked predators.

§Review comment: We are not aware of any specific study that addresses this issue.

Lake Michigan. Yellow perch are an important component of the Lake Michigan fishery and fish community. Beginning early 1990s, yellow perch population density in Lake Michigan declined dramatically and the age structure shifted toward older fish because of an almost complete lack of recruitment. These trends were reflected in assessment data and in commercial and sport harvests.

The Yellow Perch Task Group of the Lake Michigan Technical Committee was formed in March 1994 (Francis *et al*. 1996[43]) by the Lake Michigan Committee in response to this dramatic decline in yellow perch numbers in Lake Michigan. The Task Group is composed of fisheries managers and researchers from four states and tribal authorities bordering the lake, as well as invited experts from within and outside the Great Lakes basin.

In December 1994, the Lake Michigan Yellow Perch Conference convened at Kenosha, Wisconsin, by the Lake Michigan Committee with help from the Great Lakes Sportfishing

[41] Clapp, D.F. and J.M. Dettmers. 2004. Yellow perch research and management in Lake Michigan: Evaluating progress in a cooperative effort, 1997-2001. Fisheries 29:11-19.
[42] Breeggemann, J. 2011. Evaluation of Methods Used to Estimate Yellow Perch Growth in Green Bay, Lake Michigan. MS Thesis, UW-Stevens Point.
[43] Francis, J.T., S.R. Robillard, and J.E. Marsden. 1996. Yellow perch management in Lake Michigan: a multi-jurisdictional challenge. Fisheries 21(2):18-20.

Council, attracted 152 non-agency participants representing 47 sport-fishing organizations and 21 commercial companies. As a result of discussions held in this conference, the Lake Michigan Committee directed the Yellow Perch Task Group to develop a multi-agency research program to identify the likely cause(s) for the lack of perch recruitment[44]**.** Subsequent funding from Sea Grant and others has supported an aggressive research program. Funding provided through the Great Lakes Fish and Wildlife Restoration Act is supporting the development of a statistical catch at age population model covering all of southern Lake Michigan. In addition to supporting the coordinated research effort, management agencies around the lake modified commercial and sport regulations to limit harvests.

Tactic e) Continue young-of-the-year (YOY) beach seining assessments and investigate and develop an alternate index of YOY abundance.

§Review comment: In southern Lake Michigan waters, WDNR continues to use beach seining in late summer to assess YOY yellow perch abundance at fourteen index stations. Changes in lake level and algal blooms in the summer time have affected the efficiency in beach seining in recent years. However, beach seining data does provide an initial snap shot of year-class strength. In addition to beach seining, two index sites near Milwaukee area, one north of Green Can Reef and the other south of the reef have been chosen to conduct micromesh gill-net surveys in the nearshore waters. Other states, around the lake also have adopted micromesh gill survey in an effort to standardize the methodology.

Tactic f) Continue to conduct winter graded mesh assessment and spawning assessment annually to monitor yellow perch population status in Lake Michigan.

§Review comment: WDNR uses winter graded mesh assessment and spawning assessment at index sites to obtain information on age and size structure, CPE, sex ratios and general fish health condition. We use ten different mesh sizes to capture all size groups. These data are used for further data analysis by population modeling groups.

Tactic g) Continue to support cooperative research through the Yellow Perch Task Group.

§Review comment: See Tactic c, above.

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

§Review comment: Department biologists have cooperated with investigators in quantitative modeling of yellow perch populations and analysis of harvest policy options[45,46]. The long-term data from various assessments are provided to researchers with other agencies to help guide any changes to the current harvest limits. The Department did a thorough review of our yellow perch information in 2010 included running our Wisconsin yellow perch catch at age model. Results from that analyses concluded that there was not a sufficient yellow perch population in Wisconsin's waters of Lake Michigan to justify either an increase in the sport bag limit nor changes to the commercial fishing rules.

Tactic i) Continue to support and develop a southern Lake Michigan yellow perch population model.

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[44] Makauskas, D. and D. Clapp. 2001. Status of yellow perch in Lake Michigan and Yellow Perch Task Group progress report. 21p.

[45] Wilberg, M.J. B.J. Irwin, M.L. Jones. and J.R. Bence. 2008. Effects of source-sink dynamics on harvest policy performance for yellow perch in southern Lake Michigan. Fisheries Research. 94(2008) 282-289.

[46] Irwin, B.J., M.J. Wilberg, J.R. Bence, and M.L. Jones. Evaluating alternative harvest policies for yellow perch in southern Lake Michigan. Fisheries Research 94(2008) 267-281.

§Review comment: Department biologists have been active cooperators in modeling of the Lake Michigan yellow perch population. In addition, we have maintained our statistical catch at age model developed in the early 2000s and run the model every 2 or 3 years. Brad Eggold co-authored a paper on that subject published in 2005[47].

Problem 7. Alewives, at high population levels, may affect native species.

High alewife population levels may have had a negative impact on many native fish populations, including deepwater sculpins, bloater chubs, and yellow perch. Their mode of impact may have included direct predation on early life stages of other species as well as competition for food. A salmon or trout diet made up primarily of alewives is associated with Early Mortality Syndrome, a condition marked by thiamine deficiency in newly-hatched fish. Although alewife population levels are currently relatively low, if left unchecked they could well return to previous high levels. To date the most effective alewife control mechanism found has been the stocking of Pacific salmon. If possible, we would like to sustain alewives at abundances sufficient to support the salmon and trout populations but low enough to allow rehabilitation of native species.

Tactic a) Continue judicious (see discussion under Goal 2, Objective A, Problem 2) stocking of salmon and trout.

§Review comment: The Department continues to stock salmon and trout in Lake Michigan. However, chinook stocking levels were reduced in 2006 by 25% lake-wide and will be reduced again in 2013 by 50% lake-wide. Reductions were instituted in response to a decreased forage base and decreased chinook salmon growth rates. Low abundance of forage is likely a result of substantial levels of naturally recruited chinook salmon and changes in nutrient dynamics caused by invasive species. The Department has actively participated in decisions related to these lake-wide stocking cuts to try and better balance the predator to prey relationships in the lake.

Tactic b) Continue to participate with other agencies in lakewide acoustical forage assessments.

§Review comment: Aside from utilizing the data provided by USGS researchers, the Department does not actively engage in acoustical forage assessments. The newly constructed WDNR RV Coregonus does, however, have an integrated sonar tube for acoustic assessment work. Equipment to conduct acoustic surveys is available from the USGS and they have indicated that acoustic assessments conducted by the Department would be valuable to supplement their efforts. However, to date Department personnel lack the expertise to conduct this work.

Problem 8. We are unsure of the impact of stocked predators on the Green Bay food web.

Public comments to drafts of this plan included a number of questions about the impact of stocking on the native fish community.

Tactic a) Encourage research into the impacts of stocked fish, including walleye, musky, Pacific salmon, rainbow trout and brown trout, on the Green Bay food web.

[47] Wilberg, M.J., J.R. Bence, B.T. Eggold, D. Makauskas, and D.F. Clapp. 2005. Yellow perch dynamics in Southwestern Lake Michigan during 1986-2002. North American Journal of Fisheries Management. 25, 1130-1152.

§Review comment: We are not aware of specific studies that address this issue. We continue to encourage research on this topic, as indicated in the LM/GB Research Priority List developed by the LMFT[48].

Objective C. Develop and evaluate strategies that deal with nuisance species (native and exotic).

Many of the species present in Lake Michigan are non-indigenous. Most were the unintentional result of human activities while some were intentionally stocked. New invasions continue. Some of these non-indigenous species, such as sea lamprey, alewives, and zebra mussels have had undesirable impacts on the ecosystem. Prevention of further invasions is the best protection for the lake ecosystem. Although sea lamprey have been reduced through a federally coordinated program and alewives have been reduced through the stocking of salmon and trout, very few effective control methods are available once non-indigenous species are established.

Problem 1. A number of resident species, native and exotic, are of immediate concern (cormorants, white perch, round gobies, zebra mussels), although their impacts are not well understood.

Cormorant populations have increased and their impact on fish populations is poorly documented and understood. Historically, cormorant populations on the Great Lakes have fluctuated dramatically. Current Great Lakes populations are believed to be the result of range expansion from the Great Plains population. Not documented to be nesting on the Great Lakes until they first appeared on the west end of Lake Superior in 1913, cormorants expanded east across the Great Lakes and by 1945 were nesting on the St. Lawrence River below Lake Ontario. After colonization of the Great Lakes cormorant populations crashed throughout the basin as a result of nesting failures linked to toxic chemicals (primarily DDT/DDE and PCBs). With the advent of restrictions on the production and use of the toxic chemicals, cormorant populations increased exponentially across the Great Lakes basin. Cormorant diets are made up almost exclusively of fish, with each bird eating about one pound of fish per day.

Cormorants are protected and managed by the USFWS under the authority of the Migratory Bird Treaty Act. To address the increasing level of public concern regarding cormorants, the USFWS is in the process of developing a national management plan for cormorants. The Department has participated at all stages of this process and has submitted comments in response to the general scoping meetings and public hearings for the draft EIS. The USFWS is now in the process of preparing the final EIS and national cormorant management plan.

White perch were first found in Green Bay trawl surveys in 1993, and since that time the species has become well established in southern Green Bay waters. White perch is an exotic species that most likely entered the Green Bay system from Lake Erie. White perch are becoming an increasing problem for both commercial and sport fishers. Commercial fishers can spend hours picking white perch out of their yellow perch gill net sets and sport harvesters are catching them in greater numbers. The white perch is a highly desirable species on the east coast and in Ohio and Ontario, Canada, with both active sport and commercial harvests. Until recently, high PCB concentrations in white perch from Green Bay limited commercial exploitation. The recent finding that, in 2001 and 2002, PCB concentrations were in most cases low enough to meet Food and Drug Administration standards for sale in commercial markets, may lead to increased commercial sales. Very little is known about the impacts that white perch are having on other native species in the Green Bay system. Many people believe that white perch are the cause of the yellow perch decline in Green Bay, but that conclusion is not supported by the available data.

[48] http://dnr.wi.gov/topic/fishing/documents/lakemichigan/lakemichigan-greenbayresearchpriorities.pdf

Through the efforts of the Great Lakes Fishery Commission sea lamprey have been effectively controlled in Lake Michigan. The Department collects data on lamprey wounding of lake trout and other species from its own fisheries assessments and from reports submitted by charter captains. Those data contribute to a broader program of monitoring lamprey abundance. There has been an apparent increase in lamprey attacks in recent years, but a planned TFM treatment of the Manistique River may resolve that problem.

Tactic a) Encourage USFWS to adopt a management plan which would include regional population management of cormorants.

§Review comment: A Final Environmental Impact Statement (FEIS) titled "Double-crested cormorant management in the United States" was completed in 2003 by USFWS. This document allows for cormorant damage management activities to be conducted at the local level by individuals or agencies operating under USFWS depredation permits, the existing Aquaculture Depredation Order, or the existing Public Resource Depredation Order. The depredation orders are scheduled to expire on June 30, 2014. In 2012, The USFWS solicited public comments to update the 2003 FEIS to address the expiration date. The possibility of regional population management of cormorants has been considered by the Nongame Migratory Bird Technical Section of the Atlantic and Mississippi Flyway Council. The Wisconsin Cormorant Team, including WDNR Fisheries, Endangered Resources, and Wildlife staff, worked with USFWS and USDA to design and implement the management plan.

Tactic b) Once a final EIS and national cormorant management plan has been developed and published, work within established guidelines to manage cormorant populations of concern.

§Review comment: Beginning in 2006, WDNR has worked with USDA Wildlife Services to manage cormorant colonies on Cat, Lone Tree, Hat, and Jack Islands in Green Bay. Between 2006 and 2010, management primarily consisted of egg oiling. In 2011 and 2012, culling of adult cormorants was implemented to more quickly reach the management goals established for these islands. These goals are set forth in Wisconsin's Environmental Assessment, which was completed in 2009 and include 6,000 pairs on Green Bay islands, including 1000 pairs on Cat Island, 500 pairs on Hat Island, and 500 pairs on Jack Island. In 2012 the peak nest count on Cat, Hat, and Jack Islands was 1910, an 80% reduction from 9441 nests observed in 2007.

Tactic c) Cooperate with a UW-Milwaukee study of the impacts of gobies on smallmouth bass in Sturgeon Bay.

§Review comment: Department biologists have monitored the smallmouth bass populations for many years, but no studies have been completed on this topic.

Tactic d) Support Green Bay Fisheries Research Group recommendations on white perch.

§Review comment: White perch are currently allowed as a limited incidental catch by commercial fishers. Low local market demand and prices have likely kept the incidental harvest at a low amount. In addition to these economic factors, reduced numbers of adult white perch available may also play a role. WDNR trawling surveys have captured similar numbers of young of year white perch from 2003-2012 (averaging 1117 per hour) compared to the 1993-2002 (1101 per hour). However, these surveys have captured consistently low numbers of adult white perch in the last decade, averaging 60 per hour from 2003-2012, down from 409 per hour from 1993-2002. WDNR continues to collect a sample of five white perch for routine contaminant analysis every five years. We are overdue to repeat an expanded contaminant analysis, where we collect a total of 60 samples of fish 6 inches or larger from Grids 901 and 1001 in both spring and fall. This is because we do not encounter very many adult white perch during those time periods in routine surveys.

Tactic e) Continue to support sea lamprey control efforts by providing survey data and advocating continued federal support.

§Review comment: The Department provides wounding data during its lake trout surveys to the USFWS. The Department collects wounding data (number of marks) from salmon and trout at the weirs though the results are not formally written up, at least in recent years. Sea lamprey that are found attached to fish are recorded by charter fishers in their catch reports. These data are reported to the USFWS sea lamprey folks for their reporting. We collect wound information (number of marks) from lake whitefish. These data are not formally reported though requests have been made from USFWS biologists for wounding rates to calculate sea lamprey mortality in whitefish. We continue to advocate for sea lamprey control efforts by the USFWS. The Department provided funds to construct a lamprey barrier on Silver Creek, a tributary to the Ahnapee River. The Department has insured that lampricide treatments on the Menominee, Peshtigo, and Oconto rivers are implemented in late summer to minimize negative impacts on juvenile lake sturgeon.

Tactic f) Implement a program to increase public awareness of the risks associated with aquatic invasive species.

§Review comment: We cooperate with the Department's AIS program[49] and UW-Sea Grant to increase awareness and prevention of invasive species.

Problem 2. New exotic species continue to arrive via ballast water and others may be introduced from the Mississippi drainage through the Chicago Sanitary and Ship Canal.

About 160 species of exotic fish, crustaceans, mollusks, algae, and micro-organisms have been introduced into the Great Lakes in the ballast of ocean going vessels since the opening of the St. Lawrence Seaway. These include zebra mussels, spiny water fleas, and gobies. It has been estimated that almost 800,000 tons of untreated ballast water are legally discharged into the Great Lakes each year. This ongoing biological pollution is one of the most significant long-term threats to Great Lakes sport and commercial fisheries and the ecosystems that support them. The primary obstacles to solving the problem are fragmented legal authority to regulate the discharge and the lack of effective ballast treatment technologies[50].

Presently four species of Asian carp are making their way up the Illinois River toward the Chicago Sanitary and Ship Canal, which will give them access to Lake Michigan. An electricity barrier has been installed in the canal to inhibit movement of fish both upstream and down stream, and recently a backup generator was installed. Discussions are underway about finding a way to fund and install a second electricity barrier, or to find another solution to the problem.

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.

§Review comment: Bill Horns presented this concept at the 136th Annual Meeting of the American Fisheries Society in September, 2006.

Tactic b) Support efforts to block the passage of exotic species into Lake Michigan via the Chicago Sanitary and Ship Canal.

[49] http://dnr.wi.gov/lakes/invasives/

[50] Horns, W.H. 2002. Let's put someone in charge of this – a proposal to create a Great Lakes Ballast Water Commission. J. Great Lakes Res. 28(2):117-118.

§Review comment: The Department has consistently supported these efforts. Wisconsin has joined other states in legal actions to block the inter-basin connection between the Mississippi and Great Lakes drainages[51].

Problem 3. Exotic species move from the Great Lakes to inland waters

Exotic species in the Great Lakes spread into inland waters with deleterious effects on inland ecosystems and game fish populations. Examples are zebra mussels which are now found in inland waters including the Lake Winnebago system and Cedar Lake (Manitowoc County). With the mobility of modern society and boaters and sport fishers traveling between bodies of water, there is increased possibility of unintentional introduction of these non-indigenous species into inland waters.

Tactic a) 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.

§Review comment: This is being accomplished outside by the Department's Aquatic Invasive Species and Law Enforcement Programs. The statewide AIS program devotes substantial funding and manpower to this work through the watercraft inspection program[52]. Water Guards are Deputy Conservation Wardens who work in Limited Term Employment (LTE) positions for the Department of Natural Resources (DNR). They perform law enforcement duties to protect Wisconsin's lakes, rivers and waterways; with their main efforts aimed at ensuring compliance with Wisconsin's laws relating to preventing the spread of aquatic invasive species and aquatic diseases[53].

Tactic b) Support new rules restricting the transportation of live suckers from Lake Michigan tributary streams.

§Review comment: Under rules adopted in response to VHS in the Great Lakes basin, DNR adopted rules prohibiting the transport of live fish away from waters where they are caught, except under specified conditions (see s NR19.05(3), Wisc. Adm. Code).

Tactic c) Explore development of appropriate rules limiting the transport of live fish by anglers.

§Review comment: See Tactic b)

Tactic d) Coordinate outreach activities with Sea Grant and the new state invasive species program.

§Review comment: The Department's AIS program is leading efforts regarding invasive species outreach work. Details are available on the Department's AIS web page[54]. New comprehensive invasive species regulations are contained in Administrative Code Chapter NR 40.

[51] http://www.doj.state.wi.us/news/features.asp#asianCarp
[52] http://dnr.wi.gov/lakes/invasives/Watercraft.aspx
[53] http://dnr.wi.gov/lakes/invasives/WaterGuard.aspx
[54] http://dnr.wi.gov/lakes/invasives/EducationOutreach.aspx

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

This goal expresses our desire for varied sport fishing opportunities in Lake Michigan, but it also acknowledges the dependence of the sport fishery on the productive capacity of the ecosystem. The diverse sport fishery will include brook, brown, rainbow and lake trout, coho and chinook salmon, walleye, smallmouth bass, northern pike, and yellow perch. It will include fishing opportunities in tributaries, from shore and piers, and on the open lake.

Objective 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 six salmon and trout species currently stocked in Lake Michigan. Harvests of salmon and trout during the last ten years were usually within acceptable ranges. The chinook salmon fishery has recovered from the low levels experienced during the early 1990s, and the lake trout harvest has remained within limitations required by the current Lakewide Management Plan for Lake Trout Rehabilitation in Lake Michigan[55]. The ten-year range was used to define targets for the next five years. This mix of six salmon and trout species provides variety in anglers' catch and fishing opportunities throughout the fishing season.

We will continue to sustain this fishery through a stocking program similar to that employed in recent years. The distribution of stocked salmon and trout other than lake trout along the Wisconsin shoreline has been determined primarily in consideration of catch data, previous stocking patterns, and the distribution of fishery access facilities (i.e., ramps, moorings, piers, shoreline, and streams)[56].

Estimated annual sport harvest of salmon and trout from Wisconsin waters of Lake Michigan during 1992 through 2001 and target ranges for the next five years.

	1992– 2001 harvest average	target range	
		Low	high
brook trout & splake	1,867	1,000	5,000
brown trout	43,141	25,000	65,000
rainbow trout	92,797	70,000	120,000
chinook salmon	138,932	85,000	190,000
coho salmon	81,487	50,000	140,000
lake trout	52,573	30,000	82,000

§Review comment: The following estimated harvests during 2002-2011 are shown for comparison with the foregoing 1992-2001 harvest averages and 2003-2013 target ranges.

Annual estimated recreational harvests.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Brook Trout	144	126	1	18	17	62	13	27	0	26
Brown Trout	35,220	23,654	20,918	27,489	17,769	37,947	23,763	15,792	13,029	9,936
Rainbow	74,031	48,548	25,529	48,490	48,420	62,249	41,552	46,529	49,121	75,442

[55] Lake Michigan Technical Committee. 1985. A Lakewide Management Plan for Lake Trout Rehabilitation in Lake Michigan. 12 pp.

[56] Krueger, C.C. and T.R. Dehring. 1986. A procedure to allocate the annual stocking of salmonids in the Wisconsin waters of Lake Michigan. Fish Management Report 127, Bureau of Fish Management, Wisconsin Department of Natural Resources. Madison, WI.

Chinook	275,454	317,619	360,991	418,918	398,905	431,143	256,796	214,621	315,294	169,752
Coho	102,313	50,625	76,944	59,244	56,136	94,677	25,453	42,690	42,445	157,367
Lake Trout	39,865	23,881	14,209	14,139	10,638	19,281	12,763	14,946	17,483	17,788

Problem 1. The number of lake trout available for stocking in Lake Michigan is limited, and the allocation to Wisconsin waters is subject to negotiation with the other states.

Lake trout stocked into Lake Michigan are produced by the USFWS and stocked according to guidelines specified by Lake Michigan Committee. Those guidelines are expressed in the Lakewide Management Plan for Lake Trout Rehabilitation in Lake Michigan[21] and other documents. A recent Consent Decree[57] between the federal government, the state of Michigan, and several tribes in the state of Michigan calls for increasing lake trout stocking in waters of northern Lake Michigan. This will require either moving fish from previously stocked locations to this new area or increasing the total number of fish reared and stocked, and is therefore subject to agreement by the Lake Michigan Committee.

Tactic a) Work with the Lake Michigan Committee to sustain current stocking levels of lake trout in Wisconsin waters in the revised Lakewide Management Plan for Lake Trout Rehabilitation in Lake Michigan.

§Review comment: The Lake Michigan Committee, comprised of agency representatives from Wisconsin, Michigan, Illinois, Indiana and CORA, recently adopted *A Fisheries Management Implementation Strategy for the Rehabilitation of Lake Trout in Lake Michigan*[58]. This strategy specifies the strains, areas and numbers of lake trout to be stocked to achieve a self-sustaining population of lake trout in Lake Michigan. Key components include concentrating on three strains of lake trout (Seneca, Lewis Lake and Apostle Island), stocking yearling lake trout at about 2.74 million per year, concentrating stocking in refuge areas, and developing specific monitoring goals to assess the program's success.

Problem 2. The available forage in Lake Michigan can only support a limited predator population.

The salmon and trout program must recognize the limitations of the ecosystem. When salmon and trout stocking began in Lake Michigan in the 1960s, lake trout had been extirpated and burbot were very scarce. Alewife were abundant and provided plentiful forage for stocked salmon and trout. As the numbers of salmon and trout increased through the 1970s and peaked in the 1980s, forage fish populations changed. Alewife levels declined in the 1980s and remained low but stable during the 1990s. Bloater chubs proliferated and became the most abundant planktivore, but then declined substantially during the 1990s. Diet studies in our waters indicated that salmon and trout continued to feed primarily on alewife and make little use of the bloater chubs as forage populations changed. Concern developed that the high level of stocking was more than the reduced alewife populations could support. The chinook catch declined after 1987, an indication the high sport harvests of the mid-1980s could not be sustained. Bioenergetics models indicate that chinook salmon has a greater impact on alewives than any other species. In 1991 chinook salmon stocking in Wisconsin waters was reduced approximately 25% and the commercial harvest of alewife was prohibited to help stabilize the alewife population. The chinook harvest has gradually increased since then. In 1999 all four states agreed to cut annual chinook stocking by an additional 27% (from 6,000,000 to 4,400,000 fish, lakewide) because of signs of another possible crash of the chinook population. The major

[57] 1836 Great Lakes Treaty Waters Consent Decree.
[58] http://dnr.wi.gov/topic/fishing/Documents/LakeMichigan/LakeTroutImplementationStrategyforLakeMichigan.pdf

concern again was excessive stocking of trout and salmon exceeding the available forage, especially alewives.

Agencies on Lake Michigan have sought to monitor forage fish abundance and to understand how many salmon and trout can be safely stocked without depleting forage species. Since 1973 the abundance of the principal forage species has been assessed annually by biologists with the Great Lakes Science Center (USGS) using bottom trawls. In addition, the Department has recently worked with the USGS and other states to implement a cooperative lakewide forage survey using hydro-acoustics and trawling. Bioenergetics models have been used to estimate the amount of forage fish needed to support stocked salmon and trout and the Lake Michigan Technical Committee is working to identify warning signals of over stocking.

Tactic a) Maintain appropriate salmon and trout stocking levels and species mix, guided by lakewide estimates of forage abundance and modeling of forage consumption.

§Review comment: The Department continues to stock salmon and trout in Lake Michigan. Chinook stocking levels were reduced in 2006 by 25 % lake-wide and will be reduced again in 2013 by 50% lake-wide. Reductions were instituted in response to a decreased forage base and decreased chinook salmon growth rates. Low abundance of forage is likely a result of as substantial levels of naturally recruited chinook salmon and changes in nutrient dynamics caused by invasive species. The Department has actively participated in decisions related to these lake-wide stocking cuts to try and better balance the predator to prey relationships in the lake. Stocking levels are guided by estimates of alewife abundance conducted annually by the USGS and other predator/prey dynamics information (See Tactic b, below).

Tactic b) Support continued efforts to improve models of forage consumption by stocked fish.

§Review comment: The Department has been an active member (including chairmanship) of the Salmonid Working Group (SWG) of the Lake Michigan Technical Committee. The SWG's main goal is to evaluate progress toward achieving the Salmonine Fishery Community Objectives, and is accomplished by implementing a science-based approach for annually evaluating measurable indices of the salmonine and planktivore populations known as the "Red Flags Analysis" (RFA). The RFA tool was developed to provide feedback on the status of the predator/prey relationships in Lake Michigan based on an a priori set of criteria and benchmarks. The Department has provided and continues to provide data used in the RFA analysis and plays a role in the further development and refinement of the RFA. During 2011-2012, the Department actively participated in the Lake Michigan Stocking Strategy. This effort was spearheaded by Michigan State University's Quantitative Fisheries Center and utilized a Stocking Decision Analysis Model[59] to evaluate the risks to the Chinook population associated with certain levels of salmonine stocking. Salmon and trout bioenergetics models were used as one component of the overall Decision Analysis procedure. The result of these efforts was a recommendation to reduce Chinook salmon stocking by 50% starting in 2013, with a feedback process implemented based on weight of 3-year old chinook salmon returning to Strawberry Creek weir to guide future decreases or increases in stocking levels.

Tactic c) Continue to participate with other agencies in lakewide acoustical surveys.

§Review comment: Aside from utilizing the data provided by USGS researchers, the Department does not actively engage in acoustical forage assessments. The newly constructed WDNR RV Coregonus does, however, have an integrated sonar tube for acoustic assessment work. Equipment to conduct acoustic surveys is available from the USGS and they have indicated that acoustic assessments conducted by the Department would be valuable to supplement their efforts. However, to date Department personnel lack the expertise to conduct this work.

[59] http://dnr.wi.gov/topic/Fishing/Documents/LakeMichigan/SalmonidDecisionAnalysis.pdf

Tactic d) Quantify and work to continue to minimize incidental loss of forage species (e.g. alewives in water intakes; bloater chubs in trawls).

§Review comment: Fisheries personnel, as part of Department permitting process, work with various utilities with respect to planning and regulation of water intakes concerning fish impingement and entrainment issues. The incidental catch of bloater chubs in trawls has not been addressed and is still cause for concern as bloater abundance has fallen to what is a likely record low. The reported harvest of bloater bycatch (unmarketable fish) during 2011 was nearly the same as the commercial gillnet harvest. As there is little oversight of the trawl fishery, the bycatch information is unconfirmed.

Problem 3. Accurate sport harvest estimates are needed.

Our knowledge of sport harvests is based on creel surveys funded largely from the sale of Great Lakes Salmon and Trout Stamps and on reports submitted by charter captains. Creel surveys provide needed information about numbers of fish harvested, movements of marked fish, growth and fitness of harvested fish, extent of natural reproduction, and angler effort. 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, but no lakewide synthesis has occurred.

The charter reporting system needs improvement. For example, during 1998, 68 charter boats were contacted at dock by SER fisheries staff. Data collected by DEPARTMENT personnel were used to verify the accuracy of reports submitted by those captains. Despite the fact that the captains were contacted at dock and informed that they were being scrutinized, four of the 68 trips were not reported and data in 15 of the 64 submitted reports contained errors. During 1998 through 2000, surveys were mailed to 3,308 purchasers of two-day Outlying Waters Sport Fishing licenses in Manitowoc and Kewaunee counties. Four hundred fifty-eight survey responses related to charter trips. Non-reported or inaccurate reports were associated with 240 charter trips (i.e., over 50% of charter trips were found to be inaccurate). As a result of the investigation, citations were issued to approximately 25 captains.

Tactic a) Continue conducting sportfishing creel surveys.

§Review comment: The three parts to our sportfishing surveys (creel, moored and charter) have all been conducted over the last 10 years. We continue to get high quality data from all these surveys which provide valuable information needed to manage the sport fishery on Lake Michigan. Creel survey reports are available on line[60].

Tactic b) Expand the creel survey to assess winter and spring brown trout, brook trout and splake harvest and effort.

§Review comment: Several projects over the last 10 years have been written to address seasonal deficiencies in our creel survey program. Unfortunately due to lack of funding no additional creel surveys have been conducted outside of our normal open water survey time (March – October).

Tactic c) Encourage synthesis of lakewide creel results.

[60] http://dnr.wi.gov/topic/fishing/lakemichigan/ManagementReports.html

§Review comment: As part of our collaboration with other states and agencies we provide the US Fish and Wildlife service with summary statistics from our sport fishing surveys. They use that information to create an annual lakewide sportfishing report that they present the March meetings of the Great Lakes Fishery Commission. In addition, we use components of the surveys for specific reasons to analyze parameters of interest. For example, we completed an extensive review focusing on the directed effort and species specific harvest rates of selected ports to determine stocking locations for Chinook salmon.

Tactic d) Work with Law Enforcement in setting up a task force to improve charter fishing reporting, through statutory or administrative code changes if needed.

§Review comment: We provided fisheries and LE staff with monthly reports detailing those charter captains that have not turned in their mandatory monthly reports. Over time and with a lot of effort by LE, we have successfully reduced the list of delinquent captains from 175 in 2009 to 138 in 2011, which insures better data and more timely summary reports about this important fishery.

Problem 4. Population dynamics of salmon and trout are not adequately understood.

Over the last decade the agencies responsible for the management of Lake Michigan have tried to improve our collective understanding of the population dynamics of the trout and salmon populations we manage. Working through the Lake Michigan Technical Committee, a Lakewide Assessment Plan (LWAP) has been developed. Through implementation of this plan, specific attempts are being made to improve our understanding of the early life history, growth, diet, mortality, health, and movement of the three main predators in the lake (chinook salmon, lake trout, and burbot). Other studies by various cooperating agencies and universities have been designed and implemented to gather additional information regarding natural reproduction, energetics, and forage demand.

To date, good progress has been made lakewide with regard to the lake trout and burbot portion of the LWAP but the state of Wisconsin has had difficulty implementing their portion of the chinook assessment because of limited sampling capability. Wisconsin has now acquired and retrofitted a used commercial fishing vessel (the Perca) capable of fishing deep gill nets for the open lake assessment of chinook salmon, and will be able to participate in the chinook assessment portion of the LWAP.

Although burbot are naturally reproducing, chinook salmon and lake trout populations in Lake Michigan are currently maintained by stocking. Over the last decade there is increasing evidence to indicate that naturalized reproduction by chinook salmon (especially in tributaries from the state of Michigan) has reached levels that will impact overall forage fish populations in Lake Michigan. The ability to quantify the contribution of naturalized reproduction by chinook salmon that is occurring in Lake Michigan is important to understanding the overall forage demand of the predator population in Lake Michigan.

The Department has been collecting biological information from chinook salmon at the Strawberry Creek spawning weir since the early 1980s. As both the Besadny Anadromous Fisheries Facility on the Kewaunee River and the Root River Steelhead Facility have come on line, biological information has also been collected from these spawning weirs. These data sets have proved invaluable in tracking chinook, coho, and steelhead age of maturity, size at age, and rate return to the spawning weirs.

Tactic a) Continue lakewide assessments of chinook salmon, lake trout, and burbot, pursuant to LWAP.

§Review comment: The Lake-wide Assessments for lake trout and burbot, but not chinook salmon were conducted annually in spring over the last 10 years[61]. Data were entered in the Lake Michigan database and shared with partner agencies (e.g., FWS and other states). In recent years the DNR has begun focusing on off-shore spawning reefs rather than near-shore sites in order to target those populations most likely to establish and to conserve monitoring resources.

Tactic b) Participate with other states in appropriately designed lakewide estimates of natural reproduction chinook salmon.

§Review comment: For a number of years, Department biologists have cooperated with colleagues in Michigan to estimate natural reproduction. These efforts have involved marking stocked fish with oxytetracycline (OTC), fin clips, or coded wire tags (CWT) and developing estimates of natural reproduction using the ratio of marked to unmarked fish observed by creel clerks and others. Results are reported to the Lake Michigan Committee by the Salmonid Working Group, committee of the Lake Michigan Technical Committee[62]. The marking work has been incorporated in to the larger Great Lakes Fish Mass Marking Program[63].

Tactic c) Maintain weir data sets for Strawberry Creek, the Kewaunee River, and the Root River.

§Review comment: Returns of all salmon and trout species to weirs were monitored, data was entered into the Lake Michigan database, and reported in annual Lake Michigan Management Reports[64]. These long-term data sets are critical to managing Lake Michigan trout and salmon including major management issues such as overall predator and prey balance, brood stock management, and disease management.

Problem 5. Pathogens and early mortality syndrome 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, DEPARTMENT hatchery staff 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* in spawning fish to less than 5% compared to 66% in 1988.

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 B_1) deficiency in the eggs. There is evidence that this deficiency occurs when adult fish consume diets comprised exclusively of alewife. The intestine of alewife contains an enzyme, thiaminase, that breaks down thiamine. Based on these studies, hatchery staff now treat newly fertilized eggs in a thiamine solution which improves fry survival.

[61] http://www.glfc.org/pubs/SpecialPubs/lwasses01.pdf
[62] http://www.miseagrant.umich.edu/downloads/fisheries/stocking/SWG-2011-Report-1985-to-2011_final.pdf
[63] http://hbanglers.com/LHCFAC%20%20reports/The_Great_Lakes_Marking_Initiative__sm.pdf
[64] http://dnr.wi.gov/topic/fishing/lakemichigan/ManagementReports.html

Tactic a) Continue to rigorously test returning feral broodstocks and their progeny reared in the state hatcheries for fish pathogens including: *Renibacterium salmininarum*, *Aeromonas salmonicida*, *Yersinia ruckeri*, *Echinorhynchus salmonis*, *Myxobolus cerebralis*, Infectious Pancreatic Necrosis virus, Infectious Hemorrhagic Necrosis Virus, Viral Hemorrhagic Septicemia virus.

§Review comment: *Aeromonas salmonicida* is a bacterium that causes furunculosis in salmonids. Feral broodstocks are tested for *A.s.* during spawning by culturing the kidney on TSA agar. Prevalence of *A.s.* has increased in Coho sampled at the Root River and the Besadny Facility over the past decade. This may be due to the extension of warm water temperatures into October, as the bacteria thrive at temperatures between 55-65 F. *A.s.* has not been isolated from Coho while they are propagated at state hatcheries and a source of the bacteria in Lake Michigan has not been identified. In some years, prevalence of *A.s.* is as high as 32% and averages 20-25%. Surface disinfection of eggs adequately controls the transmission of the bacteria from egg to fry, however *A.s.* may cause some level of pre-spawning mortality in years when water temperatures are particularly warm.

Ichthyophthirius multifilis, or "Ich" is now a common external parasite of spawning Coho and Seeforellen brown trout; it is sometimes observed on Chinook salmon. Ich infections range from mild to severe, and based on the size of the parasites, the infections appear to be acquired within a few weeks of spawning. The life cycle of Ich is temperature dependent- the cycle is faster at warmer temperatures. Observations of Ich infections may also be related to extended periods of warmer water in the Fall, just prior to spawning. The Ich infections are significant because the parasite creates a hole in the skin, resulting in the loss of electrolytes and increasing the opportunity for pathogens to enter the fish via a break in the skin. This may be linked to the observations of increased prevalence of *A. salmonicida*, above.

In 2007, viral hemorrhagic septicemia virus (VHSv) was isolated from freshwater drum in Lake Winnebago, lake whitefish from northern Green Bay, brown trout near Algoma and smallmouth bass in Little Sturgeon Bay. Since 2007, the virus has been isolated from round goby and yellow perch near Milwaukee and from Diporeia in the central part of Lake Michigan. Increased surveillance for VHS has occurred, particularly for feral broodstocks from which eggs are obtained for the hatchery system. Egg disinfection procedures have been strengthened and so far, there have been no isolations of VHSv in hatchery fish thanks to the dedication and vigilance of hatchery staff.

In Fall 2012, cutthroat trout virus (CTV) was isolated from ovarian fluids and tissues of Seeforellen brown trout during spawning operations at the Besadny facility. This is the first isolation of CTV in the Great Lakes. Based on published studies and hatchery records of affected western US hatcheries, the virus does not cause morbidity or mortality in trout or salmon. However, little is known about the effect of the virus on non-salmonids native to the Great Lakes, or if the virulence of the virus changes when water temperatures warm, such as might be expected as climate changes in the future.

Tactic b) Continue to treat salmon and trout eggs with thiamine.

§Review comment: An early life stage mortality syndrome (EMS) was identified in the 1990s as a major cause of high mortality in fry of salmon and trout in the hatchery. It was found that thiamine deficiency in the eggs was the main cause as a result of consuming alewife. Since EMS still prevails, the hatcheries have been taking several measures to prevent this. The KMSFH uses well water at the weir for fertilization, water hardening, disinfection and transport. All eggs are water hardened in a 1000 ppm thiamine bath right after fertilization. Then the eggs are rinsed and disinfected using iodine solution. The eggs are transported to the hatchery in thiamine bath, disinfected once again at the hatchery with iodine before incubation as a measure of preventing VHS which was identified in Lake Michigan in 2007..

Tactic c) Continue 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.

§Review comment: The hatcheries regularly monitor environmental factors that affect fish in the hatchery. Some of the factors include turbidity, dissolved oxygen changes due to rain events, and water quality. Also, following good husbandry practices, monitoring proper fish density, controlling predators, and avoiding excessive handling will help reduce stress in the hatchery. Furthermore, fish managers are able to adjust the stocking numbers based on the prey availability in order to maintain a balanced and healthy sport fishery.

Tactic d) Continue to monitor the health of non-spawning salmon and trouts in open water according to the lakewide fish assessment protocol (Goal II, Objective A, Problem 4).

§Review comment: Lakewide assessment of Lake Michigan fish communities is conducted annually for lake trout using graded mesh gill net surveys to assess general fish health. A subsample of the catch is used to conduct necropsy and collect tissue samples to evaluate specific conditions of fish health, pursuant to the Lakewide Assessment Plan cited above.

Tactic e) Continue to monitor trend information regarding the percent lipid in fish fillets as an indicator of nutritional stresses.

§Review comment: The fish health and fish toxicology sections continue to monitor trends in percent lipid content as an indicator of nutritional stresses.

Problem 6. Steelhead runs have been erratic.

Wisconsin's Lake Michigan steelhead are managed as a feral broodstock. Steelhead stocked in brood rivers (i.e., the Root and Kewaunee Rivers) are marked with a unique fin clip to allow identification to strain, and marked fish that return to the brood rivers are captured for egg collections. This is in contrast to captive broodstock management, where brood fish are maintained in ponds or raceways. Natural reproduction occurs in some Michigan streams, but not in Wisconsin streams, and is an unknown component of the Lake Michigan steelhead fishery. If this natural component is ignored, then lakewide exploitation of steelhead (number harvested divided by number stocked) averaged 15.5% during 1993 through 2000, and exploitation by Wisconsin anglers (number harvested divided by Wisconsin stockings) averaged 18.6%. Research has been conducted at Michigan State University to better understand the contribution of naturally-reproduced fish.

Since 1988, Wisconsin's Lake Michigan steelhead program has been based on a steelhead management plan[65] that established an annual harvest goal of 25,000 to 50,000 steelhead. To achieve this goal the plan recommended the stocking of three strains of steelhead, Skamania, Chambers Creek and Ganaraska, to provide lake fishing opportunities as well as up to ten months of stream fishing opportunities. The harvest goal has been surpassed every year since 1991. In the years 1993 through 1995 the number of steelhead harvested was more than twice the harvest target. This dramatic improvement in the fishery may be credited to a management plan that clearly gave direction to the steelhead program. The strains selected, improved hatchery practices, and other management activities have produced a product that anglers have utilized and once again made steelhead an important component of the Lake Michigan fishery.

[65] Wisconsin Department of Natural Resources. 1988. Lake Michigan Steelhead Fisheries Management Plan. Bureau of Fisheries Management. Madison, WI. 18 pp.

Despite the success of the past decade of steelhead management, an updated Management Plan was needed to continue the successes of the past program, and to facilitate additional improvements to the steelhead fishery. The Lake Michigan Steelhead Fisheries Management Plan of 1999[66] called for the continuation of the current stocking program with an annual harvest goal of 75,000 to 100,000 steelhead. The 1999 Plan also addressed five issues that arose from the 1988 Plan. The new plan recommended 1) reallocating some of the Root River's steelhead quota to other southeast Wisconsin steelhead streams to decrease angler crowding on the Root, 2) modifying the mix of strains stocked into streams other than the Root and Kewaunee Rivers while maintaining the total number stocked into each, 3) developing and following a spawning protocol for steelhead that would maximize the genetic fitness of each strain, 4) improving near-shore fishing opportunities by stocking domestic rainbow trout, and 5) evaluating the declining steelhead return to the Besadny Anadromous Fishery Facility on the Kewaunee River.

Many anglers believe that poor steelhead runs in Wisconsin tributaries can be attributed to large harvests by trollers in the open lake. The Department has been reluctant to reduce bag limits for trollers because a) the bag limit would have to be reduced to at most two fish per day to reduce the harvest significantly, b) steelhead move throughout the lake so the harvest by trollers in Wisconsin waters may be largely composed of steelhead stocked elsewhere or produced naturally in Michigan streams, and c) other factors, especially flow rates in tributaries, may be much more important in limiting returns to our streams (see Problem 8, below).

Tactic a) Implement the recommendations of the Lake Michigan Steelhead Fisheries Management Plan-1999.

§Review comment: The 1999 Steelhead Management has been implemented to the extent possible. DNR continues to stock streams that have been historically stocked and has reallocated stocking distributions to increase spring fishing opportunities and to reduce crowding. Additionally a nearshore rainbow trout evaluation was conducted resulting in Arlee strain rainbow being stocked. However, the plan was not followed in several areas. Most notably the stocking of Skamania strain steelhead was halted in 2009 because VHS limited our ability to hold adult broodstock at the hatchery, and water quantity and quality problems at Kettle Moraine Springs has limited the total number of steelhead stocked to a level that is below the 500,000 yearling goal and in some years has caused steelhead to be stocked earlier and at a size smaller than called for in the plan.

Tactic b) Continue to closely monitor the steelhead return to weirs.

§Review comment: The number and condition of steelhead returning to both the Besadny Anadromous Fisheries Facility (BAFF) and the Root River Steelhead Facility (RRSF) has been monitored annually for the last ten years and reported in the Lake Michigan Management Reports[67].

Tactic c) Operate weirs to capture as many brood fish as possible throughout the run.

§Review comment: Both facilities (BAFF and RRSF) have been operated on a yearly basis to collect brood fish throughout their spawning run as called for in the 1999 Steelhead Management Plan. In some years weir operation has been shortened because of budgetary constraints. However, eggs were collected throughout most of the run each year.

[66] Wisconsin Department of Natural Resources. 1999. Lake Michigan Steelhead Fisheries Management Plan, 1999. Bureau of Fisheries Management and Habitat Protection Administrative Report No. 44.
[67] http://dnr.wi.gov/topic/fishing/lakemichigan/ManagementReports.html#LMC

Tactic d) Mark all steelhead to enable broodstock collections outside of brood rivers.

§Review comment: Because of limited staff time and funding, in general only steelhead stocked in the Kewaunee and Root Rivers were marked. Under the Great Lakes Mass Marking Program[68], the Lake Michigan Technical Committee is devising a plan to finclip and tag with a coded wire tag all stocked steelhead in Lakes Michigan and Huron to help us determine the extent of natural reproduction, straying and strain survival.

Tactic e) Optimize spawning techniques to maintain genetic diversity in feral steelhead stocks.

§Review comment: We have attempted to follow the Anadromous Feral Broodstock protocol, but recognize the need to review and revise it.

Tactic f) Continue to engage anglers in discussions of bag limits.

§Review comment: This is a topic raised by anglers fairly regularly, but no formal discussions have taken place in regards to changing bag limits for trout and salmon. Lake Michigan Creel survey results indicate that most anglers do not catch a full bag limit of steelhead. To reduce harvest and increase the number of returning steelhead, analysis of the data suggests the bag would need to be reduced to 1 or 2 fish to have a substantial impact.

Problem 7. Coho salmon spawning runs have been erratic.

Coho salmon have been stocked in Lake Michigan by the Wisconsin Department of Natural Resources since 1968 as spring yearlings (14-16 months old) and as accelerated-growth fall fingerlings (9 months old). From 1996 to 1999, we compared coho salmon stocked as accelerated-growth fall fingerlings (9 months old) with others stocked as post-smolt spring yearlings (15 months old) to evaluate 1) return rates of jacks and adults to spawning weirs and to the sport fishery, 2) growth rates, and 3) cost/benefit ratio for each stocking strategy. Results[69] showed that return rates of adults were higher for fish stocked as yearlings than as fingerlings.

Tactic a) Maximize the numbers of coho salmon stocked as yearlings.

§Review comment: Based on the coho fingerling-yearling stocking study[48], the proportion of yearling stocked was significantly increased which in turn increased and stabilized the return rate to the brood streams to a great extent. In addition, the Chinook stocking was reduced by 33,000 in the Root River, Racine in order to increase coho by 33,000. This adjustment helped reduce the competition for space between Chinook and coho, and also help stabilize coho returns and facilitated coho egg collection. Since 2009 only spring yearling cohos are stocked in the Root River.

Problem 8. We lack a systematic long-term research program directed at feral brood stock management.

A number of factors influence returns to spawning rivers, and hence our ability to sustain fisheries for coho salmon, chinook salmon, steelhead, and brown trout. These include factors within our control, including selection of parents for artificial propagation, age and size of fish

[68] http://hbanglers.com/LHCFAC%20%20reports/The_Great_Lakes_Marking_Initiative__sm.pdf

[69] Eggold, B.T. and W.H. Horns. 2001. A comparison of two methods of rearing and stocking coho salmon in Wisconsin's waters of Lake Michigan. North American Journal of Fisheries Management. 21:147-155.

stocked, timing of stocking relative to stream variation, location of stocking, numbers of fish stocked of all species in receiving streams, and harvest regulations.

Tactic a) Develop a systematic strategy for studying controllable factors that influence returns of stocked fish and applying the findings to fish production and stocking practices.

§Review comment: This tactic has not been implemented, but a step in the right direction was taken with the creation the position of Fish Propagation Specialist with DNR support at the University of Wisconsin – Stevens Point.

Objective 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 almost entirely dependent on artificial fish propagation and stocking. Since the stocking of salmon and trout was implemented on a large scale, one new hatchery (Kettle Moraine Springs) and two egg-collection facilities (one on the Kewaunee River and one on the Root River) have been added to the Department's Lake Michigan cold-water propagation system. The Department has also acquired the former USFWS hatchery at Lake Mills, which produces both coolwater fish (walleye, northern pike, smallmouth bass) for inland stocking and, currently, coho salmon for Lake Michigan. The remainder of the substantial increase in the number and pounds of trout and salmon required to meet Lake Michigan stocking quotas has been produced by the existing facilities to the point of overcrowding their rearing capacity, with a subsequent reduction in the quality of the fish produced. These problems have been compounded by increased space needs for the inland feral (wild) trout program, the evaluation of two new strains of rainbow trout for Lake Michigan and reductions in rearing capacity due to facility maintenance needs. Closures of two of the Department’s hatcheries (Hayward and Crystal Springs) in the early 1980s because of funding shortfalls have added to the strain of the propagation system.

Problem 1. Production capacity remains inadequate.

Most of the Department's cold-water facilities were built during the 1920s and 1930s, and most depend on a "gravity-flow" water supply, either from artesian groundwater or surface water sources. Sporadic development has occurred over the years, but nothing significant for Lake Michigan fish production since the Kettle Moraine Springs State Fish Hatchery (SFH) was renovated in the early 1980s and the lake water pipeline project was completed at the Bayfield SFH in the 1990s. Two of our primary cold-water hatcheries serving Lake Michigan, Nevin and Wild Rose, are seeing continuing erosion of their production capability because of the physical collapse of rearing units, reductions in water flow due to failing artesian wells, and environmental protection compliance issues.

Even if we had adequate, structurally sound rearing units at all of our hatcheries, waters supply limits the potential expansion of fish production. At all facilities, the available water supply is being fully utilized through out most of the year. Most of the artesian wells that many of our facilities rely on for their fish rearing water supply do not meet current environmental protection laws. Compliance with these laws will require re-design of the fish rearing water supplies that will likely include abandoning some existing artesian well water supplies and constructing new pumped water supplies. This will mean an increase in maintenance and overhead. The Great Lakes Salmon and Trout Stamp account is not adequate to resolve all facility problems.

In 1997 the Legislative Audit Bureau reviewed fish stocking in Wisconsin and raised concerns about the Department's fish propagation system[70]. Since then the Department has summarized the Department's current production capacity[71], detailed projected needs[72], and outlined plans for meeting those needs[73].

Tactic a) Help clarify and document the need for improved facilities.

§Review comment: HDR Engineering Inc. was hired to prepare a complete analysis of all WDNR Fish Hatcheries. That study was completed in January of 2012[74] and the report is being shared with the Legislature, sportsman groups, and other interested parties.

Tactic b) Identify a facility for near-shore captive broodstock.

§Review comment: This has not been done.

Tactic c) Seek an increase in the Great Lakes Trout and Salmon Stamp and Two-day Sports Fishing License prices to help pay for Great Lakes hatchery renovations.

§Review comment: In 2004, the Great Lakes Trout and Salmon stamp was increased from $7.25 to $10 and the two day Sports Fishing license was increased from $10 to $14. This increase in funding has been set aside to implement some of the recommendations of the HDR study mentioned in Tactic a.

Tactic d) Seek a license fee surcharge to support hatchery renovations.

§Review comment: The HDR Engineering report provides a basis for pursuing this idea in the future, but to date there has been no progress on this item.

Tactic e) Seek an increase in the patron license reimbursement to the Great Lakes Trout and Salmon Stamp fund.

§Review comment: This has been accomplished. Until recently $1.83 was provided to the GL Trout and Salmon Stamp account for every Patron License sold, but in recent years the allocation from Patron license has exceeded $3.

Problem 2. Wild Rose State Fish Hatchery is not meeting production goals.

To address the concerns relating to production goals, ground water compliance issues and major facility needs at the Wild Rose SFH, a partial EMS (Environmental Management System) was developed for the Wild Rose SFH. The product from the EMS was a detailed, 16 page Scope of Work that was used to guide a conceptual engineering study that will be completed early in 2003. That study will address the ground water compliance issues and the major maintenance needs for the facility. The result of this study will be conceptual level plans for the renovation of the facility along with estimates for the work required. The next step will be the

[70] Bezruki, D. P. Hammer, J. Gumley, K Monroe, and D. Varna. 1997. An Evaluation – Fish Stocking Activities – Department of Natural Resources. Report 97-9, Wisconsin Legislative Audit Bureau. Madison, WI. 57 pp.
[71] Department of Natural Resources. 1998. Production capacities of the Wisconsin Department of Natural Resources' Fish Propagation Facilities.
[72] Department of Natural Resources. 1999. An evaluation of stocking strategies in Wisconsin with an analysis of projected stocking needs.
[73] Department of Natural Resources. 2002. The Fish Propagation Action Plan for Meeting Wisconsin's Fish Stocking Needs.
[74] http://dnr.wi.gov/topic/fishing/hatcheries/hatcherystudy.html.

development of a funding package for the Wild Rose renovation.. Once funding has been identified, a major capital development project for the renovation of the Wild Rose SFH will be submitted to the Governor and the State Building Commission.

Tactic a) Complete the Scope of Work and funding package as described above.

§Review comment: Scope of work was completed and funding was secured for the renovation project.

Tactic b) Seek funding under the Joint Restoration Plan and Environmental Assessment for the Lower Fox River and Green Bay Area.

§Review comment: Six million dollars of Lower Fox River and Green Bay Natural Resource Damage Assessment money was allocated to rebuild the Wild Rose Fish Hatchery.

Tactic c) Explore other funding sources, including increasing the price of the Great Lakes Salmon and Trout Stamp.

§Review comment: $2,100,000 of Great Lakes Trout and Salmon Stamp funds was allocated to renovate the Wild Rose Fish Hatchery, but the money was refunded to the Department and remains available for other hatchery improvement work.

Problem 3. Fish quality is sometimes unacceptable.

Fish produced in state facilities may not always meet health or fitness standards, or may be larger or smaller than desired. In part this reflects problems with existing facilities, as described elsewhere, but there is always room for improvement in rearing procedures and strategies. The propagation system is reviewing its practices, procedures and production assignments at all facilities producing fish for stocking in Lake Michigan.

Tactic a) Develop and implement a quality improvement program for fish production by state hatcheries.

§Review comment: In 2012, a Propagation Research Scientist was hired to study ways to improve quality and survival of fish produced in WDNR Fish Hatcheries.

Objective C. Enhance near-shore fishing opportunities.

There is a strong public demand for near-shore fishing opportunities on Lake Michigan for native species such as yellow perch, smallmouth bass and walleye as well as for non-native species of trout and salmon. Currently a variety of near-shore opportunities exist, but often these are available only seasonally, are limited by poor public access or have been reduced by declines in popular fisheries. With reduced yellow perch abundance and salmon and trout moving farther offshore, anglers have requested the Department to evaluate and enhance the near-shore fishery of Lake Michigan and Green Bay.

Experimental stocking of native warm-water and coolwater fish or other strains of salmon and trout might expand near-shore opportunities, however care must be taken to ensure that the effects of these efforts on existing fisheries are understood before proceeding. Construction of additional access points, or improvement of those currently existing, could increase the availability of the near-shore resources to both small boat and pedestrian anglers.

Problem 1. Access to near-shore and tributary fishing opportunities is limited.

Small boats cannot safely make long runs on Lake Michigan to reach productive areas. Pedestrian anglers are restricted to fishing areas of Lake Michigan and tributary rivers that are accessible by foot and where parking is available. Those areas are often crowded. Through acquisition of land and access rights, the Department or others can expand fishing opportunities.

Land purchase and easements have been pursued to improve access to many miles of streams. In the Northeast Region access has been improved at Fischer Creek (Fischer Creek Park), Manitowoc River (old Oslo Dam Site), Kewaunee River (Besadny Fish and Wildlife Area-boat landing and handicap accessible trails), Reibolts Creek (Door County), Whitefish Dunes State Park (handicap trails), Little River (Marinette County), Oconto River (boat ramps) and the Menominee River (boat ramps).

In the Southeast Region the removal of the North Avenue Dam at river mile 3 and the construction of a fish passage facility at the Thiensville Dam at river mile 19 has improved access to 30 additional stream miles for increased fishing opportunities on the Milwaukee River, and 30 miles along its principal tributaries. Removal of the Falk Dam on the Menomonee River and planned removal of 1,000 ft of concrete channel invert will provide an additional miles of fishing opportunities along the Menomonee River and its principal tributaries in 2013. Additional access has been created on Sauk Creek (fishing easements), on the Sheboygan River (boat ramps), on the Milwaukee River at Bender Park, and in Port Washington Harbor. The Department provided input, guidance, and resources to these projects.

Tactic a) Work with the private sector and municipalities for agreements to open additional public fishing areas for pedestrians and small boats.

§Review comment: Several safe harbors in Little Sturgeon Bay- Carmody Park, Egg Harbor, Rowleys Bay were completed or purchased that provide access and poor weather protection for anglers and other water users.

Tactic b) Support Department efforts to acquire lands along Lake Michigan and tributary streams for public access.

§Review comment: Fisheries has supported the purchase of lands along the Lake Michigan shoreline that have provided access or were needed to protect critical habitat areas. These lands have either provided anglers access to the Lake Michigan shoreline or tributary streams. Examples include land along Heins Creek or 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. See Goal I, Objective A, Problem 3, Tactic b for additional information.

Tactic c) Improve public knowledge of existing access.

§Review comment: On the Lake Michigan web page, maps of fishing location on tributary stream have been posted[75].

Tactic d) Continue to remove dams when and where feasible.

§Review comment: Dams have been removed from Silver Creek in Kewaunee County, Duck Creek in Brown County, Milwaukee River in Ozaukee County, and Pigeon Creek, a tributary to the Milwaukee River in

[75] http://dnr.wi.gov/topic/fishing/lakemichigan/TributaryAccess.html

Ozaukee County, to improve upstream fishing while minimizing the movement of invasive species. Other impediments to fish movement, including concrete channel inverts along Lincoln Creek in Milwaukee County and a grade-control structure on Mineral Springs Creek in Ozaukee County have enabled fish passage as well. Removing dams or installing fishways to allow fish passage has become problematic as concerns about dispersal of invasive species and fish diseases have been raised.

Problem 2. Current salmon and trout populations provide limited pier and near-shore fishing opportunities.

For many years as the Lake Michigan salmon and trout fishery developed, there were ample opportunities for anglers on or near-shore to catch a variety of trout and salmon from early spring to late fall. Rainbow trout, brown trout, lake trout, and brook trout, along with chinook salmon, provided a somewhat predictable fishery for anglers. Changes in stocking methods, genetic strains, available forage, and other factors have caused shore fisheries for salmon and trout to decline in many areas. Over the last fifteen years, angler harvest of trout and salmon from near-shore areas of Lake Michigan declined from 11% of Wisconsin's total trout and salmon harvest in 1986 to an average of 6% of the total harvest in since 1990. Because some of the aforementioned factors, especially near-shore forage, are not within our control, it might not be possible to restore near-shore fisheries to past levels.

Restoration of near-shore trout fishing opportunities began in 2001 with the experimental stocking of Arlee strain rainbow trout, obtained from Montana. Arlees have been stocked in Illinois waters of Lake Michigan for a number of years. In 2003 the experimental stocking of Kamloops strain rainbow trout, obtained from Minnesota, will be initiated.

Tactic a) Continue to stock domestic rainbow trout and evaluate their contribution to the near-shore fishery.

§Review comment: Arlee rainbow trout and Kamloops rainbow trout strains were evaluated to determine if they contributed to the Lake Michigan fishery as part of the nearshore rainbow experiment. Returns to the fishery justified continuing the program, but limited to one easily-obtained strain, Arlee. Currently we stock 120,000 Arlee Rainbow trout at nine locations per year. At times these near-shore trout contribute substantially to the small boat and pier fishery.

Tactic b) Implement the Lake Michigan Steelhead Fisheries Management Plan-1999[76].

§Review comment: The 1999 Steelhead Plan has been implemented. However, low groundwater, poor water quality and VHS have limited our ability to meet stocking and size goals outlined in the plan.

Tactic c) Compare the contributions of current strains of brown trout to the near-shore fishery.

§Review comment: No brown trout strain comparisons have been done since the mid 1990's. We are currently comparing the contribution of brown trout that are traditionally stocked near to shore to that of brown trout stocked offshore in Green Bay.

Tactic d) Investigate new strains of brook trout that could increase near-shore angling opportunities.

[76] Wisconsin DNR. 1999. Lake Michigan Steelhead Fisheries Management Plan. Administrative Report No. 44, Bureau of Fisheries Management, Department of Natural Resources, Madison Wisconsin.

§Review comment: No work has been done to identify a new strain of brook trout for Lake Michigan. Returns to creel of brook trout have been poor, and since 2003 no brook trout have been stocked in Lake Michigan.

Problem 3. Cool and warm-water fisheries desired by anglers in Lake Michigan and its tributaries may be limited by habitat and may conflict with other management objectives.

In the lower reaches of some tributary streams the amount of available warm-water habitat has increased because of improvements in water quality and the removal of dams. With the removal of the North Avenue Dam in Milwaukee smallmouth bass have thrived and northern pike are also doing well. Additionally, in the Milwaukee River a number of mature walleye can be found (see Goal 1, Objective B, Problem 3). However, the lower reaches of most Lake Michigan tributaries provide limited habitat for warm-water species, so only small increases in harvest 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 cold-water species. Those rivers not only are host to returning adult fish, but also are the sites of stocking of thousands of fingerlings and yearlings. To mitigate this problem in the Milwaukee River, the Department has worked with the Milwaukee Great Lake Sport Fishermen to deploy net rearing pens outside the mouth of the river, where young chinook salmon can be held prior to release.

Tactic a) Survey and describe existing warm-water habitat (habitat needed by walleyes, northern pike, smallmouth bass, yellow perch, and muskies), and describe what each location can support.

§Review comment: Between 1997 and 2000, standardized quantitative physical habitat assessments were completed along 13.3 miles of the lower Milwaukee and Menomonee Rivers (7.6 miles) and principal tributaries (5.7 miles). Habitat attributes were entered into the WDNR FH Database and habitat quality metrics and indices calculated for each unique stream reach[77,78]. The lower reaches of some tributary streams provide valuable habitat for northern pike, smallmouth bass, and walleye. With the removal of some of the impediments in the last ten years the available habitat has expanded along with improvements in the water quality. Some measures have been taken to remove the contaminated sediments. A large clean-up of contaminated sediments is ongoing on the Fox River between Little Lake Butte DeMorts and Green Bay and within the Menominee River Area of Concern. A combination of dredging and capping has modified river habitat that will be beneficial to warm water fish species. Also, in the last ten years, habitat enhancement projects listed in further detail in Goal I, Objective A, Problem 1, Tactics a to g expanded opportunities to improve warm-water fish habitat. The Department cooperated with Dr. Daniel Daugherty on his project to survey and describe lake sturgeon habitat availability in northern Lake Michigan tributaries (2006 PhD dissertation Purdue University). This effort concentrated on several west shore Green Bay tributaries including Menominee, Peshtigo, Oconto, Pensaukee, Little Suamico and Suamico rivers. Even though this work was mainly associated with lake sturgeon, the results will benefit in the management of other warmwater species. The Department assisted University of Michigan researchers to document the extent of natural reproduction and to identify habitat preferences of muskellunge in Green Bay[79].

Tactic b) Assess impacts of enhanced populations on other species.

[77] Wawrzyn, Will. 1997. North Avenue Dam Feasibility Study- Application of the Fish Habitat Suitability Index Model for Dam Management Alternatives. Wisconsin DNR, Milwaukee, WI.
[78] Eggold, Bradley. 2006. Lake Sturgeon Rehabilitation in the Milwaukee River - Anadromous Fish Conservation Act Final Report. July 1, 2003 – June 30, 2006. Wisconsin DNR, Milwaukee, WI.
[79] Battige, K.D. and J.S. Diana. 2011. Great Lakes spotted muskellunge restoration: natural spawning effort and recruitment evaluation. M.S. Thesis. Univ. of Michigan, Ann Arbor.

§Review comment: WDNR continued to assess the impact on salmonids smolts of stocked walleye in the lower Milwaukee River[22]. Stocking location and stocking timings were tweaked in order to reduce predation impacts. Stomach samples were taken from the predators following stocking. These modifications in stocking have yielded positive results in that no impact was noted for stocked salmon and trout. Also, a net pen is used to hold Chinook smolts for 1-2 days in the harbor water prior to stocking to improve survival.

Tactic c) Continue to stock limited numbers of walleyes in the Milwaukee River and assess potential impacts of a walleye stocking program on other species as outlined in the lower Milwaukee River and estuary walleye restoration plan through 2004.

§Review comment: The 1998 Walleye Management Plan for the lower Milwaukee River was revised and approved in 2005[23]. Approximately 10,000 Great lakes strain extended growth walleye fingerlings were stocked in the lower Milwaukee River annually as part of restoration effort. The goal was to increase the adult population to two per acre. The stocked walleye fingerlings survived, grew well and attained maturity[24]. Stocking continued through 2007 after which the stocking was discontinued because of a shortage of suitable Lake Michigan strain of walleye as outlined in the plan. Our assessment of the impacts of stocking on other species is described under Tactic b).

Objective D. Discourage unethical fishing practices.

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 intentionally snagging these vulnerable fish or retaining foul-hooked fish. We want to give anglers the clear message that unethical angling practices are unacceptable on our waters. 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. Because new regulations must be enforceable, it is essential to involve Department law enforcement staff in the rule development process.

Problem 1. Snagging and foul hooking still occur.

Because illegal snagging often occurs after dark, night fishing is currently prohibited in most Lake Michigan tributaries from October 1 through the first Saturday in May. However, large numbers of salmon and trout begin migrating into those streams before October 1, so an extension of the night fishing prohibition was proposed to address the problems during September. This proposal was rejected in an advisory vote of the Conservation Congress because of concern with the loss of fishing opportunity. It is also felt by some members of Law Enforcement that current exemptions in statutes allowing the sale of eggs from legally caught trout and salmon also facilitate unethical practices and illegal sales. Enforcement is complicated when sport fishers do not speak or read English and may not be familiar with our regulations.

Tactic a) Enforce existing regulations.

§Review comment: LE has developed a warden recruit fall fish run training class and enforcement effort. LE has also implemented a River Watch Program with UW Stevens Point students.

Tactic b) Initiate efforts to educate anglers who do not speak or read English about fishing laws.

§Review comment: In recent years fishing regulationss have been published in both Hmong and Spanish.

Tactic c) Bring before the Conservation Congress an advisory question seeking to repeal or modify current laws authorizing the sale of eggs from lawfully caught trout and salmon.

§Review comment: This has not been pursued.

Problem 2. Some tournaments facilitate waste.

Occasionally tournaments result in unnecessary mortality of fish held by anglers for purposes of verifying the catch.

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

§Review comment: We have worked with other Department Fisheries staff to develop new tournament regulations that reduce waste[80]. Additionally we have worked with tournament organizers to reduce waste by assisting them in finding food pantries and other non-profit groups that accept unwanted fish.

A decision item transmittal was created by LE and FM relating to possession limits and donation of tournament-caught salmon and trout from outlying waters to a recognized food distribution service. This was enacted in June 2011to allow tournament organizers to provide surplus fish to needy recipients.

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

§Review comment: Fisheries staff monitor tournaments (not all) to ensure fish-handling guidelines are being met and to look for excessive levels of mortality. Evidence of disregard for fish release protocols and tournament boat identification methods was noted at some tournaments, and corrective actions have been taken. The Department has received and investigated reports of dead fish following some tournaments.

Objective E. Increase public awareness of positive aspects and benefits of the Lake Michigan sport fishery.

The Lake Michigan sport fishery provides substantial economic, sport, and ecological benefits. It has been estimated that sport fishing on both Lake Michigan and Lake Superior, of which the majority takes place on Lake Michigan, generates over $190 million in retail sales and supports over 4,000 jobs[81]. Department creel surveys estimate that sport fishing on Lake Michigan provides 3 million angler hours of recreation annually[82]. The salmon and trout stocking program reduces the abundance of alewives, thus benefiting native species. Because the salmon and trout remove the largest alewives, the maintain an alewife population that is not only reduced in numbers, but is also made up of smaller individuals with lower PCB concentrations, thus reducing the accumulation of PCBs in predators[83,84].

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[80] http://dnr.wi.gov/topic/fishing/tournaments/

[81] Preliminary data developed by Southwick Associates, Inc. for the American Sportfishing Association and presented to the International Association of Fish and Wildlife Agencies in September, 2002.

[82] Kubisiak, J. Wisconin's 2001 open water sportfishing effort and harvest from Lake Michigan and Green Bay. PUB-FH-830-2002. Wisconsin DNR. 19 pp.

[83] Jackson, L.J. 1997. Piscivores, predation, and PCBs in Lake Ontario's Pelagic Food Web. Ecological Applications, 7(3)991-1001.

[84] Stow, C.A., S.R. Carpenter, C.P. Madenjian, L.A. Eby, and L.J. Jackson. 1995. Fisheries management to reduce contaminant consumption. BioScience, 45(11): 752-758.

Problem 1. The benefits of the Lake Michigan sport fishery are not adequately communicated to the public.

Information about the benefits of the program is not readily available to the general public.

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

§Review comment: We have worked with Sea Grant and the Lake Michigan Fisheries Forum[85]. In order to improve the Forum as an avenue of communication, its membership has been expanded and its purpose and meeting format has been changed.

Tactic b) Continue to disseminate Great Lakes Memo to update information.

§Review comment: A news memo, now called "Great Lakes Fisheries News", has been prepared and mailed to our mailing list 18 times during 2003-2012[86]. The mailing list comprises the names of reporters, shoreline legislators, all commercial fishers, sport fishing leaders, and over 1000 interested individuals who have attended public hearings on sport and commercial fishing rules since 1992. Starting in 2012, we have used the Departments GOV delivery system to send meeting announcements, press releases and information to subscribers to our web pages.

Tactic c) Update information on the Department's web page.

§Review comment: Information about the Lake Michigan fisheries is continually posted to our Lake Michigan web page located at[87]. These pages contain the latest information, news and management reports that we have completed. In addition, stakeholders can subscribe to the main web page and the Lake Michigan Outdoor Fishing Report and will receive updates through the Department's "GovDelivery" system when changes and additions are made to these pages.

[85] http://dnr.wi.gov/topic/Fishing/lakemichigan/LakeMichiganFisheriesForum.html
[86] http://dnr.wi.gov/topic/Fishing/lakemichigan/FisheriesNews.html
[87] http://dnr.wi.gov/topic/Fishing/lakemichigan/index.html

GOAL III. A stable commercial fishery.

The emphasis here is on stability, again with recognition of the limitations of the ecosystem. Within this goal we address the challenges of adequately funding our commercial fishing management program, minimizing mortality of non-target species, improving the catch reporting system, and streamlining administrative procedures.

Objective A. 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 the 2001-2002 license year. Although we recognize that the ecological capacity of the lake is dynamic and changing, we believe that the historic harvest ranges shown in Table 2 are realistic and within the current ecological capacity of Lake Michigan.

Over the past two decades total annual harvest limits have been established for each of the important Lake Michigan commercial fish species. Some of the harvest limits are individually allocated to a specific licensee, generally based on some measure of past performance, and some of the harvest limits are assigned to a group of commercial fishers that have qualified to participate in a "racehorse" fishery.

A recommendation to the Natural Resources Board for the total annual harvest limit for each species is adjusted up or down 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 available 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 (i.e. USGS surveys, commercial catch rates) to develop recommendations.

Annual commercial harvest ranges (1993-2002), current annual harvest limits, and reported harvests from Wisconsin waters of Lake Michigan during the 2001-2002 license year.

	Harvest range during 1993-2002 (pounds)	Harvest Limit (pounds)	2002 Harvest (pounds)
lake whitefish	1,153,143 to 1,800,378	2,470,000	1,453,785
bloater chubs	965,516 to 2,480,665	3,600,000	1,382,459
yellow perch			
Green Bay	18,952 to 400,986	20,000	18,952
Lake Michigan	0 to 288,739	Closed	0
round whitefish	429 to 16,386	75,000	3,584
rainbow smelt	268,990 to 1,677,778	1,000,000	316,076

Harvest limits have been increased recently for lake whitefish and decreased for yellow perch and smelt. These changes have not been sufficient to keep harvests within the target ranges, demonstrating that, while harvest limits are needed to protect declining populations, factors outside our control dominate the Lake Michigan ecosystem and changes in harvest limits are insufficient to completely regulate fish populations.

§Review comment: For comparison with the harvests during 1993-2002, annual reported harvests during calendar year 2003-2011 are shown here:

Annual reported commercial harvests during 2002-2011.

	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
whitefish	1,269,087	1,344,753	1,310,414	1,477,809	1,316,200	1,303,345	1,338,550	1,493,498	1,509,601	1,503,570
chubs	1,360,690	1,186,186	1,124,931	1,265,424	844,731	419,670	252,510	183,523	96,521	39,894
GB perch	18,229	19,110	17,506	22,465	90,473	61,964	65,583	61,509	75,641	49,494
smelt	295,230	102,063	163,416	427,567	625,503	361,763	191,001	23,912	322,750	266,381

Problem 1. Periodic harvest limit adjustments are needed to address natural variations in fish populations.

Harvests of most commercial species, including lake whitefish, yellow perch, bloater chubs, round whitefish, and rainbow smelt, are limited through the establishment of annual harvest limits, which are adjusted in response to changes in fish abundance. The purpose of limiting commercial harvests is to maintain abundant fish populations that can sustain stable commercial fisheries. Annual reproductive success and survival of these species can be highly variable. Also, growth rates can vary in response to competition with other species or in response to environmental conditions. Variable growth rates affect harvest potential. As a result, extensive annual harvest and population information needs to be collected to follow long-term trends, which form the basis for harvest limit recommendations.

The lake whitefish harvest limit has been increased four times since it was first established at 1.15 million pounds for quota year 1989-90 and is currently at a record 2.47 million pounds. Recent dramatic declines in *Diporeia* populations cast doubt on the ability of Lake Michigan to continue to sustain the current whitefish population. After many consecutive years of poor yellow perch recruitment in southern Lake Michigan, the commercial season in Lake Michigan was closed. Similar problems in Green Bay, where the adult yellow perch stock is also declining, lead to the harvest limit being reduced from 300,000 pounds to 20,000 pounds. Lakewide declines in smelt populations, as documented by USGS surveys, have also lead to smelt harvest limit reductions.

The adjustment of commercial harvest limits is often highly controversial. It may be possible in some cases to link harvest limits explicitly to objective routinely-collected measures of fish abundance, thus in a sense automating the process of adjusting them. This would help reduce controversy in this area and help sport and commercial fishers work with the Department toward shared fish population goals.

Tactic a) Maintain and improve current population and harvest assessments.

§Review comment: The Department has continued most historical baseline population and harvest assessments for commercial fish species. Data are summarized in annual Lake Michigan Management Reports, available through our web site. This includes annual assessments at various life history stages of yellow perch in Lake Michigan and Green Bay and lake whitefish in Lake Michigan and Green Bay. In recent years, assessments designed to evaluate the larval and juvenile stages of whitefish abundance have been added to our population assessments. Yellow perch assessments in Green Bay are discussed under Goal I, Objective B, Problem 6. The bloater chub gillnet assessments continue to be carried out by WDNR and in cooperation with the commercial fishers. In 2012 we discontinued our Green Bay forage trawl assessment. This was the only assessment in our toolbox that evaluated smelt numbers/trends to any extent. WDNR staff continues to monitor the commercial whitefish and yellow perch fisheries via dockside monitors. Winter creel surveys continue to be conducted on Green Bay to evaluate the sport harvest of important commercial species such as yellow perch and lake whitefish. The design of the Green Bay winter survey was

modified for the 2009/2010 ice season to allow for better coverage of the developing lake whitefish sport fishery. There is some concern that the harvest tied to guided fishing trips is being underestimated considerably, especially the winter whitefish fishery where the number of guided trips is relatively high. Since 1991, fishing guides are required to report fish taken and other pertinent information during guided fishing trips on Lake Michigan including Green Bay (NR 20.65). However, this requirement has not been adequately pursued. In an attempt to collect this required information, a mail survey was sent to all licensed Wisconsin guides in 2011 to evaluate effort and harvest from the Green Bay component of guided trips. The guide survey has not been formally evaluated but some preliminary results can be reported. Approximately 865 (around 55%) guides responded of the greater than 1500 surveys sent; only 57 of those respondents actually guided on Green Bay. Effort and harvest information have not been collated though there is reason to believe the results may be skewed in any case as a second attempt to collect information from several individuals targeted for their extensive guiding efforts resulted in no response. This harvest information is important for regulating overall whitefish harvest and obtaining reliable catch estimates should continue to be a high priority. However, the process should follow something similar to the Charter Reporting system or a questionnaire in the ALIS program when guides are renewing their license. A mail survey, as was conducted, it likely not the best approach to collect this information though it's the least expensive.

Tactic b) Review and update population models used to estimate fish abundance.

§Review comment: The statistical catch at age model for yellow perch in Green Bay has been updated and run three times since 2000. A SCAA model for the Lake Michigan yellow perch fishery was developed and last run in 2010. Abundance estimates and other information from the Green Bay perch model were used to set commercial harvest limits. The Lake Michigan perch model estimates of abundance were used to evaluate potential sport bag limit changes or the re-opening of the commercial fishery. A SCAA model for the North-Moonlight Bay whitefish stock was developed in 2003 and refined/updated in 2009. The 2009 version was used to set a new quota that is still in place. Recently, we've begun to incorporate data into the model to account for the large sport whitefish fishery in Green Bay and explore integrating fishery independent data into the model.

Tactic c) Review harvest limits and make recommendations every other year, unless the resource is threatened.

§Review comment: Fisheries staff reviews commercial harvest limits annually for the Natural Resources Board. Harvest limits are changed as needed.

Tactic d) Explore ways to automate commercial harvest limit setting.

§Review comment: The Department is currently in the process of exploring ways to automate setting commercial harvest limits. A scope statement[88] has been approved by the Governor and Natural Resources board with the premise to evaluate specific procedures to automate setting harvest limits for bloater chubs. The scope statement also included terms to consider using automatic adjustment of harvest limits to possibly include other species such as yellow perch, lake whitefish, round whitefish, and smelt. We are currently in the process of evaluating procedures to automate harvest limits for bloater chubs and will work with the Lake Michigan Commercial Fisheries Board on the issue.

Tactic e) Review expiring (sun-setting) rules at least 12 months prior to expiration date.

§Review comment: This is not currently an issue, since sun-set clauses have not been employed recently.

[88] http://dnr.wi.gov/about/NRB/2012/June/06-12-3C2.pdf

Problem 2. Fisheries management is complicated because fish populations cross jurisdictional boundaries.

Four states the USFWS and the Chippewa Ottawa Resource Authority (CORA) share management responsibilities for the fishery resources of Lake Michigan. 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. This has been a particular problem for management of the North/Moonlight Bay stock of lake whitefish. The Lake Michigan Committee of the Great Lakes Fishery Commission has assembled a panel of experts which has reviewed current available information with regard to the Lake Michigan whitefish stocks with special emphasis on the North/Moonlight Bay stock. A pilot study to evaluate stock discreteness and ID using detailed scale analysis has been suggested.

Recently the U.S. Federal Government, several Tribes, and the State of Michigan reached agreement in a Consent Decree[89]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.

Tactic a) Encourage and participate in studies of whitefish stock identification.

§Review comment: With Department support and encouragement, UWSP researchers have explored this subject. Department staff cooperated during 2005-2006 on a Great Lakes Fishery Commission grant funded study to genetically identify all known spawning stocks in Lake Michigan. Efforts in Wisconsin waters were made to describe the North/Moonlight Bay stock and the reemerging population in the Menominee River, comparing them to other Lake Michigan spawning stocks. Several reports were generated from this work[90,91,92]. Following up on the genetic stock identification, department staff also cooperated on a Great Lakes Fishery Commission funded study that examined the level of whitefish stock mixing as measured seasonally in commercial catches in WI and MI during 2009 and 2010. Various progress reports, conference presentations, and a MS thesis (Andvik 2012) were generated from this work. Department staff also worked with UWSP to further characterize the genetic makeup and stock origin of the recently recolonized whitefish population in the Menominee River.

Tactic b) Work through the Lake Michigan Committee to obtain accurate annual reports of salmon harvests by tribal fisheries in Michigan waters.

§Review comment: This has not been pursued.

[89] Enslen, Hon. R.A. 2000. 1836 Great Lakes Treaty Waters Consent Decree. 121 pp.
[90] VanDeHey, J.A., B.L. Sloss, P.J. Peeters and T.M. Sutton. 2009. Genetic Structure of lake whitefish (*Coregonus clupeaformis*) in Lake Michigan. Can. J. Fish. Aquat. Sci. 66:382-393.
[91] VanDeHey, J.A., B.L. Sloss, P.J. Peeters, and T.M. Sutton 2010 Determining the efficacy of microsatellite DNA-based mixed stock analysis of Lake Michigan's Lake Whitefish commercial Fishery. Journal of Great Lakes Research, Volume 36, Supplement 1, Pgs 52-58.
[92] Andvik., R.T. 2012. Mixed-stock analysis of Lake Michigan's lake whitefish(*Coregonus clupeaformis*) commercial fishery. Master's Thesis, University of Wisconsin-Stevens Point.

Tactic c) Work through the Lake Michigan Committee to assure that stocking changes implemented in Michigan waters pursuant to the Consent Decree do not negatively affect Wisconsin fisheries.

§Review comment: The new implementation strategy for lake trout rehabilitation, recently adopted by the Lake Michigan Committee, includes strict limits on the numbers of lake trout that will be stocked[93]. This was at the insistence of the WDNR, and reflects our concerns about preserving the forage base for all salmon and trout predators.

Problem 3. Current juvenile lake whitefish surveys do not provide reliable estimates of year class strength.

An independent estimate of lake whitefish year class strength is needed for the determination of lake whitefish harvest limits. Currently, juvenile lake whitefish abundance is estimated using a limited amount of graded mesh gill net (GMGN) fished for one or two weeks in spring. The effectiveness of the GMGN surveys in any given year is affected by weather conditions and the ability of the Department research crew to locate the juvenile lake whitefish during the survey period. The biologists with the Ontario Ministry of Natural Resources (OMNR) successfully use trawls for juvenile lake whitefish stock assessment on Lake Ontario. The Department has recently acquired the trawl design from OMNR and is exploring ways to use the Perca to establish a juvenile whitefish trawl survey.

Tactic a) Explore new techniques to assess juvenile whitefish.

§Review comment: Over the past several years we have been utilizing whitefish catch data incidental to the yellow perch bottom trawls. This has provided a good index of YOY and yearling recruitment. In 2009 we began a bottom trawl assessment for juvenile whitefish near the North/Moonlight Bay spawning grounds. The Green Bay trawling shows promise for older juvenile year class evaluations though the areas and gear would need to be modified. This is worth allocating time and effort to in the future. Our juvenile whitefish small mesh GMGN survey efforts have just about fully transitioned from Lake Michigan to Green Bay as conditions and juvenile fish distribution on Lake Michigan have changed dramatically over the last decade. The GMGN juvenile surveys in Green Bay remain effective as conditions here are generally more stable than in Lake Michigan. This effort is therefore still worthwhile from the standpoint of an index of juvenile recruitment (year class strength) and measure of gill net selectivity. If we are able to transition to a trawl assessment, the gill net catches will be important for comparisons of catch composition. Nevertheless, with the ongoing improvement in water clarity on Green Bay, changes in gill net catchability may lead to a full change in sampling gear. This may ultimately lead to a total shift in sampling gear to something like trap nets since trawl net avoidance has also been a concern. Measuring the composition of the younger age classes in the lake whitefish population has become increasingly important as these fish make up a substantial proportion of the whitefish sport ice-fishery that emerged several years ago.

Problem 4. Contaminants prevent commercial utilization of white perch from Green Bay.

Commercial fishers are authorized to harvest limited amounts of certain specified rough and detrimental fish, including white perch. Until recently their ability to market white perch from Green Bay has been limited, because PCB levels sometimes exceeded the FDA action level (2 parts per million) for sale in commercial markets. However, recent results show that PCB levels in most white perch are now well below 2 ppm, opening the possibility of increased white perch harvests. Concerns about an enhanced white perch fishery include incidental catch of

[93] http://dnr.wi.gov/topic/fishing/Documents/LakeMichigan/LakeTroutImplementationStrategyforLakeMichigan.pdf

yellow perch and other species and the possibility that PCB levels could increase in the future if white perch abundance falls and fat levels return to those of the past.

Tactic a) Explore options for increasing commercial white perch harvest opportunities.

§Review comment: The commercial harvest of white perch is permitted by under contracts authorized by s. 29.424 stats. During 2003-2012 the total reported commercial harvest was 24,076 pounds, with over half of that taken in 2003 and only 387 pounds taken in 2012. The Department explored opening up a commercial harvest of white perch, but when the population decline that initiative was abandoned.

Problem 5. Yellow perch 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 yellow perch 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.

Tactic a) Seek to achieve a 50/50 split, by numbers, over the long term.

§Review comment: WDNR has maintained, in principle, a 50/50 split, by numbers, when allocating sport and commercial harvest limits. This is not fully achieved every year, but over the long term we have done reasonably well. In Lake Michigan, the commercial harvest of yellow perch has been suspended since 1996 as a result of poor recruitment. In 1996, sport harvest was reduced from a daily bag of 25 to the current daily bag limit of 5 yellow perch. In Green Bay, the sport daily bag was reduced from 25 to 10 in 2001, and increased in 2005 to the current daily bag limit of 15. The commercial harvest limit was reduced from 200,000 to 20,000 pounds in 2001, increased to 60,000 pounds in 2005, and increased to the current limit of 100,000 pounds in 2008. 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.

Objective B. Implement recommendations of the Commercial Fishing Task Force.

The Commercial Fisheries Task Force was formed in order to respond to concerns regarding the enforcement of laws and regulations within the commercial fishing industry, and to offer a recommended course of action to the Department of Natural Resources. While there are diverse perspectives among the various users of the Great Lakes fishery, the Task Force had a common commitment to the protection of that resource and the effective enforcement of laws designed to protect it. In performing their work, the Task Force utilized the DEPARTMENT staff report, prepared and submitted to Secretary Meyer on February 5, 1998, and used as a resource by the Natural Resources Board in creating this Task Force. Department staff report identified several areas of concern, including reporting, record-keeping, and licensing; monitoring the harvest; transportation and storage of fish; wholesale fish dealers; penalties, assessments and restitution; and funding. The Task Force held its initial meeting in February 1999, and has worked since that time to frame a set of recommendations that respond to these concerns. The Department's report identified issues and possible solutions as useful points of departure to our group, but the Task Force went beyond this initial thinking to attempt to craft creative solutions to these problems.

The Commercial Fisheries Task Force has reached consensus regarding several important aspects of a new and innovative system for monitoring commercial fishing in Wisconsin. They fully embrace these recommendations and promote them as a package whose elements complement one another to achieve a fair, cost-effective, efficient system that meets the needs of the Department of Natural

Resources and the commercial fishing industry. This system is likely to result in high levels of respectful compliance by almost all fishermen, coupled with an enforceable means of regulation. These recommendations are presented in twelve major sections:

1) Electronic Fish Harvest Reporting System (FHRS).
2) Dockside Inspection Program.
3) Monitoring System (EMS).
4) Repeat Offenders Monitoring System (ROMS).
5) DNR Warden Inspection Authority.
6) Illegal Fish and Fishing, Definitions and Penalties
7) Funding of the Reporting and Monitoring Systems
8) Fleet Reporting System
9) Reporting Requirements for Trawlers
10) Quotas, Landed Fish, and Monitoring of Incidental Catch
11) Additional Recommendations: License Year, Confidentiality of Business Records, Penalties for Trout and Salmon Roe, Reporting Lost Nets
12) Establishment of an Ongoing Monitoring Group

Despite the creative and concerted effort of the Commercial Fisheries Task Force, several aspects of the recommendations will need a lot of work by Departmental staff.

Problem 1. Funding is inadequate to finance all the recommendations of the Commercial Fishing Task Force.

Substantial funds are needed to establish the electronic Fish Harvest Reporting System and provide continued support for wardens to implement it. Fee increases, borne by commercial fishers, and supplemental GPR funding, would cover most costs of the system. Clear and accurate information is needed from DEPARTMENT regarding commercial fisheries costs, so adjustments can be made over time to the system.

Tactic a) Seek General Program Revenues to support Law Enforcement and Fisheries Management efforts related to the management of the commercial fishery.

§Review comment: This recommendation of the Commercial Fishing Task Force appears under section 7 of their report. A very similar resolution was widely supported by the Wisconsin Conservation Congress, but GPR funding of these programs has not been advanced in the Legislature.

Problem 2. Both Wisconsin State Statutes and Natural Resources Administrative codes must be changed to reflect recommendations of the Commercial Fishing Task Force.

The Commercial Fishing Task Force recommended 12 key areas that need to be addressed (see above). Each of these areas requires Wisconsin State Statutes or Natural Resources Administrative code changes. Over 25 separate changes are required to fully implement the recommendations. Moreover, these recommendations are dependent on each other and failure to implement one change to Wisconsin State Statutes may affect several other aspects of the recommendations.

Tactic a) Work with the Natural Resource Board, Legislators, Law Enforcement, and commercial and sport groups to insure that all statute and code revisions are completed.

§Review comment: NR 25 Administrative Code and Chapter 29 Wisconsin State Stats were modified with language that incorporates all 12 key Commercial Fishing Task Force recommendations. The legislative

and rule-making process was completed and on July 1, 2009 rule package FH-13-08 became effective implementing these recommendations.

Tactic b) Allocate time in work planning for Fisheries Staff to complete re-writes of Natural Resources Administrative code and Wisconsin Statute.

§Review comment: Fisheries and LE staff dedicated significant time to complete this task, as outlined above. In addition LE created an LTE fisheries technician position for this work.

Objective 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 fishery have cooperatively made important progress in the past to reduce non-target fish 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.

Problem 1. Commercial fishing gear kills non-target species incidentally.

The incidental catch and kill of non-target fish species continues to occur. For example significant incidental catches of bloater chubs occur in the commercial trawl fishery and lake trout are killed in gill nets set for whitefish and bloater chubs. Trawls disturb benthos, but the impacts of commercial trawling on benthic populations has not been assessed. Non-target kill 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.

Tactic a) Encourage modifications in gear and fishing practices that reduce non-target mortality.

§Review comment: There have been no changes in gear or fishing practices that might reduce non-target mortality. We continue to encourage the use of trap nets instead of large-mesh gill nets in the commercial whitefish harvest in order to limit incidental mortality of lake trout.

Tactic b) Investigate alternatives to gears with high non-target mortality (e.g., conversion of whitefish gill net fishery to trap or pound nets)

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§Review comment: Because of lack of funding and personnel we have not been able to study alternatives or strategies to convert fishery types to less lethal methods.

Tactic c) Consider a year-round 45 fathom depth restriction for chub fishing.

§Review comment: In 2006 the Natural Resource Board adopted NRB Order FH-35-06 which reduced the minimum depth to 45 fathoms during a winter period in both chub fishing zones, while also establishing a 45 fathom minimum depth for both zones during a spring period. Thus, the minimum depth is now 45 fathoms from January 16 through April 25 in both zones. We argued at the time that these changes would reduce lake trout mortality in bloater chub gill nets.

Tactic d) Encourage external studies of the impact of trawls on populations of benthic species.

§Review comment: Because of lack of funding and personnel we have not been able to study the impact of trawls on benthic communities.

Objective D. Address unresolved commercial fishing issues.

There are two long-standing, controversial issues regarding commercial fishing in Lake Michigan – the question of legalizing the harvest of incidentally-caught lake trout in some commercial gear and the length of the trap net season in Zone 3.

Problem 1. Commercial fishers want to legally harvest lake trout.

Commercial fishers in Wisconsin waters are currently not allowed to target lake trout or harvest any lake trout caught incidentally in their gear. All trout and salmon captured in commercial gear must be released, dead or alive. Commercial fishers believe that returning dead lake trout back to the water is a waste of a marketable resource and are requesting some level of legal harvest. There is resistance among the sport fishing public and some Department staff to a change in the law. The Commercial Fishing Task Force formed an oversight committee consisting of Department staff, commercial and sport fishers, and other members to address this issue in depth and make a recommendation. No changes can be effected unless all of the recommendations of the Commercial Fishing Task Force, including enhanced reporting, are successfully enacted.

Tactic a) Explore alternatives to the current law prohibiting commercial harvest of incidentally caught lake trout.

§Review comment: No new research is available on this topic due to lack of funding and personnel. However, this issue has been evaluated by the LMFT. Alternatives that were evaluated could lead to increased harvest and mortality of lake trout by allowing commercial fishers to benefit from catching lake trout and have not been pursued.

Problem 2. Commercial fishers in Zone 3 want to fish trap nets in July and August. They have support from some sport anglers, but many sport anglers oppose trap netting during the summer months.

The current rule regarding the use of trap nets in Zone 3 requires that they be removed from the water from June 28 until Labor Day. The rule resulted from concerns among sport fishers about the incidental kill of trout and salmon in those nets during summer; hazards to safety of sport trollers becoming entangled with their gear in the nets; and the belief that the nets close off a prime sport fishing area during the busy months of July and August. Attempts by Department staff and others to seek a compromise between sport and commercial fishers have so far been unsuccessful.

Tactic a) Open a summer trap net season in part of Zone 3, with restrictions on numbers of nets and requirements for conspicuous marking of nets.

§Review comment: This has been accomplished through a series of rules establishing limited areas where trap nets would be allowed during summer, setting limits on the number of nets, and establishing net marking requirements. The issue is summarized in an April 2011 briefing memo prepared for the Natural Resources Board[94].

[94] http://dnr.wi.gov/about/nrb/2011/April/04-11-3B1.pdf

Objective E. Enhance the viability and stability of the commercial fishing industry.

Problem 1. Department resources are challenged by frequent requests to increase the range of available fishing options.

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) Prioritize requests and encourage external funding for high-priority studies.

§Review comment: We have declined some rule change requests (eliminate diverters in trawls, reduce chub mesh size, allow whitefish trawling) but implemented one (whitefish season change). Our policy regarding special studies has been to require preparation of a study proposal by a mutually-acceptable independent investigator who would conduct the study or obtain outside funding for it.

Problem 2. Commercial yellow perch fishermen on Green Bay are dissatisfied with current gear restrictions.

Currently commercial fishers for yellow perch in Green Bay are restricted by gear type and season for harvest. Prior to 1983, the commercial season for yellow perch included the use of drop nets during a time period from May 20 to June 30. This time period was eliminated because of a large sub-legal, yellow perch catch and mortality problem. There are no mesh size restrictions for drop nets and as a result they were fished with mesh sizes that caught more than half sub-legal fish. This resulted in substantial net retention, handling, and mortality of sub-legal fish. Department biologists believe that a large fraction of sub-legal yellow perch released from drop nets died within 24 hours as a direct result of handling. Additionally, many sub-legal yellow perch that were returned to the water were eaten by gulls before they can recover. Since this portion of the drop net season was closed in 1983, the estimated number of dead yellow perch washed ashore in June has declined 90%. However, Department biologist believe that it may be possible to minimize mortality of sub-legal fish through mesh size restrictions, thus allowing reopening the spring season as requested by commercial fishers.

Tactic a) Consider reopening the yellow perch trap net season with appropriate gear restrictions when the yellow perch population is sufficiently restored.

§Review comment: In 2011, we received a request from one commercial fisher to utilize small trap nets to harvest yellow perch in Green Bay. A review of NR 25 by the WDNR fish and wildlife attorney, conservation warden supervisor, and fisheries staff determined that trap nets are currently legal gear.

The number of commercial fishers utilizing drop nets (defined in Ch. NR 25) during the open season has declined through the years, with only a few commercial anglers utilizing this gear. In 2011, drop net harvest accounted for less than 3% of the total commercial harvest of Green Bay yellow perch. The remaining 97% of the total harvest in 2011 was with gill nets.

Tactic b) Consider alternative gear types that may reduce by-catch and incidental mortality to non-target species.

§Review comment: No alternative gear types have been requested or considered, except for a brief consideration of lampara seines, which were not deemed feasible.

Objective F. Increase public awareness of positive aspects and benefits of the Lake Michigan commercial fishing industry.

Commercial fishing played an important role in the early history of Wisconsin. However, today few Wisconsin residents understand the current commercial fishery. Those residents aware of the commercial fishery often view it as a competing and consumptive use of the Lake Michigan resource. The Wisconsin commercial fishery serves the purpose of harvesting surplus fish to provide a human food product. Increased awareness would foster a better understanding of the role a regulated commercial fishery that can play in the management of Lake Michigan.

Problem 1. The public is poorly informed about the Lake Michigan commercial fishery.

Although Wisconsin has had a commercial fishery in Lake Michigan since the 1800s, the general public does not have a good understanding of the current commercial fishery or Department management of it. Frequently, the only time the general public sees or hears information in the media regarding the commercial fishery is in reference to a conflict with the sport fishery.

Tactic a) Provide information that describes the fishery, illustrates management goals and accomplishments, and explains the need for intensive regulations.

§Review comment: WDNR personnel attend meetings with various sport and commercial fishing organizations and discuss the fisheries management goals, involve public to obtain their input, and update the status of the fisheries on a regular basis. Information is also provide through the program's web page (with a GovDelivery option)[90] and through periodic hard copy "news memos" mailed to over 1000 individuals[95].

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

§Review comment: The WDNR has worked very closely with Sea Grant and the Lake Michigan Fisheries Forum to disseminate information on the Lake Michigan fisheries as well as obtain input to manage the resources effectively. Regular meetings are held time to time to discuss the issues and advisement, for example, commercial trapnet marking. The FORUM structure has been revised. See Tactic II.E.1.a. We worked extensively with Sea Grant to develop educational materials related to the summer trap net season in Zone 3. These materials were in the form of web postings, brochures and posters.

Tactic c) Continue to disseminate Great Lakes Memo to update information.

§Review comment: We summarize Lake Michigan fisheries issues time to time and disseminated the news letters to thousands of users to keep the public up to date. See Tactic II.E.1.b.

Tactic d) Update information on the Department's web page.

§Review comment: Lake Michigan has a dedicated page on the WDNR web site which contains summary information on various assessments, fish health, outreach activities, contaminant advisories, research vessel, and research activities[96]. All interested parties can sign up to receive updates regularly through email. See Tactic II.E.1.c.

Problem 2. Sport and commercial fishing gear are sometimes in physical conflict

[95] http://dnr.wi.gov/topic/Fishing/lakemichigan/FisheriesNews.html
[96] http://dnr.wi.gov/topic/Fishing/lakemichigan/index.html

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 fisherman don't mark their gear as clearly as they could, especially when it is in high use areas of the lake where the potential for conflict is great.

Tactic a) Educate boaters and sport fishers about commercial fishing gear and how to avoid it through literature and presentations to fishing clubs. Trap nets and their markings are illustrated in the Wisconsin fishing regulations pamphlet.

§Review comment: The Department has worked closely with Sea Grant to develop and publicize educational materials.[97,98]

Tactic b) Encourage dialogue between sport and commercial fishing groups.

§Review comment: We established the Lake Michigan Fisheries Forum to help facilitate this dialogue.[99]

Tactic c) Require standardized marking of trap nets.

§Review comment: After a 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.

[97] http://www.seagrant.wisc.edu/Home/Topics/FishandFisheries/Details.aspx?PostID=396
[98] http://dnr.wi.gov/topic/fishing/greatlakes/trapnets.html
[99] http://dnr.wi.gov/topic/fishing/lakemichigan/LakeMichiganFisheriesForum.html

GOAL IV. Science-based management.

Effective fisheries management requires well trained staff, adequate funding, inter-jurisdictional cooperation, public involvement, timely communication of information, and the involvement of trained scientists. Taken together, we refer to this as science-based management.

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

Problem 1. Continuing education is necessary for effective 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) Develop a continuing education plan for field, hatchery, and law enforcement staffs.

§Review comment: Continuing education is one element of annual performance evaluations, in which staff and supervisors plan specific training activities as needed, but we have not developed a continuing education plan. Examples of training topics include population modeling and fish stock assessment, large-boat safety, trawling technology, fish aging. Numerous opportunities arise through our work with other Great Lakes fisheries agencies, but often out-of-state travel restrictions limit staff participation. Lake Michigan fisheries staff regularly participate in the statewide fish age estimation workgroup with the goal of improving fish aging techniques. All new fisheries staff completed a new employee orientation consisting of 5-6 training sessions around the state and covering the gamut of Wisconsin fisheries issues.

Problem 2. Vessels need annual maintenance.

The Department's Lake Michigan fisheries program operates two research and assessment vessels, the Perca and the Barney Devine. They require maintenance and the 60+ year-old Barney Devine is nearing the end of its service life.

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

§Review comment: Fisheries staff have planned, budgeted and maintained our research vessel fleet though a combination of project money and special allocations. Project money has been used for the annual maintenance of the boats while special allocations have been used for more expensive items like new radar systems, hull surveys, etc. Both our current research vessels, the RV Gaylord Nelson and RV Coregonus, have specific schedules for maintenance that are followed to insure the long-term viability of both boats.

Tactic b) Acquire a replacement for the Barney Devine.

§Review comment: Over the last 10 years, Fisheries staff have planned, budgeted and built a new research vessel for our program called the RV Coregonus. The RV Coregonus has an overall length of 60 feet with a 16-foot beam (width) and weighs approximately 34tons fully loaded. It was designed to continue to meet the needs expressed by fisheries staff including important gill netting work, trawling and hydroacoustic work, SCUBA diving surveys, and deploy equipment like underwater cameras, remotely operated vehicles (ROVs), and various water sampling equipment. It will allow us to more efficiently and safely carry out our Lake Michigan fisheries research activities.

The design for the Coregonus incorporates many features that will dramatically improve vessel and crew safety. The R/V Coregonus will have four watertight bulkheads and five watertight compartments, which would keep the vessel afloat if the hull was punctured. There is an automatic fire suppression system in the engine compartment. Cold water survival suits, a U.S. Coast Guard approved 10-man life raft, and USCG approved emergency positioning beacon (EPIRB) are all part of the vessel safety equipment. The pilot house windshield and the open rear deck are designed so they can be heated to prevent icing during periods of freezing spray. An onboard deck crane will facilitate loading and unloading of equipment and samples.

Objective B. Obtain more external funding for the program.

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.

Problem 1. Insufficient staff time is devoted to obtaining outside funding.

Despite the potential value of external funding, insufficient staff time is spent understanding and pursuing the funding opportunities.

Tactic a) Dedicate staff time to track funding opportunities and obtain external funding.

§Review comment: Fisheries staff have been directly and indirectly involved in a variety of externally-funded projects. A listing of the larger scale projects that benefited Lake Michigan and tributary fisheries and their habitat since 2003 include:

- Great Lakes Spotted Muskellunge spawning study - GLFRWA ($125,000)
- Lake Sturgeon, Milwaukee and Kewaunee Rivers – Great Lakes Fishery Trust ($200,000), GLFWRA ($100,000)
- Lake Sturgeon, Milwaukee River – Anadromous Fish Conservation Act ($16,400), GLFC ($40,000)
- Coho Salmon - NOAA ($3,500)
- Lake whitefish - Genetic Stock Identification – Great Lakes Fisheries Commission ($150,000)
- Lake whitefish - Mixed-stock Analysis of Lake Michigan's Lake Whitefish Commercial Fishery And Historical Integrity of Resolved Genetic Stocks – Great Lakes Fisheries Commission ($127,000)
- Lake Sturgeon, Green Bay - GLFRWA ($118,276)
- Fox River Natural Resources Damage Assessment --
  - Pensaukee Marsh Northern Pike Habitat Preservation, Oconto County ($30,000)
  - Sensiba Wildlife Area Northern Pike Spawning Area and Waterfowl Enhancement Project, Brown county ($35,000)
  - South Bay Marina Habitat Enhancement, Brown county ($98,000)
  - Spotted Musky Population Enhancement, Wild Rose Hatchery ($615,400)
  - Lake Sturgeon Habitat and Population Enhancement, Marinette county ($42,000)
  - Duck Creek Dam Removal and Fish Passage Installation, Brown county ($15,000)
  - Yellow Perch Limiting Factors Analysis, Green Bay ($381,108)
  - Wild Rose Fish Hatchery Renovation ($6,000,000)
  - Walleye Rearing Pond construction, Kewaunee county ($50,000)
- Trinity Creek Wetland and Northern Pike Spawning Habitat - WI Coastal Management ($50,000), WDNR NPS ($373,000), WDNR Flood Control ($200,000), EPA Great Lakes ($50,000), MMSD ($27,000), City of Mequon ($652,000)

- WI Lutheran Seminary Dam Removal, Pigeon Creek - WDNR Env. Damages ($38,000)
- Chair Factory Dam Removal, Milwaukee River - WDNR Dam Safety ($100,000)
- Waubeka Dam Removal, Milwaukee River - WDNR Dam Safety ($100,000)
- Milwaukee Estuary Spawning Reef - EPA ($52,000), Walleyes for Tomorrow ($15,000), USFWS ($9,500)
- Northern Pike, Pensaukee River Watershed low order streams – Wisconsin Coastal Management Program ($11,554)

We also work with partners in cooperative projects.

- Thiensville-Mequon Fishway construction phase– USFWS ($75,000), EPA GL ($100,000), WI Coastal Mgmt. ($100,000), City of Mequon ($105,000), and Village of Thiensville ($32,000).
- Pike R. Petrifying Springs and Kenosha Country Club Dam Removals - Fund for Lake Michigan ($336,000), WDNR Dam Safety ($30,000), Sustain Our Great Lakes ($150,000), Kenosha County ($104,000), USFWS ($75,000), Root-Pike WIN ($75,000).
- Ozaukee Co Fish Passage Program inc. Milwaukee R. Lime Kiln Dam, 2 tributary dams, 40 culverts, other barriers removed NOAA GLRI ($4,700,000).

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

Lake Michigan shares management authority and responsibility with other jurisdictions. The Lake Michigan Committee and Lake Michigan Technical Committee provide the appropriate forums for resolution of issues of common concern.

Problem 1. Participation in lakewide committees is not given high enough priority.

Local, immediate demands on the time and attention of Department biologists often detracts from effective participation in and leadership of the Lake Michigan Committee and Lake Michigan Technical Committee.

Tactic a) Use the annual performance evaluation process to reaffirm and highlight commitments to lakewide committees.

§Review comment: The performance evaluation process is used in this way. Funding and travel restrictions often limit staff participation on lakewide committees.

Tactic b) Prepare annual report summaries to share with Lake Michigan Committee.

§Review comment: Annual report summaries were completed and shared with the Lake Michigan Committee. The annual Lake Michigan Management Reports are available on our web page under the tab "Reports to the Lake Michigan Committee"[100].

Objective D. Continue and expand partnerships with sport and commercial fishers, and others.

The Lake Michigan Fisheries program has established important working relationships with the University of Wisconsin Milwaukee's WATER Institute, 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, and other things.

Problem 1. UW/DNR position requires continued funding commitment and in-kind support.

[100] http://dnr.wi.gov/topic/fishing/lakemichigan/ManagementReports.html

The Department and the University of Wisconsin jointly fund a Senior Fisheries Scientist housed at the UWM's WATER Institute in Milwaukee.

Tactic a) Continue to provide in-kind support for the position.

DNR biologists support WATER Institute (now School of Freshwater Sciences) activities to the extent possible. Fish samples have been collected from Green Bay yellow perch trawling surveys for John Janssen Fish samples have been collected and submitted to John Janssen from incidental catches of several species during GMGN lake whitefish surveys on Green Bay. Incidental catch including burbot, round whitefish, longnose sucker, white sucker, longnose dace, and Spottail shiner from Lake Michigan yellow perch, and lake trout assessments have been provided to John Janssen.

Tactic b) Highlight products from the position.

§Review comment: John Janssen provides annual summaries of his work, including publications and grants[23]. The Department has not taken further steps to highlight those accomplishments .

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

§Review comment: John Janssen has been very successful in developing collaborative projects, as reflected in citations elsewhere in this report.

Problem 2. The resources and energy of private partners are not being fully utilized.

Sport fishers, commercial fishers, and others might contribute more to the Lake Michigan fisheries program if common interests were identified and appropriate arrangements were made.

Tactic a) Sustain and encourage the Lake Michigan Fisheries Forum.

§Review comment: The Lake Michigan Fisheries Forum was established about 10 years ago with 17 original members. The charge to that group was to advise the Department and provide consensus on a variety of issues brought before the group. During these 10 years, the Forum commented on a variety of tough issues including yellow perch quota and sport fish limits on Green Bay, white perch issues on Green Bay, summer trap net seasons on Lake Michigan, summer trap net locations and others.

Recently, the Lake Michigan Fisheries Team decided that they wanted to increase the information both in quantity and quality provided to the public. This warrantied several internal changes and a shift in membership and focus of the Lake Michigan Fisheries Forum. The group is being reformulated to accommodate more members and shift to an informational driven group that provides the Department with comments on a variety of fisheries issues on Lake Michigan. We believe that the new Forum will be a more useful mechanism to distribute and engage the critical sport fishing stakeholders on Lake Michigan.

Tactic b) Interact with sport and commercial fishing organizations individuals and groups to identify and develop opportunities for cooperative work.

§Review comment: We're expanding the LMFF membership to interact more with various user groups. The department has interacted with and received assistance from various sport groups in the Green Bay area for constructing walleye spawning reefs, establishing the Great Lakes Spotted Musky rehabilitation effort and the stocking of sportfish. Several sportfishing groups cooperate at the Root River and Besadny Fall Open houses providing assistance with various demonstrations and interactive activities designed to educate and engage the public. Various individuals, primarily local anglers, have assisted annually with fall operations at the Strawberry Creek Weir. This includes not only daily egg take operations but efforts made by members of

the Door County Fish Farm and Game Club to dress fish for donation to several local food pantries over the last several years. We have received assistance financially from sportfishing groups in the Green Bay area including Walleyes for Tomorrow, Fisheries Forever, and Brown County Conservation Alliance. This assistance has enabled us to purchase equipment for fisheries management activities including 2500 floy tags used to tag lake whitefish in the Menominee River (Fisheries Forever). Staff have worked closely with the Northeastern Wisconsin Great Lakes Sport Fishermen over the course of many years to cooperatively run the Manitowoc Zoo Pond that raises trout and salmon for the Lake Michigan Fisheries program. We cooperate with the Marinette/Menominee Great Lakes Sportfishing Club and Green Bay Chapter of Trout Unlimited during annual workdays to floy tag brown trout that are purchased by those groups and stocked into Green Bay waters. We have worked cooperatively with Riveredge Nature Center since 2006 to raise and stock 1,500 Lake Sturgeon on an annual basis. Many sport groups have supported hatchery and fisheries management activities in southern Wisconsin including Ozaukee, Milwaukee and Kenosha Chapters of GLSF, Salmon Unlimited of Wisconsin, SE Trout Unlimited and many others. Their financial contributions have assisted the Department in many activities including fish production, habitat rehabilitation projects and critical pieces of equipment. In addition, members of Salmon Unlimited of Wisconsin provide volunteers for the Root River Steelhead Facility that open and close the viewing window on a daily basis which provides members of the public a clear view of fish in the facility. We have also worked closely with Milwaukee GLSF on stocking primarily chinook salmon in net pens in the Milwaukee Harbor. Several commercial fishermen in Wisconsin waters of Lake Michigan and Green Bay have assisted the Department in our annual assessments of lake whitefish and bloater chubs by either providing fish from their catch and/or setting our assessment nets as part of the normal commercial fishing sets. This has provided invaluable information on these species.

Objective E. Communicate study results, policies, etc, in a timely way.

In order for the interested public, local officials, and legislators to appreciate value and needs of the Lake Michigan fisheries program, it is essential to aggressively communicate what we do. In order to maintain high professional standards, it is essential for Department biologist to communicate findings to other professionals.

Problem 1. Department biologists collect a great deal of data, which is summarized in informal reports but rarely published.

Unfortunately, biologists often find insufficient time and support for formal writing of results and findings.

§Review comment: Department biologists authored or co-authored several published papers and presentations at professional meetings:

- Caroffino, D.C., T.M. Sutton, R.F. Elliott, and **M.C. Donofrio**. 2010. Predation on Early Life Stages of Lake Sturgeon in the Peshtigo River, Wisconsin. Transaction of the American Fisheries Society. 139:1846-1856.
- Homola, J.J., K.T. Scribner, R.F. Elliott, **M.C. Donofrio**. J. Kanefsky, K.M. Smith, and J.N. McNair. 2012. Genetically derived estimates of contemporary natural straying rates and historical gene flow among Lake Michigan lake sturgeon populations. Transaction of the American Fisheries Society. 141: 1374-1388.
- Bott. K., G.W. Kornely, **M.C. Donofrio**. R.F. Elliott, and K.T. Scribner. 2009. Mixed-stock analysis of lake sturgeon in the Menominee River sport harvest and adjoining waters of Lake Michigan. North American Journal of Fisheries Management. 29: 1636-1643
- Caroffino, D.C., T.M. Sutton, R.F. Elliott, and **M.C. Donofrio**. 2010. Early life stage mortality rates of lake sturgeon in the Peshtigo River, Wisconsin. North American Journal of Fisheries Management. 30: 295-304.
- **Donofrio, M.**, K.T. Scribner, R.F. Elliott, E. Baker, B. Sloss. 2012. Adult lake sturgeon movements associated with the large rivers of Green Bay, Lake Michigan. Oral presentation at American Fisheries Society annual meeting. St Paul, MN.

- **Donofrio, M**. 2008. Harvest summaries and population characteristics for lake sturgeon from hook and line fishery on the Menominee River, WI. , 1998-2008. Michael Donofrio, WDNR Fisheries Management Report No 154, 2008.
- 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.
- **Paoli**, T.J. 2009. Decline of brown trout in a changing Green Bay ecosystem. Oral presentation joint Wisconsin, Minnesota, and Ontario American Fisheries Society chapter meeting. Duluth, MN.
- Diebel, M., **T. Paoli**, P. McIntyre, D. Oele, E. Childress, J. Maxted, A. Somor, A. Shaw, and N. Van Helden. 2011. Limiting factors for northern pike recruitment from Great Lakes tributary networks. Oral presentation at American Fisheries Society Annual Meeting. Seattle, WA.
- Breeggemann, J., D. Isermann, and **T. Paoli**. 2011. Use of scales, otoliths, and anal fin spines to back-calculate lengths at age for yellow perch. Oral presentation at American Fisheries Society Wisconsin Chapter Annual Meeting. Stevens Point, WI
- Oele, D.L., M. Diebel, **T. Paoli**, P.B. McIntyre, E.C. Childress, J. Buckingham, J. Maxted, A. Somor, A. Shaw, and N. Van Helden. 2012. Otolith microchemistry as a life history tracer, a case study with northern pike in Green Bay, WI. Oral presentation at joint Wisconsin and Michigan American Fisheries Society chapter meeting. Marinette, WI.
- Oele, D.L., M. Diebel, **T. Paoli**, P.B. McIntyre, E.C. Childress, J. Maxted, A. Somor, A. Shaw, and N. Van Helden. 2011. Modeling spawning habitat suitability for northern pike in tributaries of Green Bay. Oral presentation at 72nd Midwest Fish and Wildlife Conference, Des Moines, IA.
- VanDeHey, J.A., B.L. Sloss, **P.J. Peeters** and T.M. Sutton. 2009. Genetic Structure of lake whitefish (*Coregonus clupeaformis*) in Lake Michigan. Can. J. Fish. Aquat. Sci. 66:382-393.
- VanDeHey, J.A., B.L. Sloss, **P.J. Peeters**, and T.M. Sutton 2010 Determining the efficacy of microsatellite DNA-based mixed stock analysis of Lake Michigan's Lake Whitefish commercial Fishery. Journal of Great Lakes Research, Volume 36, Supplement 1, Pgs 52-58
- Wilberg, M.J., J.R. Bence, **B.T. Eggold**, D. Makauskas, and D.F. Clapp. 2005. Yellow perch dynamics in Southwestern Lake Michigan during 1986-2002. North American Journal of Fisheries Management. 25, 1130-1152.
- **Thompson, J.T., P.S. Hirethota and B.T. Eggold**. 2005. A Comparison of Elastomer Marks and Fin Clips as Marking Techniques for Walleye. North American Journal of Fisheries Management. 25, 308-315.
- Muzzall, P.M., **B.T. Eggold,** and **R. J. Fahey.** *2006.* Helminths of Pond-Reared Walleye from Wisconsin. Journal of Parasitology: April 2006, Vol. 92, No. 2, pp. 408-410.
- Kapuscinski, K. L., Zorn, T. G., Schneeberger, P. J., O'Neal, R. P., & **Eggold, B. T**. (2010). The status of Lake Michigan walleye stocks. *Technical Report. Great Lakes Fishery Commission*, (69).
- Dexter, J. L., **B. T. Eggold**, T. K. Gorenflo, **W. H. Horns**, S. R. Robillard, and S. T. Shipman. "A fisheries management implementation strategy for the rehabilitation of lake trout in Lake Michigan." (2011).
- **Hansen, S.** 2010. Vital Statistics for Lake Whitefish in Wisconsin Waters of Lake Michigan and Green Bay. Oral presentation at Wisconsin American Fisheries Society Chapter Meeting. Green Bay, WI.
- **Hansen, S.** 2012. Lake Whitefish in the Menominee River: Assessing a Re-Colonizing Population. Oral presentation at the meeting of the Wisconsin and Michigan chapters of the American Fisheries Society. Marinette, WI.
- **Hansen, S.,** R. Andvik, J. VanDeHey, and B. Sloss. 2012. Re-colonization of Lake Whitefish in the Menominee River, Green Bay. Oral presentation at 142nd Annual Meeting of the American Fisheries Society Annual Meeting. St. Paul, MN.
- **Hansen, S**., S. Marcquenski and S. Fajfer. 2012. Bacterial Kidney Disease Epizootic in Lake Michigan: What Were the Ecological and Management Implications for Chinook Salmon? Oral presentation at American Fisheries Society Fish Health Section Meeting. La Crosse, WI.
- Sloss, B.L., J.A. VanDeHey, R.T. Andvik, L.R. Nathan, **S.P. Hansen,** R.M. Claramunt, and T.M. Sutton. Stock Identification and Distribution in the Lake Michigan Lake Whitefish Commercial Fishery. Oral presentation at 142nd Annual Meeting of the American Fisheries Society, Minneapolis-St. Paul, MN.

- Nathan, L.R., R.T. Andvik, B.L. Sloss, J.A. VanDeHey, R.M. Claramunt, and **S.P. Hansen**. 2012. Temporal Stability of Lake Whitefish Stocks in Lake Michigan. Oral Presentation Wisconsin and Michigan American Fisheries Society Annual Meeting, Marinette, WI.
- Andvik, R.T., B.L. Sloss, J.A. VanDeHey, T.M. Sutton, R.M. Claramunt, and **S.P. Hansen.** 2011. Proportional stock harvest of the lake whitefish commercial fishery in Lake Michigan. Oral presentation at International Association for Great Lakes Research 54th Annual Meeting, Duluth, MN.
- Andvik, R.T., B.L. Sloss, J.A. VanDeHey, T.M. Sutton, R.M. Claramunt, and **S.P. Hansen**. 2011. Mixed stock analysis of Lake Michigan's lake whitefish commercial fishery. Oral presentation at Wisconsin Chapter of the American Fisheries Society 40th Annual Meeting, Stevens Point, WI.

Tactic a) Incorporate publication goals in each biologist's work plan.

§Review comment: This is a matter between supervisors and biologists.

Tactic b) Encourage supervisors to recognize the importance of publications.

§Review comment: Apart from the listing of this tactic in the LMIFMP, no specific actions were taken to encourage supervisors in this way.

Tactic c) Identify publishable topics through the LMFT.

§Review comment: The Lake Michigan Fisheries Team is provides a useful internal forum for discussion of ideas and data..

Problem 2. Information needs to be disseminated in an active and timely manner.

One of the greatest challenges for fisheries management is the timely dissemination of information about the program to the interested public.

Tactic a) Continue to use the Lake Michigan news memo to communicate with the interested public.

§Review comment: A news memo, now called "Great Lakes Fisheries News", has been prepared and mailed to our mailing list 18 times during 2003-2012. The mailing list comprises the names of reporters, shoreline legislators, all commercial fishers, sport fishing leaders, and over 1000 interested individuals who have attended public hearings on sport and commercial fishing rules since 1992[101].

Tactic b) Work with University of Wisconsin Sea Grant to expand public awareness of the Lake Michigan Fisheries Program.

§Review comment: We have a productive working collaboration with Sea Grant.

Tactic c) Publish current reports on the Lake Michigan web site.

§Review comment: This is accomplished on a routine basis[102]

Objective F. Expand Lake Michigan research by Integrated Science Services (ISS).

The Department supports fisheries research through the Bureau of Integrated Science Services.

[101] http://dnr.wi.gov/topic/Fishing/lakemichigan/FisheriesNews.html
[102] http://dnr.wi.gov/topic/Fishing/lakemichigan/index.html

Problem 1. Insufficient ISS resources are devoted to Lake Michigan issues.

Unfortunately, Great Lakes fisheries research has not been a strong focus of that Bureau.

Tactic a) Continue to encourage ISS involvement with Lake Michigan Projects.

§Review comment: There has been little progress in this area, although we have cooperated with Steve Greb in a nutrient sampling program using one of the Fisheries boats, the R/V Gaylord Nelson.

Tactic b) Identify specific research topics.

§Review comment: Research topics were compiled by LMFT and forwarded to researchers as well as posted on our website[103]

[103] http://dnr.wi.gov/topic/fishing/documents/lakemichigan/lakemichigan-greenbayresearchpriorities.pdf