

**A SURVEY OF FISH-COMMUNITY AND HABITAT GOALS/OBJECTIVES/TARGETS
AND STATUS IN
GREAT LAKES AREAS OF CONCERN**

**A report of source material for a 1993 workshop sponsored by the
U.S. Environmental Protection Agency and
Environment Canada in
Cooperation with the
Habitat Advisory Board of the
Great Lakes Fishery Commission and
Wayne State University**

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Citation: Hartig, J. H. 1993. A survey of fish-community and habitat goals/objectives/targets and status in Great Lakes areas of concern. Great Lakes Fish. Comm. 95 p.

Great Lakes Fishery Commission
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August 1993

PREFACE

Remedial-action plans are being developed to identify the responsibility and time frame for implementing remedial and preventive actions necessary to restore impaired beneficial uses in the 43 Great Lakes Areas of Concern (AOCs). Fishery-management plans are being developed for Great Lakes tributary watersheds to: describe existing environmental conditions and fish communities; identify problems and potential improvements; define management goals; and identify options and obstacles to achieve management goals. Both initiatives encourage use of an ecosystem approach. Further, governments recognize that greater coordination and strengthened partnerships between water-quality and fishery managers will be necessary to achieve common goals.

In an effort to help achieve greater coordination and strengthened partnerships between remedial-action and fishery-management planning, the U.S. Environmental Protection Agency and Environment Canada initiated a survey of fish-community and habitat goals/objectives/targets being set for AOCs as part of fishery-management programs, and summary data on current resource status relative to the goals/objectives/targets. These survey data were compiled in this report as source material for a workshop on integrating remedial-action and fishery-management planning held on February 4, 1993 as part of the Great Lakes Fishery Commission's (GLFC) Habitat Advisory Board meeting at Maumee Bay State Park Lodge in Oregon, Ohio. Survey data are presented in this report by AOC using the numerical order presented on the map found on the inside of the front cover. The purpose of the workshop was to discuss the survey data presented in this report and develop specific recommendations for water-quality and fishery managers on how to achieve greater coordination and integration of remedial-action and fishery-management planning in Great Lakes AOCs. A copy of the parallel workshop report *Toward Integrating Remedial-Action and Fishery-Management Planning in Great Lakes Areas of Concern* (Hartig 1993) can be obtained from the GLFC.

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1. PENINSULA HARBOUR	
Fish Community Goals/Objectives/Targets	Status
<p>Current fish community goals include:</p> <ul style="list-style-type: none"> * promoting self-sustaining populations of indigenous fish species (and not at the detriment of all other fish populations); * rehabilitating lake trout consistent with the Great Lakes Fishery Commission's "A Lake Trout Rehabilitation Plan for Lake Superior" (e.g. the primary target for lake trout harvest in Ontario waters is based on a historical harvest of 0.24 kg/ha in waters less than 91.4 m (50 fathoms) deep); * preventing invasion of foreign organisms to the Great Lakes through control of ballast water; and * maintaining water quality such that fish populations and health do not differ significantly from surrounding regions. 	<p>Peninsula Harbour supports a fish community which includes at least 31 species and is dominated by coldwater species. The bay is strongly influenced by Lake Superior and is characterized by an oligotrophic system, low in fish productivity and abundance. In fact, results from a 1986 electrofishing study indicated that the fish community in Peninsula Harbour was the least diverse of the four Ontario Areas of Concern in northern Lake Superior. Integrated Biotic Index scores derived from this study were low compared to Thunder Bay and Nipigon Bay. Lake trout has persisted as the dominant species, but populations have declined since the 1950s due to the introduction of the sea lamprey into Lake Superior and extensive commercial fishing. Lamprey populations have remained in check since the 1960s. Lake trout wounding incidents in Zone 19 from 1980 to 1987 ranged from 0 to 1.9%. Mercury contamination continues to contribute to health advisories on fish and wildlife, degradation of fish populations, and loss of fish habitat.</p>

Contact person: K. Cullis, Ontario Ministry of Natural Resources, Thunder Bay, Ontario.

1. PENINSULA HARBOUR	
Fish Habitat Goals/Objectives/Targets	Status
<p>Current fish habitat goals include:</p> <ul style="list-style-type: none"> * ensuring that physical habitat or water quality does not inhibit or limit self-sustaining populations of indigenous fishes; and * achieving, in the long-term, virtual elimination of persistent toxic substances resulting from human origin in aquatic organisms. <p>More specific objectives or targets have yet to be developed.</p>	<p>With the exception of Jellicoe Cove, water depth generally increases abruptly from rugged shorelines to depths of 10-40 m. As a result, littoral areas form extremely narrow bands along the shoreline and wetlands are not present in the Peninsula Harbour Area of Concern. Nearshore fish spawning and nursery habitat is restricted to isolated pockets. Jellicoe Cove comprises the greatest proportion of water less than three meters deep in Peninsula Harbour. However, sediments contain excessive levels of mercury and are contaminated with PCBs in localized areas. An experimental project is underway to remediate mercury-contaminated sediments. Historic log rafting operations have resulted in bark accumulation in the sediments of Jellicoe, Beatty, and Carden Coves. Organic accumulation in Jellicoe Cove is also the result of effluent discharge to the Cove from the main mill sump overflow. Lake trout spawning grounds near the shorelines of Jellicoe and Beatty Coves have been destroyed through the accumulation of organic matter from mill activities such as log booming and effluent discharge. Historic mill discharges also led to degraded water quality.</p>

Contact person: K. Cullis, Ontario Ministry of Natural Resources, Thunder Bay, Ontario.

2. JACKFISH BAY	
Fish Community Goals/Objectives/Targets	Status
<p>Current fish community goals include:</p> <ul style="list-style-type: none"> * the fishery of Blackbird creek and Jackfish Bay must be part of a balanced and healthy aquatic community; * Blackbird Creek and Jackfish Bay should support self-sustaining stocks of native fishes; and * the lake trout population should be rehabilitated consistent with the Great Lakes Fishery Commission's "A Lake Trout Rehabilitation Plan for Lake Superior" (i.e. the primary target for lake trout harvest in Ontario waters is based on a historical harvest of 0.24 kg/ha in waters less than 91.4 m (50 fathoms) deep). 	<p>Blackbird Creek fish populations have been totally eliminated as a result of the pulp mill effluent. Fish populations in Moberly Bay, in the vicinity of Blackbird Creek, have also been severely reduced. Prior to installing secondary treatment by the mill, toxicity tests on surface waters up to 1.5 km from the creek mouth resulted in 100% fish mortality. Recent testing indicates no acute toxicity. Degraded water quality, harvesting, the sea lamprey, and introduction of exotic species have directly depressed fisheries production in Jackfish Bay. Species diversity and densities in the northern portion of Moberly Bay are among the lowest found in Lake Superior. The zone of influence, which radiates south from the mouth of Blackbird Creek, has diminished fisheries potential in the entire Jackfish Bay area, although the degree of impact has not been determined. Lake trout populations have declined since the 1950s for a number of reasons including the accidental introduction of sea lamprey, the start-up of the Kimberly-Clark Mill, over-harvesting, and the introduction of exotic fish species. Sport fishing in Jackfish Bay declined dramatically during the 1950s and remains depressed.</p>

Contact person: K. Cullis, Ontario Ministry of Natural Resources, Thunder Bay, Ontario.

2. JACKFISH BAY	
Fish Habitat Goals/Objectives/Targets	Status
<p>The current goal is to return fish habitat and spawning areas in Blackbird Creek and Jackfish Bay to a healthy, hospitable state. More specific objectives or targets have yet to be developed.</p>	<p>Fish habitat in Jackfish Bay has not been fully described or evaluated,. However, it is known that industrial pollutants have destroyed or significantly altered fish habitat in portions of Jackfish Bay. Blackbird Creek no longer provides suitable habitat for most aquatic life and may affect the surrounding terrestrial habitat. discharge into Jackfish Bay has degraded bottom sediments, fish habitat, and potential spawning grounds. Organic sludge deposits cover most of the natural sediments in Moberly Bay. Major lake trout spawning grounds were located in Moberly Bay and along the shore of Lake Superior adjacent to Jackfish Bay, and were impaired due to deposition of organic matter and contaminated sediments. Lake whitefish spawning grounds were identified along Lake Superior's shore immediately east and west of Jackfish Bay. The quality and use of these shoals has not been assessed. Blackbird Creek was noted as a brook trout stream prior to the start-up of the mill in 1948. Recently, a habitat rehabilitation project was initiated for Moberly Lake.</p>

Contact person: K. Cullis, Ontario Ministry of Natural Resources, Thunder Bay, Ontario.

3. NIPIGON BAY	
Fish Community Goals/Objectives/Targets	Status
<p>All native species of fish that would normally inhabit Nipigon Bay should be able to live there. Nearshore mixing zones should be rehabilitated to restore the normal community of bottom dwelling organisms. Fish species in Nipigon Bay should be sustained so as to allow natural reproduction. Specific objectives include:</p> <ul style="list-style-type: none"> * the lake trout population should be rehabilitated consistent with the Great Lakes Fishery Commission's "A Lake Trout Rehabilitation Plan for Lake Superior" (i.e. the primary target for lake trout harvest in Ontario waters is based on a historical harvest of 0.24 kg/ha in waters less than 91.4 m (50 fathoms) deep); and * the walleye population should be rehabilitated to approximately 40,000 individuals greater than 364 mm. 	<p>The historic and recent loss of walleye and perch fisheries are attributed to degraded water quality and aquatic habitat, excessive exploitation, and the invasion of sea lamprey. Fluctuating river flows and water levels have adversely affected spawning success and recruitment of the resident and anadromous fish community. The nearshore aquatic community is affected by paper mill effluent. Through the Great Lakes Cleanup Fund and associated partners, a concentrated effort to rehabilitate walleye stocks commenced in 1990 and will continue through 1993. In 1957, the estimated population of walleye in Nipigon Bay was 41,000 greater than 364 mm. As of July 1992, 12,500 walleye over 364 mm have been stocked in Nipigon Bay to provide sufficient base stock for reproduction. Lake trout reproduction is the focus of a lakewide management strategy which involves stocking, sea lamprey control, and regulated exploitation. Nipigon Bay has been identified by Ontario MNR as a high priority lake trout stocking site. Lake whitefish stocks have increased through Lake Superior in the last decade. All Nipigon Bay fish stocks have not been commercially fished since 1984.</p>

Contact person: K. cullis, Ontario Ministry of Natural Resources, Thunder Bay, Ontario.

3. NIPIGON BAY	
Fish Habitat Goals/Objectives/Targets	Status
<p>Fish habitats in Nipigon Bay should be sustained so as to allow natural reproduction.</p> <p>Fish should be free to migrate to and from Alexander Landing to Lake Superior.</p> <p>Eroded sediments are deposited in Nipigon Bay and its watershed. The river banks should be stabilized to minimize erosion.</p> <p>Waterfront developments should not have an adverse effect on the aquatic ecosystem.</p> <p>Water levels in key spawning areas should be maintained to allow natural reproduction of fish and other organisms. The aquatic community of Nipigon Bay and its watershed should be protected from negative impacts associated with artificially controlling river flow fluctuations. Specifically, the impacts of exposing spawning areas and covering of the river bottom with solids originating from artificially induced river bank erosion should be minimized.</p>	<p>Fish habitat near the Domtar Water Pollution Control Plant outfall has been degraded. Wood fiber accumulation at the bottom of the Bay extends about 2 km southeast and east from the effluent outfall, diminishing nursery and forage value of the littoral zone. A shallow marsh adjacent to the Old Mill site has been degraded by historic logging activities. This area, which has been overladen with wood fiber debris, represented potential habitat for a number of fishes and other aquatic organisms. As part of the Great Lakes Cleanup Fund Program, cleanup was initiated in 1990-1991. Water level fluctuations as a result of hydro-electric operations were identified as a major concern affecting spawning and recruitment of native fish species in Nipigon River/Bay. Spawning and early life stage riverine habitat, which are critical to recruitment success, was regularly dewatered during critical time periods under past water management practices. Ontario MNR has identified critical spawning locations for fall spawners in the Nipigon River, and minimum flow required to ensure adequate water over these sites during fall and winter seasons. These flows are ensured through a 1990 short term agreement with Ontario Hydro. The RAP process is facilitating a committee to establish a long term water management plan for the Nipigon River system. The Township of Red Rock Waterfront Study was completed in 1991 and culminated a number of planning and design initiatives. Construction of a number of land based structures was completed in 1991. Construction of environmental components (i.e. water quality ponds and breakwall enhancement) began in 1992. A brook trout habitat rehabilitation project for Clearwater Creek, which flows into Nipigon Bay, will be completed in 1993.</p>

Contact person: K. Cullis, Ontario Ministry of Natural Resources, Thunder Bay, Ontario.

4. THUNDER BAY	
Fish Community Goals/Objectives/Targets	Status
<p>All native species of fish that would normally inhabit Thunder Bay should be able to live there. Nearshore mixing zones should be rehabilitated to restore the normal community of bottom dwelling organisms. Fish species in Thunder Bay should be sustained so as to allow natural reproduction. The lake trout population should be rehabilitated consistent with the Great Lakes Fishery Commission's "A Lake Trout Rehabilitation Plan for Lake Superior." The primary target for lake trout harvest in Ontario waters is based on a historical harvest of 0.24 kg/ha in waters less than 91.4 m (50 fathoms) deep. A self-sustaining chinook salmon population should be established in the Kaministiquia River in conjunction with improved water quality and habitat rehabilitation in the lower river and harbor.</p>	<p>Species diversity in Thunder Bay is much greater than the rest of Lake Superior (at least 50 species). The offshore fishery reflects oligotrophy. Pacific salmon are increasing along northern Lake Superior. Natural reproduction of chinook and coho salmon has been reported in northern rivers and catches in Thunder Bay have increased. Since 1988, chinook salmon have been released into the Kaministiquia River. However, native species continue to dominate (lake trout harvest in Thunder Bay during mid-1980s: 0.32-0.37 kg/ha). A major shift in the forage base occurred with the immigration of rainbow smelt, which are now the dominant food source for lake trout in Thunder Bay. Nearshore areas are now dominated by cool water fish such as walleye, northern pike, and white suckers. However, walleye has declined in the harbor and tributaries. Sport fishing experienced the same drastic decline during the late 1950s as the commercial fishery and remained depressed until the 1970s. Hatchery introductions and sea lamprey control resulted in substantial increases in sport fishing during the late 1970s and 1980s. Fish kills have occurred in the lower Kaministiquia River during periods of low flows and elevated water temperatures.</p>

Contact person: K. Cullis, Ontario Ministry of Natural Resources, Thunder Bay, Ontario.

4. THUNDER BAY	
Fish Habitat Goals/Objectives/Targets	Status
<p>Lower Kaministiquia River goals include:</p> <ul style="list-style-type: none"> * In order to provide hospitable habitat and prevent loss of migration corridors, oxygen levels should be adequate for the protection of aquatic life. * Water quality should be adequate to support the present, natural aquatic food chains. Water quality should be sufficient to avoid a disruption of the food chain contaminants in fish to levels which result in consumption restrictions. * River banks should be stabilized, where necessary, in order to increase aesthetic value and decrease turbidity. * Sediment quality should be sufficient to provide a hospitable environment for aquatic organisms and prevent food chain bioaccumulation. * In accordance with the Great Lakes Water Quality Agreement and the Thunder Bay public Advisory Committee Water Use Goals, there should be zero discharge of persistent toxic chemicals based on a timetable yet to be determined. The Ministry will present options. * Nearshore areas should provide productive aquatic habitat except where legitimate human activities preclude such use. <p>Thunder Bay goals include:</p> <ul style="list-style-type: none"> * Nearshore areas should be available as productive aquatic habitat. Any shoreline developments should consider effects on existing habitat. * Wetlands should be protected from human-related degradation. 	<p>Degraded water quality in the lower Kaministiquia River impedes access by fish to and from critical habitats. Current levels of organic waste from Canadian Pacific Forest Products create an oxygen sag in the river, resulting in a barrier to fish movement during low water flows. Upgrading the plant to secondary treatment in 1991 has resulted in substantial reductions in BOD loadings. Habitat in Thunder Bay tributaries has been degraded by shoreline development, erosion from water level fluctuations and agriculture, and other localized problems. Some wetlands have been altered, and remaining ones have no official status that would protect them from development. They are also threatened by chemical contamination, Historic & edged sediment disposal offshore of the Welcome Islands resulted in the loss of lake trout and lake herring spawning areas, and can only be restored by natural processes. Habitat is destroyed by & edging, but this activity will continue to be necessary within the shipping channels. Recently, fish habitat rehabilitation projects have been initiated for the tributaries entering Thunder Bay. In 1990, fish habitat rehabilitation projects were initiated in each of the tributaries entering Thunder Bay Harbour. Demonstration projects, initiated by the Great Lakes Cleanup Fund and associated partners, will provide habitat restoration techniques and tools for applications in the Great Lakes Basin.</p>

Contact person: K. Cullis, Ontario Ministry of Natural Resources, Thunder Bay, Ontario.

5. ST. LOUIS RIVER	
Fish Community Goals/Objectives/Targets	Status
<p>The RAP goal pertaining to the fishery of the St. Louis River system is:</p> <p>A healthy and well balanced aquatic ecosystem, where native species can live and reproduce naturally and are not restricted from thriving due to substrate degradation.</p>	<p>The St. Louis River estuary supports a large and diverse warmwater fish community of approximately 54 species, which include walleye, yellow perch, northern pike, burbot, black crappie, emerald shiner, spottail shiner, and white sucker. Rainbow trout, brown trout, and chinook salmon are also found in the St. Louis, Nemadji, and their tributaries. Many species are seasonally abundant, using the river and estuary to spawn, and return to Lake Superior. During 1990, average species abundance (mean number per hectare) in St. Louis River Estuary was: 267 emerald shiner, 257 ruffe, 236 spottail shiner, 175 trout perch, 46 yellow perch, 41 black crappie, 33 log perch, 30 johnny darter, 29 channel catfish, 28 black bullhead, 24 rainbow smelt, 22 white sucker, 22 white perch, 12 walleye, and 8 freshwater drum.</p> <p>During the period of severe organic pollution before 1979, fish populations were degraded and fish kills were common. Fish populations have been recovering from that area because of improvements in wastewater treatment. The fish community has exhibited a pattern of increasing abundance and diversity in the 1980s. However, fish populations are now adversely affected by the proliferation of the ruffe, an exotic species first found in the Area of concern in 1987. Other exotics threaten fish populations. The potential effects of toxic substances on fish population health in the Area of Concern are largely unknown.</p>

Contact person: D. Pratt, Wisconsin Dept. of Natural Resources, Superior, WI.

5. ST. LOUIS RIVER	
Fish Habitat Goals/Objectives/Targets	Status
<p>RAP goals pertaining to fish habitat in the St. Louis System include:</p> <ul style="list-style-type: none"> * Protection and restoration of fish and wildlife habitat, including fish spawning and nursery areas, and aquatic and/or upland breeding, nesting, or migration habitats. * Identification and protection of remaining wetlands including a program of no further loss wetlands in or along the St. Louis River or estuary, no loss of critical wetlands or wetland functions, no net loss of wetlands in the drainage basin, and an overall policy of restoring and/or enhancing diminished or drained wetlands. any unavoidable wetland losses should be compensated for by the establishment of replacement wetlands of equal value on a two for one basis. 	<p>In the past, fish habitat in the estuary was degraded because of impaired water quality. Currently, contaminated sediments may cause habitat degradation in several areas of the river system. Habitat degradation due to sediment contamination has been documented in two areas: Stryker Bay (Interlake Superfund site vicinity), and Newton Creek/Hog Island Inlet of Superior Bay. High rates of sedimentation in the estuary during the twentieth century, with ensuing turbidity and reduced light penetration, may limit macrophyte growth and therefore limit fish and wildlife habitat. Habitat loss due to sedimentation has not been documented for specific areas. wetland habitat is being degraded due to the infestation of purple loosestrife. Fish and wildlife populations have not yet been noticeably affected by this infestation, but the potential exists if the loosestrife continues to spread.</p> <p>The St. Louis River estuary has relatively large areas of undeveloped shoreline and wetland habitats, compared with many other Great Lakes Areas of Concern. Protection of these habitats is important to the stability of fish and wildlife communities. Critical habitats for some important fish and wildlife species have been identified and should be protected from loss through development or other degradation. Identification of important and critical habitats in the river system will be a continuing activity through the RAP and other planning efforts.</p>

Contact person: D. Pratt, Wisconsin Dept. of Natural Resources, Superior, WI.

6. TORCH LAKE	
Fish Community Goals/Objectives/Targets	Status
<p>The State of Michigan has designated Torch Lake to be protected for a coolwater fishery. More specific fish community objectives or targets have yet to be developed.</p>	<p>Tumors in sauger and walleye are the primary problem. The causative factor is unknown, despite considerable investigation. Torch Lake has had a diverse fish community for many years. Fisheries surveys have found more than 20 species of fish not including minnows. Walleye, sauger, northern pike, smallmouth bass, and perch are the most important sports fish. changes in fish community structure have occurred since copper mining activities ceased along Torch Lake with sauger being replaced by walleye and other species (e.g. northern pike, smallmouth bass). Less turbid waters tend to favor walleye over sauger where they coexist. Michigan DNR is currently stocking walleye in order to help test the hypothesis of historical chemical exposure and/or sensitivity to environmental conditions causing liver tumors. Walleye stocking rates in Torch Lake were 4,000 in 1987, 10,000 in 1988, 43,002 in 1989, 10,420 in 1990, and 24,581 in 1991.</p>

Contact person: R. Juetten, Michigan Dept. of Natural Resources, Baraga, MI.

6. TORCH LAKE	
Fish Habitat Goals/Objectives/Targets	Status
In general, the goal for Torch Lake is for suitable habitat to support a coolwater fishery. Additional habitat-related goals include: further stabilize shoreline copper tailings by revegetation; and regulate dredging activities when they occur. More specific habitat objectives or targets have yet to be developed.	Over 200 million tons of copper-enriched tailings exist in Torch Lake. Over 20% of this 1,100 ha lake was filled with copper tailings between the late 1860s and the 1960s. Natural attenuation and isolation of the copper-enriched sediments through transport, deposition, and burial presents the best approach to the contaminated sediments problem. Any attempt to disrupt the sediments might release copper from the system. The benthos are impacted by the copper-enriched sediments. Torch Lake currently has good spawning and forage habitat for walleye, and good cover. No quantitative fishery habitat data are available.

Contact person: R. Juetten, Michigan Dept. of Natural Resources, Haraga, MI.

7. DEER LAKE-CARP RIVER/CREEK

Fish Community Goals/Objectives/Targets	Status
<p>The State of Michigan has designated Deer Lake to be protected as a warmwater fishery. Carp River and Creek are protected for coldwater fish and are designated trout streams. The current management objective for Deer Lake is to restore the impaired sport fishery and reduce the potential for toxic impacts to human health and wildlife from eating mercury-contaminated fish. More specific fish community objectives or targets have yet to be developed.</p>	<p>The fish community of Deer Lake is dominated by yellow perch, bullheads, white suckers, and northern pike. Minnows, sunfish, and some brook trout are also caught. The fishery is currently open only for catch and release, and has proven popular and may be continued after the mercury contamination has subsided. Carp Creek, upstream of Deer Lake, has a good population of brook trout with white suckers and minnows. Downstream of Deer Lake in the Carp River, brook trout populations are restricted to river reaches around coldwater inputs during summer. Northern pike and other warmwater species from Deer Lake also exist in the river and its lower reaches. The fish community in the lower kilometer downstream of the power station, seasonally contains runs of anadromous salmonids. The power station blocks further upstream movement of fish.</p>

Contact person: D. Siler, Michigan Dept. of Natural Resources, Escanaba, MI.

7. DEER LAKE-CARR RIVER/CREEK	
Fish Habitat Goals/Objectives/Targets	Status
In general, the goal for Deer Lake is for suitable habitat to support the restoration of a warmwater fishery. More specific fish habitat objectives or targets have yet to be developed.	The Deer Lake fishery is impaired due to mercury contamination. The primary active sources of mercury (i.e. two metalurgical laboratories) have been eliminated. Sediments in Deer Lake have elevated levels of mercury and undoubtedly serve as secondary sources of mercury contamination to biota. As part of the settlement with the responsible industry, the lake was drawn down, the contaminated fish eradicated and removed, and the lake filled and stabilized in order to minimize production and release of methylmercury from sediments. Subsequently, the lake was restocked with yellow perch and walleye. No quantitative habitat data are available.

Contact person: D. Siler, Michigan Dept. of Natural Resources, Escanaba, MI.

8. MANISTIQUE RIVER	
Fish Community Goals/Objectives/Targets	Status
<p>The State of Michigan has designated Manistique River to be protected for warmwater and coldwater fish species. More specific objectives or targets have yet to be developed.</p>	<p>The Manistique River supports a diverse sports fishery. Sports fish that can be found below the dam during various times of the year include northern pike, smallmouth bass, walleye, yellow perch, rockbass, chinook salmon, coho salmon, pink salmon, brown trout, and steelhead trout. Since 1974, over 400,000 chinook salmon and 57,000 steelhead trout have been planted below the dam. The spring and fall spawning runs of steelhead trout and fall runs of chinook salmon attract many fishermen to the river and nearshore area of Lake Michigan. The Manistique River RAP concluded that the problem contributing to the fishery use impairment is sediments contaminated with PCBs.</p>

Contact person: S. Scott, Michigan Dept. of Natural Resources, Newberry, MI.

8. MANISTIQUE RIVER	
Fish Habitat Goals/Objectives/Targets	Status
In general, the goal for Manistique River is for suitable habitat to support the restoration and maintenance of a warmwater and coldwater fishery. A recommended interim goal is to rehabilitate and/or modify the sill at the Manistique Paper Company Dam to provide for lamprey and salmon blockage. More specific objectives or targets have yet to be developed.	A variety of fish habitats are present in the Area of Concern. Surveys conducted as recently as 1985 document that the substrate in Manistique Harbor has been altered due to accumulation of sawdust and wood chips over the sandy lake bottom. These materials originated primarily from sawmills that historically operated on the lower Manistique River. Based on a benthic macroinvertebrate survey performed in 1978, pollution tolerant organisms dominated the community, indicating degradation of the substrate and possible water quality impacts. No quantitative habitat data are available.

Contact person: S. Scott, Michigan Dept. of Natural Resources, Newberry, MI.

9. MENOMINEE RIVER	
Fish Community Goals/Objectives/Targets	Status
<p>Draft fishery management plan goals for the entire Menominee River system include:</p> <p>Restore lake sturgeon populations to historic levels (20,000 to 25,000 fish) throughout their former range in the river.</p> <p>Restore and enhance historic runs of northern pike, smallmouth bass, muskellunge, walleye and whitefish from Green Bay into and throughout the Menominee River System. Restore spring runs of rainbow smelt in the lower Menominee River to levels similar to those present in the 1970s.</p> <p>Block movement of sea lamprey and other undesirable species into areas of the river above the first dam upstream of the mouth and manage the lower section of the river for minimal sea lamprey numbers.</p> <p>Develop anadromous runs of selected salmonid species in the Menominee River up to the Grand Rapids Dam to enhance salmonid fishing opportunities and provide natural reproduction to enhance fishing opportunities in the waters of Green Bay.</p> <p>Manage the Menominee River System to preserve and/or enhance the endangered and threatened species of flora and fauna that exist in the watershed.</p>	<p>The lake sturgeon population in the system is currently only 30 percent of historic levels, because they can not reach previous spawning areas and do not have access to the waters of Green Bay.</p> <p>Current populations of northern pike, smallmouth bass, walleye, muskellunge and whitefish are much lower than they could be due to lack of free access up and down the river. Rainbow smelt spawning runs in the lower Menominee have declined dramatically since the 1970s and reasons for these declines are not known.</p> <p>Undesirable species such as sea lamprey are found in the lower Menominee and are felt to have an adverse effect on the native and introduced fisheries.</p> <p>Lack of suitable spawning grounds for salmonids limits the salmonid population in Green Bay and the lower Menominee River. Physical limitations also limit angler opportunities for salmonid fishing in the lower Menominee.</p> <p>An inventory of endangered and threatened flora and fauna in the watershed is underway.</p>

Contact person: G. Schnicke, Michigan Dept. of Natural Resources, Crystal Falls, MI; B. Belonger, Wisconsin Dept. of Natural Resources, Marinette, WI.

NOTE: The draft fisheries plan is a two-state effort and covers the entire river system, not just the Area of Concern. The Stage 1 RAP for the Menominee River Area of Concern was completed in 1990 and the Stage 2 RAP is under development. The Stage 1 RAP contains goals and objectives for the aquatic system which are more general, but are specific to the Area of Concern.

9. MENOMINEE RIVER	
Fish Habitat Goals/Objectives/Targets	Status
<p>Draft fishery management plan goals include:</p> <p>Reestablish natural flow patterns within the Menominee Basin to enhance habitat, water quality and food production for fish and other aquatic species.</p> <p>At a minimum, to meet all statutory and anti-degradation water quality standards and to optimize water quality for selected target and endangered species. To maintain or enhance water quality so fish contaminant levels do not rise above the advisory levels.</p> <p>Prevent hydroelectric operational fish mortalities by using best available technologies and, when appropriate, to mitigate for unavoidable losses.</p> <p>Maintain and enhance multiple use recreational opportunities and scenic qualities within the Menominee Basin that are consistent with other plan objectives.</p>	<p>Fish habitat in the river is limited due to daily fluctuating water levels from the hydroelectric operations.</p> <p>Water quality is still a concern for the fishery on selected reaches of the river.</p> <p>Entrainment and turbine mortality of game and nongame species is believed to be occurring at all Menominee River hydroelectric projects and this could be affecting the fisheries.</p> <p>Many of the river's outstanding scenic features have been lost due to human development in the watershed. There is a lack of adequate public access to some sections of the river.</p>

Contact person: G. Schnicke, Michigan Dept. of Natural Resources, Crystal Falls, MI; B. Belonger, Wisconsin Dept. of Natural Resources, Marinette, WI.

10. FOX RIVER/ LOWER GREEN BAY	
Fish Community Goals/Objectives/Targets	Status
<p>Fishery management program goals incorporated into the RAP include:</p> <p>Maintain walleye population of approximately 17 adults/ha (7 adults/acre) or average of 70,000 adults.</p> <p>Achieve yellow perch population of 2,600 yearlings and older (at least 5 age classes) per trawl hour (August average) at index sites.</p> <p>Achieve northern pike population of approximately 5 adults/ha (2 adults/acre) or average of 20,000 adults.</p> <p>Achieve muskellunge population of approximately 0.8 adult/ha (1 adult/3 acres) or average of 3,300 adults.</p> <p>Restore centrachid (panfish) populations.</p> <p>Protect against sea lamprey invasion. No sea lamprey above Ripid Creche Dam.</p> <p>Shift fish biomass toward predator and sport species: 225-337 kg/ha (200-300 pounds per acre); predator/prey ratio of 1/10-1/20.</p>	<p>Prior to 1984, levels were maintained through stocking. The objective has been achieved through natural reproduction since 1984, although the population will fluctuate due to weather or related impacts on production. The 1991 year class was very strong and may result in higher numbers in 3-4 years.</p> <p>Population abundance decreased from 1988 to 1990 and stabilized in 1991. New regulations to further protect the population in the southern bay were implemented in 1991. Perch have spread into deeper waters than previously occupied and abundance at contour intervals is being studied which may lead to a modified objective.</p> <p>This objective cannot be assessed using existing monitoring which estimates population biomass in selected spawning areas. A substantial portion of the pike spawning habitat has been lost prior to 1988.</p> <p>Musky stocking began in 1989 - 6,800 fingerlings stocked to date. Growth rates appear very good and spawning females are expected in 1996.</p> <p>To be determined.</p> <p>Lamprey found below DePere Dam in 1990 and 1991. A permanent barrier to sea lamprey invasion was constructed in 1988 at the third lock and dam on the Lower Fox River, upstream from the DePere Dam.</p> <p>Status is unknown because total fishery biomass is presently not measured.</p>

Contact person: T. Lychwick, Wisconsin Dept. of Natural Resources, Green Bay, WI.

10. FOX RIVER/LOWER GREEN BAY	
Fish Habitat Goals/Objectives/Targets	Status
<p>Fishery management program goals incorporated into the RAP include:</p> <p>No acute or chronic toxicity to fish as documented by bioassays.</p> <p>Virtually eliminate the discharge of toxic substances in toxic amounts from all sources.</p> <p>Maintain dissolved oxygen > 5 mg/L at all times.</p> <p>Maintain summer average total suspended solids concentration in the water column at 10 mg/L.</p> <p>Reduce suspended solids loads to reduce sedimentation, increase water clarity and improve aquatic habitat.</p> <p>Maintain lacustrine, palustrine and riverine wetlands (all wetlands contiguous to shoreland zone as defined by 91 m (300 feet) from river and 305 m (1000 feet) from lakeshore.</p> <p>Increase submergent vegetation.</p> <p>Provide adequate habitat for fish to meet population objectives.</p> <p>Protect other important habitat for fish, other aquatic life, wildlife, and endangered species.</p>	<p>Bioassay showed that sediment pore water and bulk sediments from several Lower Fox River sites were toxic to <u>Pimephales promelas</u>. Most of the observed toxicity appeared to be due to ammonia.</p> <p>All major dischargers in the basin and those minor dischargers where chemical specific monitoring indicates toxicity are required to perform acute and chronic bioassays of their effluent. As of 1991, two of the 19 discharges are considered to be failing their acute or chronic toxicity tests. In 1986, 13 dischargers reported failed bioassay tests. Most dischargers currently meet effluent limitations for toxic substances.</p> <p>Dissolved oxygen average 7.6-8.5 mg/L during mid-May to mid-October during 1986-1991, but fell below 5 mg/L at least once in every year except 1990.</p> <p>Currently, summer concentrations are 20-30 mg/L.</p> <p>Total suspended solids loads to the Area of Concern in 1981-1983 averaged 200 million pounds per year.</p> <p>To be determined by geographical information system mapping.</p> <p>To be determined by geographical information system mapping;</p> <p>To be determined by geographical information system mapping.</p> <p>To be determined by geographical information system mapping.</p>

<p>Essential habitats are protected by law from future development, physical degradation, or contamination.</p> <p>Fish can migrate freely in and through the Area of Concern to utilize essential habitats.</p> <p>Fish populations are self-sustaining (i.e. stable population structure without periodic stocking).</p>	<p>Some wetlands exist behind legal bulkhead lines that relinquish state authority over filling and dredging activities. Bulkhead lines do not preclude the application of federal regulations. Over 81 ha (200 acres) of wetlands are protected through, public ownership. Other wetlands in the Area of Concern are given some protection through state/local wetland zoning laws or federal 404/10 permit programs. New state water quality standards for wetlands (HR 103) will provide additional protection against activities that degrade wetlands.</p> <p>No restriction of fish movement up to DePere Dam.</p> <p>some populations of fish are being stocked to re-introduce native species. Existing fish species are self-sustaining. Walleye have not been stocked since 1984 and are now self-sustaining.</p>
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Contact person: T. Lychwick, Wisconsin Dept. of Natural Resources, Green Bay, WI.

11. SHEBOYGAN RIVER	
Fish Community Goals/Objectives/Targets	Status
<p>Long-term RAP goals related to the fish community which have been established for the Sheboygan River Area of Concern include:</p> <ul style="list-style-type: none"> * protect the ecosystem (including humans, wildlife, fish, and other organisms) from the adverse effects (on the reproduction, survival and healthy of individuals, and the integrity of interspecies relationships) of toxic substances; and * maintain and enhance a diverse community of terrestrial and aquatic life and their necessary habitat. <p>These RAP goals are further specified by objectives to achieve the goals and restore beneficial uses.</p> <ul style="list-style-type: none"> * Reduce sources of toxic substances and organism exposure to toxic substances to allow unrestricted consumption and unimpaired reproductive performance of resident fish and wildlife. * Maintain a diverse resident fishery and, with attainment of the above toxic objective, establish seasonal runs of coho and chinook salmon and steelhead. 	<p>Fish populations and diversity in the Sheboygan River, harbor, and Lake Michigan have been altered by various factors including the effects of exotic species, sedimentation, and dams. Presently, the lower Sheboygan River supports a diverse population of fish and aquatic life. However, there is concern that sediment from upstream sources which has been deposited above the upper and lower Kohler Dams, along the river bank at bends in the river, and in the harbor may be negatively impacting the diversity and health of the local fishery. Major fish species collected in the Sheboygan River and harbor are alewife, gizzard, channel catfish, yellow perch, smallmouth bass, rock bass, walleye, northern pike, black crappie, white crappie, lake whitefish, round whitefish, coho salmon, chinook salmon, and lake, brook, brown and rainbow trout. Interestingly, smallmouth bass populations downstream of the Sheboygan Falls Dam have increased dramatically since 1980. They are occasionally seen in upstream impoundments and are very common in upstream unimpounded areas. The reason for this sudden increase is unknown. At any rate, it has enhanced the recreational fishery. Generally, there is a diversity of sport fish in the river between the dams. The impoundments are inhabited mainly by carp as habitat is limited for the more desirable sport and forage species.</p>

Contact person: J. Nelson, Wisconsin Dept. of Natural Resources, Plymouth, MI.

11. SHEBOYGAN RIVER	
Fish Habitat Goals/Objectives/Targets	Status
<p>The long-term RAP goal is to maintain and enhance the necessary habitat for a diverse fish community. More specific habitat-related objectives related to this goal include:</p> <ul style="list-style-type: none"> * Reduce sources of toxic substances and organism exposure to allow unimpaired reproductive performance of resident fish. * Protect natural areas along the waterway and enhance habitat for aquatic and terrestrial communities. * Continue to control nutrient inputs to the Sheboygan River and nearshore areas of Lake Michigan to meet the goals of the Great Lakes Water Quality Agreement and to reduce abnormal occurrence of undesirable algae. * Reduce suspended solids concentrations in the Sheboygan River to meet a mean concentration of 25 mg/L during 90% of the time and reduce bedload by 50% to 75%. 	<p>Habitat necessary to maintain a diversity of aquatic life in the Sheboygan River is being degraded, primarily as a result of sediment from upland erosion. The dams also contribute to degraded habitat. The dams within the Area of Concern influence sediment deposition and surface water quality by reducing velocities, increasing sedimentation rates, trapping particulate matter, and increasing water temperatures. As a result, the dams provide degraded habitat more suited for pollution-tolerant types of fish and aquatic life. The dams also inhibit fish passage, thereby limiting the recreational fishery potential of the Sheboygan River and its tributaries.</p>

Contact person: J. Nelson, Wisconsin Dept. of Natural Resources, Plymouth, WI.

12. MILWAUKEE ESTUARY	
Fish Community Goals/Objectives/Targets	Status
<p>Fish community goals developed through the RAF process include:</p> <ul style="list-style-type: none"> * achieve and maintain water quality that protects the ecosystem including human health; and * establish high quality fisheries and urban wildlife populations that are free from toxic contamination and other human-made hazards. <p>Objectives pertaining to these goals include:</p> <ul style="list-style-type: none"> * eliminate acute and chronic toxicity to biota; * eliminate the need for fish and wildlife consumption advisories and reduce toxic contamination to levels that do not adversely affect other biota: * establish high quality fisheries by restoring both coldwater and warmwater species such as yellow perch, northern pike, smallmouth bass, walleye, trout, and salmon; * protect against significant infestations of the sea lamprey, zebra mussel and other undesirable exotic species; and * establish a balanced predator/prey ratio in the resident fish community. 	<p>Sport fishing in the Area of Concern is restricted because spawning areas are polluted and channel modifications such as dams and concrete lining have degraded habitat. Resident fish are pollution tolerant species such as carp and black bullheads. Salmon, walleye, bass, pike and trout are found in the Area of Concern, but are unable to spawn. The harbor provides habitat for perch, northern pike, suckers and carp. Some of the naturally occurring perch spawning beds were altered in 1989 when the new landfill island, Lakefront Island, was built in the Outer Harbor. However, habitat was also created in the installed rip rap which may replace some of the perch habitat lost by construction.</p> <p>In Lake Michigan, large-scale stocking of salmon and trout continues to sustain Wisconsin's Lake Michigan sport fishery, estimated to be with \$60 million per year (1981-1983 numbers) despite recent reductions and anticipated future reductions. Wisconsin DNR stocks about 7 million chinook and coho salmon, and lake, brown, rainbow and brook trout annually. Alewife populations have become a food source for stocked fish. Recent crashes or declines in alewife populations will affect future stocking programs. The hatchery in the Milwaukee area reduced its stocking quotas in 1988 by 10 percent. Another reduction is being discussed for future stocking. The chinook stocking program has shown decreased successes perhaps because of the decline in alewife populations as forage food and/or perhaps because of recent incidences of bacterial kidney disease.</p>

Contact person: C. Schrank, Wisconsin Dept. of Natural Resources, Madison, WI.

MILWAUKEE ESTUARY	
Fish Habitat Goals/Objectives/Target	Status
<p>Fish habitat goals developed through the RAP process include:</p> <ul style="list-style-type: none"> * develop high quality aquatic and wildlife habitats; and * eliminate the contribution of contaminants from sediments to the ecosystem. <p>Objectives include:</p> <ul style="list-style-type: none"> * restore and protect the quantity and quality of the benthic macroinvertebrate, aquatic macrophyte, phytoplankton, and zooplankton communities. * upgrade aquatic conditions and provide and protect streambank vegetation and in-stream habitat in the Menomonee, Kinnickinnic and Milwaukee Rivers and their tributaries to restore, to the fullest extent possible, species historically present, but currently lost or present only in small numbers; * evaluate and implement recommendations regarding removal or modification of human-made obstructions along the rivers which restrict navigation and natural fish movement, spawning, feeding, protection, development or winter habitat; * restore and/or enhance upstream fish and wildlife habitats; * protect upstream wetlands from any further loss or degradation and increase wetlands by restoration wherever feasible; * no filling of nearshore areas unless it also improves aquatic and wildlife habitat; and * where filling is to occur, assure that it does not negatively impact water quality and is designed to optimize habitat. 	<p>Within the Area of Concern, the lower reaches of the Milwaukee, Menomonee and Kinnickinnic rivers are severely degraded where the existing aquatic habitat supports mostly rough fish and pollution-tolerant species. On the Milwaukee River, habitat diversity and quality is limited by combined sewer overflows, nonpoint source pollution, sediment and silt deposition, and the composition of bottom substrate. Above the North Avenue Dam silt may be as much as 3 m deep and may contain toxic substances discharged from upstream sites. silt deposition below the North Avenue Dam is also significant because the river flows slow and silt accumulates below the dam. On the Menomonee River, streambank erosion, channelization and urban runoff impact habitat quality. Above the Area of Concern, the Menomonee River passes railroad yards and material storage areas where occasional spills occur. In the Burnham and South Menomonee canals, channel sides are made of wood, steel sheet pilings or concrete. Portions of the Kinnickinnic River above the Area of Concern are concrete channels which incur high velocity flows during storm events. Concrete channels provide very poor habitat which supports temporary populations of very pollution-tolerant macroinvertebrates and an occasional fish. Within the Area of Concern, the bottom sediments of the Kinnickinnic River are dominated by thick deposits of muck over sand and clay. Streambank erosion is minimal between Chase and Becher Streets but downstream of Becher Street, the natural banks have been replaced by steel sheet pilings. In addition, urbanization of the Lake Michigan coastline has contributed to declining water quality and destruction of aquatic and wildlife habitat and spawning areas in the Area of Concern.</p>

13. WAUKEGAN HARBOR	
Fish Community Goals/ Objectives/Targets	Status
<p>No specific fish community goals have been established due to the nature of Waukegan Harbor relative to its construction and use, and the lack of historical data and information.</p>	<p>The sport fishery that has occurred at the harbor has primarily been at the harbor mouth and entrance channel where access is provided by a long concrete pier. The majority of the harbor is private, industrial Property. sport fish caught by shore anglers at the harbor are primarily transient fish which provide seasonal fishing opportunities. Smelt and coho salmon are taken in the spring, yellow perch in the summer, and chinook salmon and rainbow and brown trout in the fall. The Illinois Department of Conservation began stocking salmon and trout in the harbor in 1969. Due to concerns regarding PCBs in sediments, stocking was discontinued in 1982. It has recently been initiated in the South Harbor Basin which was completed in 1983 and is in the open lake and not connected to the original harbor. A total of 120,000 chinook salmon, 100,000 coho salmon, 25,000 rainbow trout and 20,000 brown trout were released in the South Harbor in 1992.</p>

Contact person: R. Hess, Illinois Dept. of Conservation, Springfield, IL.

13. WAUKEGAN HARBOR	
Fish Habitat Goals/Objectives/Targets	Status
<p>No specific fish habitat goals have been established due to the nature of Waukegan Harbor relative to its construction and use, and the lack of historical data and information. One habitat-related goal is to achieve sufficient reductions in PCBs and other contaminants in the harbor sediments which will permit the lifting of the ban of eating any fish taken from the harbor. This consumption ban was recommended by the U.S. Environmental Protection Agency in 1981, and the harbor was posted by the County Health Department shortly thereafter.</p>	<p>Waukegan Harbor is about 13.8 ha in size and was constructed around the turn of the century. The harbor is primarily a commercial basin serving the needs of large freighters delivering raw materials (cement and gypsum) to several local industries and also provides mooring facilities and launch ramps for small recreational boats. Harbor depths vary from 4-6.4 m and the entrance channel area is routinely dredged to about 8 m. Harbor sediments consist of 0.3-3 m of very soft organic silt (muck) and most of the harbor is bordered by 6-7.6 long steel sheet piling. Limited habitat restoration is being pursued in terms of the removal of contaminated sediment, re-establishment of beds of aquatic macrophytes (if feasible), and the establishment of areas of hard substrate (if feasible) to add some habitat diversity to the harbor.</p>

Contact person: R. Hess, Illinois Dept. of Conservation, Springfield, IL.

14. GRAND CALUMET RIVER/INDIANA SHIP CANAL	
Fish Community Goals/Objectives/Targets	Status
<p>currently, fish community goals have not been established by Indiana Department of Natural Resources for the Grand Calumet River/Indiana Ship Canal due to severe water quality degradation. As water quality improves to the point that it no longer substantially limits the fishery, fish community goals and management strategies will be developed.</p> <p>However, the Marquette Park Lagoon, as the primary headwaters of this river system, has a unique upstream location which largely isolates its fish from those in the river/canal.* This three basin lagoon has at least 11 fish species and is stocked annually with channel catfish. As its water quality improves, fish community goals and management strategies could be developed to move the fish community toward its presettlement, ecosystem-specific diversity. This could be done separately from the river/canal and harbor.**</p>	<p>Available fishery data from the 1980s indicate that the river and harbor lack a stable fish community. In addition, the fishery is limited (i.e. less than 10 species) and dominated by extremely pollution-tolerant forms (e.g. carp and goldfish). Fish consumption advisories exist recommending no fish be eaten. Short term priorities include compiling the database into a repository in a central location and securing the resources for a qualified person to manage and interpret the database.</p>

Contact person: W. Faatz, Indiana Dept. of Natural Resources, Indianapolis, IN.

* The Marquette Park Lagoon was originally called the Grand Calumet River Lagoon, and it flowed into Lake Michigan. When Illinois changed the flow on the western end of the Grand Calumet River, the Lagoon's flow patterns changed. The lagoon became completely silted with sand and no longer allowed the river an eastern outlet to Lake Michigan. Today, the lagoon flows west into the river through an inclined, 1.5 m reinforced concrete culvert pipe that runs underneath the coal storage yard and rail storage yard of USX for 564 m. The culvert has a design flow capacity of 1.416 cubic meters/second, but it becomes partially filled with sand from the dunes to the north of the lagoon as a result of storm events. Historically, the sand has been cleaned out when the extent of blockage causes the lagoon to flood nearby residences.

Once the water quality of the river/canal improves to minimally acceptable levels, the sand blocking the culvert could be removed to fully reconnect the lagoon to the river system. The lagoon's restored fish community could then foster the natural recovery of the fish community in the river/canal and harbor. Although these actions are speculative at this point, if these actions are taken, it may be possible for the river system to move toward its presettlement productivity as a spawning site for Lake Michigan fish. If that occurs, the fish community goals and management strategies for the nearshore/open waters of the Area of Concern portion of Lake Michigan may need to be reviewed and revised accordingly.

14. GRAND CALUMET RIVER/INDIANA SHIP CANAL	
Fish Habitat Goals/Objectives/Targets	Status
<p>Goal 1: Maximize habitat values for native species</p> <ul style="list-style-type: none"> * Objective 1: Prevent further habitat pollution/degradation * Objective 2: Redirect resources to increase habitat values * Objective 3: Restore globally endangered habitats and their ecosystem-specific range of biodiversity, especially dune and swale habitat species * Objective 4: Develop and utilize new resources for habitat * Objective 5: Monitor and evaluate progress in maximizing habitat values for native species <p>Goal 2: Mobilize citizens to support native habitat values</p> <ul style="list-style-type: none"> * Objective 1: Enhance citizen appreciation of importance and use of genetic memory and biodiversity of native species * Objective 2: collect and distribute information to the public on cost savings and environmental effectiveness of using native species in public and private programs * objective 3: Encourage institutional and citizen involvement in native habitat/species monitoring and conservation, especially among those not traditionally active in conservation 	<p>Numerous human activities have historically resulted in loss/degradation of fish habitat. These activities include: changing the course of the river and draining/filling wetlands for industrial development, construction of landfills, creation of deep water ports and navigational channels, sand mining in dunes and interdunal areas, and municipal and industrial discharges and their legacy of contaminated sediments. The loss/degradation of wetlands has been substantial, but not quantified.</p>

Contact person: W. Faatz, Indiana Dept. of Natural Resources, Indianapolis, IN.

15. KALAMAZOO RIVER	
Fish Community Goals/Objectives/Targets	Status
<p>The mainstream of the Kalamazoo River is currently managed for a warmwater fishery. The upper reach from Ceresco Dam downstream to Morrow Pond and the lower reach from Calkins Bridge Dam to the river mouth are currently classified as top quality warmwater segments (i.e. containing self-sustaining populations of warmwater game fish). The middle reach of the river from Morrow Pond to Calkins Bridge Dam is currently classified as a second quality warmwater segment (i.e. containing significant populations of warmwater fish species, but game fish populations are appreciably limited by such factors as pollution, competition, and inadequate natural reproduction). Many of the tributaries to the Kalamazoo River are managed for a coldwater fishery. Management goals include:</p> <ul style="list-style-type: none"> * restoring the middle reach of the river from Morrow Pond to Calkins Bridge Dam to a top quality warmwater fishery; * reclaiming Pine Creek Pond as a warmwater fishery and Baseline Creek as a brown trout fishery; and * extending the anadromous salmon and steelhead fishery upstream to the two largest population centers of Kalamazoo and Battle creek. 	<p>The fishery in the lower reach from Calkins Bridge Dam to the mouth is excellent for a diverse group of game and panfish species including, walleye, northern pike, largemouth bass, channel catfish, salmon, and steelhead. Fishing in the middle reach of the river, a 53 km stretch from Morrow Pond to Calkins Bridge Dam, has improved significantly in the last decade as a result of improved water quality. Improved water quality is the result of upgrading municipal and industrial wastewater treatment facilities which discharge to the Kalamazoo River. Seven areas of the river where dams were used to impound water, have PCB - contaminated sediments. A 1982 fishery survey of the Kalamazoo River yielded 62 fish species. Carp were the most numerous species in the river comprising 67.5% of the total catch by weight and 18.2 by number. Game fish comprised 67.5% of the total catch by weight and 18.2% by number. Game fish comprised 12.8% by weight and 30.1% by number. Smallmouth bass, northern pike, and rock bass were collected throughout the system, but were found in low numbers in the middle reach. The lower Kalamazoo River downstream from Calkins Bridge Dam presently contains good runs of steelhead, chinook salmon and brown trout, which are maintained by annual stocking.</p>

Contact person: J. Dexter, Michigan Dept. of Natural Resources, Plainwell, MI.

15. KALAMAZOO RIVER	
Fish Habitat Goals/Objectives/Targets	Status
<p>Recommended habitat goals include:</p> <ul style="list-style-type: none"> * extend migrations of salmon and steelhead to the cities of Kalamazoo and Battle Creek by removing dams at Plainwell, Otsego, and Trowbridge, and install ladders at the Calkin's Bridge, Imperial Carving, Menasha, and Morrow Dams to allow fish passage; and * remediate the areas of PCB contaminated sediments in order to provide suitable habitat for the fishery. <p>More specific habitat objectives and targets have yet to be developed.</p>	<p>The Kalamazoo River anadromous fishery currently extends upstream only 35 km to the Calkins Bridge Dam. Removing three dams and installing ladders for four other dams would extend migrations of salmon and steelhead an additional 66 km upstream to Battle Creek. Alternative remedial options are currently being evaluated for each of the PCB contaminated sediment sites on the river. Other quantitative habitat data are not available.</p>

Contact person: J. Dexter, Michigan Dept. of Natural Resources, Plainwell, MI.

16. MUSKEGON LAKE	
Fish Community Goals/Objectives/Targets	Status
<p>The State of Michigan has designated Muskegon Lake to be protected for warm water fish species as a minimum. All tributaries to Muskegon Lake are protected for coldwater and warmwater fish. The current management objective for Muskegon Lake and River is to manage the fishery for self-sustaining populations of walleye, chinook salmon, steelhead, brown trout, rainbow trout, and lake sturgeon. Specifically, the system is being managed to restore the walleye spawning runs to historical levels of 130,000 fish.</p>	<p>Muskegon Lake currently supports excellent populations of northern pike, largemouth bass, smallmouth bass, walleye, yellow perch, suckers, sunfish, crappie, and bullheads. Salmon and trout species are also important during spawning runs. Muskegon Lake has been described to be the most popular and valuable fishery in western Michigan. Fishing by licensed anglers on Muskegon Lake was estimated at 148,000 angler days during 1982. The current spawning run of walleye is estimated at 45,000 fish.</p>

Contact person: R. O'Neal, Michigan Dept. of Natural Resources, Grand Rapids, MI.

16. MUSKEGON LAKE	
Fish Habitat Goals/Objectives/Targets	Status
In general, the goal for Muskegon Lake is for suitable habitat to support the restoration of a warmwater fishery. Additional interim goals include: provide protection against additional development along the north shore of the lake which has most of the remaining protected bays and inlets; ensure that the extensive marsh above Muskegon Lake is protected for northern pike spawning and forage fish; and restore benthic habitat in tributaries and deep lake basins to that which will support a natural fish community.	In general, many of the highly productive bays have been dredged or filled for marinas or other development. Severe habitat degradation is evident in Little Bear Creek and its unnamed tributary. Contaminated groundwater from the Cordova Chemical Company site vents to the unnamed tributary and Little Bear Creek. No quantitative habitat data are available.

Contact person: R. O'Neal, Michigan Dept. of Natural Resources, Grand Rapids, MI.

17. WRITE LAKE	
Fish Community Goals/Objectives/Targets	Status
<p>The State of Michigan has designated white Lake to be protected for warmwater fish species as a minimum. All tributaries to the White River and White Lake are protected for coldwater fish. More specific fish community objectives or targets have yet to be developed.</p>	<p>White Lake currently supports excellent populations of northern pike, largemouth bass, smallmouth bass, walleye, yellow perch, redhorse sucker, white sucker, bluegills, crappie, and carp. Salmon and trout species have also been observed in the area, especially during spawning runs up the White River. White Lake has been described to be second, only to Muskegon Lake, in popularity and value as a fishery in western Michigan. Fishing by licensed anglers on White Lake was estimated at 60,000 angler days during 1982.</p>

Contact person: R. O'Neal, Michigan Dept. of Natural Resources, Grand Rapids, MI.

17. WHITE LAKE	
Fish Habitat Goals/Objectives/Targets	Status
In general, the goal for White Lake is for suitable habitat to support the restoration of a warmwater fishery. Additional interim goals include: discontinue any additional development in the upper portion of White Lake which has most of the remaining protected areas and littoral zone habitat with high productivity; and ensure that the extensive marsh above White Lake is protected for northern pike spawning and forage fish.	In general, most of the highly productive bays which support considerable macrophytes have been dredged or filled for marinas or other development. Historically, most of these productive habitats were found in the upper portion of White Lake. Effects of development on habitat loss have been less in the lower portion of White Lake because this basin is much larger and littoral zone habitat and productivity is lower. This is because of a narrow littoral zone and sharp drop-offs in the lower portion of White Lake. No quantitative habitat data are available.

Contact person: R. O'Neal, Michigan Dept. of Natural-Resources, Grand Rapids, MI.

18. SAGINAW RIVER/BAY	
Fish Community Goals/Objectives/Targets	Status
<p>The overall fishery management goal is to restore a balanced fishery in Saginaw Bay by enhancing numbers of predaceous game fish, such that by year 2000 prey fish abundance is measurably reduced. Related goals include:</p> <ul style="list-style-type: none"> * Enhance predator abundance by stocking, regulatory protection, and habitat improvement, while maintaining harvest levels of at least 454,550 kg (1 million pounds) through year 2000; allow harvest of predators to reach at least 681,800 kg (1.5 million pounds) by year 2020. * Restore valued fisheries at lower trophic levels such that extractions of "nonpredatory" species reach at least 1,000,000 kg (2.2 million pounds) by year 2000 and 1,365,640 kg (3.0 million pounds) by year 2020. * Provide at least 600,000 days of angler recreation per year on Saginaw Bay through year 2000 and 1,000,000 days by year 2020. <p>Specific objectives include:</p> <ul style="list-style-type: none"> * Enhance the walleye population of Saginaw Bay to its estimated potential, producing an annual sport fishing yield of at least 300,000 fish or 227,270 kg (0.5 million pounds) by year 2000 and 600,000 fish or 454,550 kg (1,000,000 pounds) by year 2020. * By year 2000, inventory the largemouth and smallmouth bass fisheries of Saginaw Bay and identify their management needs. * Increase abundance of northern pike through habitat improvement and stocking, such that annual extractions increase from the present level of 54,550 kg (120 thousand pounds) to 90,910 kg (200 thousand pounds) by year 2020. * Experimentally introduce Great Lakes Muskellunge to Saginaw Bay by year 2000. 	<p>Fishery production of Saginaw Bay peaked in 1902, with a commercial, catch of 6,454,500 kg (14.2 million pounds). Production has gradually declined to a low of 636,400 kg (1.4 million pounds) in 1974. Present commercial fish production remains below even the 1974 level. Contributing to the decline were effects of introductions of nonnative fish (sea lamprey, carp, rainbow smelt, alewife, and others), heavy exploitation by the commercial fishery, extinction of lake herring from the bay, and water quality and habitat degradation. In more recent years a major sport fishery has developed in the bay, largely in response to reintroduction of walleye, but also due to sport fishery restoration lakewide, made possible by the chemical control of sea lamprey. Anglers fished Saginaw Bay a total of nearly 600,000 days in 1986, and caught over 5,000,000 fish, the vast majority of which were yellow perch; 73,000 were walleye. The 1988 walleye harvest increased to 100,000 fish. The Saginaw Bay fishery accounted for 60% of the total fishery effort on Lake Huron in 1986 and has accounted for 42-43% of the effort in the open water season (April-September) during 1986-1988. Based on available data, current annual harvest levels include: 111,800 kg walleye; 5,000 kg white bass; 265,900 kg channel catfish; 54,500 kg northern pike; 409,100 kg yellow perch; 6,800 kg white perch; 12,700 kg smelt; 48,600 kg white sucker; 368,200 kg carp; 23,600 kg freshwater drum; and 14,100 kg quillback carpsucker.</p>

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| <ul style="list-style-type: none"> * By year 2020, restore yellow perch growth and maintain yield at a level characteristic of the 1950s. Length at age 5 should be near 21.6 cm (8.5 inches). Yield should be maintained at existing levels, near 363,640 kg (800,000 pounds). * Monitor the status and ecological impacts of the invasion of white perch, while attempting to manipulate the population (by enhancement of predator numbers and promoting harvest of a desirable sport or commercial product), such that impacts upon native species are minimized. * Rehabilitate the lake herring by reducing competition from other species and, if necessary, by stocking, such that sport and/or commercial extractions recover to at least 181,820 kg (0.4 million pounds) by year 2020. * Maintain current harvest levels for commercial fisheries operating under Michigan licenses or permits, while relocating most Saginaw Bay effort to the Main Basin. * Maintain a favorable mix of species and appropriate abundance levels to support and coexist with the desired game fish population. * Maintain incentives for the commercial and sport harvest of carp, carpsucker, white sucker and drum, such that combined extractions of at least 454,550 kg (1 million pounds) annually are continued. | |
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Contact person: J. Johnson, Michigan Department of Natural Resources, Alpena, MI.

18. SAGINAW RIVER/BAY	
Fish Habitat Goals/Objectives/Targets	Status
<p>current habitat goals related to solutions for fishery management problems include:</p> <ul style="list-style-type: none"> * encourage habitat restoration, removal of dams and construction of fishways to increase the availability of tributary spawning sites, and improvements in tributary habitat and water quality for walleye; * encourage protection of wetlands and sheltered areas for largemouth and smallmouth bass; * encourage improvements in water quality, primarily reductions in turbidity, which could subsequently improve habitat for pike, and promoting recovery for access to natural wetlands for pike; and * encourage improvements in water quality, especially reductions in sediment loading, which could improve spawning habitat for lake herring. 	<p>Habitat degradation is acknowledged as an important factor contributing to the decline of the Saginaw River/Ray fishery. Pollution and degraded habitat may still limit recovery of walleye, herring and the burrowing mayfly, a key prey for yellow perch, herring, and young walleye. The primary source of sediment loading and contamination of sediments is the Saginaw River tributary system. The sediments may be affecting spawning grounds and species diversity. Contaminants are being passed up the food chain into the fishery, with especially high contaminant burdens in carp and catfish. Dredging and other disturbances reintroduce contaminants from the sediments to the food chain. Loss of wetlands limits populations of northern pike, largemouth bass, and other oriented species and life stages.</p>

Contact person: J. Johnson, Michigan Department of Natural Resources, Alpena, MI.

19. COLLINGWOOD HARBOUR	
Fish Community Goals/Objectives/Targets	Status
<p>Maintain a fish community comparable to those observed in similar habitats outside the harbor and representative of a mesotrophic environment, containing pike, bass, yellow perch and walleye.</p> <p>Proposed fish community: Piscivores 45-60% (116-150 kg/ha) Benthivores 40-50% (103-130 kg/ha) Planktivores 1% Herbivores <0.5%</p> <p>(based on effects of improved water quality in Bay of Quinte, and Hamilton Harbour Stage 2 RAP.)</p>	<p>surveys indicate healthy populations of benthivores and piscivores (pike, bass and yellow perch), indicative of a mesotrophic environment. Walleye, lake trout, rainbow trout and chinook salmon occupy the harbour seasonally; their densities vary according to conditions elsewhere in Georgian Bay. A 1986 fish inventory found white sucker and rainbow smelt to be most abundant; sport fish accounted for <4% of the survey catch. No historical data exist to confirm whether abundance and/or composition are impaired. sediment bioassays with fish confirm no significant toxicity.</p>

Contact person: D. Hughes, Ontario Ministry of Natural Resources, Owen Sound, Ontario.

19. COLLINGWOOD HARBOUR	
Fish Habitat Goals/Objectives/Targets	Status
Protect habitat to maintain current levels of fish. When the opportunity arises, rehabilitate habitat.	<p>. The destruction of habitat occurred historically with the development of the harbor. The two major types of fish habitat in the harbor are rocky rubble areas and submergent or emergent vegetation. Of 10 species of macrophytes identified in 1986, the dominant aquatic plant was milfoil.</p> <p>Water quality is being improved through reduced loadings of phosphorous and erosion control measures.</p> <p>The Collingwood Harbour Remedial Action Plan and Public Advisory Committee members are taking an active role in planning at the local level (municipal, industrial, commercial), to ensure that habitat is preserved and rehabilitated.</p>

Contact person: D. Hughes, Ontario Ministry of Natural Resources, Owen Sound, Ontario.

20. SEVERN SOUND	
Fish Community Goals/Objectives/Targets	Status
<p>Restore predator populations (walleye, pike, muskellunge) to levels observed in the mid 1970s. Top predators should make up $\geq 10\%$ of sport fishing harvest.</p> <p>As an interim measure, stock sufficient numbers of fingerling walleye to restore abundance of predators.</p>	<p>catches of black crappie and bullhead have greatly increased since 1975, while predator catches have declined. Panfish and benthic species made up 50% of the catch in 1975, compared to 90% in recent years. Panfish and benthic components comprised a balanced mix of species in 1975, but are now dominated ($>75\%$) by single species, i.e., crappie and bullhead, respectively. Thus, system is considered unstable and unpredictable. Rebuilding top predator component should restore greater stability to the Severn sound fish community.</p>

Contact person: D. Hughes, Ontario Ministry of Natural Resources, Owen sound, Ontario.

20. SEVERN SOUND	
Fish Habitat Goals/Objectives/Targets	Status
Identify and protect nearshore habitat and wetlands, including planning and development controls to prohibit alteration of these areas. NO net loss of shoreline wetland and fish habitat.	Interim fish habitat management plan has been prepared, and is being used by Ontario Ministry of Natural Resources Midhurst district staff in reviewing shoreline development proposals. Municipal planners in the area are ready to incorporate the plan in their official plan process.
Protect and enhance spawning areas used by walleye in Severn Sound.	Walleye spawning sites were previously enhanced and may be expanded if evidence suggests habitat is limiting recruitment.

Contact person: D. Hughes, Ontario Ministry of Natural Resources, Owen Sound, Ontario.

21. SPANISH HARBOUR	
Fish Community Goals/Objectives/Targets	Status
Every attempt should be made to prevent further introductions of exotic non-native species and to re-establish biological communities which reflect those existing prior to European Settlement.	The walleye population in the Spanish River appears to be self-sustaining, and may be increasing. Muskellunge, channel catfish, redhorse sucker and sauger were reported as present historically in the river, but are now rare (catfish, redhorse) or absent (muskellunge, sauger).

Contact person: D. Hughes, Ontario Ministry of Natural Resources, Owen Sound, Ontario.

21. SPANISH HARBOUR	
Fish Habitat Goals/Objectives/Targets	Status ,
<p>Water quality and habitat should be improved and maintained such that:</p> <ul style="list-style-type: none"> * a diverse range of organisms is able to survive and flourish year round: and * an edible and self-sustaining fishery exists. 	<p>Prior to implementation of secondary sewage treatment in 1983, low dissolved oxygen concentrations, frequent spills and massive fish kills were not uncommon. As late as 1980, the streambed was fouled with bark and fiber. Historical water quality and sediment contamination, that may have limited the fishery, appear to have been resolved.</p> <p>Some loss of habitat has occurred from shoreline alterations and marina construction at the village of Spanish.</p>

Contact person: D. Hughes, Ontario Ministry of Natural Resources, Owen Sound, Ontario.

22. CLINTON RIVER	
Fish Community Goals/Objectives/Targets	Status
<p>The State of Michigan has designated Clinton River to be protected for warmwater and migratory coldwater fish species. The current management goal for the reach from Red Run to the Spillway Mouth and the Natural River Mouth is to support fishable, self-sustaining populations of walleye, largemouth bass, northern pike, yellow perch, and other panfish. Specific objectives include:</p> <ul style="list-style-type: none"> * increase abundance, reproduction, and survival of the above species: and * restore impaired beneficial uses (i.e. warmwater fishery, other aquatic life, partial body contact recreation, and public water supply at point of water intake) at known sites. 	<p>There has been a resurgence of sport fishing in the main branch of the river. In the 1960s, no fish were found living in the main branch of the river from Pontiac to the confluence of the North Branch. In 1980, 33 species of fish were found in that section of the river. The cause was substantial improvement in point source pollution control efforts. Today, natural reproduction of walleye and chinook salmon occur in the river. Both walleye and trout are stocked in certain reaches of the river. Recent sampling of game fish within the recreational navigational channel include northern pike, yellow perch, pumpkinseed, large and smallmouth bass, rock bass, white bass, black crappie, walleye, and muskellunge.</p>

Contact person: R. Spitler, Michigan Dept. of Natural Resources, Livonia, MI.

22. CLINTON RIVER	
Fish Habitat Goals/Objectives/Targets	Status
<p>Current related goals include:</p> <ul style="list-style-type: none"> * minimize the effects of contaminated sediments on fish and other aquatic life; * improve physical bottom habitat to support a healthy benthic macroinvertebrate community by reducing runoff and erosion; * improve dissolved oxygen concentration in the water column so that the dissolved oxygen standard is met by controlling point source discharges, minimizing stormwater loadings, and eliminating illegal connections to the stormwater system; * improve dissolved oxygen in the natural channel by removing sediments blocking flow to the natural channel and weir modifications; * improve future sediment quality by ensuring adequate point and nonpoint source control of heavy metal and organic contaminant loadings; and * improve flow in the natural channel. <p>Other related goals from the Clinton River Watershed Management Plan include:</p> <ul style="list-style-type: none"> * increase flow stability by protecting existing groundwater recharge areas, encouraging stormwater management, and managing flows at control structures to simulate natural conditions; * identify, protect, and consider restoration of high quality reaches, especially those which are most accessible to potamodromous fishes; * restore or create riparian wetlands, where possible; * control erosion of sediment through nonpoint source management, best management practices, riparian buffer strips, etc.; and * develop productive runs of desired fish species by removing barriers to migration. 	<p>Fish habitat in the Clinton River is impacted by a mixture of natural and urban-related factors. These include: conventional pollutants, organic and heavy metal contaminants from historic discharges attached to fine particles settling out in the Area of Concern due to low velocity, high sediment oxygen demand, low river aeration rates, watershed soil types, agricultural practices, urban development, partially blocked river flow, high Great Lakes levels, and little topographical relief resulting in river water stagnation and flow reversals. The Clinton River Watershed Integrated Management Plan concludes that fishery potential is currently impaired by habitat degradation stemming from past and continuing land use practices, wastewater treatment plant discharges, and stormwater management activities. No quantitative habitat data are available.</p>

Contact person: R. Spitler, Michigan Dept. of Natural Resources, Livonia, MI.

23. ROUGE RIVER	
Fish Community Goals/Objectives/Targets	Status
<p>All main branches of the Rouge River are designated by the State of Michigan as water bodies suitable for a warmwater fishery. In addition! several coldwater tributaries exist. Therefore, the goal is to restore water quality and habitat in the Rouge River in order to meet its designated use as a warmwater fishery in the main branches and a coldwater fishery in the tributaries that can support it. More specific fish community objectives or targets have yet to be developed.</p>	<p><i>The use of the Rouge River as a warmwater fishery is frequently or severely impaired in 9 of the 11 subbasins due primarily to low dissolved oxygen concentrations, elevated toxic substances levels in water, contaminated sediments, and reduced fish and macroinvertebrate diversities. Sport fishing in the Rouge River Basin is very limited. Largemouth bass and northern pike are occasionally taken from impoundments in the river system. The Rouge River watershed is the only river system in Michigan known to support populations of the Redside Dace, a threatened fish species. There are three known locations for these cyprinids within the watershed. Rapid development within the headwaters may further stress the remaining populations. Based on a 1986 fish and macroinvertebrate survey, it was concluded that the Rouge River remains degraded from its headwaters to its confluence with the Detroit River.</i></p>

Contact person: E. Hay-Chmielewski, Michigan Dept. of Natural Resources, Livonia, MI.

23. ROUGE RIVER	
Fish Habitat Goals/Objectives/Targets	Status
<p>Although the Rouge River Basin is severely degraded, several opportunities exist for working toward a significant sports fishery in the system. Interim goals include:</p> <ul style="list-style-type: none"> * development of low flow augmentation to sustain a viable fishery (e.g. logjam removal, erosion prevention, construction of retention basins to alleviate serious flooding); * reduction of human waste contamination through construction of retention basins to store, for later treatment, combined sewer overflow discharges; * protection of headwaters and their attendant wetlands; and * reduction in bedload transport of sediment-bound toxic substances and remediation of contaminated sediment hot spots. 	<p>Much of the Rouge River Watershed is severely degraded and little fishery improvement can be made until water quality and habitat degradation is rectified. Flow rates within the Rouge River Basin are subject to wide fluctuation, ranging from almost zero during summer months of low precipitation to flood conditions after only moderate rainfalls. Spring runoff also produces flooding. Since 1986, logjams and debris have annually been removed from the river. Between 1988 and 1991, over \$500 million in sanitary sewer improvements have been made. The City of Southfield has created fish habitat in a 0.5 km stretch of the Rouge River by constructing six triangular wing dams to create a sequence of deep pools and shallow riffles.</p>

Contact person: E. Hay-Chmielewski, Michigan Dept. of Natural Resources, Livonia, MI.

24. RIVER RAISIN	
Fish Community Goal/Objectives/Targets	Status
<p>Virtually all streams in the River Raisin Basin are classified as second quality warmwater streams. This classification reflects past problems with water quality and current heavy sediment load combined with warm water temperatures in most tributaries. The relatively low amount of groundwater input and the extreme "flashy" character of many River Raisin tributaries also dictate a second quality warmwater designation. It has been recommended that the mainstream of the River Raisin from Brooklyn to Tecumseh should be designated as a top quality warmwater stream. This portion of the river supports significant gamefish populations of smallmouth bass, northern pike, and panfish. Water quality in this upstream portion of the river is generally very good. Target species for management include:</p> <ul style="list-style-type: none"> * smallmouth bass, pike, rock bass, and other panfish in the upper section from the river's origin to Tecumseh; * channel catfish, walleye, and possibly purebred muskellunge in the middle section from Tecumseh to Dundee; and * smallmouth bass in the downstream section from Tecumseh to Dundee. 	<p>Based on extensive fishery survey in 1984, 61 species were reported. The bluntnose minnow was the most numerous species throughout the River Raisin. However, when disregarding all fish less than 7.6 cm long, the northern hog sucker was the most numerous. Carp accounted for 28.3% by weight but only 1.9% by number of the total catch. Estimates of total fish standing crop in the River Raisin ranged from 23-129 kg/ha. The River Raisin mainstream from Adrian to Dundee had a lower average standing crop of fish and a higher proportion of rough fish than the rest of the river. six fish species were found at every station in the mainstream. These were the spotfin shiner, white sucker, northern hog sucker, yellow bullhead, rock bass, and johnny darter.</p> <p>The majority of fishing in the River Raisin Basin occurs in the lakes and ponds of the northwestern portion of the basin. Many of these lakes and impoundments are fished heavily. The major gamefish species available in these lakes include largemouth bass, bluegill, black crappie, yellow perch, pumpkinseed, northern pike, and bullheads. Other significant gamefish available naturally in some of the lakes or as a result of stocking programs include smallmouth bass, rock bass, tiger muskellunge, northern muskellunge, redear sunfish, rainbow trout, and walleye.</p>

Contact person: K. Dodge, Michigan Dept. of Natural Resources, Jackson, MI.

24. RIVER RAISIN	
Fish Habitat Goals/Objectives/Targets	Status
<p>The current management goal is to provide suitable habitat to support a warmwater fishery as defined below:</p> <ul style="list-style-type: none"> * smallmouth bass, pike, rock bass, and other panfish in the upper section from the river's origin to Tecumseh; * channel catfish, walleye, and possibly purebred muskellunge in the middle section from Tecumseh to Dundee: and * smallmouth bass in the downstream section from Tecumseh to Dundee <p>More specific fish habitat objectives or targets have yet to be developed.</p>	<p>The upper river is characterized by permeable soils. The stream gradient is relatively high and flow is fairly swift. The stream bed is firm in most areas; and the bottom is composed of sand, gravel, rock, and lesser amounts of silt. Fish cover is adequate, although some stream sections could benefit from more cover and pool habitat. Problems include excessive water withdrawal for irrigation and the presence of dams in several prime habitat high-gradient areas.</p> <p>The middle section of the river mainstream has been adversely affected by pollution and heavy sedimentation. The soil is less permeable and contains a higher percentage of clay than soils in the upper watershed. Stream gradient is low in the Tecumseh to Dundee portion and flow is sluggish. The stream bed remains relatively firm; but the bottom is comprised mainly of sand, silt, and clay with a lesser amount of gravel. Major obstacles include frequent high turbidity and other impacts caused by agricultural nonpoint pollution. Other problems include major logjams which discourage public use and add to the sediment load, and the extreme low gradient which favors rough fish at the expense of smallmouth bass and other gamefish.</p> <p>The lower river from Dundee to Lake Erie is characterized by relatively impermeable soils. The topography is generally flat. The stream bed is firm in almost all areas; and is comprised of rock, cobble, sand, and limestone bedrock. Fish cover is a limiting factor. The major fish management problem in the lower river is the Detroit Edison Power Plant intake which prevents upstream migration of fish. Other problems include wetland loss, lack of gamefish cover, limited access between Dundee and Ida-Maybee Road, and PCB-contaminated sediments.</p>

Contact person: K. Dodge, Michigan Dept. of Natural Resources, Jackson, MI.

25. MAUMEE RIVER	
Fish Community Goals/Objectives/Targets	Status
<p>Most of the Lake Erie tributaries in Ohio are designated by the State of Ohio for protection of warmwater habitat. Attainment/nonattainment of aquatic life uses in warmwater habitat is determined by using a number of biological community performance measures. For the fish community these include the Index of Biotic Integrity (IBI) and the Modified Index of Well-Being (MIwb). IBI incorporates 12 fish community metrics within three broad categories (species richness and composition; trophic composition; and fish abundance and condition). The value of each metric is compared to the value expected at a reference site located in a similar ecoregion where human influence has been minimal. IBI incorporates some elements of professional judgement, but primarily provides for a quantitative analysis for determining what is exceptional, good, fair, poor, and very poor based on established criteria. MIwb incorporates four measures of fish communities that have traditionally been used separately; numbers of individuals, biomass, Shannon Diversity Index based on numbers, and Shannon Diversity Index based on weight. Interim Lake Erie estuary goals for IBI and MIwb are \geq 32 and 7.5, respectively.</p>	<p>Based on 1986 fish community data, IBI values for stations at river kilometer 0.2, 1.1, 2.2, 5.8, 11.8, 21.9 and 23.7 were 19, 22, 27, 23, 23, 25, and 30, respectively. MIwb values for stations at river kilometer 0.2, 1.1, 2.2, 5.8, 11.8, 21.9 and 23.7 were 4.4, 5.9, 6.1, 6.3, 6.4, 7.1, and 7.9, respectively. These data suggest that, in general, there is nonattainment of the interim goals for warmwater habitat uses in the lower 21 km of the Maumee River. The data presented above are based on 64 samples collected over 22 hours of effort. A total of 47 species (13% exotic) and 9,709 individuals (7% exotic) were collected. Dominant species by number were: gizzard shad (4,758); emerald shiner (1,431); white perch (691); carp (504); and spottail shiner (326).</p>

Contact persons: R. Thoma and E. Rankin, Ohio Environmental Protection Agency, Columbus, OH.

25. MAUMEE RIVER	
Fish Habitat Goals/Objectives/Targets	Status
<p>Most of the Lake Erie tributaries in Ohio are designated by the State of Ohio for protection of warmwater habitat. Currently, assessment of macro-habitat quality is performed using the Qualitative Habitat Evaluation Index (QHEI). This index is designed to provide a measure of lotic habitat that generally corresponds to those physical factors that affect fish communities and which are generally important to other aquatic life such as invertebrates. The QHEI is based on six interrelated metrics: substrate, instream cover, channel morphology, riparian and bank condition, pool and riffle quality, and gradient. These metrics describe attributes of physical habitat that may be important in explaining the species presence, absence, and composition of fish communities in a stream. The index will be modified in the future for Lake Erie nearshore areas, harbors, and bays. QHEI scores of < 45 are usually associated with streams that do not attain warmwater habitat uses because habitat modifications are generally severe and widespread. QHEI scores of > 60 usually do achieve warmwater habitat uses because the effects of stream modification are usually not severe and many natural characteristics of the stream still exist. Intermediate QHEI scores of 46-60 may or may not achieve warmwater habitat uses depending on what habitat characteristics appear to be limiting aquatic life. For the intermediate QHEI scores of 46-60, other information such as biological data should be evaluated.</p>	<p>Based on 1986 physical habitat data, QHEI scores for stations at river kilometer 0.2, 1.1, 2.2, 5.8, 11.8, 21.9, and 23.7 were 49, 58, 67, 61, 64, 62, and 71, respectively. Based on these and other biological data, Ohio EPA has concluded that warmwater habitat uses at most of the stations sampled cannot be attained because of severe habitat modification.</p>

Contact persons: R. Thoma and E. Rankin, Ohio Environmental Protection Agency, Columbus, OH.

26. BLACK RIVER	
Fish Community Goals/Objectives/Targets	Status
<p>Most of the Lake Erie tributaries in Ohio are designated by the State of Ohio for protection of warmwater habitat. Attainment/nonattainment of aquatic life uses in warmwater habitat is determined by using a number of biological community performance measures. For the fish community these include the Index of Biotic Integrity (IBI) and the Modified Index of Well-Being (MIwb). IBI incorporates 12 fish community metrics within three broad categories (species richness and composition; trophic composition; and fish abundance and condition). The value of each metric is compared to the value expected at a reference site located in a similar ecoregion where human influence has been minimal. IBI incorporates some elements of professional judgement, but primarily provides for a quantitative analysis for determining what is exceptional, good, fair, poor, and very poor based on established criteria. MIwb incorporates four measures of fish communities that have traditionally been used separately; numbers of individuals, biomass, Shannon Diversity Index based on numbers, and Shannon Diversity Index based on weight. Interim Lake Erie estuary goals for IBI and MIwb are \geq 32 and 7.5, respectively.</p>	<p>Based on 1982 fish community data, IBI values for stations at river kilometer 1.4, 4.3, 5.3, 7.7, and 9.3 were 29, 22, 23, 27, and 20, respectively. MIwb values for stations at river kilometer 1.4, 4.3, 5.3, 7.7, and 9.3 were 6.7, 5.9, 5.7, 5.3, and 3.7, respectively. These data suggest that there is nonattainment of the interim goals for warmwater habitat uses at the lower 8 km of the Black River. The data presented above are based on 34 samples collected over 180 hours of effort. A total of 41 species (17% exotic) and 9,465 individuals (7% exotic) were collected. Dominant species by number were: gizzard shad (6,818); emerald shiner (1,089); goldfish (261); carp (244); and white bass (228).</p>

Contact persons: R. Thoma and E. Rankin, Ohio Environmental Protection Agency, Columbus, OH.

26. BLACK RIVER	
Fish Habitat Goals/Objectives/Targets	Status
<p>Most of the Lake Erie tributaries in Ohio are designated by the State of Ohio for protection of warmwater habitat. Currently, assessment of macro-habitat quality is performed using the Qualitative Habitat Evaluation Index (QHEI)¹. This index is designed to provide a measure of lotic habitat that generally corresponds to those physical factors that affect fish communities and which are generally important to other aquatic life such as invertebrates. The QHEI is based on six interrelated metrics: substrate, instream cover, channel morphology, riparian and bank condition, pool and riffle quality, and gradient. These metrics describe attributes of physical habitat that may be important in explaining the species presence, absence, and composition of fish communities in a stream. The index will be modified in the future for Lake Erie nearshore areas, harbors, and bays. QHEI scores of < 45 are usually associated with streams that do not attain warmwater habitat uses because habitat modifications are generally severe and widespread. QHEI scores of > 60 usually do achieve warmwater habitat uses because the effects of stream modification are usually not severe and many natural characteristics of the stream still exist. Intermediate QHEI scores of 46-60 may or may not achieve warmwater habitat uses depending on what habitat characteristics appear to be limiting aquatic life. For the intermediate QHEI scores of 46-60, other information such as biological data should be evaluated.</p>	<p>Based on 1989 physical habitat data, QHEI scores for stations at river kilometer 7.7 and 9.3 were 61 and 68, respectively. These data suggest that physical habitat modification at these two stations is not a factor impacting the fishery.</p>

Contact persons: R. Thoma and E. Rankin, Ohio Environmental Protection Agency, Columbus, OH.

27. CUYAHOGA RIVER	
Fish Community Goals/Objectives/Targets	Status
<p>Most of the Lake Erie tributaries in Ohio are designated by the State of Ohio for protection of warmwater habitat. Attainment/nonattainment of aquatic life uses in warmwater habitat is determined by using a number of biological community performance measures. For the fish community these include the Index of Biotic Integrity (IBI) and the Modified Index of Well-Being (MIwb). IBI incorporates 12 fish community metrics within three broad categories (species richness and composition; trophic composition; and fish abundance and condition). The value of each metric is compared to the value expected at a reference site located in a similar ecoregion where human influence has been minimal. IBI incorporates some elements of professional judgement, but primarily provides for a quantitative analysis for determining what is exceptional, good, fair, poor, and very poor based on established criteria. MIwb incorporates four measures of fish communities that have traditionally been used separately; numbers of individuals, biomass, Shannon Diversity Index based on numbers, and Shannon Diversity Index based on weight. Interim Lake Erie estuary goals for IBI and MIwb are \geq 32 and 7.5, respectively.</p>	<p>Based on 1984-1988 fish community data, IBI values for stations at river kilometer 1.3, 2.4, 5.4, and 8.2 were 12, 17, 14, and 14, respectively. MIwb values for stations at river kilometer 1.3, 2.4, 5.4, and 8.2 were 4.7, 3.8, 3.4, and 4.1, respectively. These data suggest that there is nonattainment of the interim goals for warmwater habitat uses at the lower 8 km of the Cuyahoga River. The data presented above are based on 54 samples collected over 17.7 hours of effort. A total of 26 species (19% exotic) and 4,068 individuals (22% exotic) were collected. Dominant species by number were: gizzard shad (2,712); carp (325); white perch (321); emerald shiner (238); and goldfish (151).</p>

Contact persons: R. Thoma and E. Rankin, Ohio Environmental Protection Agency, Columbus, OH.

27. CUYAHOGA RIVER	
Fish Habitat Goals/Objectives/Targets	Status
<p>Most of the Lake Erie tributaries in Ohio are designated by the State of Ohio for protection of warmwater habitat. Currently, assessment of macro-habitat quality is performed using the Qualitative Habitat Evaluation Index (QHEI). This index is designed to provide a measure of lotic habitat that generally corresponds to those physical factors that affect fish communities and which are generally important to other aquatic life such as invertebrates. The QHEI is based on six interrelated metrics: substrate, instream cover, channel morphology, riparian and bank condition, pool and riffle quality, and gradient. These metrics describe attributes of physical habitat that may be important in explaining the species presence, absence, and composition of fish communities in a stream. The index will be modified in the future for Lake Erie nearshore areas, harbors, and bays. QHEI scores of < 45 are usually associated with streams that do not attain warmwater habitat uses because habitat modifications are generally severe and widespread. QHEI scores of > 60 usually do achieve warmwater habitat uses because the effects of stream modification are usually not severe and many natural characteristics of the stream still exist. Intermediate QHEI scores of 46-60 may or may not achieve warmwater habitat uses depending on what habitat characteristics appear to be limiting aquatic life. For the intermediate QHEI scores of 46-60, other information such as biological data should be evaluated.</p>	<p>Based on 1988 physical habitat data, QHEI scores for stations at river kilometer 1.3, 2.4, 5.4, and 8.2 were 32, 43, 32, and 30, respectively. Based on these and other biological data, Ohio EPA has concluded that suggest that warmwater habitat uses at the lower 5 stations cannot be attained because of severe habitat modification.</p>

Contact persons: R. Thoma and E. Rankin, Ohio Environmental Protection Agency, Columbus, OH.

28. ASHTABULA RIVER	
Fish Community Goals/Objectives/Targets	Status
<p>Most of the Lake Erie tributaries in Ohio are designated by the State of Ohio for protection of warmwater habitat. Attainment/nonattainment of aquatic life uses in warmwater habitat is determined by using a number of biological community performance measures. For the fish community these include the Index of Biotic Integrity (IBI) and the Modified Index of Well-Being (MIwb). IBI incorporates 12 fish community metrics within three broad categories (species richness and composition; trophic composition; and fish abundance and condition). The value of each metric is compared to the value expected at a reference site located in a similar ecoregion where human influence has been minimal. IBI incorporates some elements of professional judgement, but primarily provides for a quantitative analysis for determining what is exceptional, good, fair, poor, and very poor based on established criteria. MIwb incorporates four measures of fish communities that have traditionally been used separately; numbers of individuals, biomass, Shannon Diversity Index based on numbers, and Shannon Diversity Index based on weight. Interim Lake Erie estuary goals for IBI and MIwb are ≥ 32 and 7.5, respectively.</p>	<p>Based on 1989 fish community data, IBI values for stations at river kilometer 0.8, 2.1, and 2.9 were 13, 26, and 32, respectively. MIwb values for stations at river kilometer 0.8, 2.1, and 2.9 were 2.8, 5.8, and 7.7, respectively. These data suggest that there is nonattainment of the interim goals for warmwater habitat uses at the lower two stations (river kilometer 0.8 and 2.1) in the Ashtabula River. The data presented above are based on 15 samples collected over 7.7 hours of effort. A total of 33 species (15% exotic) and 1,361 individuals (4% exotic) were collected. Dominant species by number were: gizzard shad (423); pumpkinseed (214); bluegill (123); brook silverside (100); and bluntnose minnow (71).</p>

Contact persons: R. Thoma and E. Rankin, Ohio Environmental Protection Agency, Columbus, OH.

28. ASHTABULA RIVER	
Fish Habitat Goals/Objectives/Targets	Status
<p>Most of the Lake Erie tributaries in Ohio are designated by the State of Ohio for protection of warmwater habitat. Currently, assessment of macro-habitat quality is performed using the Qualitative Habitat Evaluation Index (QHEI). This index is designed to provide a measure of lotic habitat that generally corresponds to those physical factors that affect fish communities and which are generally important to other aquatic life such as invertebrates. The QHEI is based on six interrelated metrics: substrate, instream cover, channel morphology, riparian and bank condition, pool and riffle quality, and gradient. These metrics describe attributes of physical habitat that may be important in explaining the species presence, absence, and composition of fish communities in a stream. The index will be modified in the future for Lake Erie nearshore areas, harbors, and bays. QHEI scores of < 45 are usually associated with streams that do not attain warmwater habitat uses because habitat modifications are generally severe and widespread. QHEI scores of > 60 usually do achieve warmwater habitat uses because the effects of stream modification are usually not severe and many natural characteristics of the stream still exist. Intermediate QBEI scores of 46-60 may or may not achieve warmwater habitat uses depending on what habitat characteristics appear to be limiting aquatic life. For the intermediate QHEI scores of 46-60, other information such as biological data should be evaluated.</p>	<p>Based on 1989 physical habitat data, QHEI scores for stations at river kilometer 0.8, 2.1, and 2.9 were 35, 49, and 55, respectively. These data suggest that the warmwater habitat uses at the lower station (river kilometer 0.8) cannot be attained because of severe habitat modification. In this case this station at river kilometer 0.8 is located in the shipping channel.</p>

Contact persons: R. Thoma and E. Rankin, Ohio Environmental Protection Agency, Columbus, OH.

29. PRESQUE ISLE BAY	
Fish Community Goals/Objectives/Targets	Status
<p>It will be the policy of the Pennsylvania Fish and Boat commission to protect, conserve, and enhance the quality and diversity of the commonwealth's fishery resource (including reptiles and amphibians) and to provide continued and varied angling opportunity through scientific inventory, classification, and management of that resource. To achieve the objectives of this policy, the Commission shall:</p> <p>1) Establish and maintain a current data base on the quality and quantity of Pennsylvania's aquatic and fishery resources for effective environmental protection and resource conservation.</p> <p>2) Develop statewide management programs to assure consistent treatment of all resources within a given class. Similar waters will be managed to meet the same objectives under the same philosophy on a statewide basis.</p>	<p>This policy continues to be in effect.</p> <p>The Pennsylvania Fish and Boat Commission (PFBC) has established and continues to maintain a database which includes: biological (fish population statistics), chemical (basic productivity), physical (morphometric) and social (angler use, harvest, and accessibility) data on Presque Isle Bay and all Commonwealth waters subject to Commission management. Two comprehensive biological/chemical/physical surveys have been completed (1982 and 1987), and one comprehensive social (angler and boater use and harvest) survey has been completed (1981/82) on Presque Isle Bay since the implementation of this policy. In addition, a volunteer angler catch reporting program was initiated on Lake Erie and Presque Isle Bay (1986 - present) to monitor angler catch rates of sport fish species on an annual basis. Future comprehensive surveys are planned.</p> <p>Presque Isle Bay, Lake Erie, and their tributaries have been and continue to be managed differently than Commonwealth inland waters. Open seasons, creel limits, and size limits of various fish species in these waters account for their unique biological characteristics. In addition, recent strategic planning efforts to guide the PFBC into the next century have identified a number of "resource categories" which are sufficiently homogeneous to be managed similarly. Presque</p>

<p>3) Manage self-sustaining fish populations as a renewable natural resource to preserve and/or conserve that resource and the angling it provides.</p> <p>4) Use hatchery fish to provide recreation in those waters where fish populations are inadequate to sustain the fishery at desired levels.</p> <p>5) Develop appropriate regulations and operational strategies to replace policies that are not compatible with management through resource classification.</p>	<p>Isle Bay, Lake Erie, and their tributaries comprise one specific resource category. Concise fishery management goals and objectives are currently being formulated for this resource category which includes Presque Isle Bay.</p> <p>Within Presque Isle most warm/cool water fish species are managed on a self-sustaining basis, exceptions include northern pike and muskellunge. In recent years releases of artificially cultured northern pike have been canceled due to high densities of this species in the Bay resulting from naturally produced year classes. Muskellunge natural reproduction appears to be minimal, consequently artificially cultured muskellunge fingerlings are released annually or bi-annually by the PFBC for a fishery.</p> <p>Recreational fisheries for two exotic species, coho salmon and steelhead trout, have been developed by release of approximately 400,000 (combined) artificially cultured fingerling into Presque Isle Bay annually. In addition, as was noted, artificially cultured fingerling muskellunge and northern pike are managed on a put-grow-take basis to provide a trophy component to the Presque Isle Bay 'fishery.</p> <p>Presque Isle Bay, Lake Erie (Pennsylvania waters) and their tributaries are considered a unique "resource category" within Pennsylvania, consequently these waters are managed uniquely where warranted. Although many fishing regulations (season limits, size limits, and creek limits) are similar to Commonwealth inland waters, Presque Isle Bay regulations differ substantially from inland waters in some instances.</p>
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Contact person: R. Lorantas, Pennsylvania Fish and Boat Commission, Bellefonte, PA.

29. PRESQUE ISLE BAY	
Fish Habitat Goals/Objectives/Targets	Status
<p>It will be the policy of the Pennsylvania Fish and Boat commission to protect, conserve, and enhance the quality and diversity of the Commonwealth's fishery resource (including reptiles and amphibians) and to provide continued and varied angling opportunity through scientific inventory, classification, and management of that resource. To achieve the objectives of this policy, the commission shall:</p> <p>1) Establish and maintain a current data base on the quality and quantity of Pennsylvania's aquatic and fishery resources for effective environmental protection and resource conservation.</p> <p>2) Develop statewide management programs to assure consistent treatment of all resources within a given class. Similar waters will be managed to meet the same objectives under the same philosophy on a statewide basis.</p> <p>3) Manage self-sustaining fish populations as a renewable natural resource to preserve and/or conserve that resource and the angling it provides.</p>	<p>This policy continues to be in effect.</p> <p>As previously noted this data base has been established and is continuously updated.</p> <p>A regulatory agency within the Commonwealth, the Department of Environmental Resources (DER), assigns and maintains water quality designations or standards for all Commonwealth waters, including Presque Isle Bay. Discharges or development activities that would negatively impact the water quality designation would not be permitted. Along with DER, the PFBC is involved in their permit review process, and it is the policy of the PFBC to advance and seek, where supported by the current data base, the highest DER water quality designation for waters of the Commonwealth. Presque Isle Bay is designated as a warm-water fishery. This designation calls for the maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat. In 1985 the PFBC biologist responsible for field surveys on Presque Isle Bay had reviewed Erie County Department of Health's (ECDH) report on pollutants in Presque Isle Bay and Lake Erie. That report found that point source pollution of "highly contaminated" areas was not sufficiently delineated to allow for clean-up. The biologist expressed concern and noted that although the</p>

<p>4) Use hatchery fish to provide recreation in those waters where fish populations are inadequate to sustain the fishery at desired levels.</p> <p>5) Develop appropriate regulations and operational strategies to replace policies that are not compatible with management through resource classification.</p>	<p>abundance of quality size sport fish was very good in recent biological surveys, characteristics for individual fish suggested problems. Red spot (a bacterial disease of fishes particularly esocids), black "unnatural pigment spots" on largemouth bass, and brown bullheads with "unnatural pigment spots" and sores on their mouths were relatively frequently observed during spring surveys and suggested that some pollution problem may exist. In an effort to determine the cause of some of these anomalies, particularly those observed on brown bullheads, the PFBC Environmental Services office is supplying manpower to a study being conducted jointly by DER, Erie County Dept. of Health, and the PFBC to ascertain the cause of the anomalies on bullheads in Presque Isle Bay and outer Erie Harbor. Field and laboratory data collection for the study is underway.</p> <p>Muskellunge and northern pike are two species indigenous to Presque Isle Bay whose natural populations are supplemented with artificially cultured fish produced by the PFBC. In the case of northern pike, naturally produced year classes make releases of cultured fish unnecessary in some years. Natural recruitment of muskellunge appears minimal, the cause for lack of recruitment could be habitat related, however, a cause-effect relation has not been conclusively established. As previously noted muskellunge are managed on a put-grow take basis.</p> <p>Presque Isle Bay, Lake Erie (Pennsylvania Waters) and their tributaries are considered a unique "resource category" within Pennsylvania, consequently these waters are managed uniquely.</p>
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Contact person: R. Lorantas, Pennsylvania Fish and Boat Commission, Bellefonte, PA.

30. WHEATLEY HARBOUR	
Fish Community Goals/Objectives/Targets	Status
<p>Under the auspices of the Joint strategic Plan for the Management of Great Lakes Fisheries, the following draft fish community goal has been set for Wheatley Harbour: to ensure a fish community based on a foundation of stable, self-sustaining stocks and provide from that community an optimum contribution of fish, fishing opportunities, and associated benefits to meet societal needs.</p> <p>Due to a lack of data, quantifiable objectives cannot be developed at this time. However, some general objectives include: maintaining self-sustaining populations of forage species at levels adequate to sustain predator populations and to allow utilization as bait fish; and managing rare and endangered species to ensure that no native species disappear from the system.</p> <p>Management priority for fish species is as follows: 1) rare and endangered species, 2) forage species, 3) yellow perch, 4) panfish, 5) bullheads, and 6) smallmouth bass.</p>	<p>It is not possible to determine the degree of degradation of the fish, community because there is a lack of historical data against which the current fish community can be compared. It known, however, that at least two introduced species of fish are relatively abundant in the fish community (i.e. carp and white perch). The presence of these species is not believed to have been beneficial to the native fish community.</p>

Contact person: H. Manson, Ontario Ministry of Natural Resources, Wheatley, Ontario.

30. WHEATLEY HARBOUR	
Fish Habitat Goals/Objectives/Targets	Status
<p>Under the auspices of the Joint strategic Plan for the Management of Great Lakes Fisheries, the following draft fish habitat objective has been recommended for Wheatley Harbour: ensure no net loss of the productive capacity of habitats supporting the fish community in the wetland portion of Wheatley Harbour. It is unrealistic to attempt to restore substrate or shoreline habitat in the boat-basin portion of Wheatley Harbour. However, through education and/or regulation it is realistic to attempt to prevent the degradation of water quality from the discharge of vessel bilge or wastewater to Wheatley Harbour.</p>	<p>Loss of habitat has resulted from infilling of the marsh, shoreline, hardening, and harbor dredging. At least one introduced fish species (i.e. carp), which is seasonally very abundant in the wetland portion of Wheatley Harbour, has probably been responsible for the destruction of rooted vegetation and increased turbidity.</p>

Contact person: H. Manson, Ontario Ministry of Natural Resources, Wheatley, Ontario.

31. BUFFALO RIVER	
Fish Community Goals/objectives/Target	Status
<p>The overall fisheries management goal is to protect, restore, and enhance the Buffalo River fish stocks, their environment, and the forage base, and manage the fisheries resources to optimize recreational and economic benefits. Fisheries management in the near term is directed to: maintaining and enhancing, where possible, a diverse mix of sport fish species to support a year-round fishery; maximizing reproduction potential for warmwater/cool water species utilizing the lower river/harbor area; and maximizing reproduction potential for forage fish species (e.g. spottail shiner, gizzard shad, alewife, emerald shiner) utilizing the river/harbor area.</p>	<p>Substantial improvements in the Buffalo River fishery have occurred since a 1928 New York State conservation Department Survey found no fish in the lower river. The most recent data available from 1981-1982 indicated that over 20 fish species were observed in the river during spring, summer, and fall. Carp, white suckers, and shiners dominated the community throughout the spring and into summer, but bullheads, gizzard shad, and pumpkinseed became more important as summer progressed. During late summer and early fall, carp, pumpkinseed, and gizzard shad dominated. Fish numbers declined sharply as water temperatures fell and fish movement declined in fall. During 1981, the percent of species tolerant of environmentally-degraded conditions (i.e. brown bullhead, carp, goldfish, and carp-goldfish) ranged from 7-45% in the harbor and 15-58% in the river. In recent years, a number of gamefish species have been collected in the Buffalo River, including largemouth bass, smallmouth bass, northern pike, muskellunge, walleye, and rainbow trout.</p>

Contact person: S. Mooradian, New York State Dept. of Environmental Conservation, Olean, NY.

31. BUFFALO RIVER	
Fish Habitat Goals/Objectives/Targets	Status
<p>The overall goal is to improve fish habitat in the river. Short-term objectives include carrying out an assessment of habitat conditions and the potential for improvement in the Area of concern (i.e. identifying target species for management and developing management objectives and strategies for achieving objectives), and developing a habitat improvement plan (i.e. develop strategies for remediating water quality impacts and improving physical habitat).</p>	<p>Habitat loss impairs the Buffalo River fishery. The lower river is heavily bulkheaded to facilitate docking, loading, and unloading of freighters. The river is usually dredged annually for navigational purposes. The combination of dredging and bulkheading has substantially reduced fish habitat by eliminating many productive shallow waters and wetlands. Other habitat-related factors adversely affecting the fishery include: low dissolved oxygen levels; high turbidity; elevated siltation; and toxic substances contamination.</p>

Contact person: S. Mooradian, New York State Dept. of Environmental Conservation, Olean, NY.

32. EIGHTEEN MILE CREEK	
Fish Community Goals/Objectives/Targets	Status
<p>The overall fisheries management goal is to protect, restore, and enhance the Eighteen Mile Creek fish stocks, their environment, and the forage base, and manage the fisheries resources to optimize recreational and economic benefits. Fisheries management in the near term is directed to: maintaining and enhancing, where possible, a diverse mix of sport fish species to support a year-round fishery; maximizing reproduction potential for warmwater/cool water species utilizing the lower river/harbor area; and maximizing reproduction potential for forage fish species.</p>	<p>The fishery in the lower reaches of Eighteen Mile Creek is diverse and provides substantial recreational and economic benefits. Recent monitoring in June 1989 found 25 species present. A comparison of relative abundance found two species abundant (i.e. alewife and gizzard shad), 14 species common (i.e. rainbow and brown trout, two shiner species, two sucker species, carp, brown bullhead, two sunfish species, smallmouth and largemouth bass, freshwater drum, American eel), and nine species rare (i.e. walleye, black crappie, rock bass, white bass, white perch, northern pike, muskellunge, long nose gar, goldfish).</p> <p>In addition, stocking of salmon and trout during 1991 in the Eighteen Mile Creek/Olcott Area included: 25,500 coho salmon, 189,000 chinook salmon, 20,600 brown trout, 10,200 rainbow trout, and 124,180 lake trout.</p>

Contact person: S. Mooradian, New York State Dept. of Environmental Conservation, Olean, NY.

32. EIGHTEEN MILE CREEK	
Fish Habitat Goals/Objectives/Targets	Status
<p>Different habitat goals exist for the two distinct reaches of Eighteen Mile creek. For the lower 300 m reach which is highly developed with public and private boat launching/docking facilities, the goal is to enhance habitat where possible (e.g. remediate contaminated sediment areas), while supporting multiple uses (e.g. public access for recreation, dredging for navigational purposes). The upper reach is from the Route 18 Bridge to Burt Dam and is primarily undeveloped shoreline with high quality wetlands. These upper reach wetlands have been designated as Class I Wetlands by NYSDEC, the highest rank based on wetland function and benefits. The goal for this upper reach is to provide special protection in order to preserve these habitats and allow no new development.</p>	<p>In the lower reach of Eighteen Mile Creek the combination of recreational shoreline development, dredging for navigational purposes, and contaminated sediments has resulted in loss of fish habitat. However, the extent of habitat loss has not been quantified. In the upper reach (i.e. from Route 18 Bridge to Burt Dam)! there continues to be outstanding fish habitat as evidenced by NYSDEC's Class I Wetland designation.</p>

Contact person: S. Mooradian, New York State Dept. of Environmental Conservation, Olean, NY.

33. ROCHESTER EMBAYMENT	
Fish Community Goals/Objectives/Targets	Status
<p>The overall fishery management goal is to protect, restore, and enhance fish stocks, their environment, and forage base, and manage fishery resources to optimize recreational and economic benefits. Specific goals include:</p> <ul style="list-style-type: none"> * In Irondequoit Bay, water quality will be such that angling will be possible for a wide range of cold and warmwater species; * Irondequoit, Allen, and Thomas Creeks will: support a wide variety of cold and warmwater species, except for those segments with unavoidable physical limitations; and be managed in order to achieve and maintain the standards for Class B waters as set forth by NYSDEC such that trout fishing will not be impaired; * Rochester Embayment will: maintain and enhance a diverse fish community; support self-sustaining populations of walleye and Atlantic salmon; have sufficient protective legislation, policies, and enabling powers for appropriate agencies in order to maintain and enhance a diverse and self-sustaining fishery; maintain trophic relationships to minimize fish dieoffs and fouled beaches; and have no negative impact from contaminated sediments in the lower Genesee River on water quality, fish, and other biota. 	<p>The fish community of the lower Genesee River exhibits low species diversity. This is attributed to heavy sediment loads from the upper watershed. High sedimentation and turbidity can restrict development of the fish community by affecting growth and interfering with the hatching and survival of young fish. Siltation causes clogging of gills of larvae as well as adult fish, and can suffocate developing eggs. All of these factors can restrict propagation of a local fish population. As a result, the fish that inhabit the Genesee River downstream of Upper Falls appear to be restricted to those able to tolerate high turbidity. During the 1980s, 14 species were common in the lower river (carp, goldfish, gizzard shad, white sucker, white perch, brown bullhead, white bass, spottail shiner, alewife, northern pike, walleye, river herring, golden shiner, and rock bass).</p>

Contact person: B. Abraham, New York State Dept. of Environmental Conservation, Avon, NY.

33. ROCHESTER EMBAYMENT	
Fish Habitat Goals/Objectives/Targets	Status
<p>It is the primary goal to ensure that water and shore habitats within Rochester Embayment support thriving fish populations. Specific objectives include:</p> <ul style="list-style-type: none"> * maintenance of all present water and shore habitats which are critical to aquatic and terrestrial organisms; * prohibition of discharges into the Rochester Embayment which adversely affect aquatic habitats; and * support for public education programs which focus upon the importance of wetlands and other habitats necessary to support fish populations. 	<p>Loss of fish habitat is recognized in the Area of Concern due to a number of human activities. Major activities include: shoreline development, high sedimentation loads from the upper watershed, dredging for navigational purposes, and contaminated sediments. Although the loss of fish habitat is well recognized, it has not been quantified.</p>

Contact person: B. Abraham, New York State Dept. of Environmental Conservation, Avon, NY.

34. OSWEGO RIVER/HARBOR	
Fish community Coals/Objectives/Targets	Status
<p>The overall fisheries management goal is to protect, restore, and enhance the Oswego River fish stocks, their environment, and the forage base, and manage the fisheries resources to optimize recreational and economic benefits. Fisheries management planning for the near term is directed to: maintaining and enhancing, where possible, a diverse mix of sport fish species to support a year-round fishery; maximizing reproduction potential for warmwater/cool water species utilizing the lower river/harbor area; and maximizing reproduction potential for forage fish species (e.g. smelt, alewife) utilizing the river/harbor area.</p>	<p>Historically, the Oswego River has had the largest run of Atlantic salmon in the Lake Ontario basin. The Oswego River continues to be an outstanding salmonid fishery. Annual salmonid stocking in the river and harbor during the 1980s was approximately 250,000 chinook, 25,000 coho, 15,000 steelhead, 36,000 brown trout, and 18,000 Skamania steelhead. In addition, the remaining portion of the fishery is usually rich, with seasonally high abundance and diversity. Based on the most recent electrofishing data from 1981, catch per hour in the harbor during July was 20 walleye, 4 northern pike, 6 yellow perch, 4 pumpkinseed, 2 white perch, 2 rock bass, 6 white sucker, 2 redhorse sucker, 2 carp, 4 American eel, 12 gizzard shad, 10 alewife, 4 spottail shiners, and 2 freshwater drum. The walleye fishery is considered outstanding when compared to similar systems in New York. High size limits on walleye and bass are also maintained to guarantee fish spawning once.</p>

Contact person: L. Wedge, New York State Dept. of Environmental Conservation, Cortland, NY.

34. OSWEGO RIVER/HARBOR	
Fish Habitat Goals/Objectives/Targets	Status
<p>Loss of fish habitat is the result of urban development. Fish habitat enhancement goals in the near-term include:</p> <ul style="list-style-type: none"> * Provide access to upriver areas for reproduction/residence of native species (e.g. lake sturgeon, Atlantic salmon, walleye, American eel) and provide downstream passage; * Provide minimum flow in Varick bypass so that the entire channel will be used for production of fish and invertebrates; provide minimum flow in Varick tailrace to prevent oxygen depletion: alter Varick bypass channel to prevent stranding of fish due to sudden flow reduction (the channel must be configured to prevent oxygen depletion and illegal angling activity); and * Substantially reduce hazards to anglers who fish in the Varick bypass reach. 	<p>NYSDEC is working with Niagara Mohawk and other hydroelectric utilities to explore the feasibility of allowing restricted fish passage at Oswego River facilities. Estimated completion: 1995.</p> <p>NYSDEC is working with Niagara Mohawk to resolve this problem as part of the Federal Energy Regulatory commission relicensing process. Estimated completion: 1995.</p> <p>Involvement in the Oswego River Safety Task Force and negotiations with the power company have resulted in: 1) a warning siren sounded before water is spilled or flows increased in the bypass reach; 2) steel posts set in bedrock along the edge of the excavated tailrace indicating danger to anglers; and 3) a walkway across the face of the Varick Powerhouse connects the forebay island with the west side linear park. Previously, a sudden release of water would result in anglers being stranded on the island, requiring rescue.</p>

Contact person: L. Wedge, New York State Dept. of Environmental Conservation, Cortland, NY.

35. BAY OF QUINTE	
Fish Community Goals/Objectives/Targets	Status
<p>The overall goal pertaining to the fish community is to re-establish and maintain aquatic, shoreline, and wildlife habitat conditions and sites within Bay of Quinte ecosystem capable of supporting healthy, diverse, stable, and self-sustaining aquatic and terrestrial communities.</p>	<p>Significant changes in composition and abundance of the fish community have occurred in recent decades. Reductions in walleye, lake whitefish, and several centrarchids during the 1950s and 1960s have been linked to the white perch invasion and increasing eutrophication. Stocks of alewife and white perch were especially abundant during the 1960s and up to 1978, while northern pike, bowfin, longnose gar, and walleye were at near record lows. Eutrophication impaired the production of piscivorous fish in the Bay while enhancing the production of smaller-bodied planktivores and benthivores. There was a resurgence of walleye and a collapse of white perch beginning in 1977 which was coincident with reduction in phosphorus inputs from sewage treatment plants and severe winters in 1977 and 1978. Today, the fishable walleye population is estimated at 700,000. Alewife have declined in the upper bay, but decreased in the middle and lower bays only in the late 1980s (i.e. in response to walleye predation and intraspecific competition). Walleye are now at the lowest numbers seen since the 1960s.</p>

Contact person: A. Mathers, Ontario Ministry of Natural Resources, Picton, Ontario.

35. BAY OF QUINTE	
Fish Habitat Goals/Objectives/Targets	Status
<p>The overall goal is to re-establish and maintain aquatic, shoreline, and wildlife habitat conditions and sites within the Bay of Quinte ecosystem capable of supporting healthy, diverse, stable, and self-sustaining aquatic and terrestrial communities. General objectives include:</p> <p>* To support, promote, and encourage all feasible actions to restore damaged aquatic shoreline habitats in the Bay of Quinte watershed.</p> <p>* To limit the use of artificial habitat enhancement measures to situations where it is necessary to offset habitat damage caused by irreversible past destruction; and to protect and conserve remaining aquatic habitats by applying the "no net loss" of habitat principle to all urban, rural, agricultural, and shoreline development or redevelopment.</p> <p>Specific objectives include:</p> <p>* Selective harvesting of fish to alter composition of the fish community.</p>	<p>Reforestation and stream rehabilitation projects have been sponsored by the local conservation authorities and Ontario MNR. Ontario Ministry of Agriculture and Food initiated erosion control programs. Stream cleanup and restoration projects have been undertaken by agricultural associates, local environmental groups, and citizens. See also section below on developing channels in cattail marshes.</p> <p>All shoreline works require a permit under Ontario's Public Lands Act. Ontario MNR staff are able to review all work plans to ensure "no net loss" of fish habitat and, if possible, achieve net gains.</p> <p>Theoretical only at this time.</p>

<p>* constructing artificial shoals to establish spawning and nursery areas.</p>	<p>No artificial shoals have been constructed to date.</p>
<p>* Developing interconnecting channels and ponds through solid cattail marshes to create open water areas, additional edge, migration routes, and spawning, resting, and nursery habitat.</p>	<p>Marsh restoration was accomplished at Pine Point. The total gain of wetland and productive habitat for fish, wildlife, and various plant species was greater than five hectares. Habitat compensation agreements under the Fisheries Act allowed channels to be created in the Sawquin Creek wetland and thus enhancing both fish and wildlife habitats. The Great Lakes Cleanup Fund has agreed to fund a project which will protect habitats over the next three years.</p>

Contact person: A. Mathers, Ontario Ministry of Natural Resources, Picton, Ontario.

36. PORT HOPE HARBOUR	
Fish community Goals/Objectives/Targets	Status
The Stage 1 Port Hope Harbour Remedial Action Plan concluded that there was no evidence of degradation of fish populations. No specific fishery goals, objectives, or targets have been developed for Port Hope Harbour.	Fish population densities and community structure are considered to be typical of similar enclosed small urban harbors on Lake Ontario. Local populations of fish species such as rainbow, brown, and lake trout, as well as Pacific salmon, use the turning basin. Rainbow trout are concentrated in the area in the spring and increasing numbers of brown trout, lake trout, and Pacific salmon concentrate in the area in the fall.

Contact person: S. Weston, Environment Canada, Toronto, Ontario.

36. PORT HOPE HARBOUR	
Fish Habitat Goals/Objectives/Targets	Status
The Stage 1 Port Hope Harbour Remedial Action Plan concluded that - there was no loss of fish or wildlife habitat attributable to discharges to the harbor. No specific habitat goals, objectives, or targets have been developed for the harbor.	Port Hope Harbour is operative as a small craft harbor. The Area of Concern is bounded by concrete and/or steel retaining walls typical of small harbors.

Contact person: S. Weston, Environment Canada, Toronto, Ontario.

37. TORONTO HARBOUR	
Fish Community Goals/Objectives/Targets	Status
<p>The goal is to achieve self-sustaining native communities that maintain populations suitable for recreational fishing opportunities and provide indicators of ecosystem health. Objectives include:</p> <ul style="list-style-type: none"> * Numerical proportion/biomass of resident native piscivore species present within littoral fish communities to be increased to a minimum of 10-20%, shifting dominance from benthivores towards greater abundance of piscivores. Biomass of specialist fishes to be targeted towards a minimum of 40%, generalists \leq 20%, and piscivores \geq 10-20%. * Eventually phase out native species stocking/reintroduction programs in favor of community self-sustenance in waterfront and watershed habitats when and where environmental conditions are appropriate. * Protect genetic resource of the remnant native fish stocks. * Rehabilitate formerly abundant fish populations where locally depressed or extinct (walleye, muskellunge, whitefish, atlantic salmon). * Reduce or maintain incidence of individuals that are diseased or have tumors or ulcerations associated with contaminants present within waterfront towards that which is considered background within the community. Proportion of diseased fish within a community is a bio-indicator of ecosystem health. * Increased proportion of native species towards 100% of total fish community. 	<p>Present piscivores numerical proportions are at 1-3%. Current representative biomass of specialists 10%, generalists 56%, and piscivores 5%.</p> <p>self-sustenance occurs within the resident littoral fishery. cold water migrant fishes (salmonids) continue to be sustained by means of put-and-delayed-take stocking.</p> <p>Limited populations remain across the waterfront (largemouth bass, smallmouth bass, northern pike).</p> <p>Watershed currently unsuitable for atlantic salmon self-sustenance, although limited populations exist offshore. Muskellunge populations extinct within Toronto area. Walleye and whitefish stocks in a collapsed state, rarely encountered.</p> <p>Occurrence of abnormalities present within fish community is currently unknown.</p> <p>Present proportion of native species is 83% (present/absent). Biomass is approximately 50% native.</p>

Contact person: I. Buchanan, Ontario **Ministry** of Natural Resources, Maple, Ontario.

37. TORONTO HARBOUR	
Fish Habitat Goals/Objectives/Targets	Status
<p>The fish habitat goal for Toronto Harbour is that aquatic habitats and their fish communities must be protected, enhanced and rehabilitated, where possible and feasible, in order to maximize overall fish community health. Fish habitat objectives include:</p> <ul style="list-style-type: none"> * Open coast: provide/improve habitat suitable for spawning populations of salmonids such as lake trout to promote self-sustenance. * Sheltered bays: enhance productive capacity of areas suitable for macrophyte growth by re-establishing submergent-emergent plant communities favorable to northern pike and smallmouth bass spawning, nursery and feeding habitat. * River mouths and estuaries: enhance productive capacity by reestablishing macrophyte communities, where possible, suitable for largemouth bass and northern pike production; establish rubble/rock slopes in non-depositional river areas favorable to smallmouth bass production. * Protect remaining and created wetlands. * Protect, enhance and rehabilitate biotic corridor linkages across the waterfront. * Improve watershed characteristics (i.e. hydrologic cycle/regime) to minimize degradation impacts upon the waterfront aquatic habitat. 	<p>Evidence for successful spawning as yet uncertain; shore substrate suitability not established with regard to location, substrate type, water quality limitations; predator (e.g. smelt) interactions may be limiting; reef creation is being considered.</p> <p>Water quality may create depressed trophic states, limiting primary production due to turbidity and sedimentation; rehabilitation must proceed concurrent with water quality improvements; emergent plant community reestablishment has been initiated on trial basis.</p> <p>same as status for sheltered bays.</p> <p>Most wetland areas within the Toronto waterfront have been eliminated by urban development.</p> <p>Physical and biological linkages not well understood.</p> <p>current watersheds contribute significantly to impairment of aquatic habitats within the ecosystem.</p>

Contact person: I. Buchanan, Ontario Ministry of Natural Resources, Maple, Ontario.

38. HAMILTON HARBOUR	
Fish Community Goals/Objectives/Targets	Status
Total biomass of fish in littoral habitats: 200-250 kg/ha	Estimated 1990 biomass: 300 kg/ha
Native piscivores (northern pike, largemouth bass and others): 20-25% of total biomass	Estimated 1990 percent: 9%
Percent of native species: 50-90%	Estimated 1990 percent: 37%
Species richness: 6-7 species per survey transect	1990 average: 4 species/survey transect
Trophic group targets in littoral habitats:	Estimated 1990 biomass:
Piscivores: 40-60 kg/ha	17 kg/ha
Specialists: 70-100 kg/ha	53 kg/ha
Generalists: 30-90 kg/ha	233 ka/ma

The overall objective is to shift from a fish community indicative of a eutrophic environment, such as white perch, alewife, bullheads and carp, to a self-sustaining community more representative of a mesotrophic environment, containing pike, bass, yellow perch and sunfish.

Piscivores include top predators such as northern pike, largemouth bass and smallmouth bass. Generalists include omnivores such as carp and brown bullheads. Specialists include insectivores and planktivores such as yellow perch, pumpkinseeds and alewife.

The percent of fisheries biomass allocated to the three trophic groups was based on fish data collected from healthier littoral habitats in the Bay of Quinte and Severn Sound. The littoral fish biomass of 200-250 kg/ha was based on electrofishing data collected from Hamilton Harbour, Bay of Quinte and Severn Sound in 1990.

Contact persons: B. Randall and V. Cairns, Canada Dept. of Fisheries and Oceans, Burlington, Ontario.

38. HAMILTON HARBOUR	
Fish Habitat Goals/Objectives/Targets	Status
Increase quantity of emergent and submergent aquatic plants in Hamilton Harbour, Cootes Paradise, Grindstone Creek delta, and Grindstone Creek marshes to approximately 500 ha in accordance with the Fish and Wildlife Restoration Projection.	Since 1900, more than 85% of the productive wetlands have disappeared from Hamilton Harbour, Cootes Paradise and its tributaries.
Rehabilitate 344 ha of littoral fish habitat.	90 ha of marginal habitat is currently present.
Rehabilitate 39 ha of pike spawning marsh and nursery habitat.	Marsh exists but access restricted (restricted access of juvenile fish back to harbor).
Provide an additional 10 km of littoral shore by creating 5 km of narrow islands.	Approximately 65% of the littoral habitat in the harbor has been irreversibly lost over time due to industrial development and construction of shipping facilities. This project represents a net gain in littoral habitat.
Water clarity targets for the summer season (June to September) as measured by Secchi Disc: Harbour - 3.0 m; and Cootes Paradise and Grindstone Creek - 1.0 m.	1991 average in harbour: 1.5 m; 1991 average in Cootes Paradise: 0.3 m.

Contact persons: B. Randall and V. Cairns, Canada Dept. of Fisheries and Oceans, Burlington, Ontario.

39. ST. MARYS RIVER	
Fish Community Goals/Objectives/Targets (Draft)	Status
<p>The St. Marys watershed shall support healthy, diverse, self-sustaining fish communities consistent with sound ecosystem and biodiversity management principles.</p> <p>Introduction of exotics shall generally be avoided. However, fish communities will be managed to provide an optimum contribution of fish, fishing opportunities and associated benefits to meet the needs identified by society.</p> <p>Exotic species which now form part of the fish community should not be managed to the detriment of native species.</p>	<p>The sport fishery is generally healthy, but lake herring and lake whitefish in the lower river have decreased. Negative impacts to fish populations include habitat loss, reduced populations and diversity of benthic fauna and increasing numbers of sea lamprey.</p>

Contact person: D. Hughes, Ontario Ministry of Natural Resources, Owen Sound, Ontario.

39. ST. MARYS RIVER

Fish Habitat Goals/Objectives/Targets (Draft)	Status
<p>critical habitat must be identified, protected and conserved, consistent with an ecosystem approach. The goal is no net loss of critical habitat. Efforts shall be made to restore, rehabilitate and enhance habitat, where required. Efforts to protect and enhance existing wetlands shall be encouraged. Creation of new wetlands and critical fish habitat should be encouraged, consistent with maintaining ecosystem integrity.</p>	<p>'Fish spawning and rearing habitat in both Michigan and Ontario have been lost due to construction of structures for navigation and power generation, as well as from dredging and filling activities.</p>

Contact person: D. Hughes, Ontario Ministry of Natural Resources, Owen sound, Ontario.

40. ST. CLAIR RIVER	
Fish Community Goals/Objectives/Targets	Status
<p>Under the auspices of the Joint Strategic Plan for the Management of Great Lakes Fisheries, the following draft fish community goal has been set for the St. Clair River-Lake St. Clair-Detroit River System: to ensure a percid community with walleye as the top predator based on a foundation of stable self-sustaining stocks and provide from that community an optimum contribution of fish, fishing opportunities, and associated benefits to meet societal needs. Due to lack of uniformity in data collection methods between Michigan and Ontario and data gaps, quantifiable objectives cannot be developed at this time. However, some general objectives include: maintaining stable, self-sustaining stocks of walleye; managing muskellunge to provide trophy fishing opportunities; maintaining self-sustaining populations of forage species at a level adequate to sustain predator populations and to allow utilization as bait fish; maintaining stable, self-sustaining sturgeon populations at levels to serve as a potential source of fish for future rehabilitation efforts; managing rare and endangered species in order that no more species become extinct in the system; and determining the impact of stocked salmonids on the native fish community. Management priority for fishes is as follows: 1) walleye, 2) yellow perch, 3) smallmouth bass, 4) muskellunge, 5) white bass, 6) white perch, 7) forage species, 8) largemouth bass and panfish, 9) northern pike, 10) channel catfish, 11) sturgeon, 12) Pacific salmon, rainbow trout, and brown trout, and 13) rare and endangered species.</p>	<p>Overall, the fish community of the system has changed significantly during the last century due to exploitation by commercial and recreational fisheries, extensive shoreline modification, increased human activities in the watershed, and species' introductions. For example, from 1900 to 1986 walleye yields increased from 163,000 kg to over 334,000 kg, yellow perch increased from 37,000 kg to over 115,000 kg, lake sturgeon decreased from 34,000 kg to 133 kg, lake herring decreased from 24,000 kg to 0, lake whitefish decreased from 18,000 kg to 0, and while whitebass were not recorded in 1900 they had a yield of 308,000 kg in 1986. Based on data collected between 1983 and 1985, estimates of annual harvests from the Michigan waters of the St. Clair River were: 57,880 kg walleye; 610 kg smallmouth bass; 1,530 kg white bass; 820 kg yellow perch; 3,240 kg freshwater drum; and 290 kg rock bass.</p>

Contact persons: J. Brisbane, Ontario Ministry of Natural Resources, Chatham, Ontario; and R. Spitler, Michigan Dept. of Natural Resources, Livonia, MI.

40. ST. CLAIR RIVER

Fish Habitat Goals/Objectives/Targets	Status
<p>Under the auspices of the Joint Strategic Plan for the Management of Great Lakes Fisheries, the following draft fish habitat objectives have been recommended for the St. Clair River-Lake St. Clair-Detroit River System:</p> <p>Achieve no net loss of the productive capacity of habitats supporting the fishery; and</p> <p>Restore the productive capacity of habitats that have suffered damage.</p>	<p>Loss of fish habitat has resulted from marsh draining, water level fluctuations, dredging, and deposition of dredged materials. For example, wetlands in the system totalled 7,274 ha in 1873, but had declined to 2,022 ha in 1973. Extensive navigation and shoreline modifications have also contributed to loss of habitat. Additional work is needed to clarify and quantify the impacts of habitat loss, contaminants, eutrophication, and introductions upon fish communities in the system, and to develop recommendations to mitigate these impacts.</p>

Contact persons: J. Brisbane, Ontario Ministry of Natural Resources, Chatham, Ontario; and R. Spitler, Michigan Dept. of Natural Resources, Livonia, MI.

41. DETROIT RIVER	
Fish community Goals/Objectives/Targets	Status
<p>Under the auspices of the Joint Strategic Plan for the Management of Great Lakes Fisheries, the following &ft fish community goal has been set for the St. Clair River-Lake St. Clair-Detroit River system: to ensure a percid community with walleye as the top predator based on a foundation of stable self-sustaining stocks and provide from that community an optimum contribution of fish, fishing opportunities, and associated benefits to meet societal needs. Due to lack of uniformity in data collection methods between Michigan and Ontario and data gaps, quantifiable objectives cannot be developed at this time. However, some general objectives include: maintaining stable, self-sustaining stocks of walleye; managing muskellunge to provide trophy fishing opportunities; maintaining self-sustaining populations of forage species at a level adequate to sustain predator populations and to allow utilization as bait fish: maintaining stable, self-sustaining sturgeon populations at levels to serve as a potential source of fish for future rehabilitation efforts; managing rare and endangered species in order that no more species become extinct in the system; and determining the impact of stocked salmonids on the native fish community. Management priority for fishes is as follows: 1) walleye; 2) yellow perch; 3) smallmouth bass; 4) muskellunge; 5) white bass; 6) white perch; 7) forage species; 8) largemouth bass and panfish; 9) northern pike; 10) channel catfish; 11) sturgeon; 12) Pacific salmon, rainbow trout, and brown trout; and 13) rare and endangered species.</p>	<p>overall, the fish community of the system has changed significantly during the last century due to exploitation by commercial and recreational fisheries, extensive shoreline modification, increased human activities in the watershed, and introductions. For example, from 1900 to 1986 walleye yields increased from 163,000 kg to over 334,000 kg, yellow perch increased from 37,000 kg to over 115,000 kg, lake sturgeon decreased from 34,000 kg to 133 kg, lake herring decreased from 24,000 kg to 0, lake whitefish decreased from 18,000 kg to 0, and while whitebass were not recorded in 1900 they had a yield of 308,000 kg in 1986. Based on data collected between 1978 and 1985, estimates of annual harvests in the Detroit River were: 106,980 kg walleye; 3,690 kg smallmouth bass; 288,570 kg white bass; 14,810 kg yellow perch; 29,930 kg freshwater drum; and 12,190 kg rock bass.</p>

Contact persons: R. Spitler, Michigan Dept. of Natural Resources, Livonia, MI; and J. Brisbane, Ontario Ministry of Natural Resources, Chatham, Ontario.

41. DETROIT RIVER	
Fish Habitat Goals/Objectives/Targets	status
<p>Under the auspices of the Joint strategic Plan for the Management of Great Lakes Fisheries, the following draft fish habitat objectives have been recommended for the St. Clair River-Lake St. Clair-Detroit River system:</p> <p>Achieve no net loss of the productive capacity of habitats supporting the fishery: and</p> <p>Restore the productive capacity of habitats that have suffered damage.</p>	<p>Loss of fish habitat has resulted from marsh draining, water level fluctuations, dredging, and deposition of dredged materials. For example, wetlands in the system totalled 7,274 ha in 1873, but had declined to 2,022 ha in 1973. Extensive navigation and shoreline modifications have also contributed to loss of habitat. Additional work is needed to clarify and quantify the impacts of habitat loss, contaminants, eutrophication, and introductions upon fish communities in the system, and to develop recommendations to mitigate these impacts.</p>

Contact persons: R. Spitler, Michigan Dept. of Natural Resources, Livonia, MI: and J. Brisbane, Ontario Ministry of Natural Resources, Chatham, Ontario.

42. NIAGARA RIVER (New York)	
Fish Community Goals/Objectives/Targets	Status
<p>The overall fishery management goal is to protect, restore, and enhance the Niagara River fish stocks, the forage base, and their environment, and manage the fishery resources to optimize recreational and economic benefits. Fishery management planning in the near term is directed to: maintaining self-sustaining populations of land-locked salmon, lake trout, northern pike, muskellunge, walleye, and smallmouth bass; stabilizing forage species (e.g. emerald shiner) and achieving self-sustaining populations with utilization for optimal recreational and economic benefits; developing an outstanding walleye fishery in the lower river; maintaining a trophy muskellunge fishery; protecting sturgeon and other endangered species; and minimizing impingement and entrainment losses at facilities which withdraw water from the river.</p>	<p>The Niagara River is a very productive and diverse fishery. Ninety species have been identified in the river and its tributaries. In 1988, the Niagara River was the fifth most popular freshwater fishery in New York State with 525,000 angler days of fishing.</p> <p>The upper river is a warmwater/cool water fishery, with an excellent smallmouth bass fishery and an excellent muskellunge fishery. Salmon and trout are important in winter-spring. Northern pike and walleye are also important in the spring.</p> <p>In the lower river during fall-winter-spring, there is an outstanding salmon and trout fishery (e.g. chinook, steelhead, lake trout). During spring, northern pike and walleye are important, and during summer, smallmouth bass are important. Stocking of salmon and trout in the lower Niagara River during 1991 included: 61,000 steelhead; 21,250 coho; 273,000 chinook; and 26,700 land-locked salmon. Historically, the lake sturgeon population has substantially declined riverwide and the northern pike population is believed to be degraded in the upper river.</p>

Contact person: S. Mooradian, New York State Dept. of Environmental Conservation, Olean, NY.

42. NIAGARA RIVER (New York)	
Fish Habitat Goals/Objectives/Targets	Status
<p>In the near term fish habitat goals for the Niagara River include:</p> <ul style="list-style-type: none"> * maintain all existing undeveloped shorelines; * provide special protection to twelve areas identified as Significant Coastal Fish and Wildlife Habitats by New York State (i.e. Buckhorn Island - Goat Island Rapids, Buckhorn Island Wetlands, Buckhorn Island Tern Colony, Grand Island Tributaries, North Buffalo Harbor, Smoke Creek Shoals, Strawberry Island - Motor Island Shallows, Tiffit Farm Nature Preserve, Times Beach Diked Disposal Site, Small Boat Harbor-Buffalo, Goat Island Rapids, Lower Niagara River Rapids); * protect and maintain the integrity of strawberry Island as a critical muskellunge spawning habitat; * enhance habitat, where possible, during repair and replacement of breakwalls and bulkheads; * provide additional regulatory protection for submerged beds of aquatic plants (by designating these areas as New York State Protected Wetlands); and * protect existing fish Habitat during hazardous waste site remedial activities. 	<p>A variety of human activities has historically resulted in loss/degradation of fish habitat.' These activities include: construction of dams and other barriers on tributaries which limit fish migrations; dredging and filling of important/critical fish spawning/nursery habitats; diversion of flows or alteration of water levels; development of riparian lands; siltation; channelization of streams; extraction of sand and gravel deposits from waterways; and contamination with toxic substances. The loss of wetlands has been substantial, but not quantified.</p>

Contact person: S. Mooradian, New York State Dept. of Environmental Conservation, Olean, NY.

42. NIAGARA RIVER (ONTARIO)	
Fish Community Goals/Objectives/Targets	Status
<p>The overall natural resource management goal is to provide a diversity of native animal and plant communities within the limits imposed by the physical, social, and spiritual needs of the human population using sound ecological principles within sustainable environmental management. Proposed fishery targets include:</p> <p>Predators \geq 20 cm: 40 individuals/ha; 60 kg/ha Other fish \geq 20 cm: 200 individuals/ha; 70 kg/ha Total fish $<$ 20 cm: 29,800 individuals/ha; 90 kg/ha Total fish community: 30,000 (+ or -) individuals/ha; 220 kg/ha</p>	<p>Current Ontario Ministry of Natural Resources' annual angling harvest estimates based on creel censuses include:</p> <p>Number of fish from Lower River: 28,428 Number of fish from Upper River: 56,894 Number of fish from the Total River: 85,322 Weight of fish from Lower River: 20,119 kg weight of fish from Upper River: 17,859 kg Weight of fish from Total River: 37,978 kg Mean harvest rate from the Lower River: 39.4 kg/ha Mean harvest rate from the Upper River: 8.84 kg/ha Mean harvest rate from the Total River : 15.01 kg/ha</p> <p>In addition to the angling harvest, the Upper Niagara River supported an average commercial bait fish harvest of approximately 105 metric tons per year between 1980 and 1984. The long-term average (1969-1984) commercial bait fish harvest is 117 metric tons per year in the Upper Niagara River. The Lower Niagara River commercial bait fish harvest is insignificant compared to the Upper Niagara River.</p>

Contact person: B. Lewies, Ontario Ministry of Natural Resources, Fonthill, Ontario.

42. NIAGARA RIVER (ONTARIO)	
Fish Habitat Goals/Objectives/Targets	Status
The overall goal is to ensure an integrated land and water approach to habitat and environmental management. More specific habitat objectives or targets will be developed in the future within watershed planning activities.	Impacts from development have caused loss/degradation of habitat in all of the Niagara Peninsula's waterways. Although it is generally accepted that the loss of habitat is substantial, it has not been quantified. No complete fishery habitat inventory exists, although there is a wetland inventory.

Contact person: B. Lewies, Ontario Ministry of Natural Resources, Fonthill, Ontario.

43. ST. LAWRENCE RIVER (MASSENA, NEW YORK)	
Fish Community Coals/Objectives/Targets	status
The fisheries management goal for the New York portion of the St. Lawrence River (Lake St. Francis) is to maintain a viable, self-sustaining fish community with an emphasis on yellow perch, northern pike, walleye, smallmouth bass, muskellunge, and lake sturgeon.	Yellow perch abundance has oscillated between 1984 and 1990, and the population shows signs of overexploitation. Abundance of northern pike, smallmouth bass, and walleye has been relatively stable between 1984 and 1990, although sample sizes for smallmouth bass and walleye have been relatively small in gill net catches. Anecdotal accounts suggest that a quality muskellunge fishery exists in the tailwaters of the Moses-Saunders Power Dam, however, catches of muskellunge over 13.6 kg are uncommon. A population of lake sturgeon exists below the Moses-Saunders Power Dam, and recent sampling in an area that produced catches of sturgeon in the early 1970s indicates recent recruitment to the population.

Contact person: A. Schiavone, New York State Dept. of Environmental Conservation, Watertown, NY.

43. ST. LAWRENCE RIVER (MASSENA, NEW YORK)	
Fish Habitat Goals/Objectives/Targets	Status
The goal for fish habitats within the Area of Concern is to maintain their productive capacity and to restore the productive capacity of impaired habitats.	Physical impairments to fish habitats in the Area of Concern have resulted primarily from dam construction and dredging. These modifications have restricted movements of fish and may have destroyed or altered historic spawning habitats. In addition, contaminated sediments may have contributed to degradation of habitat in localized areas.

Contact person: A. Schiavone, New York State Dept. of Environmental Conservation, Watertown, NY.

43. ST. LAWRENCE RIVER (CORNWALL, ONTARIO)	
Fish Community Goals/Objectives/Targets	Status
<p>The goal of the Cornwall and Massena RAPS is restore, protect, and maintain the chemical, physical, and biological integrity of the St. Lawrence River ecosystem, and, in particular, the Akwesasne, Cornwall-Lake St. Francis, and Massena Area of Concern, in accordance with the Great Lakes Water Quality Agreement. Objectives related to the fish community include:</p> <ul style="list-style-type: none"> * Restore the ecosystem in the Area of Concern such that populations of flora and fauna, including humans, be robust and self-sustaining in a balanced community, by: rehabilitating and protecting required habitats; ensuring that the reproduction and health of individuals is not impaired by toxic and other potentially hazardous substances and effects; and preventing adverse impacts resulting from the introduction of non-native species. * Increase the enjoyment provided by other recreational uses such as wildlife viewing, hunting, sport fishing, etc. by restoring the flora and fauna; improving the aesthetics of the river and shore; and maintaining access to these resources. 	<p>Fish community structure probably shifted as result of Seaway and dam construction. Sturgeon, walleye, muskellunge, and American eel were negatively affected, while yellow perch, bass, and northern pike benefited from these changes. Despite heavy fishing pressure and habitat loss, the fish community appears to have reached some stability. The only exception is sturgeon, which has continued to decline. Impacts on sturgeon and walleye are probably due to flooding of historical spawning areas. Exploitation (sport, commercial, subsistence) continues to be a major factor controlling fish population abundance. Information on other sport fish species does not include any recent changes in status of any significance (1984-1988), however, data prior to 1984 were are not available except for yellow perch. Perch populations have fluctuated since the mid-1970s, but no trend is apparent (i.e. no significant increase or decrease in size). The impact of recent zebra mussel invasion cannot be quantified at this early stage. Incremental littoral zone habitat loss due to shoreline development activities is a problem. Impacts of contaminants on fish are unknown.</p>

Contact person: M. Eckersley, Ontario Ministry of Natural Resources, Cornwall, Ontario.

43. ST. LAWRENCE RIVER (CORNWALL, ONTARIO)	
Fish Habitat Goals/Objectives/Targets	Status
The goal of the Cornwall and Massena RAPs is to restore, protect, and maintain the chemical, physical, and biological integrity of the St. Lawrence River ecosystem, and, in particular, the Akwesasne, Cornwall-Lake St. Francis, and Massena Area of Concern, in accordance with the Great Lakes Water Quality Agreement. The ecosystem health objective related to habitat is to restore the ecosystem in the Area of Concern such that populations of flora and fauna, including humans, be robust and self-sustaining in a balanced community, by: rehabilitating and protecting required habitats; ensuring that the reproduction and health of individuals is not impaired by toxic and other potentially hazardous substances and effects; and preventing adverse impacts resulting from the introduction of non-native species.	Construction of the Seaway and dams has had a major impact on fish and wildlife habitat in terms of physical alteration associated with dredging, and change in habitat stability due to flooding, stabilization of water levels, and stream channel morphometry (which has affected aquatic plant and wetland communities). Continual shoreline development has affected both wildlife and nearshore fish habitats.

Contact person: M. Eckersley, Ontario Ministry of Natural Resources, Cornwall, Ontario.