Ministry of Natural Resources

Ontario

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Fisheries Management Plan for Fisheries Management Zone 17: November 2009

Ontario Ministry of Natural Resources – Peterborough District

FISHERIES MANAGEMENT PLAN FOR FISHERIES MANAGEMENT ZONE 17

NOVEMBER 2009

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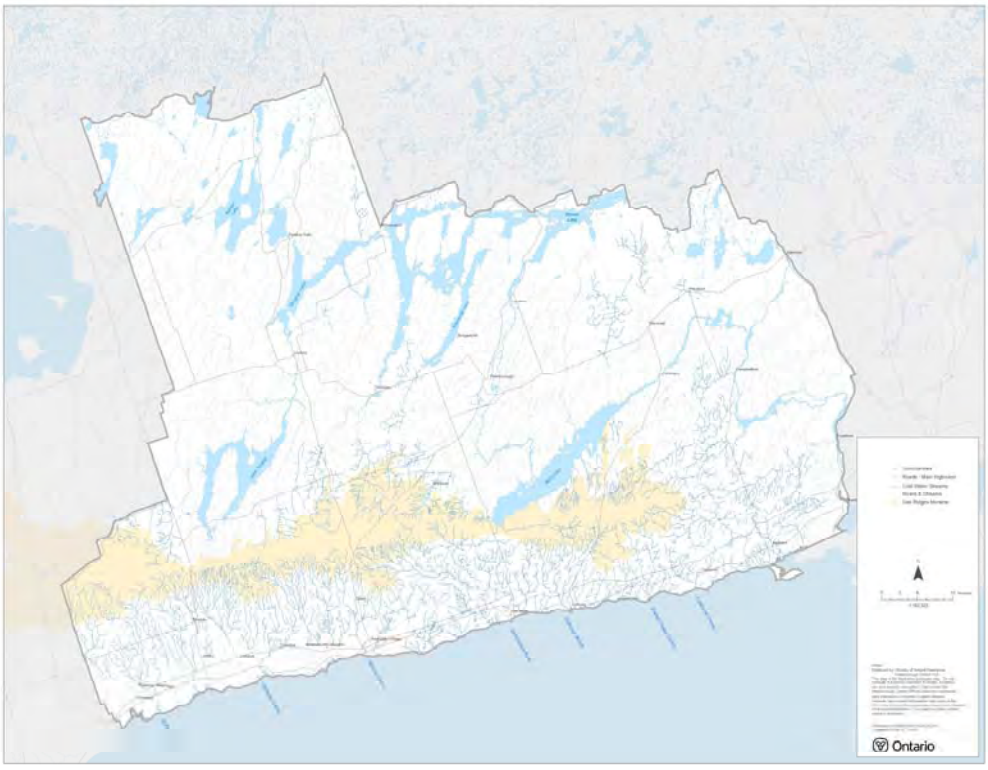
FISHERIES MANAGEMENT ZONE (FMZ) 17 FISHERIES MANAGEMENT PLAN: EXECUTIVE SUMMARY

The Fisheries Management Zone 17 (FMZ 17) Fisheries Management Plan will guide the management of the fisheries resources of FMZ 17 and will be in effect for 10 years with an internal review after five years. The goals, objectives, successes and future direction of the plan will be reviewed at the end of the 10-year period. The plan is designed to be flexible and adaptable to a wide range of future conditions. The plan is to be a dynamic document that may be amended as circumstances require.

Purpose and Scope of the Plan

The FMZ 17 Fisheries Management Plan is being developed by the Ministry of Natural Resources (MNR) with input and advice from the FMZ 17 Advisory Council. The planning area is all of FMZ 17, including waters of the Trent-Severn Waterway from the mouth of the Trent River to Canal Lake, the Crowe River Watershed, and the eastern portion of the Oak Ridges Moraine.



Map of Fisheries Management Zone 17

The Fisheries Management Plan identifies management challenges associated with the recreational fishery. The plan addresses these management challenges through the establishment of goals and objectives within the context of sustainable resource management. The intent of the plan is to assist the MNR in

balancing the demands placed on the resource with the biological capacity of the systems. This balance is based on analysis of fisheries data and collaborative discussions with members of the public, First Nations and Aboriginal communities and non-governmental agencies.

In addition, the Fisheries Management Plan identifies management opportunities, along with objectives and actions to develop these opportunities. The plan will focus on enhancing, promoting and maintaining open communication between government agencies and stakeholders by providing a framework for the coordinated and cooperative management of the fishery. The objectives of the plan are to:

- Protect and enhance the biological integrity of the aquatic ecosystem;
- Promote the sustainable utilization of fisheries resources;
- Develop a greater knowledge of fish populations, fish habitat and aquatic ecosystems;
- Describe the existing conditions of the fish community to establish a benchmark of ecosystem health;
- Provide a framework for fisheries management;
- Rehabilitate degraded fish communities and fish habitat, for self-sustaining, native stocks;
- Promote public awareness, appreciation and understanding of fisheries resources and the aquatic habitats on which they depend; and
- Involve organized angling associations, environmental interest groups and the general public in fisheries management activities.

The Fisheries Management Plan is comprised of a series of strategies that reflect management priorities within the FMZ. Each strategy identifies the management challenges or opportunities, associated objectives and management actions. Specifically, these strategies include:

- Walleye management;
- Largemouth and smallmouth bass management;
- Panfish (yellow perch, black crappie, pumpkinseed and bluegill sunfish) management;
- Muskellunge and northern pike management;
- Coldwater stream management;
- Other fish species;
- Invasive species and fish pathogens;
- Education and awareness; and
- Monitoring and assessment.

Walleye Management Strategy

Key highlights include developing size-based regulations to provide increased protection for adult walleye, increasing assessment of walleye spawning areas,

and initiating Put-Grow-Take walleye stocking in select waterbodies within FMZ 17.

Largemouth and Smallmouth Bass Management Strategy

Key highlights include promoting the quality bass fisheries that exist within FMZ 17 and providing additional angling opportunities through the extension of the fall bass season.

Panfish (yellow perch, black crappie, pumpkinseed and bluegill sunfish) Management Strategy

Highlights of the panfish management strategy include promoting harvest opportunities afforded by these species, regulations to ensure equitable distribution of resources, and providing additional angling opportunities through extended seasons.

Muskellunge and Northern Pike Management Strategy

Muskellunge populations within FMZ 17 are considered strong, and provide a high quality angling experience. Primary management challenges include the potential spread of Viral Hemorrhagic Septicaemia (VHS) and the spread of northern pike through the Kawartha Lakes. Pike will be managed as an invasive species throughout most of FMZ 17, using liberal angling regulations and the promotion of harvest. Increased angling opportunities for muskellunge are provided by extending the fall season, along with the implementation of a science-based approach to establishing minimum size limits.

Coldwater Stream Fisheries Management Strategy

This section of the strategy builds on the Coldwater Stream Strategy for Peterborough Area (OMNR, 2005). Highlights include promoting the development of Watershed-Based Fisheries Management Plans within FMZ 17, as well as increased cooperation between inland and Lake Ontario fisheries managers to develop consistent direction for the management of migratory salmonids. Native brook trout populations are currently threatened by numerous habitat stressors, which are addressed by actions described in the strategy. Efforts to restore Atlantic salmon populations to select streams within FMZ 17 are also supported.

Other Fish Species Management Strategy

This section identifies management objectives and actions associated with forage fish species, non-traditional angling species, and Species at Risk (SAR) within FMZ 17.

Invasive Species and Fish Pathogens Strategy

This strategy outlines proposed management actions to address the threat of invasive species and fish pathogens in the zone, which are considered to be among the largest threats to the integrity of aquatic ecosystems. Key areas of concern include the introduction of round goby and the potential for the introduction of Viral Hemorrhagic Septicaemia (VHS).

Education and Awareness Strategy

This chapter highlights a means to increase public awareness associated with the fishery and its management. Promotion of quality fisheries resources and the socio-economic values that they support were considered high priority by MNR and the FMZ 17 Advisory Council.

Monitoring and Assessment Strategy

This chapter identifies proposed fisheries assessment and monitoring that would be completed at a district level. Assessment activities of the Kawartha Lakes Fisheries Assessment Unit are not included in this strategy. Highlights include implementing the Broad-scale Monitoring Program, continued sampling of tournament caught bass, assessing walleye spawning sites, and collecting information associated with the use of migratory and inland salmonid fisheries. Assessment activities associated with SAR are also identified.

1.0 INTRODUCTION TO THE FISHERIES MANAGEMENT PLAN FOR FISHERIES MANAGEMENT ZONE 17

Towards the Development of a Fisheries Management Plan for FMZ 17

Lester et al. (2003) identified the necessity for a change in the spatial and temporal scale for the management of Ontario's fisheries resources. In 2005, the Ecological Framework for Recreational Fisheries Management in Ontario was implemented to ensure fisheries resource sustainability and to optimize angling opportunities. The approach described in the "framework" is consistent with the Ministry of Natural Resources strategic direction as outlined in "Our Sustainable Future" (OMNR, 2005a) and with the principles stated in the Strategic Plan for Ontario Fisheries (SPOF II – OMNR, 1991).

Newly created Fisheries Management Zones based on biological, climactic and social factors establish the landscape for fisheries management. This is a core component of the ecological framework, resulting in the creation of 20 new FMZs that replaced the previous 37 fishing divisions. Fisheries Management Zone 17 (FMZ 17) is one of these new zones.

In addition to the new FMZs, the ecological framework also emphasizes enhanced public input and involvement in fisheries management. As a result, fisheries advisory councils were to be established in each of the new FMZs. The FMZ 17 Fisheries Advisory Council (herein FMZ 17 Council) was initiated late in 2006 as one of three pilot councils in the province. Members of the council played a critical role in the development of this plan by identifying goals, objectives and management actions. Representatives from the FMZ 17 Council who contributed to the development of this plan included:

- Buckhorn District Tourist Association,
- City of Kawartha Lakes Tourism,
- Cold Creek Fly Fishers,
- Competitive anglers,
- Crowe Lake Waterways Association,
- Curve Lake First Nation,
- Federation of Ontario Cottage Associations,
- Live bait industry,
- Muskies Canada,
- Ontario BASS Federation Nation,
- Ontario Chinese Anglers Association,
- Ontario Federation of Anglers and Hunters,
- Peterborough Field Naturalists,
- Recreational anglers,
- Rice Lake Tourist Association,
- Trent University, and

- Victoria Land and Water Stewardship Council.

Purpose and Scope of the Plan

The FMZ 17 Fisheries Management Plan was developed by the MNR with input and advice from the FMZ 17 Council. The planning area is all of FMZ 17, including waters of the Trent-Severn Waterway from the mouth of the Trent River to Canal Lake, the southern portion of the Crowe River Watershed and the eastern portion of the Oak Ridges Moraine.

The Fisheries Management Plan identifies management challenges associated with the recreational fishery. The plan addresses these management challenges through the establishment of goals and objectives within the context of sustainable resource management. The intent of the plan is to assist the MNR in balancing the demands placed on the resource with the biological capacity of the systems. This balance is based on analysis of fisheries data and collaborative discussions with members of the public, government and partner agencies, First Nations and Aboriginal communities and non-governmental agencies.

In addition, the Fisheries Management Plan identifies management opportunities, along with objectives and actions to develop these opportunities. The plan also focuses on enhancing, promoting and maintaining open communication between government agencies and stakeholders by providing a framework for the coordinated and cooperative management of the fishery. The objectives of the plan are to:

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Description of FMZ 17

Fisheries Management Zone 17 (Figure 1.1) covers an area of 9,360 km^2 and spans three MNR administrative districts within Southern Region: Bancroft, Aurora and Peterborough. There are 64 waterbodies greater than 5 ha in FMZ 17 of which 12 are larger than 1,000 ha. Rice Lake is the largest at more than 10,000 ha. The total surface area of all lakes exceeds 44,800 ha. The lakes are highly developed in terms of both seasonal and year round residences and play a very important socioeconomic role in the region.

All of the Kawartha Lakes have similar fish communities because of their similar habitat and their connectivity via the Trent-Severn Waterway (TSW). Originally, native fish communities in the portions of the Crowe River watershed that are within FMZ 17 were slightly differently from the Kawartha Lakes. Over recent time, species have extended their range from the Crowe River into the Kawartha Lakes and vice-versa resulting in similar fish communities. Lakes not directly connected to the TSW (i.e. Dalrymple and Head Lakes) exhibit some differences in fish community, particularly the absence of some species not originally found in the Kawarthas such as bluegill and black crappie.

In addition to the warmwater lakes and rivers, FMZ 17 includes a number of coldwater stream fish communities. FMZ 17 includes the Lake Ontario tributaries from Duffins Creek in the west, eastwardly to and including the Trent River. Within FMZ 17, the Oak Ridges Moraine (ORM) is the main source of more than 80% of coldwater streams flowing south into Lake Ontario, north into the Kawartha Lakes and east into the Trent River. These coldwater streams support fisheries for migratory trout and salmon from Lake Ontario, as well as resident populations of brook and brown trout.

Additional information on FMZ 17 and its fish communities is available in the *Background Information to Fisheries Management Plan for Fisheries Management Zone 17* (OMNR, 2008).

Figure 1.1: Map of Fisheries Management Zone 17.

Guiding Principles for developing the Fisheries Management Plan

The following Guiding Principles provide direction for the development of fisheries management goals, objective and actions.

1. **ECOLOGICAL APPROACH**: An ecological approach to fisheries management will be followed to ensure conservation and use of the resource in a sustainable manner.

2. **LANDSCAPE LEVEL MANAGEMENT**: Fisheries will be managed on a landscape scale. However, in some limited cases, components of the resource within a FMZ may need to be managed differently.

3. **BALANCED RESOURCE MANAGEMENT**: Strategies and actions will consider the ecological, economic, social and cultural benefits and costs to society, both present and future.

4. **SUSTAINABLE DEVELOPMENT**: The finite capacity of the resource is recognized in planning strategies and management actions within a FMZ. Only natural resources over and above those essential for long-term sustainability requirements are available for use, enjoyment and development.

5. **BIODIVERSITY**: Fisheries management will ensure the conservation of biodiversity by committing to healthy ecosystems, protecting our native and naturalized species and sustaining the genetic diversity of fisheries in the FMZ. All species in the FMZ including non-sport fish and Species at Risk must be considered.

6. **NATURAL REPRODUCTION**: Priority will be placed on native, naturally reproducing fish populations that provide predictable and sustainable benefits with minimal long-term cost to society. Hatchery-dependent fisheries will also play a role in providing fishing opportunities.

7. **HABITAT PROTECTION**: The natural productive capacity of fish habitats will be protected and habitat will be enhanced where possible.

8. **VALUING THE RESOURCE**: Stakeholders and other users will be invited to understand and appreciate the value of fisheries resources and to participate in decisions to be made by MNR that may directly or indirectly affect aquatic ecosystem health.

9. **RESPONSIBILITY:** Local, regional, provincial and federal cooperation and sharing of knowledge, costs and benefits will be sought to manage fisheries at a FMZ level.

10. **MULTI-PARTY INVOLVEMENT**: A wide range of stakeholders, Aboriginal peoples and interested parties will provide fisheries management advice to ensure an open and transparent process that acknowledges their valuable role in the process.

11. **ABORIGINAL INTERESTS**: Ontario is committed to building better relationships with Aboriginal peoples and in involving them in decisions that affect them.

12. **DIRECT ACTION**: All possible options must be considered and evolve to implementation actions that are feasible.

13. **KNOWLEDGE**: The best available information will be used for FMZ-based objective setting and strategy development and implementation.

14. **ADAPTIVE MANAGEMENT**: FMZs will be managed using an adaptive management approach. Objectives will be set, monitoring will occur, results will be compared against objectives and management regimes adjusted as necessary and where possible to ensure attainment of objectives.

15. **PRECAUTIONARY PRINCIPLE**: When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause-and-effect relationships are not fully established scientifically.

The Fisheries Management Plan has been prepared as a series of strategies that reflect management priorities within the zone. Each strategy identifies the management challenges or opportunities, associated objectives and management actions. Specifically, these strategies include:

- Walleye management;
- Largemouth and smallmouth bass management;
- Panfish (yellow perch, black crappie, pumpkinseed and bluegill sunfish) management;
- Muskellunge and northern pike management;
- Coldwater stream management;
- Other fish species;
- Invasive species and fish pathogens;
- Education and awareness; and
- Monitoring and assessment.

2.0 WALLEYE MANAGEMENT STRATEGY

Population Trends and Information

Over the past 30 years, there is a general declining trend in walleye abundance on the four lakes routinely sampled by the Kawartha Lakes Fisheries Assessment Unit (KLFAU). A pronounced decline has also been observed on Rice Lake and Lake Scugog since the early 1990s. On Balsam and Buckhorn Lakes, observed declines in abundance have not been as dramatic. This is, at least in part, due to the fact that initial abundance on these lakes was not as high as on Lake Scugog or Rice Lake. Although assessed only on four lakes, it is highly likely that similar trends in walleye abundance have occurred on the majority of waters in FMZ 17, based on information from anglers and the assessment information that is available.

The period of decline in walleye abundance corresponds with a significant increase in the abundance of either largemouth or smallmouth bass and the emergence of new species (specifically bluegill and black crappie). These changes were associated with decreases in total phosphorus and increases in both summer water temperature and water clarity (Robillard and Fox, 2006). Increased water clarity reduces the competitive advantage that walleye possess over other species in turbid water conditions and potentially increases predation on young-of-year walleye by other species. Declines in the number of walleye may be a result of the reduction in the number of strong year classes (Rutherford et al., 1999). These declines are compounded by the direct removal of adult walleye from the population via angler harvest. Ultimately, the role of walleye as the dominant predator has been diminished in most FMZ 17 lakes. Fewer large walleye in the system means reduced predation of other species such as yellow perch, resulting in more yellow perch, which in turn feed on juvenile walleye (Walters and Kitchell, 2001). Changes in the physical characteristics of the lakes and the fish community balance, coupled with reductions in year class strength, likely limit the productive capacity of the walleye fishery. The effectiveness of management actions and the expectations of the walleye fishery must be considered within this context.

Status of the Fishery

In recent ‘on the water’ angler creel surveys, walleye have been the most commonly targeted species, accounting for approximately one-third of all fishing effort. The majority of winter anglers on Crowe Lake and Lake Scugog are targeting walleye, or walleye and yellow perch – although these were the only species that could be legally harvested on Lake Scugog during the winter at the time of the most recent surveys. Among sport fish species, the release rate for walleye is lowest, with only one in four walleye released (including those required to be released by regulation).

Historically, walleye effort accounted for between 60-70% of total angling effort on Balsam, Buckhorn, Chemong, Pigeon and Scugog Lakes. Walleye targeted effort exceeded 30 rod hours per hectare during the early 1980s on Rice Lake and the Trilakes (Pigeon, Buckhorn, Chemong Lakes), but has since declined to approximately 10 rod hours per hectare. Effort on Balsam Lake and Lake Scugog has also declined, from approximately 15 rod hours per hectare to less than 10 rod hours per hectare in more recent surveys.

Walleye catch rates have varied within lakes through time, making interpretation of trends difficult. Catch rates have consistently been highest on Rice Lake, exceeding 0.20 walleye per hour in all years with the exception of 2004, where the walleye CUE (catch per unit of effort) was only 0.06 walleye per hour, the lowest catch rate from any survey. Catch rates on the Trilakes exceeded 0.20 walleye per hour until the late 1990s and have since declined. Catch rates on Lake Scugog have generally increased. On Balsam Lake, catch rates have been lower than the other lakes, generally between 0.10 and 0.15 walleye per hour.

Current Walleye Regulations

The current walleye season in FMZ 17 opens on the second Saturday in May and closes on November 15th. The existing winter closure has been in place for a number of years and has been maintained because walleye populations could not sustain angling effort in addition to what occurred in the summer months.

Open winter seasons are currently in place on Lake Scugog (January 1st – last day in February) and Crowe Lake (2nd Saturday in May – March 1st). These lakes were outside the administrative boundaries of the original winter closure and have been maintained to the present. The current opening season dates, in concert with the existing sanctuary locations, are thought to be effective in protecting walleye during and shortly following the spawning period.

The current catch and possession limit for walleye is four (4) for sport licence holders, and two (2) for conservation licence holders. Only one fish can exceed 46 cm (~18 inches) for both licence types. This regulation was initially implemented as an interim measure in 2008.

Walleye Management in FMZ 17

Walleye Management Goal

The observed declines in walleye abundance and associated shifts in the structure of the fish community, have been identified as the highest priority fisheries management challenge in FMZ 17. The MNR, with advice from the FMZ 17 Council, have identified the following walleye management goal:

To reverse declines and rebuild existing, self-sustaining walleye populations to maintain and enhance benefits to the public

Walleye Management Challenges

A number of challenges to achieving this goal were identified by the MNR and the FMZ 17 Council. Objectives and actions to overcome these challenges have been identified.

CHALLENGE #1: Spring water level and flow fluctuations may cause recruitment failure

OBJECTIVE: *Protect, maintain and enhance critical habitats for naturally reproducing walleye populations and associated fish and aquatic communities*

The timing of the walleye spawning period, as well as characteristics of their spawning activities (shallow water, no parental care), means that walleye spawning success can be influenced by changes in water levels and flows at the spawning grounds. In rivers, both water flows and levels need to be considered. Excessive flows impede access to spawning habitat, can scour eggs, or be harmful to hatching larval walleye. Low flows and levels can be harmful, particularly if they result in the exposure of all or portions of a spawning bed. This can either increase the risk of predation, or kill eggs if they are above water. In lakes, the same problems can occur if water levels recede following the spawning period.

Dams and/or hydropower facilities control water levels and flows throughout most of FMZ 17. Many of these locations are identified as walleye spawning habitat. MNR contracted Parish Geomorphic and Warme Engineering and Biological Services to complete a survey of walleye spawning protection and enhancement opportunities in the Trent River (Parish Geomorphic and Warme Engineering and Biological Services, 2003). These conclusions and recommendations can be applied to other walleye spawning locations. These values should provide reference points for the assessment of walleye spawning habitat in FMZ 17 (Table 2.1).

ACTIONS:

- **Identify critical walleye spawning locations within FMZ 17**
- **MNR to meet on an annual basis with TSW in advance of the walleye spawning season to share information and to link water management with fisheries values**
- **Monitor spawning locations to:**
    - Identify and verify spawning locations;
    - Estimate the number of walleye utilizing a spawning site;
    - Identify the quality habitat on a site specific basis (using criteria in Table 2.1);

  - Identify habitat rehabilitation/creation/alteration priority areas; and
  - Develop site-specific water management plans
- **Develop spawning-site specific action plans where required**
- **Rehabilitate/create critical spawning habitat where existing habitat is degraded**
- **Support the evaluation of the effects of climate change on local weather patterns, and in turn how they might influence water management practices**
- **Initiate research to determine impacts of current water level management, with emphasis on determining effects on recruitment and population dynamics**

Table 2.1: Summary of walleye spawning targets for hydraulic habitat assessments (from Parish Geomorphic and Warme Engineering and Biological Services, 2003)

Depth	
0.6 – 4.0 m	Resting/holding water depth in proximity to spawning grounds and beds
0.3 – 1.5 m	Optimum depth over spawning grounds
0.3 – 0.8m	Optimum depth over eggs on spawning beds
Velocity	
<1 m/sec	Optimum for spawning migration and over spawning grounds
1 – 1.3 m/sec	Fair for spawning migration and over spawning grounds
1.3 – 2 m/sec	Adversely high for migration, spawning and egg scour
>2 m/sec	Virtually no migration and chronic adverse egg scour
Substrate	
2.5-25 cm	Preferred range over which spawning takes place
2.5-15 cm	Range for highest production of embryos
Supporting Diagnostics	
Threshold velocity for minimum preferred substrate size => 2.5 cm = 0.91 m/sec	
Threshold velocities for identified egg size range* => 1.5-2 mm = 0.25 – 0.50 m/sec	
Threshold shear stress for minimum preferred substrate size => 2.5 cm = 26 N/m^2	
Threshold shear stress for identified egg size range* => 1.5-2 mm = 1.5 - 2.1 N/m^2	

*assumes water hardening of eggs and comparable specific weight of equivalent sediment size

NOTE: Threshold velocities based on USDA Isbash Curve Method (USDA, 1994) and threshold shear stress based on Shield's entrainment function (in Newbury and Gaboury, 1993b)

CHALLENGE #2: Decreased adult abundance has reduced productive capacity of walleye populations

OBJECTIVE: *Increase walleye abundance and improve population structure to promote population recovery. Measures from index netting surveys include:*

- **Walleye CUE (relative abundance);**

- **CUE of adult walleye >450mm;**
- **Number of age classes;**
- **Maximum age; and**
- **Diversity of adult female walleye**

Historical harvest rates exceeded the theoretical maximum harvest (known as MSY or maximum sustainable yield) using two different measures, on all lakes except Lake Scugog. On Rice Lake in the late 1970s, harvest exceeded MSY by more than 150%. This data suggests that historical harvest may have contributed to declines in walleye populations.

Walleye populations across most of FMZ 17 have declined in recent years. A decrease in adult numbers reduces the abundance of spawning walleye and thus the total number of eggs produced in a lake. Lower adult abundance reduces the stability of populations, as reproductive success is based on fewer individuals. An adult population with representation from a diverse range of sizes and ages is consistent with healthy walleye populations in other areas of Ontario. Increasing the number of eggs produced in a lake will increase the odds of some small fish surviving their first year. The largest threat to adult walleye is harvest. One of the most effective tools to protect adult walleye and improve the structure of walleye populations is angling regulations.

ACTIONS:

- **Maintain existing sanctuary locations to protect walleye at critical times of the year. Revise current sanctuary dates to reflect changes to the seasons of other fish species in the FMZ**
- **Maintain existing open-water season (2nd Saturday in May to November 15th) and review existing winter walleye seasons during the scheduled review of this plan**
- **Maintain a catch and possession limit of 4 walleye for sport licence holders, reduce the conservation licence limit to 1 walleye**
- **Implement the following size-based regulation to protect adult walleye:**
    - Harvest Slot Option of 35 to 50 cm (13.8 to 19.7 inches). Only walleye within the slot may be harvested.
- **Maintain a volunteer presence to monitor spawning locations**
- **Quantify current levels of harvest by First Nation and Aboriginal communities**

CHALLENGE #3: Changes to the fish community, decreased production of juvenile walleye

OBJECTIVE: *Increased survival of juvenile walleye*

A number of new fish species have become established in the Kawartha Lakes in recent years. Some, such as black crappie and bluegill, may impact walleye

productivity by direct predation on larval walleye or by competition for resources decreasing the survival of juvenile walleye. On some lakes, successful recruitment has occurred less frequently than in previous years. Even when successful year classes do occur, they often are not as strong as historical levels. Other species, such as largemouth and smallmouth bass, have increased in numbers (Robillard and Fox, 2006). Largemouth bass have been shown to have a negative association with walleye populations (Fayram et al., 2005). Bass may prey on walleye at various stages. Increases in bass populations may largely be driven by changes in climate and are expected to continue. A warmer climate is better suited to warm water species such as bass than coolwater walleye. Collectively, these changes to the piscivore community and the introduction of predators and competitors of young walleye may be decreasing walleye recruitment, which subsequently lowers adult walleye populations.

ACTIONS:

- **Protect adult walleye to increase the predation on competitor species of juvenile walleye (see Challenge 2 above) and increase the number of eggs produced**
- **Harvest of predator and competitor species (see Panfish Management Strategy, Section 4.0)**
- **Review current research to determine viable management tools to reverse changes in fish community structure**

CHALLENGE #4: Physical changes to the lakes that have made them less suitable to walleye and more suitable for other species

OBJECTIVE: *Increase public awareness regarding changes to the aquatic ecosystems to manage expectations*

The spread of zebra mussels has increased water clarity and decreased the nutrients available to lower levels of the food chain. This has likely decreased the overall productive capacity of the lakes and contributed to observed fish community shifts, creating more favourable conditions for some species (i.e. bass, muskellunge) and less favourable conditions for others (i.e. walleye). The aggressive feeding behaviour of zebra mussels has resulted in increased water clarity as they filter plankton from the water column. As water clears, the amount of habitat for the light sensitive walleye is reduced and predation on young walleye is likely to increase. Water clarity is thought to have a very dramatic effect on the productivity (yield) of walleye in inland lakes (Lester et al. 2004).
If changes to the lakes have decreased their suitability for walleye, public expectations of walleye fisheries should reflect the current productive capacity for walleye rather than historic values.

ACTIONS:

- **Develop educational materials to inform anglers and the general public of the changes to the productive capacity of walleye resources as a result of physical changes to the lakes**
- **Develop strategies to prevent further introductions of invasive species and subsequent changes to the aquatic ecosystem (see Invasive Species Strategy – Section 8.0)**
- **Monitor the fisheries and aquatic ecosystems as they continue to change in response to environmental variables**

CHALLENGE #5: Reduction in walleye-targeted angling effort in many lakes

OBJECTIVES: *Provide walleye angling and harvest opportunities based primarily on naturally reproducing walleye populations*

Provide Put-Grow-Take (PGT) walleye angling opportunities with more liberal regulations to deflect angling pressure away from naturally reproducing populations

Across FMZ 17, walleye angling effort has declined. In most instances, the decline in angling effort is consistent with observed declines in walleye abundance. The most critical step in increasing angling opportunities for walleye is to improve the quality of walleye fisheries. These fisheries will be based primarily on naturally reproducing, self-sustaining populations. This document identifies a number of strategies that should increase the abundance of walleye and subsequently improve the quality of the walleye fishing experience in FMZ 17. Opportunities exist to diversify angling opportunities in the zone. Lakes stocked for Put-Grow-Take (PGT) purposes would no longer be managed for naturally reproducing walleye populations, but rather for the sole purpose of providing angling and harvest opportunities. The establishment of PGT walleye fisheries within the zone would allow for more liberal regulations on some waterbodies and may absorb angling pressure from more sensitive lakes within the zone. The contribution of stocked walleye to a fishery in complex ecosystems is typically poor. In the face of this uncertainty, establishment of PGT walleye fisheries is being considered on a pilot basis at this time, based on criteria developed by MNR in association with the FMZ 17 Council.

ACTIONS:

- **See items above to increase walleye abundance but select actions with recognition of the social and economic values of the fishery**
- **Implement an angler satisfaction survey**
- **Implement provincial monitoring program to monitor angler effort**
- **Establish Put-Grow-Take walleye fisheries on a pilot basis following identified lake selection criteria**
- **Implement liberal regulations (e.g. seasons, catch limits, size restrictions) on PGT waterbodies**

3.0 LARGEMOUTH AND SMALLMOUTH BASS MANAGEMENT STRATEGY

Population Trends and Information

The catch rate of smallmouth bass increased since 1980 in Balsam and Rice Lakes but remained unchanged in Buckhorn and Scugog Lakes. The average catch rate was higher on Rice and Balsam Lakes than on Lake Scugog and Buckhorn Lake. The catch rate of largemouth bass increased since 1980 in Balsam and Buckhorn Lakes but remained unchanged in Rice Lake and Lake Scugog. The average catch rate was lowest on Scugog, intermediate on Balsam and Buckhorn Lakes and highest on Rice Lake.

The trends in the abundance and size distribution of largemouth and smallmouth bass are best explained by the ecology of each species and the habitat present in each lake. Some lakes, such as Rice and Pigeon Lakes, provide diverse habitat and are able to support abundant populations of both species. Other lakes, such as Balsam Lake offer limited habitat for largemouth bass but are able to support healthy and abundant smallmouth bass populations. At the other end of the spectrum, lakes such as Chemung and Scugog provide a greater amount of shallow, vegetated largemouth bass habitat while smallmouth bass habitat is less abundant. Changes in the water clarity, climate change and shifts in the predator community have also increased the productive capacity of many of the lakes in FMZ 17 for visual predators such as bass. Overall, bass populations in the majority of FMZ 17 should be considered healthy.

Characteristics of the Fishery

Bass represent approximately 20% of the total angling effort from recent creel surveys, accounting for approximately 250,000 angler hours. This proportion of effort has increased through time, based on both an increase in angling effort for bass and a decrease in walleye-targeted effort. Current bass effort is currently comparable to walleye effort and now exceeds 10 rod hours per hectare on Rice Lake and the Trilakes. The increase in effort has led to an overall increase in the number of bass harvested, with yields approaching 3kg/ha on some lakes. There is evidence of increased catch and release of bass through time. Catch rates for bass have increased, exceeding 0.5 fish per hour on Rice Lake and 1.0 fish per hour on the Trilakes. The mean size of bass harvested (both species combined) has decreased, with the exception of Lake Scugog. This could be due to changes in angler attitudes resulting in increased release rates of larger fish, or an emerging trend of targeting smaller bass for harvest.

Current Bass Regulations

Within FMZ 17, the bass fishery is currently regulated with an open season from the 4th Saturday in June to November 15th, a catch and possession limit of six (6) fish for a sport fishing licence and two (2) for a conservation licence. No size limits are in place and the catch and possession limit is an aggregate limit for largemouth and smallmouth

bass. Exception regulations provide extended seasons on Crowe Lake and the lower portions of the Trent River (November 30th closure).

Bass Management in FMZ 17

Bass Management Goal

The productivity of bass populations has increased in recent years, with bass now accounting for a greater proportion of the piscivorous fish community. Both large and smallmouth bass are considered integral components of healthy warm-water fish communities in FMZ 17 and support high quality recreational fisheries. The MNR, advised by the FMZ 17 council, has identified the following bass management goal:

To manage the existing high quality bass fishery to maintain or enhance the quality of the fishery supported by naturally reproducing populations.

Bass Management Challenges

A number of challenges to achieving this goal were identified by MNR and the FMZ 17 council. Objectives and actions to overcome these challenges have been identified.

CHALLENGE #1: Invasive pathogens and disease threaten the quality of the bass fishery in FMZ 17

OBJECTIVE: *Prevent the introduction and/or spread of invasive pathogens that threaten native and naturalized fish species in FMZ 17*

Bass populations in FMZ 17 are known to be susceptible to a number of pathogens. Some parasites such as Black Spot Disease are relatively common, but are not believed to represent a threat to the sustainability of bass populations.

The connectivity of the Kawartha Lakes to the Great Lakes, in combination with the mobility of anglers and recreational boaters increase the susceptibility of these lakes to the introduction of an invasive pathogen. A number of other fish diseases are also of potential concern in FMZ 17 and may be spread by similar vectors as invasive species. Management of invasive species and disease is detailed in Section 8.0.

CHALLENGE #2: Provide opportunities for Competitive Fishing Events within the context of diverse recreational fishing values and the biological sustainability of the bass fishery

OBJECTIVE: *Provide competitive fishing opportunities consistent with the sustainability of the bass fishery*

The lakes within FMZ 17 and the Kawartha Lakes in particular, currently support a large number of competitive fishing events targeting large and smallmouth bass. There are

numerous social issues and benefits associated with these events. A perception exists that these events threaten the sustainability and/or quality of the recreational bass fishery.

Significant resources have been allocated to quantifying and identifying the causes of tournament related mortality, particularly for bass. Bass tournament research led directly to improved tournament procedures that have resulted in the decline in overall mortality to the point where properly organized events can have initial mortality rates for bass that are below 5% (Gilliland et al., 2002). As the popularity of competitive fishing increased, resource managers shifted the focus to less obvious impacts such as delayed mortality or the displacement of fish from natural home ranges. A large-scale study of competitive fishing events on the Trilakes concluded that these events did not represent a threat to the sustainability of the largemouth bass populations (Ridgway, 2006). Furthermore, research has identified air exposure, particularly during the tournament weigh-in, as a critical stressor on tournament caught bass (Suski et al., 2004). This research has contributed to improvements in tournament weigh-in procedures that may further increase survival of tournament caught bass. The economic benefits of competitive fishing events for local communities can be considerable and the long-term success of such events is entirely dependent on the proper and responsible management of existing resources. Trophy bass fisheries can generate a great amount of economic revenue (Corbett, 1999; Chen et al., 2003). All potential threats, including tournament angling, must be incorporated into fisheries monitoring programs.

ACTIONS:

- **Promote the use of the best fish handling practices at competitive fishing events (e.g. In-water weigh-in)**
- **Communicate the facts associated with competitive fishing events to the angling and general public (e.g. economic revenues, results of previous biological monitoring)**

CHALLENGE #3: Increased exploitation of bass

OBJECTIVE: *Provide opportunities for the harvest of bass within the context of sustainable bass populations*

Angling effort for bass has increased on FMZ 17 lakes. As a result, the total harvest of bass has increased, although harvest rates (relative to the proportion caught) have decreased. In addition, the average size of bass harvested has decreased, which may be attributed more to an increased emphasis on releasing larger fish than a decline in the quality of the fishery. Selective harvest is an important tool for fisheries managers to regulate the size structure of bass populations and maintain quality angling opportunities. Research has shown that minimum size limits can result in the stunting of bass populations. Harvest of small bass increases growth rates and can improve the structure of the population. Large bass are also typically the most successful spawners and are critical to the sustainability of bass populations.

Climate change modeling predicts a dramatic increase in the recruitment of warmwater fish species, including bass. In addition, changes to the physical characteristics of the lakes may have contributed to a shift in the piscivore community. These changes to the fish communities in FMZ 17 suggest that the lakes can absorb increased angling effort and harvest directed at bass populations without compromising the sustainability of the fishery. This trend must continue to be monitored to ensure that the quality of the bass fishery is maintained.

ACTIONS:

- **Continue to monitor angler harvest and effort trends through creel surveys or other means**
- **Establish sustainable harvest estimates in the context of expected increases in bass productivity (e.g. due to climate change)**
- **Develop and implement a biological sampling and monitoring program at competitive fishing events**
- **Encourage anglers to voluntarily practice selective harvest of bass, where larger fish are released and smaller fish are harvested**
- **Develop education and communication materials for anglers about the productivity of bass populations**

Bass Management Opportunities

OPPORTUNITY #1: Climate change and changes to the fish community structure, have resulted in abundant bass populations in FMZ 17

OBJECTIVE: *Utilize the existing abundant bass populations to promote bass fishing and increase bass opportunities*

As identified above, bass populations are considered to be increasing despite increased angling effort and total harvest. Climatic patterns are likely to increase bass productivity. When coupled with an increasing ethic for catch and release fishing for bass, it is likely that bass populations can continue to support increased angling effort while continuing to provide high quality angling experiences and opportunities for the harvest of fish.

ACTIONS:

- **Develop promotional products associated with the bass fishery**
- **Establish or enhance linkages to local stakeholders (e.g. tourism associations, chamber of commerce)**
- **Provide extended fishing seasons for bass in the fall (December 15 closure)**
- **Participate in the review of early season (pre-spawn) closures at a provincial level**

4.0 PANFISH MANAGEMENT STRATEGY

Population Trends and Information

Yellow perch

Yellow perch were present in all fisheries surveys in FMZ 17, although the catch rate among lakes was variable. Yellow perch abundance was highest on Rice Lake, more than double the catch rate on Buckhorn and Chemong Lake surveys and more than ten times higher than the catch rates from many of the other lakes. Catch rates were the lowest in the Cameron and Belmont Lake surveys. Although catch rates were only moderate on Balsam Lake, the abundance of perch exceeding 200 mm (8 inches) was highest. Perch ranging from age-1 to age-5 were present in all surveys, indicating successful and consistent recruitment

Black Crappie

Black crappie were first collected in KLFAU sampling programs on Rice Lake in 1985 and it was more than 10 years before they were sampled in another FAU Lake (Buckhorn Lake, 1996). By 1999, they were sampled in both Lake Scugog and Balsam Lake and have increased in abundance rapidly and spread into the majority of lakes in the area. Black crappie catch per unit effort (CUE) was highest on Pigeon and Rice Lakes and lowest on Balsam Lake. The largest average size was observed on Balsam and Sturgeon Lakes, the smallest on Rice Lake and Lake Scugog. Consistent year classes are observed on all lakes, with fish as old as nine being sampled.

Sunfish (Pumpkinseed and Bluegill)

The catch rate of pumpkinseed decreased on Buckhorn Lake over the period 1980 to 1999 and remained unchanged on Balsam, Rice and Scugog Lakes. The average catch rate was lowest on Balsam Lake, intermediate on Scugog and Rice Lakes and highest on Buckhorn Lake. The CUE for fish greater than 18 cm was highest on Rice Lake. The pumpkinseed age composition shows consistent recruitment, with between six and seven age-classes present in each survey.
Bluegill populations became established in the Kawartha Lakes in a progressive manner beginning with Rice Lake in the 1970s. Bluegill were first captured in 1983 in Buckhorn Lake, in 1990 in Lake Scugog and in 1993 in Balsam Lake. The average catch rate was lowest on Balsam, intermediate on Rice and highest on Buckhorn and Scugog Lakes. Bluegill were largest in Balsam and Sturgeon Lakes and smallest in Lake Scugog. The CUE for fish greater than 180 mm (7 inches) was highest on Rice Lake and lowest on Chemong Lake. The bluegill age composition included 6 to 10 age-classes, indicative of consistent successful reproduction, although fish exceeding age-8 were uncommon in most surveys.

The abundance and distribution of bluegill, black crappie and pumpkinseed populations may be best explained collectively, as there are likely interspecific relationships at many levels. Both bluegill and black crappie demonstrate the typical abundance trends of an introduced species, where the initial establishment is facilitated by a dramatic increase in population size. In the case of bluegill, there appears to be a stabilization of abundance, however the introduction of black crappie may be recent enough that this stabilization has not yet occurred. These species both compete at various levels with the native pumpkinseed sunfish, which have shown a gradual decline in abundance over the same time period.

Characteristics of the Fishery

Fishing effort for panfish within FMZ 17 is highly variable from species to species and lake to lake. Yellow perch effort is relatively low, accounting for less than 5% of angling effort on most area lakes. Black crappie effort is also typically low, although the species is supporting an increasing fishery, particularly in the early spring. Angling effort for sunfish is low on the majority of lakes, with the exception of Rice Lake where sunfish (primarily bluegill) targeted effort has exceeded 15 rod hours per hectare historically, with even more effort targeting a combination of 'panfish' species (commonly exceeding 20 rod hours per hectare on Rice Lake). Overall, sunfish effort has accounted for as much as 40% of total angling effort on Rice Lake in many years. The large majority of sunfish effort and harvest within the FMZ occurs on Rice Lake. Although panfish effort is increasing on the other waterbodies, effort is still typically well below 10 rod hours per hectare. Sunfish harvest on Rice Lake typically exceeds 50 fish per hectare, with recent estimated from the Trilakes of close to 10 fish per hectare. Harvest on Balsam Lake occurs at a much lower rate, typically below one sunfish per hectare. Harvest rates are consistent across lakes, typically ranging from 3-5 sunfish per angler hour.
A critical data gap relating to the panfish fishery in general is the absence of data for shore-based anglers. All data presented is from on the water angler creel surveys.

Current Panfish Regulations

Currently, the panfish species across much of FMZ 17 are managed in a consistent manner. With the exception of Lake Scugog, Crowe Lake and the lower Trent River the panfish season opens on the 4th Saturday in April and closes on November 15th. The season opening date is consistent with the opening date for a number of fish species, primarily trout and salmon, in the zone. The closing date is based on the establishment of a winter closure, which has been in place for more than fifty years. Currently, there are no catch and possession limits in place for panfish species in FMZ 17.

Panfish Management in FMZ 17

Management Goal

The introduction of bluegill and black crappie has diversified the panfish fishery, creating angling opportunities and associated tourism benefits. The warmwater lakes in FMZ 17 are highly productive and can support a quality panfish fishery based on naturally reproducing populations. The MNR, advised by the FMZ 17 council, has identified the following panfish management goal:

Sustainable populations of panfish species that support quality fisheries.

Panfish Management Challenges

CHALLENGE #1: Impacts of non-native species

OBJECTIVE: *Prevent the spread of black crappie and bluegill into new waters within the zone*

Black crappie and bluegill are not native to lakes within FMZ 17, but have become well established throughout the majority of the FMZ. These populations are now considered naturalized and it is unrealistic to expect a significant reduction in these populations at current levels of angler harvest. However, the establishment of these populations does provide additional angling and harvest opportunities. Management of invasive species and disease is detailed in Section 8.0.

CHALLENGE #2: Maintain/Enhance quality of the sunfish fishery

OBJECTIVE: *To increase proportion of larger sunfish 180mm (~ 7") or greater in existing bass and sunfish dominated communities to provide associated socioeconomic benefits including:*

- *Tourism*
- *Recreational*
- *Aboriginal*

Male sunfish gain a reproductive advantage by growing large and out-competing smaller sunfish for nesting areas and breeding females. Larger males are also considered more effective nest defenders. The presence of large parental males results in increased prematuration body size of sunfish and maintains the quality size structure of the population. When large parental males are removed, smaller males become more successful spawners and as a result mature earlier. The end result is a shift in the population structure and a decreased abundance of large parental males. Sunfish in these populations may be abundant, but offer a low-quality fishery.

ACTIONS

- **Protect large sunfish to maintain/improve population size structure and protect genetic integrity through the implementation of the following regulation**
    - Sport Licence limit of 300 sunfish, not more than 30 greater than 18 cm (~7 inches)
    - Conservation Licence limit of 15 sunfish (any size)
- **Consider the implementation of voluntary sunfish sanctuaries on a pilot basis to determine their effectiveness**

CHALLENGE #3: Managing panfish species within a provincial context

OBJECTIVE: *Where consistent with management objectives, consider the harmonizing regulations with those for panfish species in other fisheries management zones*

Yellow perch populations in FMZ 17 provide a critical prey base for a number of species, including walleye. Fisheries that produce sufficient numbers of large perch within the zone are limited or absent. No specific challenges for the management of perch have been identified; however, significant perch fisheries exist in adjacent FMZs. Harmonizing yellow perch regulations across FMZs, where consistent with zone-specific objectives, will help ensure effectiveness of enforcement.

Black crappie limits have been implemented in every other FMZ in Ontario. Although harvest of black crappie is consistent with the management objectives for FMZ 17, implementing catch and possession limits will improve enforcement in adjacent FMZs while having little influence on the total harvest of crappie.

ACTIONS:

- **Establish catch and possession limits for panfish species**
    - Yellow perch: 50 (Sport); 25 (Conservation)
    - Black crappie: 30 (Sport); 10 (Conservation)

Panfish Management Opportunities

OPPORTUNITY #1: Increase and diversify angling opportunities and associated recreational and tourism benefits

OBJECTIVES: *Increase and diversify angling opportunities for panfish*

Increase angler use of the panfish fishery, in particular as a means to recruit new anglers

Increase the profile of panfish species as valued sportfish species

In other jurisdictions, yellow perch, black crappie and sunfish are highly sought by anglers as both a quality sportfishing experience and desirable harvest opportunity. Ontario resident anglers largely disregard the quality angling experiences offered by these species.

One component of MNR's mandate is to provide fishing opportunities within the sustainable use of the fisheries resource. The abundance and diversity of panfish species can support a significant level of harvest. Currently, angling opportunities in the early spring, late fall and winter period are limited in FMZ 17.

ACTIONS:

- **Extend panfish (yellow perch, black crappie and sunfish) seasons to be open all year**
- **Develop a monitoring program to evaluate the biological, social and economic impacts of extended seasons**
- **Engage municipalities to improve winter access points, including appropriate waste disposal**
- **Promote the quality of the existing sunfish fishery, including harvest opportunities available from these fisheries**
- **Develop an angler recruitment strategy**
- **Educate anglers regarding sunfish reproductive biology**

5.0 MUSKELLUNGE AND NORTHERN PIKE MANAGEMENT STRATEGY

Population Trends and Information

Northern pike are not present in the majority of waters in FMZ 17; however, they are present around the periphery of the Trent and Severn River watersheds. Self-sustaining populations exist in the Crowe River watershed in the east and Canal Lake in the west. Pike in FMZ 17 have typically been managed as an invasive species due to concerns about potential impacts on existing muskellunge populations and disruption of the ecosystem dynamics. Routine index netting and creel surveys have collected single specimens of northern pike and tiger muskellunge (pike-muskellunge hybrids) on Pigeon Lake and Lake Scugog. The 2006 survey on Balsam Lake sampled two mature female northern pike. Reports of angler caught pike in Balsam Lake are now common. Lakes within FMZ 17 do not currently provide trophy pike fishing opportunities. The largest pike sampled in the Crowe Lake survey measured only 71 cm (~28 inches).

Muskellunge were sampled in the majority of lakes in FMZ 17, but at a much lower level of abundance than other fish species. Comparisons between individual lake surveys indicate muskellunge had high CUE in Pigeon, Buckhorn and Head Lakes and low abundance in Dalrymple and Rice Lakes. Muskellunge were largest on average in Rice Lake and smallest in Sturgeon Lake. The CUE for fish greater than 90 cm was highest on Sturgeon and Pigeon Lakes and lowest on Rice Lake. The catch rate of muskellunge since 1980 has increased on Lake Scugog, with limited change on Rice, Balsam or Buckhorn Lakes.

The relatively high density of muskellunge populations in FMZ 17 is likely attributable to the combination of an abundance of suitable habitat and absence of northern pike. Pike and muskellunge compete for both habitat and food resources and muskellunge density is typically lower when pike are present. Muskellunge in most of FMZ 17 have existed in an environment absent of pike.

Characteristics of the Fishery

Muskellunge make up a limited component of the recreational fishery. On most lakes, fewer than 5% of anglers target muskellunge, with the exception of Pigeon Lake where muskellunge anglers accounted for close to 15% of the total fishing effort. Northern pike accounted for almost 25% of fishing effort on Crowe Lake in a 1999 open water creel survey. In addition to creel data, members of Muskies Canada have participated in an angler diary program since 1979 (Kerr, 2004), providing data from angler catches of muskellunge. The average catch rate by anglers in FMZ 17 (0.16 fish per angler hour) is more than twice the Ontario average (0.07 fish per angler hour), with muskellunge exceeding 114 cm (45 inches) reported on all but one of the 16 lakes for which angler diary data was available (Bald Lake, n=8 fish). On eight lakes anglers reported catches of

muskellunge as large as, or exceeding, 127 cm (50 inches). The vast majority of muskellunge anglers do not target the fish for harvest.

Current Muskellunge and Northern Pike Regulations

The current catch and possession limit for FMZ 17 is one fish for a sport fishing licence holder and zero for a conservation licence holder. A minimum size limit of 91cm 36 inches) is in place across most of the FMZ, with a few exceptions (e.g. Crowe Lake and Crowe River.

The muskellunge season opens on the 1st Saturday in June and closes on November 15th. The northern pike season is consistent with the walleye season, opening on the 2nd Saturday in May and closing on November 15th, with the exception of Crowe Lake and the lower Trent River where pike seasons are open from the 2nd Saturday in May until March 31st. A catch and possession limit of six (6) pike for Sport Licence holders and two (2) for conservation licence holders is in place across the entire zone.

Muskellunge and Northern Pike Management in FMZ 17

Muskellunge and Northern Pike Management Goal

FMZ 17 supports an abundant, high quality muskellunge fishery. Muskellunge are native to the area and Ontario supports the overwhelming majority of naturally reproducing native populations worldwide. MNR, advised by the FMZ 17 Council, have identified the following muskellunge management goal:

To manage the warmwater fish community where muskellunge are the top predator species, based on naturally reproducing populations. Where northern pike have become established, manage as an invasive species.

While muskellunge populations in FMZ 17 are largely considered healthy, there are a number of potential management challenges that threaten the quality and/or sustainability of the fishery.

Muskellunge Management Challenges

CHALLENGE #1: Invasive pathogens and disease threaten the quality of the muskellunge fishery in FMZ 17

OBJECTIVE: *Prevent the introduction and/or spread of invasive pathogens that threaten native and naturalized fish species in FMZ 17*

Muskellunge populations in FMZ 17 are known to be susceptible to a number of pathogens. Lymphosarcoma is a viral disease affecting esocids (northern pike and muskellunge) of spawning age. The disease is highly contagious and is

usually fatal to fish within one year. Lymphosarcoma is believed to spread by direct skin contact during spawning. Lymphosarcoma is monitored via the Muskies Canada Angler Diary program. It is estimated that 15% of the Kawartha Lakes muskellunge are affected by the disease and this infection rate has remained consistent for the past 20 years. Current infection rates are not believed to represent a threat to the sustainability of the fishery, but continued monitoring efforts are required.

Viral hemorrhagic septicemia (VHS) is a viral disease that has recently been discovered in fishes in the Great Lakes, including a number of species in Lake Ontario. VHS is considered to have been a factor in muskellunge die-offs on the St. Lawrence River, Lake St. Clair and the Detroit River. The connectivity of the Kawartha Lakes to the Great Lakes, the mobility of anglers and recreational boaters increase the susceptibility of these lakes to the introduction of an invasive pathogen. A number of other fish diseases are also of potential concern in FMZ 17 and may be spread by vectors similar to invasive species. Management of invasive species and disease is detailed in Section 8.0.

CHALLENGE #2: The invasion of northern pike into the Kawartha Lakes threatens the sustainability of muskellunge populations

OBJECTIVES: *In waters where northern pike are not native, manage for muskellunge as the top predator*

Maximize the abundance of muskellunge populations to increase their resistance to the invasion of northern pike.

Northern pike have posed a risk of invasion into the Kawartha Lakes for many years and the presence of pike has been confirmed originally in Canal Lake and Crowe Lake in the 1980's and more recently in Balsam Lake. Outside of the Kawartha Lakes, pike have become established in the Gull River system as well as throughout the Crowe River system and are believed to be native to both Dalrymple and Young Lakes. Increases in northern pike abundance in both Canal Lake and Crowe Lake have corresponded with apparent declines in muskellunge populations, with similar declines reported in other jurisdictions (Harrison and Hadley 1978; Inskip and Magnuson 1983). The presence of the northern pike – muskellunge (*E. masquinongy*) hybrid, the tiger muskellunge, *E. masquinongy* X *E. lucius,* has also been confirmed in Lake Scugog, Balsam and Pigeon Lakes (Deacon 1996; OMNR unpublished data). Pike are suspected to have a detrimental impact on muskellunge populations due primarily to direct predation of young-of-year (YOY) muskellunge by YOY northern pike, as pike gain a size advantage due to earlier spawning (Harrison and Hadley 1978; Inskip and Magnuson 1983; Osterberg 1985; Dombeck et al. 1986; Inskip and Magnuson 1986; Wahl 1989; Wahl and Stein 1993; Monfette et al. 1995).

The size limit recommendations in the Regulatory Guidelines for the Management of Muskellunge in Ontario (aka Muskellunge Toolkit) were developed based on extensive analysis of female growth characteristics and are based on the Minimum Ultimate Size for a given population. The Minimum Ultimate Size represents the length 99% of female muskellunge would reach if they grew indefinitely (Casselman, 2007). Implementation of the recommendations should maximize muskellunge abundance and increase the resistance of muskellunge populations to northern pike invasion. Examination of the data available for FMZ 17 muskellunge populations indicates that a minimum size limit of 111.8 cm (44 inches) is biologically appropriate for the FMZ.

ACTIONS:

- **Educate anglers and the general public on the threats of northern pike**
- **Educate anglers on identification of northern pike and muskellunge**
- **Where northern pike have invaded, increase angling opportunities for pike and promote their harvest (see Opportunity 2.0)**
- *Explore the potential for experimental management (e.g. spring water level manipulations)*
- *Establish appropriate size-based regulations for muskellunge (minimum size limit of 112 cm (44 inches))*

CHALLENGE 3.0: Muskellunge are susceptible to post-release mortality if handled improperly

OBJECTIVES: *Promote effective catch and release practices for muskellunge*

Provide competitive fishing opportunities consistent with the sustainability of the muskellunge fishery

Catch and release rates for muskellunge have increased dramatically over the past 30 years, due to the combination of increased regulation and more importantly voluntarily by anglers themselves. Muskellunge anglers commonly release in excess of 99% of muskellunge angled in Ontario (Kerr, 2007), with release rates exceeding 95% in FMZ 17 creel surveys.

With the increase in regulatory and voluntary release of muskellunge, emphasis on post-release survival of angler-caught fish has increased. A number of factors including hooking location, water temperatures, handling time and handling procedures can contribute to the mortality of fish. MNR and Muskies Canada have developed a number of best practices to ensure the survival of angled fish. Communication of these best management practices to anglers will help increase post-release survival of muskellunge in FMZ 17.

Muskellunge are targeted to a limited extent in competitive fishing events. MNR, in concert with Muskies Canada, developed a series of guidelines for

muskellunge competitive fishing events in Ontario. These guidelines should be utilized for all competitive events targeting muskellunge in FMZ 17.

ACTIONS:

- **Develop and distribute educational materials regarding appropriate fish handling practices**
- **Encourage the use of the Guidelines for Competitive Fishing Events for Muskellunge in Ontario**

Muskellunge and Northern Pike Management Opportunities

OPPORTUNITY #1: The muskellunge fishery in FMZ 17 provides a unique, high quality angling experience

OBJECTIVE: *Utilize the existing populations to promote muskellunge fishing and increase muskellunge angling opportunities*

The muskellunge fishery in FMZ 17 offers a unique, high quality angling experience. MNR and the FMZ 17 Advisory Council recognize the global importance of this fishery and have endorsed the actions to address the above-noted management issues. Opportunities for additional muskellunge fishing could be achieved through the adoption of the Muskellunge Toolkit recommended season closing date of December 15th, providing an additional month of angling opportunities.

ACTIONS:

- **Establish or enhance linkages to local stakeholders (e.g. tourism associations, chamber of commerce)**
- **Develop promotional products to assist with advertising the muskellunge fishery**
- **Extend fishing seasons for muskellunge in the fall to close on December 15th**

OPPORTUNITY #2: Promote the harvest of northern pike in waterbodies where they have been introduced

OBJECTIVE: Manage northern pike as an invasive species in waterbodies where they have become established.

As stated above, the spread of northern pike throughout FMZ 17 presents a significant challenge to muskellunge populations. As such, the management objectives for northern pike provide for the promotion of angling and harvest opportunities.

ACTIONS:

- **Extended fishing seasons for northern pike to be open all year, consistent with additional opportunities for other fish species.**
- **Maintain liberal catch and possession limits for northern pike with no size-based restrictions**

6.0 COLDWATER STREAM FISHERIES MANAGEMENT STRATEGY

Population Trends and Information

Brook trout are the only self sustaining, naturally reproducing native salmonid species in FMZ 17 and are synonymous with high quality environments. In many streams, particularly Lake Ontario tributaries, brook trout are limited to isolated, often low density, populations in the headwater areas. The low abundance and limited distribution of brook trout populations may be attributed to interspecific competition with migratory and resident non-native salmonids, susceptibility to angling, sensitivity to habitat degradation and predation by larger salmon and trout on juvenile brook trout (Fausch and White, 1981).

Brown trout were stocked between 1920 and 1975 in many streams initially to introduce populations with continued stocking to supplement populations and diversify fishing opportunities. Streams in FMZ 17 support primarily resident brown trout that carry out their entire life cycle in the stream, with migratory brown trout being relatively uncommon. Brown trout are a fall spawning species that occur sympatrically with brook trout in many FMZ 17 streams but often out-compete and suppress native brook trout, particularly when rainbow trout are also present. Brown trout gain a competitive advantage through their ability to spawn in a wider range of flows, higher thermal tolerance and ability to withstand heavier angling pressure, increased aggression and larger body size (Marshall and MacCrimmon, 1970).

The coldwater fish community in coldwater tributaries to Lake Ontario are largely influenced by the Fish Community Objectives (Stewart et al., 1999) and associated stocking programs in Lake Ontario. The management of migratory species is shared with the MNR Lake Ontario Management Unit (LOMU) and Conservation Authorities. Stocking of rainbow trout occurred as early as the 1920s and has led to the establishment of self-sustaining populations in many FMZ 17 streams to the extent that they are now the most dominant salmonid in most Lake Ontario tributaries. Rainbow trout abundance in tributaries is largely driven by changes in adult abundance in the lake environment. Control of lamprey and habitat improvement allowed for rainbow trout abundance to increase between 1974 and 1989. Increased water clarity through the early 1990s resulted in fish community changes in Lake Ontario and a subsequent decline in rainbow trout abundance; however, populations have remained relatively stable since 1998. MNR continues to stock rainbow trout into Lake Ontario with an annual target of 140,000 yearlings. These fish are not stocked into FMZ 17 waters due to the high abundance of wild rainbow trout in these tributaries.

Since 1974, the spring rainbow trout run has been monitored at the Ganaraska fishway at Corbett's Dam. The construction of the fishway in the 1970s provided access to upstream spawning and nursery habitat and resulted in a rapid

increase in the size of the run. Changes in the Lake Ontario fish community led to a reduction in the population in the 1990s. Since the late 1990s, the population appears to be stable with a spring run in the Ganaraka of between 5,000 and 6,000 fish.

Native to the Pacific coast, Chinook (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*) were stocked in Lake Ontario in the late 1960's to provide recreational angling opportunities and to establish a top predator salmonid species following the dramatic decline in lake trout abundance in Lake Ontario. Present populations are maintained through stocking which is augmented by natural reproduction in many Lake Ontario tributaries including the Ganaraska River, Cobourg Brook, Port Britain Creek, Wilmot Creek and Shelter Valley Creek.

Atlantic salmon (*Salmo salar*) were one of the dominant coldwater fishes in lake Ontario when European settlers arrived but were extirpated by the late 1800's due to fishing pressure, the construction of dams preventing access to spawning grounds and the degradation of stream habitat. Atlantic salmon have been experimentally stocked in eight Lake Ontario streams including Duffins, Cobourg, Shelter Valley and Barnumhouse Creeks in FMZ 17. In FMZ 17 streams, the initial restoration phase for Atlantic salmon was in Wilmot Creek between 1988-1995 and Ganaraska River in 1995. Restoration began in Cobourg Creek in 2002 and in Barnumhouse Creek in 2003-2005. In 2006, the restoration phase of the Atlantic salmon recovery project continued, with increased stocking efforts on Cobourg and Duffins Creek within FMZ 17. Streams in FMZ 17 with excellent juvenile habitat for Atlantic salmon include Duffins Creek, Ganaraska River, Cobourg Creek, Shelter Valley and Barnumhouse Creeks. The first wild Atlantic salmon was recorded from Smithfield Creek, in Northumberland County. The future of the Atlantic salmon restoration will be guided by the recovery plan for the species, which is currently under development.

Characteristics of the Fishery

The Ganaraska River is an important destination fishery, particularly in the spring, where 24,400 angler hours were spent targeting migratory rainbow trout in 1999. In the fall of 1991 and the spring of 1992, angler effort at Port Hope Harbour was estimated to exceed 73,000 angler hours, again primarily targeting migratory rainbow trout. In 1994, the combined spring and fall angling effort targeting migratory coldwater fish species on Wilmot Creek was estimated to exceed 40,000 angler hours. Fishery data (angler effort and harvest) on other Lake Ontario tributaries and inland coldwater streams are currently lacking.

Current Trout and Salmon Regulations

Current regulations for trout and salmon species in FMZ 17(Table 6.1) are consistent with the regulatory guidelines for each species, in terms of seasons

and catch limits. No size restrictions are currently in place. An aggregate limit of five trout or salmon applies to sport licence holders (two for conservation licence holders). In addition, extended fall seasons and year-round fishing opportunities are provided by exception regulation in the lower waters of Lake Ontario tributaries.

Table 6.1: Current regulations for trout and salmon species in FMZ 17

Species	**Open Season**	**Catch Limit** **S – Sport Licence** **C- Conservation Licence**	**Size Limit**
Brook trout	4th Sat. in Apr. to Sept. 30	S(5) C(2)	None
Brown trout	4th Sat. in Apr. to Sept. 30	S(5) C(2)	None
Rainbow trout	4th Sat. in Apr. to Sept. 30	S(2) C(1)	None
Lake trout	4th Sat. in Apr. to Sept. 30	S(3) C(1)	None
Pacific salmon	4th Sat. in Apr. to Sept. 30	S(5) C(2)	None
Atlantic Salmon	Closed all year	NA	NA

Existing Planning Initiatives

Watershed-Based Fisheries Management Plans

Currently, planning for coldwater streams occurs at two spatial scales: the FMZ scale (this document) and on an individual watershed basis. Under the Oak Ridges Moraine Conservation Act, municipalities are required to prepare a Watershed Plan for any watershed originating from the Oak Ridges Moraine. In many instances, these watershed plans are being prepared by Conservation Authorities and include a fisheries specific component. Currently, watershed-based fisheries management plans have been completed or are in the final stages for Duffins/Carruthers Creek, Wilmot Creek, Bomanville Creek, Oshawa Creek, Lynde Creek and Black/Farewell/Harmony Creeks. Plans are currently in development for the Ganaraska River, Cobourg Creek, the Nonquon River and Gages Creek.

A zone-wide strategy will provide direction for future watershed plans in terms of the issues that should be addressed and management actions that should be considered. Many actions identified in the zone-wide strategy require implementation at the watershed scale.

Peterborough Area Coldwater Stream Strategy

In 2005, the Peterborough Area Office of the MNR completed the development of the Peterborough Area Coldwater Stream Strategy (OMNR, 2005b). This document provided direction for the management of coldwater streams with a focus on protecting coldwater habitats. The establishment of new Fisheries Management Zones in 2008, necessitated a change in the scale at which coldwater streams are managed. FMZ 17 includes important coldwater resources that lie within the administrative boundaries of the MNR Aurora District Office. Many of the challenges and actions identified in this document have been taken directly from the Peterborough Area Coldwater Stream Strategy. In addition, challenges associated with the management of the fishery are also identified.

Lake Ontario Fish Community Objectives

Many species targeted by anglers in FMZ 17 migrate into the tributaries to spawn. Management objectives for these species are established by the Lake Ontario Fish Community Objectives in cooperation with New York State. Management of migratory species within FMZ 17 must be consistent with the Fish Community Objectives for Lake Ontario.

Coldwater Stream Fisheries Management in FMZ 17

Coldwater Stream Fisheries Management Goal

FMZ 17 supports a diverse, high quality coldwater stream fishery. The fishery is based on a combination of native and introduced species. MNR, advised by the FMZ 17 Council, have identified the following coldwater stream fisheries management goal:

A sustainable and diverse native fish community including sport and non-sport fishes that provides a fishery that is attractive to anglers.

A number of challenges to achieving this goal have been identified. Objectives and actions to overcome these challenges have been identified.

Coldwater Stream Fisheries Management Challenges

CHALLENGE #1: Planning For effective management of coldwater streams

OBJECTIVE: *Effective multi-agency and multi-stakeholder management of coldwater streams in FMZ 17*

The management of coldwater fisheries within the zone requires the cooperation of multiple levels of government, as well as non-government organizations. A number of previous planning initiatives have already occurred within the zone,

including the development of a Coldwater Stream Strategy for Peterborough Area (OMNR, 2005b) and a number of watershed-based fisheries management plans. These existing planning documents will continue to provide direction for the management of the fishery where they currently exist. The Coldwater Stream Strategy for Peterborough Area focuses on the management of stream habitat and the required multi-agency coordination. The direction provided will be carried forward for the management of coldwater streams across FMZ 17.

PRIORITY ACTIONS (FROM OMNR 2005b):

- **Promote the development of Watershed Management Plans and Fisheries Management Plans in high priority areas such as the Oak Ridges Moraine, Ganaraska River, Cobourg Creek, Jackson Creek, Baxter Creek and Cold Creek**

Further to the recommendations from the Coldwater Stream Strategy for Peterborough Area, the following management actions should also be considered:

- **Form a FMZ 17 Coldwater Streams Technical Management Team involving management partners from across the FMZ**
- **Work towards implementation of the recommendations of the Peterborough Area Coldwater Stream Strategy (OMNR, 2005b) across the FMZ**
- **Develop linkages between FMZ 17 and FMZ 20 fisheries managers and advisory councils to provide input into the management of migratory trout and salmon**

CHALLENGE #2: Restricted native species abundance and distribution (particularly brook trout)

OBJECTIVES: *Maintain and/or increase brook trout abundance and promote distribution into favourable habitats*

Maintain healthy populations of existing species at risk and re-establish extirpated species

Brook trout have experienced considerable losses across their native range in eastern North America primarily resulting from a loss of habitat and through competition with other species. Competitive and predatory interactions with rainbow trout and brown trout have contributed to the decline of brook trout numbers in many Lake Ontario watersheds. Resident brook trout populations have been dramatically reduced in areas where non-native salmonids are abundant.

ACTIONS:

- **Restrict or reduce access and abundance of naturalized salmonid species in areas designated for native salmonid management, consistent with watershed-specific objectives**
- **Protect native brook trout streams from access by competitors such as coho salmon, Chinook salmon, rainbow trout, brown trout and other species**
- **Protect brook trout populations and increase productivity within headwater areas**
- **Expand knowledge of native aquatic species distributions and factors limiting production (see Monitoring and Assessment Strategy, Section 10)**
- **Address threats posed by invasive species and fish pathogens (see Invasive Species and fish Pathogens Section 8.0)**
- **Document the presence and distribution of aquatic species at risk**
- **Support the provincial Atlantic salmon recovery initiatives to create conditions that will facilitate restoration in selected watersheds (e.g. Cobourg Creek, Duffins Creek, Soper Creek, Shelter Valley Creek and Barnum House Creek)**

CHALLENGE #3: Declines in Naturalized Species Abundance

OBJECTIVE: *Maintain or enhance naturalized fish species (e.g. rainbow trout and brown trout) populations*

Declines in the abundance of naturalized fish species (in particular rainbow trout) have been observed in many watersheds within FMZ 17. Changes to the physical characteristics of Lake Ontario, as well as Fish Community Objectives, may account for some of these changes. Although native species are considered priorities for management, naturalized species will still be managed to provide quality recreational angling opportunities.

ACTIONS:

- **Determine factors limiting production with consideration of lake effects**
- **Address limiting factors (e.g. spawner abundance, habitat, harvest, etc.)**
- **Set spawner escapement targets for each migratory species and monitor success based on Fish Community Objectives for Lake Ontario**
- **Increase the access for naturalized salmonids to areas not designated for brook trout or Atlantic salmon management**
- **Consider retrofitting barriers to increase access to spawning habitat in areas not designated for brook trout management**

- **Develop linkages between FMZ 17 and FMZ 20 fisheries managers and advisory councils to provide input into the management of migratory trout and salmon**

CHALLENGE #4: Ensure an effective regulatory framework for coldwater fish species

OBJECTIVE: *Evaluate the effectiveness of the current regulatory framework for trout and salmon*

Currently, very little data exists on the coldwater stream fisheries, particularly inland streams that are surrounded by private lands. Increased understanding of resource use contributes to effective long-term management of the resource. In addition, building increased understanding of the current regulations is important to maximize compliance.

ACTIONS:

- **Inventory fishing effort, use and harvest levels through creel surveys, including emphasis on non-migratory fisheries**
- **Review existing regulations (seasons and catch limits) to determine effectiveness and adjust regulations as required**
- **Clarify current regulations by summarizing regulations specific to streams and prepare river mouth maps to clarify exception regulations**

CHALLENGE #5: Stressors and Impacts on Coldwater Stream Habitats

OBJECTIVE: *Protect, maintain and enhance fish habitat to support sustainable fish communities with a focus on protecting and restoring native brook trout populations*

Over the last 200 years, habitat loss, pollution and alteration of natural flow regimes from dams, channelization and various land uses have had catastrophic impacts on biotic and abiotic components of streams (Reid, 2001). Many of the stresses on streams are directly related to continued growth in human populations. Many large cold water streams flow through urban centres including the cities of Bowmanville, Pickering, Ajax, Whitby, Oshawa, Peterborough, Port Hope and Cobourg and many smaller communities including Millbrook, Trenton, Norwood, Havelock, Brighton and Colborne. Stream reaches within these urban centres are significantly degraded and with increased population growth it is anticipated that they will increasingly be affected.

The protection of fish habitat is best achieved via the implementation of the Coldwater Stream Strategy for Peterborough Area and through the development and implementation of watershed-based fisheries management plans

PRIORITY ACTIONS (FROM OMNR 2005b):

- **Develop a barrier management plan at a watershed level**
- **Support riparian planting and restoration initiatives**
- **Work with municipalities to institute adequate stormwater controls, develop site alteration and topsoil preservation by-laws and protect priority areas through the municipal planning process**

CHALLENGE #6: Lack of information and management of information relating to coldwater stream and fisheries management

OBJECTIVES: *Increase the amount and quality of information available relating to coldwater streams fisheries*

Improve management of information relating to coldwater streams and fisheries

In FMZ 17, information on streams is outdated and many data gaps exist. Many agencies have databases with stream data that would assist in making management decisions. A mechanism and process for sharing expertise and information between organizations and agencies is not well established. Databases are not comprehensive and are limited in scope. The data is not easily accessible to all partners that need it.

PRIORITY ACTIONS (FROM OMNR 2005b):

- **Inventory and assess cold water streams, fish populations, habitat and stressors:**
    - Identify and protect priority streams to prevent further habitat loss
    - Identify and protect areas with native gene pools through genetic research
    - Inventory the thermal regime of streams where there is no information
    - Map tributaries of streams not mapped on Ontario Base Maps
    - Map discharge and recharge areas
    - Identify fish migration routes and barriers
    - Understand scope and scale of stressors and determine an appropriate scale for rehabilitation
    - Undertake stream-gauging projects to gain a better understanding of base flows and low flows and develop water budgets for priority streams
    - Research the impacts of water-taking on base flow and fish habitat. Establish a protocol to improve data management by promoting consistency in collection and cataloguing information and by sharing databases

Coldwater Stream Fisheries Management Opportunities

OPPORTUNITY #1: Increase Public Access and Associated Fishing Opportunities

OBJECTIVE: *Increase angler access to cold-water streams*

Much of the land surrounding FMZ 17 streams is privately owned, limiting angling opportunities. Distributing angler effort over a larger spatial scale may contribute to increased economic benefits being derived from the fishery, as well as reduce social concerns associated with the density of anglers in some public access areas. It is the responsibility of the individual angler to secure landowner permission prior to accessing their property.

ACTIONS:

- **Promote the fishery by identifying public access areas and fishing opportunities**
- **Investigate opportunities to increase public access on public properties including:**
    - Develop a strategy for reducing litter;
    - Increase angler involvement in stream steward activities;
    - Encourage angler groups doing work for the benefit of the landowner; and
    - Promote responsible public access.
- **Promote the use of existing access areas**
    - Create a map or signage to inform anglers of public access areas

OPPORTUNITY #2: Increase angler effort towards non-traditional species or species not being managed for natural reproduction

OBJECTIVE: *Optimize harvest opportunities for identified species*

Migratory species in FMZ 17 must be managed in a manner that is consistent with the Fish Community Objectives for Lake Ontario. Currently, migratory populations of Chinook salmon, coho salmon and brown trout are not being managed for naturally reproducing populations. Instead, these fish are stocked to increase and diversify angling opportunities and associated benefits. Focusing angling effort on these species may aid in the increased abundance of those species being managed for natural reproduction (e.g. brook trout, rainbow trout).

ACTIONS:

- **Review existing boundaries of fall fishing zone for Chinook, coho and brown trout**
- **Promote angling for non-salmonid species (warm and cool water species)**
- **Encourage harvest of migratory brown trout**

OPPORTUNITY #3: Promoting stewardship on coldwater streams

OBJECTIVE: *Increase land stewardship initiatives and increase capacity*

Implementing proper land use practices can benefit an individual landowner as well as the overall health of the coldwater stream and fish community. Currently, there are many non-government organizations involved in stewardship initiatives on private land, providing both technical guidance and financial assistance for stream stewardship activities. Increasing the capacity of existing stewardship networks will contribute to the long-term sustainability of stream habitats and stream fisheries.

PRIORITY ACTIONS (FROM OMNR 2005b)

- **Work with landowners through programs such as the Community Stream Steward Program:**
  - Focus on restoration;
  - Work with farming communities and naturalists;
  - Focus on tree planting and buffer management; and
  - Establish a method to identify and reward stream-friendly contractors.
- **Initiate highly visible habitat protection projects:**
  - Focus on urban-oriented areas to take pressure off of farmers; and
  - Focus on buffer protection and management through FMZ 17.
- **Promote workshops with Conservation Authorities and other agencies. Road maintenance workshops are a priority.**
- **Provide input and technical advice to municipalities. Prepare planning design tools for urban style development for use by municipalities and developers. Showcase and promote good examples of stream protection techniques through demonstration projects to landowners, municipalities and developers.**
- **Organize a stream restoration train-the-trainers course for biologists, technicians and stewardship coordinators to increase the capacity of local professionals to support stream rehabilitation projects.**

7.0 ADDITIONAL FISH SPECIES MANAGEMENT STRATEGY

In addition to the sportfish species identified in previous chapters of the FMZ 17 Fisheries Management Strategy, there are a number of other species or groups of species that provide important recreational or ecological functions. Included in this group of species are those species that are formally designated as Endangered, Threatened, or of Special Concern under federal or provincial legislation.

Forage Fish Community

Traditional MNR fisheries assessment programs are largely ineffective in sampling forage fish species and communities. Non-standardized methods have been used in the past. The small-bodied fish community is dominated by small cencharchids in many lakes, or yellow perch (Taillon et al., 2004).

The species, size and abundance of forage species sampled suggest that potential forage for top predators are available in each lake, although in some instances available forage may not be optimal species. Although most species are opportunistic predators, spiny rayed, gibbose species (e.g. sunfish and bass) are generally not preferred forage due to low capture efficiencies and nutrient value relative to other species (e.g. white sucker (*Catostomus commersonii*), cisco, large cyprinids). The forage requirements on a population level need to be identified before it can be determined if forage availability is a limiting factor for predator fishes. In addition, it must be considered that these trends may be attributable to the size selectivity of the gear types used rather than the absence of these prey sizes.

OBJECTIVE: *Monitor and assess forage species within FMZ 17 lakes*

Small-bodied fishes (less than 10cm) provide critical forage for predatory fish species. These populations are not vulnerable to many traditional index netting techniques or have not been a priority component of the survey objectives. Alternative means of sampling are often used to target this segment of the fish community.

ACTIONS:

- **Include small fish sampling as a component of the Broad-scale Monitoring program**
- **Explore partnerships with bait harvesters to determine species abundance and distribution within FMZ 17**

Other Species

OBJECTIVE: *Provide recreational angling opportunities for other fish species*

The lakes within FMZ offer very little in terms of coldwater fish habitat, lake trout are believed to have disappeared from Stoney Lake by late 1980's. Cisco (*Coregonus artedi*) are uncommon across the zone, but individuals were captured in netting programs in Stoney, Balsam and Pigeon Lakes. Lake whitefish and cisco have been sampled from Stoney Lake, with abundance of whitefish comparing favourably to provincial averages. No other lakes in FMZ 17 offer any measurable level of habitat for coldwater fish species.

A shore-based fishery is developing for common carp (*Cyprinus carpio*), with both resident and non-resident (often European) anglers targeting common carp with increased frequency. Although not native to Ontario, FMZ 17 supports abundant common carp populations, with fish exceeding 80 cm (31 inches) sampled in surveys. Fish exceeding 10 kg (22 lbs) are relatively common, easily accessible and provide a high quality sport fishing experience.

Brown bullhead (*Ameiurus nebulosus*), a member of the catfish family, are also present in the warmwater lakes in FMZ 17 and support a relatively low intensity recreational fishery. Local residents have identified a dramatic decline in bullhead abundance on Lake Scugog. Current index netting is either ineffective at sampling bullheads or their 'clumped' distribution makes meaningful data interpretation difficult.

Channel catfish (*Ictalurus punctatus*) have a limited range in FMZ 17, restricted to sections of the Trent River below Hastings. Channel catfish are considered quality table fare and have the potential to support a recreational fishery.

Rock bass are another species with distribution across FMZ 17. This species occupies a similar niche to bluegill, pumpkinseed and black crappie. Although not a common target species for anglers, rock bass are suitable table fare and are easily caught. Rock bass can influence the composition of the fish community and may be a significant predator of the early life history stages of various sport fish species.

Longnose gar (*Lepisosteus osseus*) are present in parts of FMZ 17, in particular the Trent River and the lower portions of some Lake Ontario tributaries. Very little information exists about the status of these populations.

ACTIONS:

- **Maintain liberal angling regulations associated with these species to encourage angling and harvest where appropriate, including providing additional angling opportunities**
- **Promote available angling opportunities to non-traditional markets (e.g. European anglers and the common carp fishery)**
- **Where possible, include monitoring and assessment of these species in on-going assessment surveys**

Fish Species at Risk in FMZ 17

OBJECTIVES: *Contribute to the protection and/or recovery of aquatic species at risk within FMZ 17*

Gain increased information associated with the distribution and abundance of these species

In Ontario, species at risk are protected under both federal and provincial legislation. The federal *Species at Risk Act* (SARA) provides protection to species considered at risk on a national scale. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses species status for listing under SARA. Species listed under Schedule 1 of SARA are afforded protection. Provincially, the *Endangered Species Act* (ESA) 2007, replaced the previous legislation that was written in 1971. Under the ESA 2007 species thought to be at risk are assessed by The Committee on the Status of Species at Risk in Ontario (COSSARO). Once species are classified "at risk", they are added to the Species at Risk in Ontario (SARO) list in one of four categories. Endangered, threatened and extirpated species on this list automatically receive legal protection under the ESA 2007. The final category is special concern, and includes species with characteristics that make them sensitive to human activities or natural events. The act in which a species is listed determines which piece of legislation affords its protection. In FMZ 17, five fishes that are formally listed under SARA or the ESA have been identified: channel darter (*Percina copelandi*), American eel (*Anguilla rostrata*), river redhorse (*Moxostoma carinatum*), Redside dace *(Clinostomus elongates*), and Lake sturgeon (*Acipenser fulvescens*).

ACTIONS:

- **Participate in recovery planning teams for the above-noted species and implement recommendations of recovery plans**
- **Develop and/or distribute information products associated with these species as a component of the Education and Awareness Strategy for FMZ 17**
- **Encourage stewardship activities with general public including landowners**
- **Other actions have been developed and are part of the Monitoring and Assessment Strategy (Section 9.0)**
- **Form partnerships with various agencies as appropriate to achieve the above actions**

8.0 Invasive Species and Fish Pathogens Management Strategy

Invasive Species

Invasive species are defined as plants, animals and micro-organisms that have been accidentally or deliberately introduced into habitats outside their normal range. Invasive species are those harmful alien species whose introduction or spread threatens the environment, the economy and/or society including human health. These species are able to proliferate because in their new environment they are often free from the predation and competition that would normally limit their distribution and abundance. For the purpose of this document, invasive species will refer to those which have either not yet been introduced into the zone or those which have not become established in some areas. The management of individual species such as northern pike, bluegill and black crappie have previously been addressed.

The Invasive Alien Species Strategy for Canada (Environment Canada, 2004) identifies numerous pathways for the introduction or spread of aquatic invasive species and diseases that are relevant to Fisheries Management Zone 17. These pathways each represent individual challenges preventing the introduction and spread of species within the zone. The pathways identified include:

- Shipping;
- Recreational Boating;
- Use of Live Bait;
- Aquarium and Water Garden Trade;
- Live Foodfish;
- Unauthorized Introductions; and
- Canals and Water Diversions.

FMZ 17 lakes and rivers are particularly susceptible to the introduction of invasive species. Many of the lakes are connected to Lake Ontario and Georgian Bay via the Trent-Severn Waterway. This connectivity increases the risks associated with species that become established within the Great Lakes. In addition, anglers and recreational boaters are active and mobile within the zone, increasing the potential for the spread of invasive species. The prevalence of waterfront property owners also increases the potential spread of aquatic invasive species through aquariums and water gardens.

The introduction of a new species can have significant effects on the aquatic ecosystem. The spread of zebra mussels (*Dreissena polymorpha*) has increased water clarity and decreased the nutrients available to lower levels of the food chain. This has likely decreased the overall productive capacity of the lakes and contributed to observed fish community shifts, creating more favourable conditions for some species (i.e. bass, muskellunge) and less favourable conditions for others (i.e. walleye). As water clears, the amount of habitat for the

light-sensitive walleye is reduced and predation on young walleye is likely to increase. Water clarity is thought to have a very dramatic effect on the productivity (yield) of walleye in inland lakes (Lester et al. 2004).

Current threats include round goby (*Neogobius melanostomus*) which have had significant negative impacts including reductions in species diversity through competition with and predation on, other fish species in areas where they have become established. Other negative impacts associated with round goby are an increased contaminant burden and potential human health concern for anglers who eat them and the potential link between zebra mussels, goby and botulism outbreaks that have killed hundreds of thousands of waterfowl and fish in the Great Lakes. Gobies feed heavily on invasive zebra mussels and are thought to re-introduce nutrients into the food chain that were previously filtered out by zebra mussels (Bunnell et al., 2005).

Invading species awareness program

In the early 1990s, the Ontario Federation of Anglers and Hunters (OFAH) and MNR established the Invading Species Awareness Program. The program has established the following objectives:

- Raise public awareness of invasive species and encourage their participation in preventing their spread;
- Monitor and track the spread of invading species in Ontario waters through citizen reports to the Invading Species Hotline and the Invading Species Watch Program; and
- Conduct research on the impacts and control of invasive species.

Fish Disease

Many fish diseases are caused by parasites, viruses and/or bacteria that can be considered within the context of invasive species. Throughout the summer of 2007 and 2008, tens of thousands of carp died within the Trent-Severn Waterway. In addition to bacterial infections, koi herpesvirus (KHV) was identified in many of the samples tested. The detection in 2007 represented the first confirmed case of KHV in Ontario. KHV is a fish disease caused by a virus that affects only carp, goldfish and koi. Fish can become infected with the virus as it is passed through close physical contact. When stressed, fish that have become infected with this virus may become sick. Survivors of a disease outbreak may become carriers of the virus, passing it to other fish.

KHV is believed to have moved throughout the world via the ornamental fish industry. The virus was first found in the United States in 1999 and has been associated with large scale carp and koi die-offs in New York State. It is not known how or when KHV arrived in Ontario waters.

In addition to KHV, there are a number of other fish pathogens that have recently been discovered in Ontario. Viral Hemorrhagic Septicemia (VHS) was first identified in 2005 after a die-off of freshwater drum (sheepshead) in the Bay of Quinte in Lake Ontario. The virus has now been found in at least 28 species of fish in the Great Lakes including: walleye, yellow perch, muskellunge, smallmouth bass, rock bass, Chinook salmon, white bass, black crappie, freshwater drum, round goby, gizzard shad, emerald shiner, bluntnose minnow and spottail shiner. VHS has been linked to significant die-offs of muskellunge in the St. Lawrence River and Lake St. Clair. VHS has not yet been found in fishes from the inland waters of FMZ 17.

Largemouth Bass Virus (LMBV) has been identified in bass in Lake St. Clair and the western portion of Lake Erie. In areas where LMBV has been a factor in bass die-offs, the larger individuals in the population have been more susceptible.

The Canadian Food Inspection Agency (CFIA) is dedicated to safeguarding food, animals and plants. The CFIA has the lead for fish disease control in Canada and works with Fisheries and Oceans Canada (DFO), which has the lead for fish research including disease diagnostics and testing at a federal level. The CFIA is in the process of establishing the National Aquatic Animal Health Program (NAAHP), a science-based regulatory program for aquatic animal diseases which will include diseases designated reportable or notifiable in Canada because of their potential impact on trade and our economy. Specifically, the activities of CFIA under the NAAHP will include: protecting the health of the fisheries resources, maintaining a list of regulated aquatic animal diseases, implementation of surveillance and monitoring programs geared towards the early detection of fish diseases, control and eradication of aquatic animal diseases as appropriate, establishing requirements for import and export and sustaining and increasing export market opportunities.

Responses to Invasive Species

Governments are actively working to reduce the threat of invasive species at both a provincial and national level. The Canadian Council of Fisheries and Aquaculture Ministers formed the Aquatic Invasive Species Task Group which developed the Canadian Action Plan to Address the Threat of Aquatic Invasive Species (CCFAM, 2004), an action plan under An Invasive Alien Species Strategy for Canada (Environment Canada, 2004). At a provincial level, Ontario's biodiversity strategy identifies the implementation of the national strategy and action plans as a priority. Ontario is currently working with other agencies and stakeholders to identify current initiatives underway to implement the national strategy, identify gaps and outline actions to address the gaps.

MNR has the legislative authority to determine rules associated with the bait industry and the use of bait by anglers under the Ontario Fishery Regulations (OFR). MNR has worked closely with the Bait Association of Ontario (BAO) to

address the potential for the spread of invasive species through the live bait industry. Through this partnership, numerous education and awareness tools have been developed, as well as best management practices for the industry. More recently, baitfish licence holders must prepare a Hazard Analysis and Critical Control Point (HACCP) plan to address the threat of invasive species associated with their operations.

The unfortunate reality is that, once an invasive species becomes established within an ecosystem, there are few effective options for control and eradication is often an unachievable goal. The focus must be on preventing the spread of invasive species and fish pathogens. In some instances, MNR has implemented measures to prevent the introduction and spread of non-native species. These include bans on the sale of crayfish and more recently restrictions on the movement of live baitfish by licenced harvesters to prevent the spread of VHS. MNR has prepared Regulatory Guidelines for Bait and Gear Restrictions (toolkit) to streamline the use and description of angling regulations. Currently, there are no specific live bait restrictions in Fisheries Management Zone 17 aside from those that apply across the province. Should further regulations on the use of bait be desired upon review of this Fisheries Management Plan, the Regulatory Guidelines will provide a starting point for consideration.

Responses to Fish Pathogens

Once a disease becomes established, the focus switches to measures to control or slow down the spread of the disease. The government's approach in dealing with viral hemorrhagic septicemia (VHS) is an example.

In 2007, the Minister of Natural Resources established interim measures to control the harvest and transport of live baitfish. These measures were necessary to address immediate risks involving potential spread of VHS into inland waters but they also had a significant impact on baitfish harvesters.

Later that year the Minister announced further actions to control the spread of VHS in Ontario. New measures included:

- Implementing a VHS Management Zone (the 'zone') that contains VHS-positive waters in an area bounded by the provincial road network. The VHS-positive waters include lakes Ontario, Erie and Huron (including Georgian Bay) and their connecting waterways and tributaries up to the first impassable barrier, excluding fishways;
- Operating all fishways as planned and allowing existing manual transfers of fish over barriers into the same watershed;
- Requiring salmon spawn and trout spawn collected from the VHS Management Zone to be disinfected according to the MNR protocol or transferred only to a facility located within the zone;

- Allowing walleye spawn collection from the VHS Management Zone only if the fish are stocked into the zone and the receiving fish culture facility is located in the zone; and
- Allowing baitfish harvesters and dealers in the VHS Management Zone to harvest baitfish, but restrict movement of live baitfish out of the zone.

Management of Invasive Species and Pathogens in FMZ 17

Management Goal

Invasive species and fish pathogens represent one of the most significant stressors on aquatic ecosystems and fisheries resources in FMZ 17. MNR, advised by the FMZ 17 Council, have identified the following management goal:

Prevent the introduction and/or control the spread of invasive species and pathogens within FMZ 17.

The most cost-effective means to achieve this management goal is to prevent the initial introduction of invasive species and pathogens that cause disease in the first place. As highlighted above, many regulations and best management practices help prevent the spread of invasive species; however, there remains an ongoing need for increased public awareness regarding the threats of invasive species and associated regulations.

Management Challenges

CHALLENGE 1.0: Susceptibility of lakes and rivers within FMZ 17 to the introduction and spread of invasive species

OBJECTIVES: *Reduce the risk of the introduction and spread of invasive species and pathogens through each of the identified pathways*

Promote public awareness regarding the threat of aquatic invasive species and pathogens among various resource users

Respond effectively to large-scale fish die-offs

Respond effectively to the introduction of new invasive species

ACTIONS

- **Support the development and implementation of an Aquatic Invasive Species Action Plan for Ontario**
- **Support the development of effective legislation to prevent the introduction and spread of invasive species and fish pathogens (e.g. ballast water control measures)**

- **Ensure compliance of bait harvesters and dealers with Hazard Analysis and Critical Control Point (HACCP) policies**
- **Monitor for the presence of aquatic invasive species and pathogens as a component of the Broad-scale Monitoring Program and promote detection monitoring in all lakes within the zone**
- **Develop a program to monitor the distribution and abundance of aquatic invasive species once they become established in FMZ 17**
- **Increase enforcement emphasis on regulations prohibiting the transfer of live fish**
- **Where consistent with management objectives, promote the harvest of invasive species**
- **Encourage anglers to use live bait captured within the watershed they are fishing**
- **Support existing fish disease surveillance programs (e.g. CFIA surveillance programs for VHS)**
- **Support a surveillance program to enable the early detection of invasive fish pathogens**
- **Explore the use of barriers to protect populations of native species from invasive species, particularly within coldwater stream systems**
- **Reduce the escapement of fish populations from aquaculture facilities including on-line ponds**
- **Communicate the rules and regulations regarding the unauthorized introductions**
- **Continue to work with and support the Invading Species Awareness Program and Invasive Species Monitoring Program at a local level**
- **Review the existing communication and public awareness materials associated with aquatic invasive species and pathogens to identify gaps in the messaging and target audiences**
    - Identify communications requirements to the Invading Species Awareness Program
- **Engage local stakeholders (e.g. aquarium stores, marina operators, Ontario Competitive Fishing Council) to ensure invasive species and pathogens messaging materials are accessible and effective**
- **Distribute invasive species and pathogen information materials at public events and other consultation initiatives**
- **Encourage the distribution of invasive species and pathogens information materials at locks along the Trent-Severn Waterway**
- **In the event of a large-scale fish die-off, implement the Peterborough District Fish Die-off Response Protocol**
- **Develop an invasive species response protocol for FMZ 17**
- **Support research and experimental management activities to control the spread of aquatic invasive species and pathogens**

9.0 Fisheries Awareness and Education Strategy

FMZ 17 has world-class fisheries. The Kawartha Lakes are the most heavily fished inland lakes in Ontario by resident and non-resident anglers. The Oak Ridges Moraine's cold water streams are another example of the unique resources within FMZ 17. Collectively, these water bodies attract hundreds of thousands of anglers annually. Although these resources are well known to many, there is a great deal that can be done to educate anglers and stakeholders on issues relating to the management of the fishery and promote the social and economic benefits associated with its use.

MNR has worked with the FMZ 17 Advisory Council to identify key areas for education and awareness. The public awareness strategy will be a multi-year, proactive communications initiative that is intended to increase awareness of the challenges and opportunities in managing these multi-million dollar fisheries. Increased understanding of the issues should result in better decisions being made by individuals as they use the resources, an increase in lake specific stewardship activities and a better understanding of fisheries management initiatives.

Awareness and Education Challenges

Challenge #1: Creating an understanding of the factors influencing fish communities and fisheries within a changing environment

Objective: *Help individuals, organizations and communities better understand the stressors and other factors that influence the productivity of the fishery*

Management of the fisheries resources in FMZ 17 is complex and the fishery has been in a constant state of change. The fisheries within FMZ 17 have experienced changes in the fish community due to species introductions and invasions, changes to environmental water quality and climate and changes in the use of the resource.

Actions

- **Develop plain-language information materials associated with the following key topics:**
    - Recent changes to lakes and their effects on the fish community;
    - Influence of climate change on the structure of FMZ 17 fish communities now and in the future;
    - Biology and ecology of FMZ 17 sportfish species;
    - Characteristics of lakes within FMZ 17;
    - Impacts of invasive species and fish pathogens
        - What people can do,
        - What industry can do,
        - Why it should be done,

        - What will happen if it is not done;
    - Use of the FMZ 17 Fisheries Resources; and
    - Importance of and stressors on, coldwater stream habitats.
- **Report on the State of the Resource based on results of the Broad-scale Monitoring program and other monitoring initiatives**

CHALLENGE #2: Building an understanding from the public relating to management of the fishery

OBJECTIVE: *Provide better communications to the public regarding the rationale for fisheries management actions*

General support for management actions can be increased by improving the public's understanding of the rationale behind decisions that are made regarding the fishery. Frustration with management agencies can occur when the public is not aware of the rationale for a decision, or do not feel that their perspective was considered during the development of management objectives and actions.

ACTIONS

- **Develop plain-language information materials associated with the following key topics:**
    - The roles of various agencies within the zone, in terms of managing fish and fish habitat;
    - Management actions that can be taken and their potential effectiveness;
    - Proper fish handling practices for catch and release fishing;
    - Selective harvest practices for fish species in FMZ 17; and
    - Facts associated with competitive fishing events (e.g. economic revenues, results of previous biological monitoring).
- **Continue public involvement in the fisheries management decision making process through the FMZ 17 Advisory Council**

CHALLENGE #3: Distribution of information materials to diverse audiences

OBJECTIVE: *Develop consistent and cost-effective means for distribution of Awareness and Education materials*

Partner and stakeholder web sites will be the main destination for written products. For some topics, partners may actually provide a leadership role in the development and distribution of materials (e.g. Invading Species Awareness Program).

The target audiences associated with the awareness and education program are diverse and include:

- Anglers (avid and casual);
- General public;

- Government agencies
    - Federal
    - Provincial
    - Municipal; and
- First Nation and Aboriginal communities;
- Property owners (cottagers, waterfront land owners);
- Stewardship councils;
- Chamber of Commerce.

ACTIONS

- **Post information materials to MNR and/or partner websites and encourage distribution via other means**
- **Engage media to identify opportunities to contribute items relating to the topics above in regular outdoor-related columns or articles**

Awareness and Education Opportunities

OPPORTUNITY #1: Increase the profile of existing high quality fisheries currently present within FMZ 17

OBJECTIVE: *To promote the existing high quality fisheries within the zone to optimize social and economic benefits*

While walleye populations have declined, the lakes and rivers within FMZ 17 support an incredible diversity of fish species and in a number of cases provide world class, easily accessible, angling opportunities. Sunfish, black crappie, muskellunge, largemouth bass and rainbow trout are all highly marketable fisheries that are currently present within the zone. MNR and tourism-based partners need to share information to increase the marketing associated with the current and potential, social and economic benefits that can be derived from the resource.

ACTIONS

- **Support the development of tools to determine the economic value associated with the fisheries resources within the zone**
- **Develop promotional products to assist with advertising existing quality fisheries:**
    - Muskellunge;
    - Largemouth and smallmouth bass;
    - Sunfish and black crappie;
    - Migratory trout and salmon; and
    - Non-traditional species (e.g. common carp).
- **Distribute promotional products in concert with the partners that derive economic benefits from the fishery**

- **Establish or enhance linkages to local tourism associations, Chamber of Commerce and municipalities to increase understanding of the economic opportunities and quality fisheries within FMZ 17**
- **Develop a means to measure angler satisfaction within the zone**

10.0 MONITORING AND ASSESSMENT STRATEGY

Long term monitoring is critical to determine if management actions are effective and management objectives are achieved. There are a number of tools that can be utilized to assess the state of the fishery. Each tool includes inherent biases in terms of the target species, timing, size of fish sampled, etc. Unfortunately, there is no single tool that can be utilized to assess the entire fishery.

Monitoring of lakes within FMZ 17 is conducted by the MNR district offices (Peterborough, Bancroft and Aurora) and the Kawartha Lakes Fisheries Assessment Unit (KLFAU). Historically, the KLFAU has collected the majority of data from standard assessment methods within the zone. Partner agencies such as Conservation Authorities are active on the landscape, primarily on small streams. Additional data are collected by private consultants and organizations such as the Ontario Federation of Anglers and Hunters, Trent University and Sir Sanford Fleming College. This strategy will focus on monitoring efforts of district offices, under the assumption that KLFAU will continue monitoring on its current schedule. This strategy will be reviewed on a bi-annual basis.

Fisheries Monitoring and Assessment Tools

Trap Netting Surveys

A trap netting survey is a passive netting technique that targets fish in the nearshore areas of lakes. Trap nets can be particularly effective for targeting adult centrarchids (bass and sunfish) and the vast majority of fish captured are easily live-released. MNR utilizes two standard index trap netting surveys: End of Spring Trap Netting (ESTN) which is designed as a live-release walleye survey and Nearshore Community Index Netting (NSCIN) which targets the littoral zone fish community in late summer. Historically, Spring Index Netting surveys were used by MNR as a walleye assessment program. Trap net surveys provide information on fish populations including relative abundance, size distribution, age distribution and growth rates. These surveys are biased by the fact that the catch of small-bodied fishes is limited (e.g., perch, minnows, young-of-year fish) and that they do not sample fish outside of near-shore areas. Trap nets are relatively ineffective in areas with high flow.

Gill Netting Surveys

Gill netting surveys are passive netting programs that can target fish across a wider range of size categories and can be set in numerous locations within a lake. Depending on the fish species targeted, the duration of the net sets and the timing of the survey, gill netting surveys can result in high mortality rates of fish captured. Lethal sampling can provide additional information about the fish populations including sex, maturity, condition, accurate age estimates and contaminant loading in addition to the parameters collected in a live-release

survey. The size of mesh in the gill net dictates the size range and species of fish sampled. In Ontario, Fall Walleye Index Netting (FWIN) is a provincial standard gill netting program targeting walleye. Summer Profundal Index Netting (SPIN) is utilized to sample coldwater fish communities in lakes. Other gill netting programs are utilized within Ontario but not in FMZ 17 due to the absence of lake trout or brook trout lakes. Current gill netting programs are not selective to bass and sunfish populations and therefore have limited effectiveness beyond presence-absence.

Currently, MNR is in the process of developing a standard gill-netting survey for the assessment of large rivers, which ultimately will become a component of State of the Resource monitoring. Riverine Index Netting (RIN) utilizes standard FWIN netting techniques and is intended to assess large bodied fishes in slow-moving portions of rivers.

Broad Scale Monitoring Program

The Broad-scale Monitoring Program (BsM) was developed to address the monitoring component of the Ecological Framework for Fisheries Management. The BsM uses a combination of two types of gillnets:

- "Large mesh" gillnet that target fish larger than 20 cm in length, the size range of interest to anglers;
- "Small mesh" gillnet that target smaller fish

The large mesh gillnet has been proposed by the American Fisheries Society as a North American standard for sampling angler harvested freshwater species. The small mesh gillnet is a new standard, developed in Ontario. Jointly, the large and small mesh gillnets span a mesh size range that is similar to a standard that has been adopted in Europe. This combination of gear was proposed as an optimum compromise between North American and European standards.

The broad scale monitoring program was first implemented in 2007 across Ontario. Within FMZ 17, the program focuses on walleye lakes. Twenty lakes were randomly selected as 'fixed' lakes, which will be sampled on a regular basis (currently targeted every five years). These lakes will provide data to assess both the current 'State of the Resource' as well as changes in the fishery over time. The list of fixed lakes in FMZ 17 is provided in Table 10.1. In addition, four lakes within FMZ 17 are randomly selected as 'variable lakes' and are assessed to contribute to the current 'State of the Resource'. These lakes are selected at random with each sampling cycle.

In addition to the fisheries surveys, the BsM program includes sampling for invasive species (plankton hauls) and water quality monitoring. Where required, bathymetry data is collected for lakes as well.

Electrofishing Surveys

Electrofishing surveys are commonly used to collect, sample and live release fish. This provides information on fish abundance and species composition. Captured fish can also be sampled for biological attributes such as length, weight and age. Electrofishing involves stunning fish by passing an electric current through the water. Stunned fish are then captured with a dip net. Electrofishing surveys can be conducted in wadeable waters using backpack, punt or shore-based units and in larger waterbodies using electrofishing boats. The Ontario Stream Assessment Protocol (OSAP) includes standard protocols for sampling wadeable streams using backpack units. MNR has mandatory training requirements for staff involved in electrofishing projects. When staff are properly trained, electrofishing is safe and effective on a wide range of fish species and sizes.

Table 10.1 - List of FMZ 17 'Fixed' lakes that are included in the Broadscale Monitoring Program

Big Bald Lake
Buckhorn Lake (Lower)
Buckhorn Lake (Upper)
Canal Lake
Chemong Lake
Cordova Lake
Dalrymple Lake
Dummer (White) Lake
Four Mile Lake
Head Lake
Katchewanooka Lake
Lake Scugog
Little Lake (Peterborough)
Pigeon Lake
Rice Lake
Rylstone Lake
Shadow Lake
Silver Lake
Stony/Clear Lake
Young Lake

Bass Tournament Sampling

Fishing tournaments are common across many lakes in FMZ 17 and primarily target bass, with less frequent events for walleye and other fish species. Competitors in these events often collectively catch in excess of hundreds of fish at an individual event, which are typically brought to a central location for the 'weigh-in'. Prior to the release of these fish, it is possible to collect biological data

including length, weight and age. In many instances, fish can be tagged prior to release to provide additional information on distribution and survival. Tournament data have been used in the past to calculate survival rates and productivity. One limitation of tournament data relates to the bias towards larger fish; however, it has been demonstrated that tournament data can be a valuable addition to both fisheries management and research in many areas of Ontario (Corbett, 1999).

Cleithrium Project

In 1979, MNR through Dr. John Casselman and the Royal Ontario Museum, through Dr. Ed Crossman, initiated the Cleithrum Project as a joint study to collect, archive and disseminate biological data on trophy muskellunge. The cleithral bone provides accurate information on both the age and growth of a fish, but cannot be obtained without lethal sampling. A guiding principle of the project is fish should not be killed for the data but every fish killed should be used to provide the data. Data collected via the Cleithrum Project are critical for determining muskellunge growth patterns and determining appropriate regulations.

Fish Observations

In some instances, observational data can be collected to provide information on the fishery. These data can be used to address specific management questions. One example utilized within FMZ 17 is walleye spawning observation data that is collected across a number of locations. These data can be used to determine the timing of spawning and to identify spawning locations. It is difficult to use this data to assess the abundance of walleye within a lake or river as they are subject to a number of biases. The monitoring program is being utilized to collect site-specific data to aid identify priority areas for habitat rehabilitation/creation and best management practices for water flows and levels.

Angler Creel

The MNR conducts routine angler creel surveys to collect data on angler harvest, effort and catch characteristics. Within FMZ 17, on-the-water surveys are primarily limited to the lakes surveyed by the Kawartha Lakes Fisheries Assessment Unit (Balsam, Rice, Scugog and Tri-lakes). These surveys estimate angler effort, catch, harvest and yield, as well as target species effort, catch rate, harvest rate and size and age distribution of the harvest. Creel surveys describe the use of the resource but are not necessarily a good measure of the populations.

In addition to the on-the water creel surveys, MNR is proposing to utilize aerial surveys to assess angler effort across FMZs as a component of the Broad-scale Monitoring program. These surveys are utilized to collect information on relative

fishing effort across a number of lakes but are limited in terms of providing species-specific information.

Angler Diary Programs

Angler diary programs allow individual anglers to track their fishing efforts and success over a specified time period. These surveys provide a similar suite of data to creel surveys. One limitation of angler diary programs is that the quality of the data collected are dependent on the individual angler and are subject to a number of potential biases. Within Ontario, members of Muskies Canada have maintained angler diaries associated with their fishing activities. Given the low catch rates of muskellunge in most index netting surveys, this provides a means of tracking trends in the muskellunge fishery over time.

Proposed Monitoring and Assessment Programs in FMZ 17

MONITORING AND ASSESSMENT PROGRAM 1.0 – PERCIDS (WALLEYE AND YELLOW PERCH)

OBJECTIVES: *Determine current walleye population status*

- *Relative Abundance*
- *Population structure*
- *Growth*
- *Maturity*

Monitor changes in populations through time, particularly in response to regulation changes

Determine critical walleye spawning habitats within the zone

Monitor yellow perch size and abundance through time

ACTIONS:

- **Adopt the BsM program as the primary index netting survey to assess walleye and yellow perch population status across the FMZ**
- **Utilize BsM methodologies where data is required to assess a specific management concern on a lake that is not a part of the BsM program. FWIN and ESTN surveys can be utilized to assess walleye populations as an alternative, with priority placed on lakes that are neither a part of the BsM 'fixed' lakes nor KLFAU lakes**
- **Support the development of benchmarks and indicators associated with the BsM program and link to FMZ 17 objectives once established (linked to objectives 1.2 and 1.4)**
- **Continue and expand the voluntary walleye spawning monitoring program. MNR will work with the FMZ 17 Advisory Council to**

continue to implement this program, Priority areas for monitoring activities are identified in Table 10.2

Table 10.2: Priority Areas for Volunteer Walleye Spawning Observation Program within FMZ 17.	
Bobcaygeon (TSW dam)	Lindsay (TSW dam)
Buckhorn (TSW dam)	Otonabee River (Lock 19 – Peterborough)
Chemong Causeway	Rosedale (TSW dam)
Coboconk (TSW dam)	Scugog Causeway
Fenelon Falls (below falls)	Trilakes shoal/shore spawning sites
Gannons Narrows	

MONITORING AND ASSESSMENT PROGRAM 2.0 - CENTRARCHIDS (BASS AND SUNFISH)

OBJECTIVE: *Monitor centrarchid populations through time based on the following criteria:*

- *Abundance*
- *Population structure*
- *Growth*
- *Maturity*
- *Relative abundance by size (e.g. proportional size structure)*

ACTIONS:

- **Utilize NSCIN surveys to monitor centrarchid populations, focusing on KLFAU lakes and Sturgeon Lake (assessed via Sir Sandford Fleming College) with complimentary netting projects considered**
- **Implement a bass tournament monitoring program on an annual basis. The Trilakes events would be considered a priority, based on the history of tournament sampling on these lakes and the predominance of the bass fishery on the system. Individual fish information will be collected from a sample of fish at the tournament weigh-in.**
- **Develop a program to monitor sunfish life history characteristics (e.g. age and size at maturity) to track responses to management actions**
- **Collect information on sunfish productivity to determine defensible management approaches (e.g. harvest and potential size-based regulations)**

MONITORING AND ASSESSMENT PROGRAM 3.0 - ESOCIDS (PIKE AND MUSKELLUNGE)

OBJECTIVES: *Track the distribution and abundance of northern pike*

Monitor abundance of muskellunge populations through time

Monitor muskellunge growth potential through time

ACTIONS:

- **Utilize existing index netting standards to track northern pike distribution (e.g. NSCIN, BsM)**
- **Track muskellunge abundance via NSCIN trap netting surveys on KLFAU lakes and Sturgeon Lake**
- **Conduct periodic NSCIN surveys on non-FAU lakes as required – focus efforts on lakes within the Crowe River watershed**
- **Where lethal sampling of muskellunge is required, submit cleithrum for analysis through the Cleithrum Project**
    - Encourage anglers who harvest muskellunge to participate in the project

MONITORING AND ASSESSMENT PROGRAM 4.0 - COLDWATER FISH COMMUNITIES

OBJECTIVE: *Collect standardized data for the assessment and comparison of coldwater fish communities*

ACTIONS:

- **Continue to support spring assessment at the Ganaraska River fishway led by the Lake Ontario Management Unit. Explore the potential to collect information relating to the fall salmonid migrations**
- **Continue assessment of adult Atlantic salmon returning to Cobourg Creek, Duffins Creek, Shelter Valley Creek and Barnum House Creek.**
- **Implement additional Atlantic salmon monitoring and assessment as directed by the recovery planning process**
- **Where possible, ensure data collected by private consultants follow Ontario Stream Assessment Protocols and is entered into the appropriate provincial database**
- **Conduct electrofishing surveys as a component of the development of Watershed-based Fisheries Management Plans consistent with OSAP protocols (often in partnership with Conservation Authorities)**
- **Archive stream data in the appropriate provincial database**
- **Contribute to or support the development of index netting methods for non-wadeable streams – employ new techniques**
- **Continue to work with the Lake Ontario Management Unit to gain understanding of the results of their ongoing assessment programs**

MONITORING AND ASSESSMENT PROGRAM 5.0 - SPECIES AT RISK AND SPECIAL INTEREST

In FMZ 17, five fishes that are formally listed in Ontario and Canada have been recorded. The channel darter (*Percina copelandi*) is listed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and under the *Endangered Species Act, 2007* (ESA 2007), American eel (*Anguilla rostrata*) has been designated as a special concern nationally by COSEWIC and

listed as Endangered under the ESA, 2007. The river redhorse (*Moxostoma carinatum*) is a species of special concern at the Provincial and National level. At the Provincial level, the Great Lakes-Upper St. Lawrence River lake sturgeon population is listed as threatened. At the National level this population has been designated as threatened by COSEWIC and the federal government is considering listing this population under the *Species At Risk Act* (SARA). Redside dace *(Clinostomus elongates)* is currently listed as endangered in Ontario. Atlantic salmon are considered extirpated under the ESA, 2007. Monitoring of Atlantic salmon reintroduction will be guided by the recovery planning process and is outlined in the management of coldwater streams.

OBJECTIVE: *Determine current population status and species distributions within FMZ 17 and monitor the state of these populations over time*

ACTIONS:

- **Design and implement a gill netting program to assess the state of lake sturgeon populations in areas of the Trent River**
- **Design and implement an assessment and monitoring program to determine the state of river redhorse populations**
- **Implement monitoring recommendations put forward by the recovery teams for American eel and channel darter where appropriate**

MONITORING AND ASSESSMENT PROGRAM 6.0 - FMZ 17 FISHERY CHARACTERISTICS

OBJECTIVES: *Monitor trends in resource use through time*

Fill data gaps associated with resource use on coldwater streams

Evaluate the impacts and benefits of increased angling opportunities (e.g. angler hours, harvest, etc.)

Develop a mechanism for monitoring angler satisfaction

Quantify harvest activities of First Nation and Aboriginal communities

Understanding the use of the resource by anglers is equally important to understanding the state of the fisheries. Programs to asses the use of the fishery should focus on established parameters including angler effort and harvest. Biological data should be collected from harvested fish wherever possible.

ACTIONS:

- **Encourage the continued use of roving creel surveys by the KLFAU to monitor:**
    - Angler effort;
    - Target species;
    - Angler catch;

  - Angler harvest;
  - Angler origin; and
  - Characteristics of the harvest (size of fish, age, etc).
- **Where necessary, the district office will support this program on existing lakes and/or augment with creel surveys on other lakes**
- **Support the collection of angler effort data as a component of the Broadscale Monitoring program**
- **Develop a program to monitor additional fishing opportunities, including potential Put-Grow-Take fisheries, that will assess:**
  - Angler effort;
  - Target species;
  - Angler harvest;
  - Harvest characteristics (e.g. size an age distributions);
  - Catch of non-target species (e.g. walleye);
  - Angler origin; and
  - Economic benefits.
- **Develop a program to evaluate and monitor harvest activities of First Nation and Aboriginal communities**
- **Extend angler diary programs to potentially include bass clubs, angler organizations or tourist operators. Priority should be placed on implementing a program that will assess angler use characteristics associated with coldwater stream fisheries as these data are currently lacking**
- **Provide technical support in terms of program design and data analysis**
- **Encourage the development of an angler satisfaction survey as a component of the National Recreational Fishing Survey.**

MONITORING AND ASSESSMENT PROGRAM 7.0 – INVASIVE SPECIES AND FISH PATHOGENS (NATIVE AND EXOTIC)

OBJECTIVE: *Monitor distribution and spread of invasive species and fish pathogens within FMZ 17*

ACTIONS:

- **Support ongoing efforts of the Invasive Species Awareness Program to detect invasive species within FMZ 17**
- **Incorporate invasive species monitoring into the Broadscale Monitoring program**
- **Contribute to the development of a fish pathogen surveillance program at a provincial level**
- **Explore means of incorporating fish health testing into ongoing fisheries monitoring programs**

MONITORING AND ASSESSMENT PROGRAM 8.0: RESEARCH

OBJECTIVE: *Support research projects in FMZ 17 that fill information and knowledge gaps identified in the fisheries management plan. These include:*

- Determine impacts of physical and limnological changes to area lakes and the subsequent changes to the fish community with emphasis on determining the carrying capacity of walleye populations;
- Determine the impacts of current water level management with emphasis on walleye recruitment and population dynamics;
- Determine the economic value of the fishery in FMZ 17;
- Determine how muskellunge populations respond to the establishment of northern pike in new waterbodies and identify management tools to prevent their further spread;
- Assess the success of Atlantic salmon reintroduction efforts in priority streams;
- Determine how fish communities respond to recent large-scale carp die-offs;
- Determine how fish communities will respond to the invasion of round gobies in small inland waterbodies;
- Determine if water quality and habitat variables in Stony Lake are sufficient to provide an opportunity for the reintroduction of lake trout;
- Assess the effects of fragmentation (e.g., Trent Severn Waterways) on native species (would include some of the diadromous SAR species); and
- Assess the effects of climate and climate change on FMZ 17 fish communities.

11.0 LITERATURE CITED

Bunnell, D.B., T.B. Johnson, and C.T. Knight. 2005. The impact of introduced round gobies (*Neogobius melanostomus*) on phosphorus cycling in central Lake Erie. Canadian Journal of Fisheries and Aquatic Sciences 62: 15-29.

Casselman, J.M. 2007. Determining minimum ultimate size, setting size limits, and developing trophy standards and indices of comparable size for maintaining quality muskellunge (Esox masquinongy) populations and sports fisheries. Environmental Biology of Fishes 79: 137-154

CCFAM. 2004. A Canadian Action Plan to Address the Threat of Aquatic Invasive Species. Canadian Council of Fisheries and Aquaculture Ministers Aquatic Invasive Species Task Group. 26 pp.

Chen, R.J., K.M. Hunt, and R.B. Ditton. 2003. Estimating the economic impacts of a trophy largemouth bass fishery: Issues and applications. North American Journal of Fisheries Management 23: 835-844

Corbett, B.W. 1999. Kenora Bass International Tournament: Opportunities for fisheries management. P. 51-60 *In* Competitive Fishing in Ontario Workshop Proceedings. S.J. Kerr [ed.]. Southcentral Sciences Section, Ontario Ministry of Natural Resources, Kemptville, Ontario.

Deacon, L. 1996. The Kawartha Lakes muskellunge fishery. In: Managing Muskies in the '90s Workshop Proceedings. Ontario Ministry of Natural Resources.

Dombeck, M.P., Nenzel, B.W., and P.N. Hinz. 1986. Natural muskellunge reproduction in midwestern lakes. Pages 122-134 *in* Hall (1986).

Environment Canada. 2004. An Invasive Alien Species Strategy for Canada. 40 pp.

Fausch, K.D. and R.J. White. 1981. Competition between brook trout and brown trout for positions in a Michigan stream. Canadian Journal of Fisheries and Aquatic Sciences 38: 1220-1227.

Fayram, A.H., M.J. Hansen, and T.J. Ehlinger. 2005. Interactions between walleyes and four fish species with implications for walleye stocking. North American Journal of Fisheries Management 25:1321–1330.

Gilliland, E.R., H. Schramm, and B. Shupp. 2002. Keeping bass alive: a guidebook for anglers and tournament organizers. Bass Anglers Sportsman Society. 44 p.

Harrison, E.J. and W.F. Hadley. 1978. Ecologic separation of sympatric muskellunge and northern pike. American Fisheries Society Special Publication 11:129-134. Editor: R.L. Kendall. Selected Coolwater Fishes of North America.

Inskip, P.D., and J.J. Madnuson. 1983. Changes in fish populations over an 80-year period: Big Pine Lake, Wisconsin. Transactions of the American Fisheries Society 112: 378-389.

Inskip, P.D., and J.J. Madnuson. 1986. Fluctuations in growth rate and condition of muskellunge and northern pike in Escanaba Lake, Wisconsin. Pages 176-188 *in* Hall (1986).

Kerr, S.J. 2004. Characteristics of Ontario muskellunge fisheries based on volunteer angler diary information. Fish and Wildlife Branch, Ontario Ministry of Natural Resources, Peterborough, Ontario. 138 pp.

Kerr, S.J. 2007. Characteristics of Ontario muskellunge fisheries based on volunteer angler diary information. Environmental Biology of Fishes 79: 61-69.

Lester, N. P., T.R. Marshall, K. Armstrong, W.I. Dunlop and B. Ritchie. 2003. A Broad-Scale Approach to Management of Ontario's Recreational Fisheries North American Journal of Fisheries Management 23:1312–1328

Lester, N.P., A.J. Dextrase, R.S. Kushneriuk, M.R. Rawson, and P. A. Ryan. 2004. Light and temperature: Key factors affecting walleye abundance and production. Transactions of the American Fisheries Society 133:588–605

Marshall, T.L. and H.R. MacCrimmon. 1970. Exploitation of self sustaining Ontario stream populations of brown trout (*Salmo trutta*) and brook trout (*Salvelinus fontinalis*). Journal of the Fisheries Research Board of Canada 27:1087-1102.

Monfette, R., S. Guenette, N. Dubuc, R. Fortin, and H. Fournier. 1996. Northern pike and muskellunge spawning ecology and reproductive success in the lower Ottawa River. In: Managing Muskies in the '90s Workshop Proceedings. Ontario Ministry of Natural Resources.

Ontario Ministry of Natural Resources. 1991. Strategic Plan for Ontario Fisheries (SPOF II).

Ontario Ministry of Natural Resources. 2005a. Our Sustainable Future. Ministry of Natural Resources Strategic Directions. 22 p.

Ontario Ministry of Natural Resources. 2005a. Coldwater Stream Strategy Peterborough Area. French Planning Services Inc. 54 p.

Ontario Ministry of Natural Resources. 2008. Background Information to Fisheries Management Strategy for Fisheries Management Zone 17. Ministry of Natural Resources Peterborough District and Kawartha Lakes Fisheries Assessment Unit. 130 pp.

Osterberg, D.M. 1985. Habitat partitioning by muskellunge and northern pike in the international portion of the St. Lawrence River. New York Fish and Game Journal 32(2):158-166.

Parish Geomorphic and Warme Engineering and Biological Services. 2003. Trent River Walleye Spawning Protection and Enhancement Study. Prepared for Ministry of Natural Resources, Peterborough District. Report Number 03-2002. 46pp + 3 Appendices.

Reid, R., 2001. Fish and Wildlife Habitat Status and Trends in the Canadian Watershed of Lake Ontario, Canadian Wildlife Service, Environment Canada, Technical Report 364.

Ridgway, M.S. 2006. The Tri-lakes Bass Project 1999-2003. P. 79-82 *In* S.J. Kerr (ed.). Bass Research and Management in Ontario II.

Robillard, M.M., and M.G. Fox. 2006. Historical changes in abundance and community structure of warmwater piscivore communities associated with changes in water clarity, nutrients, and temperature. Canadian Journal of Fisheries and Aquatic Sciences 63: 798-809.

Rutherford, E.S., K.A. Rose, E.L. Mills, J.L. Forney, C.M. Mayer, and L. G. Rudstam. 1999. Individual-based model simulations of a zebra mussel (*Dreissena polymorpha*) induced energy shunt on walleye *(Stizostedion vitreum*) and yellow perch (*Perca flavescens*) populations in Oneida Lake, New York Canadian Journal of Fisheries and Aquatic Sciences 56: 2148–2160

Stewart, T.J., R.E. Lange, S.D. Orsatti, C.P. Schneider, A. Mathers, M.E. Daniels. 1999. Fish-community objectives for Lake Ontario. Great Lakes Fish. Comm. Spec. Pub. 99-l. 56 p.

Suski, C.D., S.S. Killen, S.J. Cooke, J.D. Kieffer, D.P. Philipp, and B.L. Tufts. 2004. Physiological significance of the weigh-in during live-release angling tournaments for largemouth bass. Transactions of the American Fisheries Society 133: 1291-1303.

Taillon, D., J. Wiltshire, and M. Robillard. 2004. Summary of forage fish sampling data 2003/04. Ontario Ministry of Natural Resources Peterborough District. 35 pp.

Wahl, D.H. 1989. The population ecology of two species of esocids and their hybrid. Diss. Ph.D. Ohio State University, Columbus.

Wahl, D.H., and R.A.Stein. 1993. Comparative population characteristics of muskellunge (*Esox masquinongy*), northern pike (*E. lucius*), and their hybrid (*E. masquinongy* X *E. lucius*). Canadian Journal of Fisheries and Aquatic Sciences 50: 1961-1968.

Walters, C., and J.F. Kitchell. 2001. Cultivation/depensation effects on juvenile survival and recruitment: implications for the theory of fishing. Canadian Journal of Fisheries and Aquatic Sciences 58: 39–50